FROM

THE DIGITAL DIVIDE TO DIGITAL OPPORTUNITIES

MEASURING INFOSTATES FOR DEVELOPMENT

George Sciadas | Editor

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ITU
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From the Digital Divide to DIGITAL OPPORTUNITIES

Measuring Infostates for Development

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EXECUTIVE SUMMARY

The catalytic role of ICTs in creating digital opportunities conducive to development and the danger posed by the Digital Divide have been well documented in recent years. In this context, a reliable monitoring instrument is indispensable. This project builds on the enthusiastic reception of the *'Monitoring the Digital Divide…and Beyond'* report, presented at the Geneva 2003 WSIS, and offers such an instrument to the international community. Based on the **Infostate** conceptual framework and model, it incorporates measurements of ICT capital and labour stocks, indicative of a country's productive capacity, and ICT consumption flows, indispensable to function in an Information Society.

The large-scale empirical application measures ICT networks, skills, uptake and intensity of use based on 21 reliable, tested and publicly available indicators. Measurements of networks are offered for 192 countries representing 98% of the global population, and of overall Infostates for 139 countries, accounting for 94% of the global population. The results extend over the 1995-2003 period, providing the perspective of almost a decade of evolution. Unique features include:

- **a cohesive conceptual framework**, which goes beyond connectivity measures and logically incorporates skills, and offers rich analytical linkages
- explicit **measurements** both **across countries** at a given point in time and **within countries** over time, such that comparisons are not reduced to changing rankings
- **policy-relevant results** on a component-by-component basis
- immediate and intuitive **benchmarking** against the average of all countries (Hypothetica) and the planet as a whole (Planetia)
- use of **existing and reliable data** sets with a **rigorous and transparent statistical methodology**

An early finding of the empirical application is that the ***magnitude*** of the Digital Divide remains huge. Infostate gaps between countries continue to be enormous, with values ranging from a high of 255 to a low of 8…Thus, literally, *have* and *have-not* countries are worlds apart, separated by many decades of development. Countries with the least developed Infostates are heavily concentrated in Africa, with some Asian countries as well.

Infostates for all countries increased over the 1995-2003 period. Many countries made significant improvements, others more modest. The countries with the highest growth were those with the lowest Infostates, a typical pattern in analyses of digital divides, whether across or within countries, and largely the product of the initial values. However, this does not indicate a closing divide. The Digital Divide is a relative concept and its ***evolution*** cannot be subjected to blanket generalizations. Detailed analysis reveals that:

- While it is true that the Digital Divide is closing in a general sense, this is so because countries in the middle - and especially the upper-middle – of the Infostate scale made good progress against countries at the top.
- The progress made by countries with low Infostates was not sufficient to close the gap and they were outpaced by most countries - except for those at the top with whom they are separated by huge gaps. Thus, **the digital divide between countries with the lowest Infostates and most others is widening**. This happens despite the undeniable progress made in cell phones and other ICTs.

Relative movements of individual countries over the period also prove revealing: some started with similar Infostates and ended up far apart – or the other way round. Extensive analysis documents **which** countries made progress, **when**, **how fast** and through **what** ICTs. The analytical potential of the model was further exploited by going beyond the numbers to answer the all-important **why** questions. What macro environments, government policies, regulations and business strategies are moving the numbers? This work was carried out by researchers in the South, for several countries in Africa, Asia, and Latin America and the Caribbean. **A wealth of findings has emerged** to feed constructive debate. Some common threads among countries include: the geopolitical, macroeconomic and governance issues matter tremendously; the importance of modern Telecommunications Acts, the role of regulators and the conflicts of interest when they exist, the effects of taxation and pricing on affordability, and the continuous need for information and awareness exert strong influences; education, specific ICT training, and their many linkages with the Information Society are key determinants of future progress; distinctions between cities and rural areas are also identified as critical; the influence of competition emerges crystal-clear, while the impacts of business practices, chiefly pricing plans, are shown to be extremely influential - for instance, the introduction of pre-paid cards has been a major innovation in the diffusion of cell phones, and the 'calling party pays' principle is considered a key driver in the context of several countries.

Econometric work found a **strong relationship between ICTs and economic growth**. Infodensity is highly correlated with per capita GDP, and this gets stronger at higher levels of ICTs - although the relation is complex, indicating that many factors are at work. The impact of ICTs is large: on average, a 1% increase in Infodensity results in 0.9% increase in per capita GDP, but such an impact is unequal among countries at different stages of development. Countries with comparable levels of GDP and Infodensity shares benefit more than the poorest countries, which points to the need of a critical threshold of ICTs for serious growth to occur.

Based on the compilation of the best possible dataset on ICTs by gender, a quantitative analysis of the **gender digital divide** finds women at a disadvantage. Access, location of use, patterns of use, frequency, intensity and type of use are all areas of concern. As well, gaps in ICT literacy, education and training pose specific challenges for women. A qualitative report presents detailed information from fieldwork, case studies and anecdotal evidence to begin assessing the outcomes and impacts of ICTs in the working and social lives of women, particularly in developing regions. The study also found that while the gender divide tends to be generally smaller in countries with high Infostates, its relationship with the overall digital divide is at best tenuous. This provides credence to the need for policies designed specifically for women rather than to rely on generic e-strategies.

Considering the ongoing debate on the potential role of **free and open source software** in development, the report also offers an objective account of its pros and cons.

From the Digital Divide to Digital Opportunities

A GLOBAL ENDEAVOUR IN DIRECT RESPONSE TO THE WSIS ACTION PLAN

by Claude-Yves Charron

Secretary General of Orbicom and Vice-rector of Université du Québec à Montréal

and Abdul Waheed Khan

Assistant Director-General for Communication and Information / UNESCO

This publication represents a collaborative global endeavour in direct response to the Plan of Action of the World Summit on the Information Society (WSIS, Geneva 2003), which called for the development and the launching of a "Composite ICT Development Index". It provides the international community with a much-needed measuring instrument, complemented with several in-depth analytical chapters.

This joint Orbicom-ITU project was made possible with the collaboration of the International Development Research Centre (IDRC), the Canadian International Development Agency (CIDA), L'Agence Intergouvernementale de la Francophonie (AIF), and United Nations organizations such as UNESCO and UNCTAD. It was initiated in the aftermath of the 2003 Geneva phase of WSIS to build on the enthusiastic reception by the international community of Orbicom's "*Monitoring the Digital Divide… and Beyond"* report. The current publication is now launched in the context of the second phase of WSIS, Tunis, 16-18 November 2005. This edition is based on a three-part work plan:

- the ICT opportunity index based on the Infostate framework and model;
- detailed regional analyses with a policy focus for countries in Africa, Asia and Latin American and the Caribbean, and;
- women in the Information Society, which incorporates quantitative and qualitative research to study the gender digital divide.

Additional topics are also incorporated in the course of the research.

The empirical application for measuring the digital divide which was first done for the Geneva phase of WSIS was updated with the most recent data available. The measurements cover the period 1995-2003, providing the perspective of almost a decade of evolution and extend to include up to 192 countries, accounting for 98% of the planet's population. This ICT opportunity index is the

only measuring tool that can, by design, provide cross-sectional and time series-results. This enables benchmarking and comparisons across economies, but also the tracking and monitoring of progress within each economy year-after-year and component-by-component. The measurement of Infostates incorporates *skills* to emphasize the importance of education and underscore the need for the requisite abilities to effectively use ICTs rather than their mere availability.

The results of the empirical application can answer well questions like: *which* country improved, *how much, when* and from *what* factors. But this report takes the analytical potential of the model further by going beyond the numbers to answer the all-important *why* questions. What factors (government policies, business strategies, macro environments) are moving the numbers? The South assumed complete ownership of this part of the research. Many reputable researchers contributed significantly by carrying out this work for several countries in Africa, Asia and Latin America and the Caribbean. They conducted detailed analyses of the movement of Infostates and their components in their respective regions and countries. Not only the country research was carried out exclusively by researchers in the region, but also the coordination of each region was undertaken by reputable regional organizations: the RIA! in Africa, MIMOS in Asia and Centro REDES-RICYT in Latin America and the Caribbean. This type of detailed policy work contains a wealth of findings that are sure to contribute to a constructive dialogue among stakeholders.

The research contained in this volume also addresses the issue of ICTs and gender. It is not possible to quantify the gender digital divide in a way comparable to the systematic measurement of countries' Infostates due to the scarcity of data, both in the scope of coverage and the degree of detail available. However, based on the painstaking compilation of the best dataset possible, this report by a dedicated expert team provides a compelling analysis of the gender digital divide. It offers a more holistic view of the gender digital divide that has been possible until now, facilitates the understanding of its underlying causes and should help contribute to the design of pragmatic actions that need to be taken. Women's issues are right in the hearth of the Information Society, and more generally absolutely indispensable in the achievement of the Millennium Development Goals.

In addition, the current publication contains an *overview of the global trends* in ICTs produced by the ITU staff, as well as chapters on the *Macroeconomic impacts of Infodensity on economic growth* and on *Free and Open source Software* produced by UNCTAD staff.

In conclusion, a project of this magnitude would not have been possible without the collective competence and dedicated efforts of many individuals and organizations. More than a dozen teams were at work across all continents, with 50-60 people working directly on the project and many more contributing indirectly through the extended networks. Believing that "*communication links us together*" we take pride in having coordinated and managed this project, a truly collaborative global endeavour, in direct response to the WSIS Action Plan.

FOREWORD

by Hamadoun I. Touré
Director, Telecommunication Development Bureau
International Communication Union (ITU)

It is a pleasure to present the publication "*From the Digital Divide to Digital Opportunities: Measuring Infostates for Development*" in time for the second phase of the World Summit on the Information Society (WSIS). This work is the first result of the merger of two well-known initiatives, ITU's Digital Access Index (DAI) and Orbicom's Monitoring the Digital Divide/Infostate conceptual framework and model, and from now on it will be known as the "ICT Opportunity Index". This is a response to calls from the international community and follows the explicit recommendation of the WSIS Plan of Action, paragraph 28, to "…*develop and launch a composite ICT Development (Digital Opportunity) Index*" to combine statistical indicators with analytical work on policies and their implementation. This measurement tool reflects the importance the ITU attaches to the collection, dissemination and exchange of information on telecommunications and other Information and Communication Technologies (ICTs). It further highlights the role of ITU as the main source of global telecommunication and other ICT statistics.

The compilation of statistics and analysis of trends have accelerated recently with increased focus around the world on ICTs and the recognition that ICTs are an effective tool for social development and economic growth. It is crucial for countries to foster higher access levels, and improve their Infostates, so as to create digital opportunities. Countries' desire to increase the availability of ICTs has highlighted the growing need for reliable, comprehensive and comparable statistical information. This is important on a national level to help countries identify their progress, strenghts and weaknesses over time, so as to tackle and finally overcome barriers to wider and better access. Statistical information further helps governments identify targets and adopt policies accordingly. It is, however, not enough for governments to look just at their own development. Benchmarking and interntational comparisons are important to assess their progress objectively and to help them set realistic targets.

The ICT Opportunity Index is an inclusive tool that measures economies' ICT networks, skills, and use. The unique methodology of the index allows each economy to measure its *Infostate* over time, both in terms of its relative position towards other countries, but also against its own progress. It is the only measuring tool today that can, by design, provide cross-sectional and

time series results. The index's latest results are based on 2003 data but the measurements cover the period 1995-2003, providing the perspective of almost a decade of evolution.

To exploit the analytical potential of this measurement tool, the results are linked to national and regional policies. Concrete examples highlight the linkages between policy and *Infostate* levels, providing a wealth of explanations for the differences in performance across countries. The report also highlights government actions geared towards strenghtening the information society and shows their impact, for example, in the area of regulatory policy, and ICT training and skills. A major contribution of this report is the investigation of the gender divide, particularly since ICT measurements and comparative analyses in this area have been scarce. The study's statistical and analytical overview and real-life illustrations of female connectivity and use of ICTs present and important stepping stone in overcoming disparities and highlighting opportunities.

I trust that to ICT policy-makers, operators, investors, researchers, statisticians, and international, regional and non-governmental organizations, as well as all those closely following the World Summit on the Information Society, this report will be an important instrument in their work and future projects.

PREFACE

by Richard P. Fuchs
Director, Information and Communications Technologies for Development
International Development Research Centre (IDRC), Ottawa, Canada

The International Development Research Centre (IDRC) is delighted to be associated with this second volume of work on the measurement of the Digital Divide and its insights on Digital Opportunities. Our colleagues at Orbicom, for whom we have the highest regard, have once again demonstrated leadership in undertaking this important work in collaboration with the ITU and many other partners.

As mobile telephony approaches near-ubiquity all over the world and Internet access increases in previously underserved regions, people's capacity to share ideas and information becomes more common and likely. Billions of people can now learn, know and share. This has a direct impact on the prospects for social and economic development.

Monitoring the changes in the access and use of these technologies contributes considerably to our understanding of this important matter. Data is just the beginning of an informed discussion leading to information, knowledge and wisdom. The Infostate framework provides a cohesive conceptual structure to accommodate the data and make them more meaningful. As such we hope this publication stimulates the kind of exchanges that help people through the information value chain.

We are especially pleased that Orbicom has focused on gender and information and communication technologies (ICTs) in this volume. The information economy can represent very special opportunities for women throughout the world. Indeed, it is difficult to imagine a society making progress in the information economy without the unbridled participation of women. The special measures taken to focus on this matter valuably broaden the scope of the discussion, which this volume will engender.

As proud as we are to be associated with this volume, we are similarly pleased with the partnerships we have developed with regional institutions to develop locally relevant information economy indicators. Our work with the Economic Commission for Latin America and the United Nations Economic Commission for Africa in building national and regional statistical capacity in the information economy is a fortuitous supplement to this volume.

As the second phase of the World Summit on the Information Society (WSIS) closes in Tunis in November 2005, it is a useful time to monitor, measure and reflect on how far we've all traveled since the first Information Society and Development Conference in Midrand, South Africa, in 1996. This event was followed by the Global Knowledge Partnership, the DotForce, the UN ICT Task Force and the WSIS events. Ideally, the discussions that publications such as ***"From the Digital Divide to DIGITAL OPPORTUNITIES: Measuring Infostates for Development"*** present will help inform the next steps we take in bringing access to ICTs and skills to people the world over.

Chapter 1

INFOSTATES AND THE DIGITAL DIVIDE

We live in times of sweeping change, wide in scope and dizzying in speed. Beyond the geopolitics of our era, the major force behind this wholesale transformation is the new technological tsunami that envelops our planet, epitomized by the digital revolution. Largely due to the explosive surge of ICTs and their applications, actual and impeding, we are witnessing fundamental shifts in economic arrangements with critical consequences for the future of our societies. Some are already well underway, some are expected over the longer term, and others are still unknowable. Yet some things, particularly those associated with old imbalances, move at a snail's pace or even in the wrong direction.

For good reason, keen interest and sheer curiosity have skyrocketed over the last decade in particular, as to what it all means and how the new-found possibilities can be harnessed to better serve humankind. Concerted efforts have been devoted to the specific issue of untangling the linkages between the diffusion and use of ICTs and economic development. Almost-instinctive early beliefs that ICTs represent a powerful new addition to the development arsenal are increasingly coupled with hard evidence that this is so. At a time when the new offers previously unimaginable opportunities, it also comes with the potential to seriously exacerbate existing sizeable and unwanted imbalances to the point that, if not properly addressed, they may look desirable down the road. In a nutshell, this is the story of the Digital Divide.

Simply understood as the gaps between ICT 'haves' and 'have-nots', the Digital Divide represents the newest addition to the enormous chasms in the stage of development and the standard of living among economies. It represents the area of overlap between the economic and the social aspects of the Information Society, and matters enormously to the extent that ICTs represent an historic opportunity for our evolution. Not only it is economically and socially undesirable to leave behind substantial population masses, but the realization of many of the promises of ICTs, including phenomena like e-government and e-commerce, also depend crucially on the elimination of the Digital Divide. The twin issues of the opportunities and the threats associated with ICTs provided the impetus for the World Summits on the Information Society (WSIS, Geneva 2003 and Tunis 2005).

While these broad issues are largely understood by now, numerous others remain to be dealt with, including those related to the transmission channels that link ICTs and development and the balance of mainstreaming ICTs through ongoing efforts for development. As an area of investigation, the Digital Divide is multifaceted and serves as a prime example of the need

for multi-disciplinary approaches. From early on, much like every Information Society issue, the Digital Divide came to the fore with the need for measurement. The specific need for an instrument that would quantify the Digital Divide and systematically monitor its evolution became evident. This is where the present project is situated. While the issue is clearly applicable wherever masses of people live, including within economies, the focus of this work is on measurements across economies.

The project's objectives and terms of reference

In recent years, measurement initiatives have taken on the examination of several aspects of the Information Society. Our focus is on the Digital Divide, which is ICT-centric. Furthermore, the stakeholders established clear overall objectives for the project: develop a model, grounded on a sound conceptual framework, the empirical application of which will make possible the systematic measurement of the state and the evolution of the Digital Divide internationally. Thus, the new instrument should be capable of monitoring the Digital Divide:

- **across economies at a given point in time, and;**
- **within economies over time.**

Moreover, it was stipulated that its development will be guided by the following terms of reference:

- Place emphasis on developing economies;
- Rely on a modeling approach that yields policy-relevant results;
- Focus on ICTs, but be broader in scope than pure connectivity measures.

All along, the aim has been to ascertain the relative status of economies and, especially monitor relative progress - both across economies and components of interest within economies. Therefore, this instrument provides the international community with a useful mechanism towards: the identification of the state of affairs and relative needs among economies; the allocation of investments to their most appropriate uses, and; the monitoring of performance.

Several implications stem from the above, which were addressed during the development of the conceptual framework (Orbicom 2002), as well as the full application of the model (Orbicom 2003). A synopsis of the new approach is offered next.

1.1 The Conceptual Framework

Like other well-known imbalances, the measurement and analysis of the Digital Divide require a rigorous framework.

The conceptualization begins with the basics. The overriding issue of a society concerns the quality of life of its people. In that regard, the economy plays the key role, but it is situated all along within the broader socio-economic, geopolitical and cultural environment of a country. ICTs affect everything and they are treated as an economic and social reality.

A distinction is made between *consumptive* and *productive* functions. Following economic theory, while the current standard of living of the people depends largely on consumption, over time we

must confront the problem of expanding the production capabilities of a country in a sustainable way. This brings us to the whole issue of economic growth and, by extension, to economic development.

The nature of ICTs is dual; they are both productive assets, as well as consumables. In that setting, the conceptual framework developed the notions of a country's **infodensity** and **info-use**. Infodensity refers to the slice of a country's overall capital and labour stocks, which are ICT capital and ICT labour stocks and indicative of productive capacity. Info-use refers to the consumption flows of ICTs. Technically, it is possible to aggregate the two and arrive at the degree of a country's 'ICT-ization', or **infostate**. The Digital Divide is then defined as the relative difference in infostates among economies. Thus,

Infodensity = *sum of all ICT stocks (capital and labour)*
Info-use = *consumption flows of ICTs/period*
Infostate = *aggregation of infodensity and info-use*

Infodensity: The productive capacity of a country is determined by the quantity and quality of its factors of production. At any given point in time, the productive capacity is fixed because the factor stocks and the technology with which they are combined are fixed, but over time they are all expandable. Factor growth, technological improvements and productivity gains are instrumental and ICTs affect them all.

ICT and non-ICT factor inputs are combined to produce ICT and non-ICT goods and services, without a one-to-one correspondence. At the end of the numerous production processes, part of the outputs will be in the form of ICT outputs, which will be absorbed as consumables (final demand) or will be added back to the capital stock (gross investment – replenishing the used-up ICT capital and augmenting it). The same holds true for ICT skills.

ICT capital comprises **network** infrastructure and ICT machinery and equipment. ICT labour is perceived not as a collection of individuals, but as the stock of the ICT **skills** of those in the labour force. In this formulation, produced output will be an increasing function of these ICT stocks, as it is for all other forms of capital and labour.

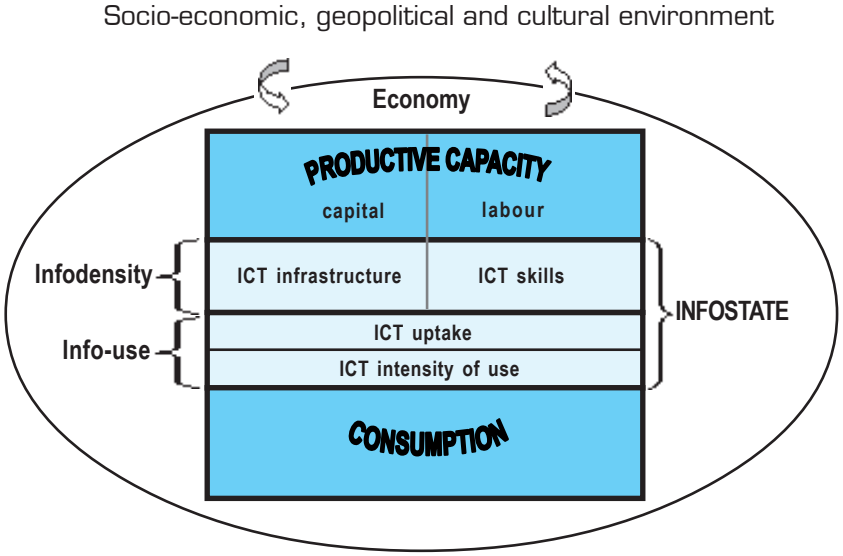
Info-use: The availability of ICT goods is indispensable for the consumption of ICT services that would satisfy ultimate needs, and building 'consumptive capacity' is a prerequisite to generating consumption flows. In that vein, a distinction is made between ICT **uptake** and ICT **intensity of use**. (Roughly speaking, uptake refers to ICT goods, while intensity of use to ICT services).[1]

Uptake and intensity of use also permit any level of desired detailed disaggregation, subject to the availability of statistical data. For instance, sectoral measurements and analyses can be accommodated. Businesses can be split by size or industry sector, and governments by level (national, regional, local) and type of institution (public administration, schools, health). Furthermore, groups of households/individuals can be differentiated by gender, urban and rural locations, income, level of education and other characteristics important for the understanding of digital divides internal to an economy.

[1] *A good case can me made that, in addition to the intensity of use (how much), how "smart" the use is also matters. This relates to the derived satisfaction in the case of individuals and to the issue of productivity in businesses (organizational innovations accompanying technological innovations). Considering that it would be futile to hope for such data today, this is left outside the purview of the framework. It can be dealt with more appropriately with case studies.*

The figure below provides a schematic of the conceptual framework.

Figure 1



What really matters for development is the utilization of the productive stocks rather than their availability. Having underutilized roads, abandoned factories and rusted telecommunications networks does not increase productive capacity. The same holds true for unemployed or underutilized labour and its skills. The supply-side refers clearly to the productive capacity of the country, but it is differentiated from actual production both because of capacity underutilization and trade.

Considering the intuitive and inextricable link of ICTs with the overall factor stocks and the continuous introduction of new ICTs, infodensity and info-use are clearly not bounded upwards but are expandable over time. Even as consumables, achieving complete uptake today means nothing for tomorrow. For instance, if every available ICT had achieved 100% penetration and use rates prior to the arrival of the Internet, the ceiling would have moved upwards immediately after. The same holds true for skills, with obvious implications for productivity. Consequently, there is no pre-set, absolute upper infostate limit that can be achieved over time.

1.2 The Empirical Model

For measurement purposes, the conceptual framework serves as a guide for an operational model which approximates pragmatically the purity of the concepts. Statistical techniques are combined with, and guided by, subject matter considerations and the project's terms of reference. As is always the case, such an exercise involves several nuances and is invariably imperfect. Practically, many decisions must be made, driven largely by the availability of comparable statistical data across a very large number of economies. Therefore, the empirical application of the model reflects the best measurements that can be had today. At the same time, it serves to identify data gaps. If the latter are closed, through concerted long-term multi-stakeholder efforts, future measurements will naturally improve.

The building blocks of the model are the notions of infodensity and info-use, and their constituent components: ICT capital, ICT skills, ICT uptake and ICT intensity of use. Several alternative empirical applications are admissible under the framework. The modeling approach chosen here relies on **indicators**. While often times matching concepts with existing indicators is straightforward, there are instances where the existing data and/or their available disaggregation make for a less obvious choice. Nevertheless, an exercise relying on existing data involves allocation decisions that must be made. The list of indicators chosen and their allocation in the Infostate model is shown in the following table. The complete methodology and the technical specifications, together with explanatory notes, are contained in detail in Chapter 8.

Indicators are useful to focus the discussions of complex issues on their important components, and to illustrate the direction of their movement and the order of magnitude of change. Indicators come in any kind, shape or form and can be expressed in various units of measurement. Invariably, the value of individual indicators depends on the context within which they are used. Indicators are generally more useful for differences of some scale and are not substitutes for detailed analyses of specific issues. One must have knowledge of what indicators purport to indicate, which requires knowledge of the subject matter around them, including as much 'metadata' information related to their construction as possible.

Chosen indicators should be 'well-behaved', that is, the direction of their movement should be unambiguously linked to whether or not we are moving towards, or away from, a desired state. In addition, they should be unbiased and in the case of ICTs 'technology-neutral'. Practically indicators are selected through a combination of reasonableness and availability, and every indicator has its strengths and limitations. Over the longer term, areas of interest and statistical gaps can be identified for investment in the production of more and better indicators. In principle, we do not gain by merely adding indicators. It is more productive to find more suitable ones to substitute.

Consistent with the need for policy relevance, as opposed to business usefulness, infostates are expressed in **relative terms**. Thus, a small country like Luxembourg can have a higher infostate than a much larger one, say, India. In absolute terms something like that is unlikely to happen - and this matters for businesses with an eye on market size.

Considering the relative nature of the Digital Divide due to the constant evolution of infostates everywhere, the model calls for a **reference country** and a **reference year**.

The reference country facilitates benchmarking, while the reference year makes possible the monitoring of the evolution of each country's infostate components over time. The year 2001 was chosen as the reference due to the availability of additional indicators. Rather than choose a specific country, two useful alternatives that offer immediate and intuitive initial benchmarking were created and included in the calculations: Hypothetica, a country that represents the average values of all economies examined, and; Planetia, whose values are those of the planet as a whole.

INFOSTATE

Infodensity

Networks

Main telephone lines per 100 inhabitants
Waiting lines/mainlines
Digital lines/mainlines
Cell phones per 100 inhabitants
Cable TV subscriptions per 100 households
Internet hosts per 1,000 inhabitants
Secure servers/Internet hosts
International bandwidth (Kbs per inhabitant)

Skills

adult literacy rates
gross enrolment ratios
- primary education
- secondary education
- tertiary education

Info-use

Uptake

TV equipped households per 100 households
Residential phone lines per 100 households
PCs per 100 inhabitants
Internet users per 100 inhabitants

Intensity

Broadband users/Internet users
International outgoing telephone traffic minutes per capita
International incoming telephone traffic minutes per capita

The reference country facilitates benchmarking, while the reference year makes possible the monitoring of the evolution of each country's infostate components over time. The year 2001 was chosen as the reference due to the availability of additional indicators. Rather than choose a specific country, two useful alternatives that offer immediate and intuitive initial benchmarking were created and included in the calculations: Hypothetica, a country that represents the average values of all economies examined, and; Planetia, whose values are those of the planet as a whole.

Further empirical considerations

ICT capital comprises all kinds of material goods, from wires and cables, to keyboards, printers, sophisticated routers and switches. They combine to form machinery, equipment and networks. Compared with conventional analyses of goods and services, networks come with their own idiosyncractic nature. One of their major features concerns the well-known 'externalities'. Simply put, the value of a network and the benefits accruing to its users, increase with the number of users. Moreover, major infrastructure build-ups are accompanied by small marginal costs of connections. It is the same networks that are used for consumption and production of many services. In the model, **ICT networks** are associated with infodensity.

The ICT labour stock is really a set of skills, as opposed to ICT versus non-ICT occupations or employment in ICT sector industries. As the use of ICTs becomes more pervasive, such skills are used by people whose primary occupation is a computer programmer, but also a secretary, a waiter or a car mechanic. While the labour stock includes those with labour force age, there are also those below and above the limits who consume ICTs - students and seniors. They obtain skills at school or through some other formal or informal training and consume ICT goods and services, but they are not part of their production. There is substantial overlap between consumption-related skills and skills related to the productive capacity of a country, since a very large number of individuals are involved as both employees and consumers. Such skills are transferable back and forth between productive and consumptive functions. Work in measuring ICT skills is at an early stage. Until it is further advanced, it is not unreasonable to assume that ICT skills necessary for production and consumption move in parallel. Furthermore, **ICT skills** cannot be viewed in isolation but they are part of the overall continuum of people's skills, which starts with basic literacy.

Although households are seen as a consumptive sector, ICT consumption involves the use of capital and skills, both of which are becoming increasingly complex as consumption expands from staples to sophisticated technological goods and services. Many ICT goods are indispensable for the ultimate consumption of ICT services. Such **ICT uptake** forms part of households' 'consumptive capacity', which determines current and future consumption flows. According to the framework, what matters in a society is overall consumption, not just consumption of ICTs. As more ICTs are consumed, many substitutions take place. They can come either in the form of opportunity costs (spending on a cell phone by prolonging the life of clothing) or displacement (substituting a broadband Internet connection for dial-up service). In the very least, they will be substitutions in consumption due to the inescapable 24-hour-day constraint. When a new ICT enters the consumption basket, the relative proportions of ICT and non-ICT consumables will change. Although a continuously higher relative proportion of ICTs in consumption is not the objective, such substitutions do not represent 'force-feeding'. Thus, they will be regarded as reflective of consumer choices and therefore positive. This is closely related to **ICT intensity of use**, a component for which the exiting data are deemed unsatisfactory to measure independently at this stage.

Finally, ICTs are the product of technological convergence between new and older technologies. The newer ones are mainly associated with two-way interactivity rather than one-way information provision. Frequently, in work involving developed economies, the older ICTs are either ignored or downplayed because they have achieved such a widespread penetration that it makes them uninteresting in comparative analyses. A prime example is television. While this may make sense in that context, their inclusion is indispensable when the emphasis is on developing economies and therefore they will be included here.

Data gaps

It is well-known that data gaps exist in the area of Information Society. In the course of the research, the following limitations were identified:

- lack of enough indicators,
- lack of adequacy of fit of indicators,
- insufficient quality of some indicators.

Clearly, there is ample room for a concerted international effort to develop ongoing information concerning matters of information and knowledge-based societies with a development angle. Indeed, such an effort is underway by an international partnership (see UNCTAD 2004, 2005). If the present framework, in conjunction with its information requirements and identification of data gaps, proves helpful towards such a mission, it will have made a modest contribution.

Chapter 2

OVERVIEW OF GLOBAL TRENDS

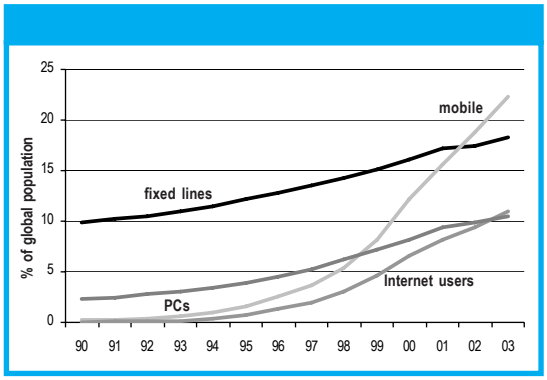
by Vanessa Gray and Esperanza Magpantay
International Telecommunication Union

As the world moves towards a global information economy and information society, economies are becoming increasingly aware of the central importance of extending Information and Communication Technology (ICT) access to their populations. With the growing recognition of ICTs as effective tools for economic growth and social development, there are ever-greater incentives for economies to foster higher access levels, improve their *Infostates*, and eventually overcome the digital divide, the gap that separates those *with* and those *without* ICT-related opportunities.

Access to ICTs has been growing at high speeds, exceeding global economic growth. This growth is being driven by both demand-side factors, such as the increasing popularity of mobile phones and the Internet, and by supply-side factors, such as regulatory reforms, falling costs and prices, and technological innovation. The astounding speed with which ICTs, and particularly the mobile phone and the Internet, are permeating every country, exemplifies the world's path towards a global information society. ICTs are affecting lives everywhere around the world and historic developments are taking place across the technological board.

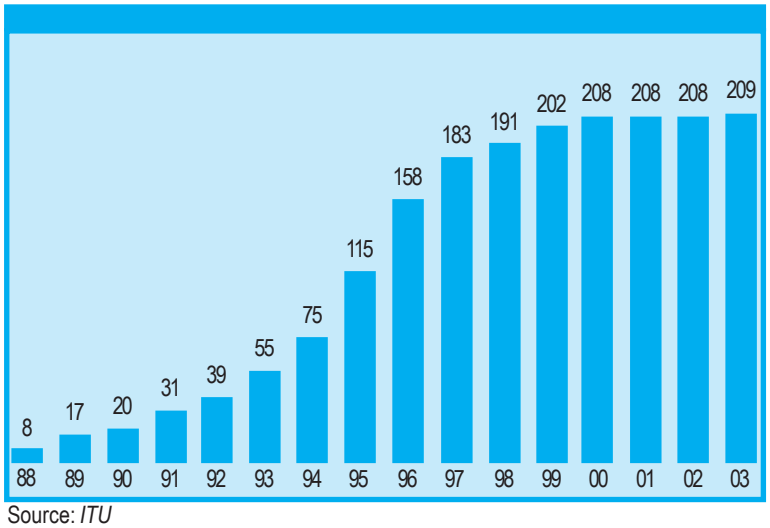
The growth in the use of mobile phones, in particular, has been phenomenal, and since 2002 there are more mobile than fixed telephone subscribers around the world. From just 11 million subscribers in 1990, the number of mobile cellular subscribers exceeded 1.4 billion by the end of 2003, experiencing an annual average growth rate of 45% compared to just 6% for fixed telephone line subscribers. In terms of users, one in five people around the world today has a mobile phone, up from one in 339 people in 1991 (Chart 2.1). The total number of telephone subscribers (the sum of fixed and mobile) more than quadrupled from 530 million lines in 1990 to 2.5 billion in 2003. As a result, total telephone penetration rose from 10.1 subscribers per 100 inhabitants to 40.5 during the 1990-2003 period.

Chart 2.1 **ICT users worldwide**



Source: *ITU World Telecommunication Indicators Database*

Chart 2.2 **Number of economies connected to the Internet**



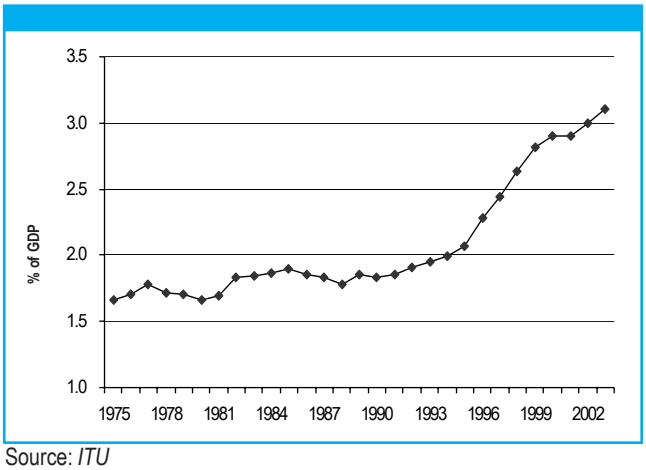
Source: *ITU*

The Internet, a network that began accepting global connections only some 15 years ago, has also spread at great speed. From only eight economies online in 1988, virtually every country in the world has an Internet connection today (Chart 2.2). By the end of 2003, there were an estimated 691 million Internet users around the world. Expressed as a global average, this means that by the end of 2003 some 11% of the global population used the Internet.

The estimated number of personal computers (PCs) rose from some 120 million in 1990 to 650 million in 2003. Worldwide PC penetration (PCs per 100 people) stood at 10.1, just below the Internet penetration rate at the end of 2003. Growing investment in information technology, falling prices through technological improvement and reductions in trade barriers, domestic production, and greater functionality have driven PC sales. Another major factor has been the use of the PC as the leading access device to the Internet.

The economic and social impacts of ICTs are equally important. The growth in ICT sector industries has been much higher than growth in overall economic activity, as measured by Gross Domestic Product (GDP), something that is reflected in the growing share of ICT industries in global output. Between 1975 and 2003, for example, telecommunication service revenues as a percentage of GDP doubled, from 1.6% to 3.2% (Chart 2.3). Although the ICT sector is important in its own right, its greatest impact is through the use of ICT services and products by other sectors to enhance productivity and generate new revenue streams. Economies are just starting to try to measure this impact of ICTs outside the ICT sector itself.

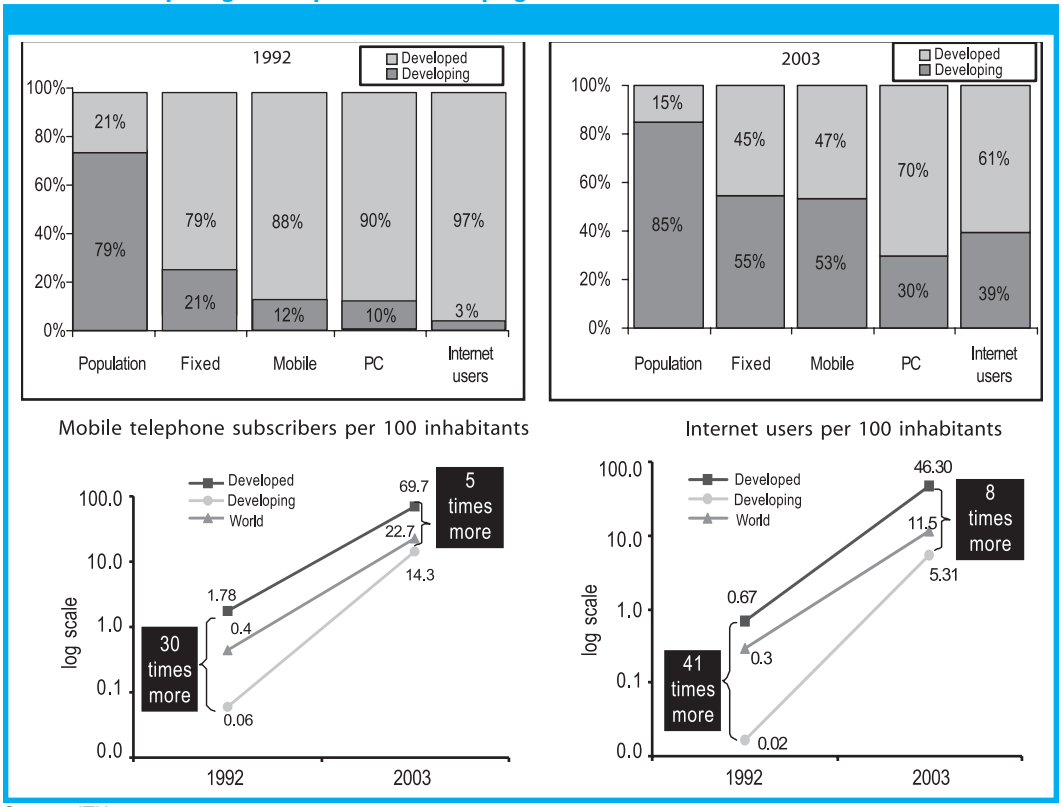
Chart 2.3 **Telecom service revenues, worldwide**



Source: *ITU*

Over the last fifteen years the growth in fixed and mobile phones, PCs, and the Internet has been greatest in the developing world moderating somewhat the overall gap between developed and developing economies. While, for example, in 1992, only 3% of the world's Internet users were from the developing world, this increased to nearly 40% just over a decade later. This trend is true for fixed and mobile phones, and the Internet, and occurs despite the increase in the population living in the developing world (Chart 2.4).

Chart 2.4 **Comparing developed and developing economies**



Source: *ITU*

Notwithstanding the impressive ICT growth in recent years, the digital divide has not been erased and continues to separate the information-poor from the information-rich. Indeed, very sizeable gaps remain. While at the end of 2003 the developing world made up 85 percent of the world's population, it hosted just 55 percent of the world's fixed lines, 53 percent of the world's mobile subscribers, and 39 percent of its Internet users. In fact, by year-end 2003, the Internet penetration rate of the developed world was still eight times that of the developing world (Chart 2.4, top right and bottom left).

The world is also divided by major regional differences in ICT access and use (Table 2.1). While almost half of the population in many developed economies use the Internet, only one in one hundred people in Sub-Saharan Africa were online at the end of 2003. In the mobile sector, a number of economies had more mobile subscribers than population (such as Italy or Luxembourg), but others, including D.R. Congo, Ethiopia, and Lao P.D.R, had penetration rates of less than 3%.

A technology that has been receiving a great amount of attention is broadband, a term used to describe technologies that offer a high-speed and permanent connection to the Internet. Its ability to deliver a variety of new applications promises wide-ranging social and economic benefits. Broadband has also become a very important indicator to benchmark economies and show how far they are in turning into information economies and societies. Given the importance attributed to

Table 2.1 **Access to ICTs by region**

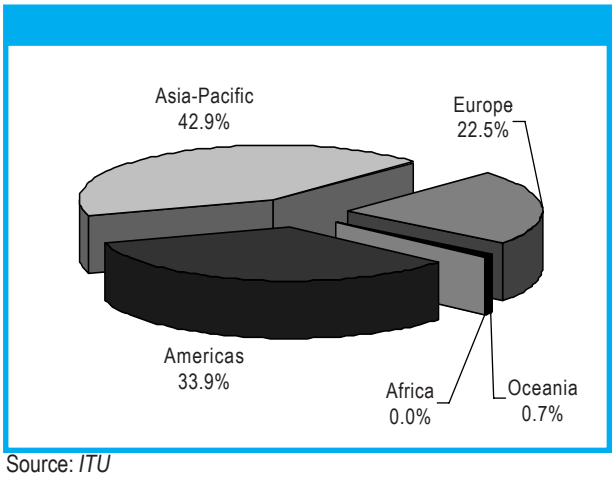
	Telephone lines and cellular subscribers		PCs		Internet users	
	per 100 inhabitants					
	1990	2003	1990	2003	1990	2003
World	**10.1**	**40.5**	**2.5**	**10.1**	**0.05**	**11.1**
Developed	45.4	124.7	11.1	44.9	0.3	44.8
CIS	12.5	29.4	0.3	6.8	0.0	3.6
Transition economies of south-eastern Europe	13.8	57.7	0.2	6.5	0.0	13.5
Developing	2.3	25.0	0.3	3.4	0.0	5.1
Northern Africa	2.9	21.0	0.1	2.0	0.0	3.4
Sub-Saharan Africa	1.0	6.0	0.3	1.2	0.0	1.1
Latin America and the Caribbean	6.4	40.4	0.6	6.8	0.0	9.0
Eastern Asia	2.4	47.3	0.3	5.6	0.0	8.9
South Asia	0.7	7.1	0.0	1.1	0.0	1.7
South-eastern Asia	1.4	20.9	0.3	2.8	0.0	6.1
Western Asia	10.0	45.8	1.2	5.6	0.0	7.2
Oceania	3.4	10.1	0.0	6.1	0.0	3.8

Source: *ITU*

this enabling technology, it is particularly worrying that by the end of 2003 more than half of the world's economies had not yet started offering this service. While worldwide 15% of the world's Internet users were going online through a high-speed connection, these were mainly concentrated in a few developed economies and regions - particularly parts of Asia, Europe and North America (Chart 5). Twelve economies, including the Republic of Korea, Canada, the U.S., Israel, Japan and a number of European economies had double-digit broadband penetration rates.

These trends show that even though disparities have been generally decreasing somewhat over the last decade, particularly in terms of access to mobile phones and the Internet, there are still major gaps amongst economies today. In many parts of the world the arrival of the information economy and society is still a long distance away, and many barriers remain to be identified, dealt with, and overcome. This requires additional detailed analysis, and analysis requires statistics. Economies and other interested stakeholders in the development of ICTs need to identify disparities, track progress and benchmark through international comparisons.These trends show that even though disparities have been generally decreasing somewhat over the last decade, particularly in terms of access to mobile phones and the Internet, there are still major gaps amongst economies today. In many parts of the world the arrival of the information economy and society is still a long distance away, and many barriers remain to be identified, dealt with, and overcome. This requires additional detailed analysis, and analysis requires statistics. Economies and other interested stakeholders in the development of ICTs need to identify disparities, track progress and benchmark through international comparisons.

Chart 2.5 **Broadband subscribers by region, 2003**



Source: *ITU*

Chapter 3

EMPIRICAL APPLICATION AND ANALYSIS

Based on the conceptual framework and the model outlined in Chapter 1, the first full-scale empirical application was carried out in 2003 and provided measures up to 2001. The results were disseminated in time for the Geneva WSIS (Orbicom 2003). What follows in this chapter, is an update of that empirical application and covers the period from 1995-2003, the last year for which data were available. In total, 192 economies are included in the measurements of *networks*, covering 98% of the global population in 2003, 153 economies are included in *skills* and overall *Infodensity*, covering 96% of the population, 149 economies are included in *Info-use* and 139 economies are included in the measurements of overall *Infostates*, covering more than 95% and 94% of the global population, respectively. The sole criterion for not including the remaining economies, either in their entirety or in specific components of the model, has been data availability. The reference year used in the measurements is 2001 due to the availability of additional indicators. The specific list of indicators used and their allocation by component is that contained in Chapter 1. Full methodological details and technical specifications are contained in Chapter 8. The results of the empirical application provide a rich framework with which to conduct a thorough analysis of the Digital Divide.

3.1 Magnitude of the Digital Divide

One of the first pertinent questions in the context of the Digital Divide has always been: **How big is the Digital Divide?** The following results quantify its magnitude through the measurement of Infostates and the major components of Infodensity and Info-use for individual economies and economy groupings.

Infostates

The Infostate results obtained from the model for 2003 are shown in Table 3.1. It becomes immediately evident that the gaps between the top and the bottom continue to be enormous. Infostate values range from a high of 254.9 to a low of 7.9. Literally, the *have* and the *have-not* economies are worlds apart, separated by many decades of development.

The 139 economies for which existing data make it possible to estimate Infostate values were divided into five groups, for analytical

Table 3.2 **Economy groups**

	Number of economies	% of population		Infostate index values	
		world	Infostate	low	high
HIGH	23	13.0	13.8	192.1	254.9
ELEVATED	24	4.1	4.4	114.5	175.7
INTERMEDIATE	26	33.2	35.2	72.8	111.1
MODERATE	34	29.3	31.1	33.7	69.6
LOW	32	14.7	15.6	7.9	31.2
Total	**139**	**94.2**	**100.0**	**7.9**	**254.9**

purposes. These groups, together with the number of economies within each group and the populations they represent are shown in Table 3.2.[2] Economies in the group with highly advanced Infostates are from Western Europe (including all Scandinavian economies, the Netherlands, Switzerland, Belgium, Luxembourg, the U.K. and Germany), the U.S. and Canada from North America, Hong Kong, Singapore, the Republic of Korea and Japan from Asia, as well as Australia, New Zealand, and Israel. This group of 23 economies accounted for 13% of the global population in 2003. It must be emphasized that the exact positions among economies in this group is not considered analytically useful. The true objective of the model is to measure the difference between this group with very ***high*** Infostates and the others, rather than differences within this group of economies - for which a lot more and very detailed data would be required.

The 32 economies in the ***low*** Infostate group represented about 15% of the world's population in 2003 and their values range from a low of 7.9 to a high of 31.2. They are heavily concentrated in Africa, with Chad, Ethiopia, and the Central African Republic at the very bottom. Non-African economies in this group are Myanmar, Cambodia, Bangladesh, Nepal, Lao, Yemen and Pakistan.

Between the groups with high and low Infostates, are three very diverse groups. The second group contains 24 economies with sufficiently ***elevated*** Infostates, ranging from 114.5 to 175.7. These economies collectively accounted for only 4% of the world's population, as many are small. Here we find economies from Southern Europe (Portugal, Italy, Spain, Malta, Cyprus and Greece), from Eastern Europe (Slovenia, Estonia, the Czech Republic, Hungary, the Slovak Republic, Poland, Latvia, Croatia and Lithuania), together with Chile, Uruguay and Argentina from Latin America, United Arab Emirates, Bahrain and Qatar from the Arab states, Macau and Brunei Darussalam from Asia. From the Caribbean, Barbados is also here.

The third group contains 26 economies with ***intermediate*** Infostate values ranging from 72.8 to 111.1, accounting for one-third of the world's population. This group represents a geographically diverse list with Latin American economies (Brazil, Costa Rica, Belize, Colombia, Venezuela, El Salvador, Panama, and Peru), economies from the Arab states (Kuwait, Saudi Arabia and Jordan), a couple of relatively advanced African economies (Mauritius and South Africa), as well as Malaysia, Thailand and China from Asia. It also includes economies from the Balkans (Bulgaria, Romania, Yugoslavia), as well as Jamaica and Trinidad and Tobago.

The fourth group contains 34 economies with ***moderate*** Infostates, whose values range between 33.7 and 69.6, and accounts for 29% of the global population. Many Latin American economies are here (Ecuador, Bolivia, Paraguay, Guatemala, Nicaragua and Honduras), as well as Asian economies (Iran, Armenia, Mongolia, Kyrgyzstan, Indonesia, Sri Lanka, Vietnam and India). In this group we also find North African economies (Tunisia, Egypt and Algeria) and several others from sub-Saharan Africa (Botswana, Gabon, Zimbabwe, Togo and Gambia).

The groups with *intermediate*, *moderate* and *low* Infostates contain economies with values below the average economy, Hypothetica (Chart 3.1). A closer examination reveals that this is the case for the majority of economies. From the 139 included in Infostate measurements, 92 economies (two-thirds), accounting for over three-quarters of the global population, are performing below average. The 47 economies in the two groups with *high* and *elevated* Infostates have above average values, but accounted for 17% of the population in 2003. More specifically, the *moderate* and *low* Infostate

[2] *Like any line drawing, this is arbitrary. However, the analytical findings based on these groupings are robust regardless of the exact lines.*

groups combined accounted for 44% of the global population (about half if we factor in the missing 6% of the population in economies for which Infostates were not measured). (This situation would have been worse, had it not been for the rapid rise in China, which moved from the *moderate* to the *intermediate* group after 2001). Thus, easily half the population of the planet lives in economies with relatively low Infostate development.

Infodensity and Info-use

Considering that the Digital Divide is defined as the difference between economies' Infostates, it is clearly affected by anything that affects Infostates. A closer look at the two main building blocks, the Infodensity and Info-use aggregates (also shown in Table 3.1), sheds more light on their relative influence.

There is generally a high degree of consistency between the Infodensity and Info-use values for a given economy. If an economy is high in one, it is likely to be high in the other. All 23 economies in the *high* Infostate group would be classified there according to Infodensity, and 22 of them would again be classified in the *high* group according to Info-use. Generally, the same holds true for economies with *intermediate*, *moderate* or *low* Infostates. Of the 32 economies in the low group, for instance, only two improve their grouping according to Infodensity (Djibouti and Kenya move from the high end of the *low* group to the low end of the *moderate* group), while only Senegal moves from the *low* group to the *moderate* group according to Info-use.

Info-use has a greater range of values (between 264.0 and 5.9) than Infodensity (between 246.1 and 10.8), mostly due to the skills measurements which are subject to a lesser gap and therefore moderate the Infodensity range. Overall, however, the gaps between the economies in the top and the bottom of the distributions in either aggregate are not very different.

Among economies in the *high* Infostate group, Denmark and Sweden dominate Infodensity, followed by the Netherlands, Finland and Norway, whereas in Info-use, it is Switzerland, Singapore, Hong Kong and Canada faring comparatively better. Small differences exist at the *low* Infostate goup, with African economies, along with Myanmar, falling short in both Infodensity and Info-use.

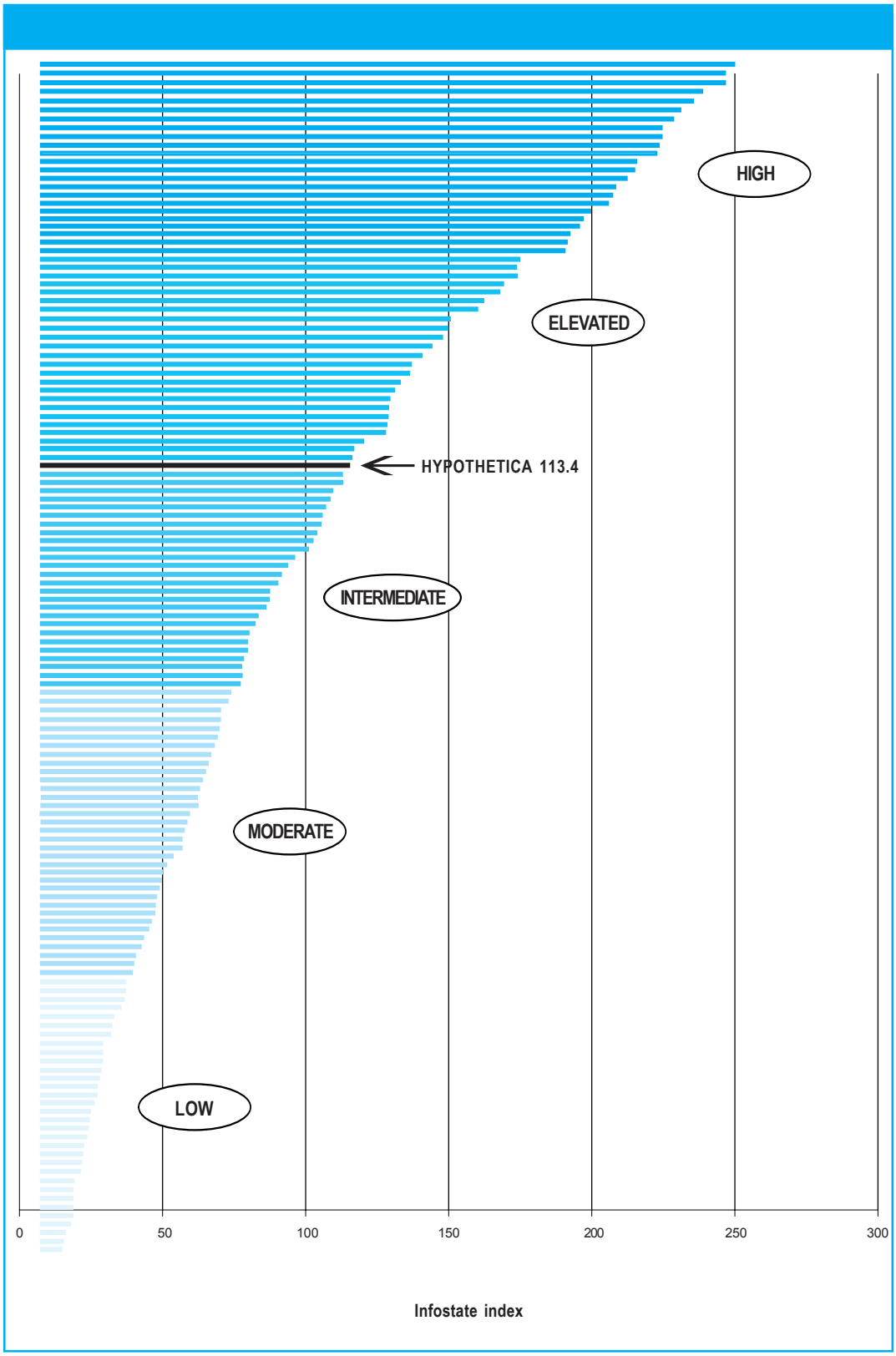
From the *high* group, only Finland has a higher Infodensity value than Info-use. This is also the case for many Eastern European economies in the group with *elevated* Infostates (the Czech Republic, Hungary, Latvia, the Slovak Republic, Poland and Lithuania), as well as Greece, Uruguay, Argentina and Brunei Darussalam. The list becomes longer for the remaining economy groups – largely African and Latin American economies. Moreover, Greece, Uruguay, Argentina, Brunei Darussalam, Bulgaria and Brazil have above-average Infodensity values but below-average Info-use values. The reverse is the case for Macau, Barbados, Bahrain, UAE and Malaysia with above-average Info-use values but below average Infodensities.

The benchmarking economies, Hypothetica and Planetia, behave very similarly in both Infodensity and Info-use.

Table 3.1 **Infostates, 2003**

	Infostate	Infodensity	Info-use
	indices		
HIGH (23 economies)			
Denmark	254.9	246.1	264.0
Sweden	251.1	242.4	260.1
Switzerland	250.7	219.0	286.9
Netherlands	242.5	238.5	246.6
Norway	239.5	234.3	244.8
Canada	235.0	201.4	274.1
United States	231.8	212.3	253.2
Finland	228.4	238.4	218.8
Hong Kong, China	227.9	185.2	280.5
Iceland	226.7	200.5	256.3
Singapore	225.7	180.1	282.7
Luxembourg	218.9	194.5	246.3
Belgium	217.8	207.5	228.7
United Kingdom	214.9	209.7	220.2
Austria	210.6	203.4	218.1
Australia	209.6	197.5	222.5
Korea (Rep.)	208.6	171.1	254.2
Germany	201.9	186.1	219.2
Japan	198.9	176.7	223.9
Ireland	197.7	189.7	206.1
Israel	194.0	177.5	212.0
France	193.7	181.2	207.1
New Zealand	192.1	177.4	208.0
ELEVATED (24 economies)			
Estonia	175.7	159.8	193.2
Slovenia	174.7	165.7	184.2
Malta	174.6	150.1	203.0
Italy	169.2	151.1	189.6
Spain	168.0	156.2	180.8
Portugal	162.2	154.7	170.0
Cyprus	160.0	132.7	192.9
Macao, China	149.9	105.4	213.3
Czech Republic	149.7	160.2	139.8
Hungary	147.2	159.3	135.9
Qatar	143.8	131.7	157.1
Barbados	139.5	96.5	201.8
Latvia	135.8	136.0	135.7
Slovak Republic	135.6	142.4	129.0
Poland	131.8	135.3	128.4
Croatia	130.2	117.3	144.5
Lithuania	128.1	132.6	123.7
Chile	127.7	118.7	137.5
Bahrain	127.3	97.8	165.7
Greece	127.0	140.8	114.5
United Arab Emirates	126.9	107.6	149.6
Uruguay	118.3	126.4	110.8
Argentina	115.0	124.4	106.2
Brunei Darussalam	114.5	121.4	108.1
HYPOTHETICA	**113.4**	**110.3**	**116.6**
PLANETIA	**113.4**	**110.4**	**116.4**
INTERMEDIATE (26 economies)			
Bulgaria	111.1	112.0	110.1
Malaysia	110.9	91.5	134.5
Brazil	107.3	110.7	104.0
Kuwait	106.1	84.6	133.2
Costa Rica	104.3	82.3	132.2
Lebanon	103.0	86.3	122.9
Mauritius	102.8	88.6	119.2
Romania	101.5	91.5	112.5
Trinidad & Tobago	99.9	94.4	105.7
Mexico	98.5	99.0	98.0
Turkey	92.9	94.9	91.0
Russia	90.2	95.1	85.6
Jamaica	88.1	79.0	98.1
Belize	86.8	83.9	89.8
Saudi Arabia	83.6	67.2	104.0
Yugoslavia (Serbia & Montenegro)	83.6	87.0	80.3
Colombia	82.8	79.5	86.3
Venezuela	79.6	73.8	85.8
Thailand	78.5	82.1	75.1
El Salvador	76.4	64.1	91.0
South Africa	76.1	86.7	66.8
Jordan	75.8	69.3	83.0
Panama	75.0	82.6	68.1
Moldova	73.5	79.1	68.3
China	73.5	61.5	87.7
Peru	72.8	70.8	75.0
MODERATE (34 economies)			
Fiji	69.6	66.9	72.4
Ukraine	68.6	82.0	57.4
Iran	66.0	47.3	92.1
Oman	65.9	55.0	79.0
Ecuador	65.6	61.3	70.1
Guyana	64.5	62.6	66.4
Georgia	63.5	67.2	60.0
Samoa	62.5	82.4	47.4
Namibia	60.8	62.9	58.8
Philippines	60.5	66.1	55.5
Armenia	59.1	56.4	61.9
Tunisia	58.0	46.7	72.0
Bolivia	57.6	66.9	49.6
Paraguay	57.5	68.7	48.0
Mongolia	54.8	52.2	57.5
Botswana	53.5	64.1	44.6
Egypt	52.4	44.4	61.9
Kyrgyzstan	52.3	52.8	51.8
Guatemala	52.1	59.1	45.8
Nicaragua	48.5	50.9	46.3
Albania	46.4	54.3	39.7
Indonesia	44.6	48.4	41.0
Gabon	44.1	47.2	41.2
Morocco	43.9	40.8	47.2
Syria	42.8	34.8	52.6
Zimbabwe	41.9	38.9	45.2
Honduras	41.9	42.1	41.7
Cuba	40.6	35.2	46.8
Algeria	39.7	36.0	43.7
Sri Lanka	37.8	45.1	31.6
Viet Nam	37.0	31.1	44.1
Togo	34.9	29.1	41.8
Gambia	33.9	34.8	33.1
India	33.7	34.5	33.0
LOW (32 economies)			
Djibouti	31.2	32.2	30.2
Senegal	31.0	25.8	37.4
Côte d'Ivoire	30.7	31.6	29.9
Sudan	29.1	27.6	30.7
Pakistan	26.9	26.2	27.6
Kenya	25.7	34.0	19.4
Yemen	25.7	23.0	28.6
Mauritania	22.7	26.0	19.8
Lao P.D.R.	22.7	30.5	16.8
Papua New Guinea	22.5	21.1	23.9
Zambia	22.3	27.5	18.1
Ghana	21.8	24.9	19.2
Cameroon	21.1	26.6	16.8
Benin	21.0	24.8	17.9
Nigeria	19.6	20.7	18.6
Tanzania	18.3	23.1	14.6
Nepal	18.2	19.7	16.8
Bangladesh	17.5	20.6	15.0
Cambodia	16.9	23.4	12.3
Mozambique	15.9	22.6	11.1
Madagascar	15.4	21.4	11.1
Uganda	15.0	24.3	9.2
Guinea	14.6	17.3	12.4
Burkina Faso	12.6	14.4	11.0
Angola	12.2	12.5	12.0
Malawi	12.2	18.2	8.1
Mali	12.1	14.9	9.8
Eritrea	11.9	9.7	14.6
Myanmar	10.7	14.7	7.7
Central African Rep.	8.8	11.5	6.8
Ethiopia	8.6	9.9	7.4
Chad	7.9	10.8	5.9

Chart 3.1 **Infostates by economy groups, 2003**



A profile of Hypothetica

Hypothetica is an economy with values equal to the average of all economies covered in the empirical application of the model. Consequently, it is based on a different number of economies for each component measured. That is, for indicators related to networks, Hypothetica represents the average of 192 economies, accounting for 98% of the planet's population in 2003. For indicators related to skills and overall infodensity it is based on the average of 153 economies, representing 96% of the population, while for info-use it is based on 149 economies representing 95% of the global population. Finally, for overall Infostate it is based on 139 economies accounting for 94% of the global population. In other words, it is the best average economy that can be derived from the existing data and not the average of each and every economy in existence.

In this context, every economy carries effectively the same weight regardless of its population. The use of Hypothetica as a benchmark fits well with how comparisons across economies are typically made. When policies are contemplated, implemented or monitored, it is not customary to benchmark the results against the average of the planet. It is, however, instructive to compare the situation of such an economy (Hypothetica) with that of the planet as a whole (Planetia). Several differences emerge, with their own analytical usefulness.

	1995	2003	growth 95-03	growth avg. annual
population	29,121,059	31,939,353	9.7	1.3
households	7,139,018	8,145,537	14.1	1.9
avg. family size	4.5	4.4	-	-
mainlines	3,590,137	5,979,896	66.6	7.6
waiting lists	226,456	96,599	-57.3	-11.5
digital lines	2,595,758	5,712,565	120.1	11.9
cell phones	472,373	7,272,669	1,439.6	47.8
cable	1,092,579	2,013,853	84.3	9.1
Internet hosts	49,440	1,127,952	2,181.4	56.3
secure servers	-	1,131	-	-
bandwidth (Kbs)	-	11,765,510	-	-
television households	5,955,850	7,704,394	29.4	3.7
residential mainlines	3,262,267	5,788,801	77.4	8.5
PCs	1,413,296	4,360,774	208.6	17.5
Internet users	265,620	4,863,044	1,730.8	51.5
broadband users	-	675,223	-	-
avg. int'l traffic (min.)	812,316,840	1,893,613,071	133.1	12.9

Infostate indicators	1995	2003
mainlines/100	18.9	23.2
waiting lists/mainlines	27.6	8.4
digital lines/100 mainlines	70.5	93.1
cell phones/100	2.2	33.5
cable/100 households	9.8	15.7
Internet hosts/1000	1.6	23.4
secure servers/1000 Internet hosts	-	10.9
bandwidth (Kbs/capita)	-	0.6
literacy rate (%)	78.6	82.5
gross enrolment in primary ed. (%)	94.5	99.7
gross enrolment in secondary ed. (%)	61.7	69.9
gross enrolment in tertiary ed. (%)	18.8	25.4
television households/100 households	58.6	68.0
residential mainlines/100 households	41.9	49.8
PCs/100	5.0	14.6
Internet users/100	0.7	16.4
broadband users/100 Internet users	-	5.1
avg. int'l traffic (min/capita)	44.2	81.4

A profile of Planetia

Planetia represents the planet at large, as if it were one economy. Consequently, its values are the sums of all economies covered in the empirical application. It is offered as an additional benchmark.

It is often the case that the values assumed by individual indicators of Planetia fall short of those for Hypothetica, whereas other times they exceed them. This is so because of the sizeable differences among economies with respect to their levels of connectivity, as well as their population bases. When large economies fall substantially below average, Planetia's indicators trail those of Hypothetica. Moreover, in Hypothetica, many small economies may have sizeable measures, which are weighted as much as a large economy's. Some examples include the average family size, where the average country has values higher than the planet, as well as telephone mainlines, cell phones and PCs. Conversely, when economies with substantial populations have penetration rates higher than average, Planetia's indicators surpass Hypothetica's. Examples are television households and Internet hosts. For skills indicators, where literacy rates and gross enrolment ratios are measured in percentages rather than absolute figures, the values for both Hypothetica and Planetia are the same.

In effect, Planetia is the weighted average of all economies, the weights being the economy populations. Considering, for instance, that China and India together account for more than one-third of the planet's population demonstrates this perspective well.

			growth		Infostate indicators		
	1995	2003	95-03	avg. annual		1995	2003
population	5,591,243,376	6,132,355,746	9.7	1.3	mainlines/100	12.3	18.7
households	1,370,691,485	1,563,943,183	14.1	1.9	waiting lists/mainlines	6.3	1.6
avg. family size	4.1	3.9	-	-	digital lines/100 mainlines	72.3	95.5
mainlines	689,306,277	1,148,140,103	66.6	7.6	cell phones/100	1.6	22.8
waiting lists	43,479,572	18,547,025	-57.3	-11.5	cable/100 households	15.3	24.7
digital lines	498,385,523	1,096,812,482	120.1	11.9	Internet hosts/1000	1.7	35.3
cell phones	90,695,594	1,396,352,406	1,439.6	47.8	secure servers/1000 Internet hosts	-	1.0
cable	209,775,226	386,659,773	84.3	9.1	bandwidth (Kbs/capita)	-	0.4
Internet hosts	9,492,558	216,566,760	2,181.4	56.3	literacy rate (%)	78.6	82.5
secure servers	-	217,164	-	-	gross enrolment in primary ed. (%)	94.5	99.7
bandwidth (Kbs)	-	2,258,978,003	-	-	gross enrolment in secondary ed. (%)	61.7	69.9
television households	887,421,620	1,147,954,636	29.4	3.7	gross enrolment in tertiary ed. (%)	18.8	25.4
residential mainlines	486,077,775	862,531,292	77.4	8.5	television households/100 households	66.3	75.3
PCs	210,581,084	649,755,374	208.6	17.5	residential mainlines/100 households	36.3	56.5
Internet users	39,577,376	724,593,538	1,730.8	51.5	PCs/100	3.9	11.0
broadband users	-	100,608,246	-	-	Internet users/100	0.7	12.2
avg. int'l traffic (min.)	60,517,604,577	141,074,173,792	133.1	12.9	broadband users/100 Internet users	-	13.9
					avg. int'l traffic (min/capita)	11.0	23.0

Component analysis

A more detailed analysis of the components used to derive Infodensity and Info-use reveals that each and every one is partially responsible for the Digital Divide. This includes ICT networks, skills, uptake and intensity of use. Inevitably, it is individual indicators that identify the relative importance of the causes.

Networks

Networks are a major contributor to the overall Digital Divide between economies. With values ranging from 420.0 to just 1.8, the gap between the top and bottom is far greater than in the higher-level aggregates examined so far. This is due particularly to the top end moving much higher, increasing by nearly 175 points, whereas the bottom is only falling by a few points. The usual economies dominate, with Scandinavian economies, led by Denmark, the Netherlands and Switzerland occupying the very top, while African economies, with the addition of Myanmar, are at the tail-end. Eritrea has a value of less than 2% of the average and more than 200 times lower than the top. These gaps reveal the difficulties some economies encounter in the deployment of networks. The *networks* index, together with the indicators for telephone mainlines, mobile subscribers and Internet hosts are shown in Table 3.3.

From the 192 economies contained in the measurement of networks, 53 are above the average. This represents a much lower proportion (28%) than that of the Infodensity (32%) and Info-use (34%) aggregates, indicative of the larger divide in networks. Increased gaps are also observed within each of the five economy groups examined previously.

Analysis at the level of the individual indicators for telephone mainlines, cell phone subscriptions and Internet hosts reveals that the gaps are relatively more pronounced in the newer technologies, particularly the Internet. While penetration of mainlines and cell phones vary widely among economies, variability is even larger in Internet hosts. (Here, unlike the case in mainlines and cell phones, Planetia has a value significantly higher than Hypothetica, indicative of the large number of economies with next to nothing in Internet hosts).

The values for wireline telecommunications range from 482.8 to practically zero. Interestingly, several smaller economies have quite dense networks, more so than highly advanced economies overall, namely the channel islands of Guernsey and Jersey, as well as the Cayman islands and Bermuda. At the very bottom we see the African economies of Congo, Liberia, Niger, Chad, Uganda and the Central African Republic, and Cambodia from Asia. Seventy-one economies (37%) are above average, though, indicative of the age of such networks. Discrepancies among economies related to fixed telecommunications networks have been well-documented over the years (ITU 2001). While progress is slow in the developing world, it was humming along steadily in developed economies until recently, due to increased demand for new lines, including for Internet connections. However, this has been reversed more recently due to cell phone substitution. Overall, waiting lines

continue to decrease, while digitization of networks is complete in many economies and proceeding quickly in others.

A relatively newer part of networks gaps was created by mobile telephony and the Internet. While many developing economies have significantly expanded their wireless infrastructure and subscription base of late, again developed economies have done better. However, many developing economies have skipped entirely wireline infrastructure and leapfrogged to mobile networks. The gap is slightly more pronounced according to the mobile index, ranging from 500.6 to zero, although 75 economies of the 192 are above average – a slightly higher proportion than that for wireline. Luxembourg tops the list, followed by Taiwan, Hong Kong, Italy and Martinique. At the bottom, Eritrea, Liberia, Myanmar, Ethiopia, Cuba, Niger, Turkmenistan and Nepal still have undeveloped mobile networks.

It is not surprising that the largest divide comes from Internet hosts, where the range becomes really extreme. Top economies (Iceland, Finland, the Netherlands, the U.S.) have values that reach more than 1,400, whereas values barely register for about a quarter of the 192 economies. In these cases, Internet networks are practically non-existent. In addition to African economies, here we also find Myanmar, Haiti, Vietnam, Yemen, Tunisia, Syria, and even Egypt and Pakistan. An additional indicator of how the Internet contributes more to the Digital Divide comes from the fact that only 47 of the 192 economies are above average – and many of them have extremely high values. Therefore, the Internet has emerged not only as a revolutionary new technology but also as a major source of the Digital Divide. Many economies, especially in Africa, did not have any measurable access until very recently, albeit it is now expanding.

Related to networks is the issue of international bandwidth, which is extremely skewed.[3] Secure servers do not reveal a great deal on their own, but many island states are disproportionately represented. However, these e-commerce-related technologies are not yet widespread anywhere. Cable is an additional network that contributes to a lesser extent to the Divide; however many economies do not have such networks at all.

[3] *While this deteriorates the Digital Divide, it is not reflected much in the actual index for reasons explained in the methodology section.*

Table 3.3 **Networks, 2003**

	Fixed /100	Mobile /100	Internet /1000	Networks index
Denmark	66.9	88.3	207.6	420.0
Netherlands	61.4	76.8	207.6	399.2
Sweden	71.8	98.0	105.2	379.2
Norway	71.3	90.9	124.8	378.6
Switzerland	73.4	84.3	75.2	369.6
Finland	49.2	91.0	207.6	369.2
Taiwan, China	59.1	114.1	122.9	350.4
Luxembourg	54.3	119.4	62.7	338.2
United States	62.1	54.3	207.6	322.9
Hong Kong, China	55.9	107.9	87.0	315.3
Austria	48.1	87.9	71.5	305.3
Iceland	66.0	96.6	207.6	300.2
Canada	62.9	41.7	101.5	294.0
United Kingdom	58.8	98.4	54.8	289.4
Belgium	48.9	79.3	32.5	284.6
Singapore	45.0	85.2	115.7	277.4
Germany	65.7	78.5	31.6	264.7
Ireland	49.1	88.0	40.1	263.7
Australia	54.2	71.9	143.1	254.4
Bermuda	85.4	50.2	135.6	251.2
Liechtenstein	57.6	35.6	114.8	244.4
Israel	43.9	110.6	64.5	240.2
France	56.6	69.6	40.2	239.9
Japan	47.2	67.9	101.7	236.3
New Zealand	44.8	64.8	118.6	217.2
Andorra	53.5	61.6	49.3	212.6
Czech Republic	35.8	96.5	27.5	210.3
Korea (Rep.)	53.8	70.1	20.8	204.0
Hungary	31.4	76.9	35.8	198.8
Slovenia	40.7	87.1	21.5	197.2
Guernsey	105.7	74.3	31.1	196.5
Malta	52.1	72.5	19.5	196.2
Virgin Islands (U.S.)	64.4	44.3	35.5	189.4
Estonia	28.0	77.7	47.5	182.3
Jersey	86.2	94.3	19.5	180.0
Faroe Islands	45.3	74.0	51.2	177.9
Portugal	41.0	89.8	21.8	177.0
Gibraltar	86.2	52.7	20.4	175.1
Spain	38.5	90.9	22.3	174.8
Italy	48.4	101.8	12.3	174.3
Aruba	32.6	56.8	31.8	169.0
Slovak Republic	20.5	68.4	21.2	168.8
Cayman Islands	91.5	46.5	34.3	165.8
Qatar	28.9	59.0	15.9	161.3
Greenland	42.7	38.5	50.9	156.8
Cyprus	56.8	74.4	17.4	151.9
Greece	45.2	90.2	17.1	147.6
Brunei Darussalam	25.1	49.9	17.7	136.9
Latvia	25.0	52.6	17.8	135.2
Poland	31.2	45.1	20.4	135.1
Lithuania	21.8	63.0	19.3	128.5
Uruguay	27.6	22.4	25.7	125.2
United Arab Emirates	28.1	73.6	13.9	124.8
PLANETIA	**17.6**	**22.8**	**35.4**	**120.4**
HYPOTHETICA	**22.3**	**33.5**	**20.3**	**120.3**
French Polynesia	21.3	45.1	20.5	119.7
Chile	22.0	51.1	13.8	116.7
New Caledonia	22.5	42.4	25.9	116.4
Argentina	21.3	19.4	20.1	113.4
Croatia	42.8	58.4	6.8	113.2
Brazil	23.9	26.4	18.0	102.0
Bulgaria	20.9	46.6	6.7	99.8
Bahamas	40.6	49.5	1.1	93.3
Mexico	15.7	29.1	12.9	91.3
Trinidad & Tobago	25.7	36.0	6.2	87.6
Bahrain	26.7	63.8	1.9	86.4
Turkey	24.2	39.4	5.1	86.3
Seychelles	23.5	59.5	3.4	84.3
Macao, China	38.9	81.2	0.5	83.3
Guam	57.5	26.2	1.1	83.0
Guadeloupe	50.0	91.4	1.0	82.1
Tonga	10.0	4.4	93.0	80.9
Malaysia	18.0	44.2	4.3	80.1
Martinique	43.9	100.1	0.9	80.0
Mauritius	27.9	37.9	3.3	78.2
Dominican Rep.	11.5	27.1	8.2	76.6
Romania	14.5	32.4	2.2	72.5
South Africa	10.2	36.4	6.2	72.0
Belize	10.9	20.5	9.0	71.7
Barbados	49.4	51.9	0.8	71.6
Kuwait	19.8	57.8	1.5	69.0
Samoa	5.3	5.8	45.2	66.2
Puerto Rico	32.2	54.9	0.5	65.3
French Guiana	29.1	61.0	0.8	64.8
Russia	14.1	13.9	4.2	64.4
Lebanon	19.3	23.6	2.2	64.2
Yugoslavia (Serbia & Montenegro)	20.1	33.8	1.8	63.5
Costa Rica	24.9	13.6	2.6	63.2
TFYR Macedonia	27.2	22.6	1.7	61.7
Panama	11.9	26.8	2.3	60.5
Jamaica	12.4	60.8	0.6	59.5
Colombia	18.7	14.1	2.6	59.4
Thailand	9.6	39.4	1.6	56.8
Moldova	13.4	13.2	3.3	56.4
Venezuela	8.9	27.3	1.4	52.2
Ukraine	11.9	13.6	1.9	50.4
Saudi Arabia	15.4	32.1	0.7	49.3
Maldives	10.5	16.9	1.9	48.9
Guatemala	7.1	16.2	1.7	47.6

Table 3.3 **Networks, 2003** *(cont'd)*

	Fixed /100	Mobile /100	Internet /1000	Networks index		Fixed /100	Mobile /100	Internet /1000	Networks index
Grenada	29.0	37.6	0.2	46.8	Senegal	2.2	5.6	0.1	15.0
Paraguay	4.1	29.9	1.6	45.5	Algeria	5.9	4.6	0.0	14.3
Botswana	7.1	29.7	1.1	45.3	Mauritania	1.0	12.8	0.1	14.2
El Salvador	11.2	17.6	0.6	44.3	Syria	8.0	2.7	0.0	14.0
Peru	6.4	10.6	2.4	44.0	Pakistan	2.5	1.8	0.1	13.9
Namibia	6.5	11.6	2.1	43.5	Solomon Islands	1.3	0.3	1.2	13.2
Belarus	18.8	11.3	0.5	43.1	Sudan	1.9	2.0	0.1	13.0
Jordan	11.3	24.2	0.6	42.1	Turkmenistan	5.0	0.2	0.4	12.7
Saint Lucia	31.0	11.3	0.3	42.1	Lesotho	1.3	5.8	0.1	12.7
Fiji	12.0	13.3	1.0	41.8	Lao P.D.R.	1.2	2.0	0.2	12.5
Kazakhstan	9.7	8.5	1.3	39.7	Togo	0.9	4.4	0.1	12.0
St. Vincent & the Grenadines	23.4	10.8	0.3	39.4	Benin	0.7	3.4	0.1	11.9
Georgia	8.0	10.7	1.0	38.3	Libya	9.9	1.8	0.0	11.7
Bolivia	7.2	15.2	0.8	38.3	Zambia	0.7	2.2	0.2	11.5
China	20.8	21.5	0.1	38.2	Uzbekistan	4.0	1.3	0.0	11.2
Reunion	45.7	74.7	0.0	37.5	Cuba	6.7	0.2	0.1	10.6
Philippines	3.6	27.0	0.6	37.2	Tanzania	0.4	2.5	0.2	10.5
Suriname	10.2	31.9	0.2	36.8	Mozambique	0.4	2.3	0.2	10.5
Ecuador	12.0	18.9	0.3	36.8	Viet Nam	4.7	3.4	0.0	9.7
Guyana	6.4	13.0	0.7	34.4	Cameroon	0.5	6.6	0.0	9.5
Oman	9.1	22.3	0.3	34.3	Tajikistan	2.3	0.7	0.0	9.2
Swaziland	3.6	8.4	1.3	31.9	Rwanda	0.2	1.6	0.2	8.9
Nicaragua	2.9	8.5	1.3	31.5	Ghana	1.0	3.6	0.0	8.8
Northern Marianas Islands	29.2	4.8	0.2	31.0	Uganda	0.2	3.0	0.1	8.6
Cape Verde	15.4	11.6	0.1	29.0	Yemen	2.0	3.5	0.0	8.3
Albania	7.9	35.8	0.1	28.7	Congo	0.4	9.4	0.0	8.2
Armenia	8.2	3.0	0.8	27.5	Cambodia	0.2	3.5	0.1	7.9
Gabon	2.7	22.4	0.2	26.4	Papua New Guinea	1.0	0.3	0.1	7.7
Azerbaijan	7.5	12.8	0.1	25.6	Burkina Faso	0.5	1.9	0.0	7.6
Morocco	4.0	24.3	0.1	25.0	Sierra Leone	0.3	1.6	0.1	7.4
Gambia	2.7	9.6	0.4	24.5	Madagascar	0.3	1.7	0.0	7.4
Indonesia	3.9	8.7	0.3	24.1	Bangladesh	0.4	1.0	0.0	7.2
Mongolia	4.4	13.0	0.1	23.2	Guinea	0.3	1.4	0.0	7.1
Iran	18.6	5.1	0.1	22.7	Mali	0.5	2.3	0.0	7.0
Kyrgyzstan	4.5	1.3	1.1	22.5	Haiti	1.2	3.8	0.0	6.4
Djibouti	1.5	3.4	1.0	22.2	Nigeria	0.6	2.6	0.0	6.4
Honduras	3.1	6.0	0.3	22.2	Nepal	0.8	0.2	0.1	6.1
Tunisia	11.1	19.2	0.0	22.0	Malawi	0.7	1.3	0.0	5.2
Bhutan	3.1	1.1	1.7	21.9	Angola	0.6	1.2	0.0	3.7
Egypt	12.6	8.4	0.0	21.3	Burundi	0.3	0.9	0.0	3.7
Sri Lanka	4.1	7.3	0.1	19.9	Niger	0.2	0.2	0.0	3.3
Côte d'Ivoire	1.4	7.7	0.2	18.3	Central African Rep.	0.2	1.0	0.0	3.1
Zimbabwe	1.6	3.2	0.4	18.1	Chad	0.2	0.8	0.0	2.7
Kiribati	6.2	0.6	0.4	16.4	Myanmar	0.5	0.1	0.0	2.6
India	4.5	2.5	0.1	16.3	Ethiopia	0.5	0.1	0.0	2.4
Marshall Islands	8.2	1.1	0.1	15.4	Congo D.R.	0.0	1.9	0.0	2.3
Kenya	0.8	5.0	0.3	15.3	Liberia	0.1	0.1	0.0	2.0
					Eritrea	0.3	0.0	0.3	1.8

Skills

ICT skills are also a cause of the Digital Divide. However, work on measurement in this area is still in progress and sufficient information for a good assessment does not yet exist. For this reason, the measurement of ICT skills relies on literacy and enrolment indicators, which moderates the severe gaps caused by networks. While skills are not analysed in detail, clearly the indicators used are such that they underestimate the gaps, to the extent that ICT skills in a society move in parallel with the pervasiveness of ICTs. This is reinforced by the fact that the gaps increase as we move to more advanced levels of education, especially tertiary. This is particularly true among developed economies, where not much differentiation is observed through the use of more generic indicators.

Economies at the top of the skills index include Sweden, Finland, Australia, the U.K. and Belgium, while at the bottom we find exclusively African economies. With the caveats of the previous paragraph in mind, the range of values is comparatively low – between 155.0 and 20.0 - with the majority of the 153 economies included in the measurements (58%) above the average. There are some notable differences in the skills rankings compared to networks. The Eastern European economies of Russia, Estonia, Slovenia, Lithuania, Latvia, Poland, Belarus and Ukraine occupy higher positions in skills than in networks. Moreover, Eritrea and Liberia, the bottom two economies in networks, also move to substantially higher positions in skills. Table 3.4 presents the skills index, along with the indicators for literacy rates and gross enrolment in primary, secondary and tertiary education.

The more modest contribution of skills to the Digital Divide is, to a good extent, accounted for by the smaller differences in literacy rates, combined with the fact that developed economies have already achieved near-complete literacy, whereas less developed economies continue to improve. The same, more or less, holds true for gross enrolment ratios in primary education. Interestingly, ranked by primary education, less-developed economies fare quite well. Not surprisingly, the gaps start to widen as we move to higher and more specialized levels of education. In secondary education the gap between developed and developing economies increases substantially (top value 226.0 and bottom 8.3). The spread becomes even more pronounced in tertiary education (top value 335.2 and bottom 1.5). Thus, as the level of education increases, the gaps begin to resemble the big ones encountered in networks.

Considering the movements observed through the preceding analysis, it is reasonable to assume that as we move towards more specific indicators of ICT skills, the gaps become larger. Consequently, the overall skills indices underestimate the extent of the Digital Divide.

Table 3.4 **Skills, 2003**

	Literacy (%)	Enrolment (%)			Skills		Literacy (%)	Enrolment (%)			Skills
		Primary	Secondary	Tertiary				Primary	Secondary	Tertiary	
	indicator	*indicators*			*index*		*indicator*	*indicators*			*index*
Sweden	99.0	110.0	148.8	70.0	155.0	United States	99.0	100.3	94.1	70.7	139.5
Finland	99.0	101.7	125.9	85.3	154.0	Spain	97.9	107.1	114.2	56.8	139.5
Australia	99.0	102.4	153.8	64.6	153.3	Slovenia	99.7	100.2	106.4	60.5	139.2
United Kingdom	99.0	101.0	157.9	59.0	152.0	Canada	99.0	99.6	106.2	59.1	138.0
Belgium	99.0	105.2	154.4	58.3	151.3	Lithuania	99.6	104.4	98.5	59.1	136.9
Norway	99.0	101.5	114.6	70.0	145.0	France	99.0	105.0	107.7	53.6	136.8
New Zealand	99.0	99.0	113.2	71.7	145.0	Latvia	99.8	98.8	92.6	64.3	136.7
Denmark	99.0	102.0	128.2	58.9	144.3	Argentina	97.1	119.6	99.6	56.6	136.5
Korea (Rep.)	98.1	100.1	94.2	82.0	143.5	Ireland	99.0	118.9	109.1	47.3	136.5
Netherlands	99.0	107.7	124.4	55.0	142.4	Austria	99.0	103.3	98.6	57.2	135.5
Russia	99.6	113.8	92.0	68.4	140.3	Poland	99.8	99.5	101.3	55.5	135.5
Estonia	99.8	103.0	110.1	59.3	140.2	Portugal	93.3	121.2	113.6	50.2	135.2

Table 3.4 **Skills, 2003** *(cont'd)*

	Literacy (%)	Enrolment (%)			Skills
		Primary	Secondary	Tertiary	
	indicator	*indicators*			*index*
Belarus	99.7	110.3	84.1	62.1	134.9
Greece	97.5	96.6	95.7	61.0	134.3
Iceland	99.0	101.2	107.5	48.1	133.9
Ukraine	99.7	90.5	96.8	57.2	133.6
Macao, China	94.6	104.1	87.1	66.4	133.2
Japan	99.0	100.7	102.5	47.7	132.1
Israel	95.6	113.9	93.2	52.7	131.2
Italy	98.6	100.9	95.9	49.9	130.9
Germany	99.0	103.2	98.9	46.2	130.8
Barbados	99.7	108.3	103.3	38.8	130.0
Switzerland	99.0	107.3	99.6	42.1	129.8
Hungary	99.4	101.6	98.2	39.8	127.7
Uruguay	97.8	108.3	101.4	37.7	127.7
Libya	82.6	114.1	104.8	58.1	127.1
Bulgaria	98.6	99.4	94.3	40.1	125.8
Kyrgyzstan	97.0	102.0	85.4	43.8	124.1
Kazakhstan	99.5	99.3	88.8	38.7	123.9
Czech Republic	99.0	104.3	94.7	29.8	122.1
Croatia	98.5	95.6	88.4	36.4	121.5
Chile	96.2	102.7	85.5	37.1	120.7
Brazil	88.1	148.5	107.5	17.9	120.2
Slovak Republic	99.7	103.0	87.3	30.3	120.2
Yugoslavia (Serbia & Montenegro)	94.0	98.8	88.7	36.0	119.1
Thailand	96.0	97.7	82.8	36.8	118.7
Georgia	99.0	92.0	78.6	36.1	117.9
Philippines	95.6	112.1	81.9	30.4	117.4
Cuba	97.0	100.3	89.1	27.4	117.3
Mongolia	98.6	98.7	76.1	34.7	117.2
Bolivia	87.2	113.6	84.4	39.1	117.0
Singapore	93.1	94.3	74.1	43.8	117.0
Lebanon	87.5	102.7	77.4	44.7	116.0
Armenia	98.6	96.3	86.5	25.8	116.0
Cyprus	97.6	96.7	93.4	22.2	115.9
Romania	98.4	98.8	82.3	27.3	115.5
Malta	92.9	105.7	90.0	25.1	114.8
Bahamas	95.6	92.2	91.5	24.8	114.6
Jordan	91.5	98.6	86.3	30.5	114.2
Guyana	98.7	120.2	90.5	11.6	114.2
Peru	90.9	121.3	81.7	25.8	113.7
Panama	92.6	110.0	69.2	33.6	112.7
Luxembourg	99.0	100.2	96.1	9.7	111.8
Moldova	99.1	85.3	72.4	28.7	111.0
Tajikistan	99.4	106.8	82.0	14.8	110.9
Bahrain	89.1	98.0	95.0	20.7	110.7
Hong Kong, China	94.0	94.3	71.9	27.4	108.8
Brunei Darussalam	91.7	106.3	87.7	13.4	107.7
Qatar	82.5	105.9	90.2	23.3	107.5
Mexico	92.0	110.3	73.5	20.5	107.3
Fiji	93.9	108.8	80.4	13.5	107.0
Costa Rica	95.9	108.4	66.8	20.5	107.0
Colombia	92.4	109.6	65.2	24.0	106.4
Jamaica	88.0	100.5	83.6	16.9	104.9
Dominican Republic	84.7	126.1	67.4	23.1	104.8
South Africa	86.4	105.1	86.4	14.6	104.5
Malaysia	88.9	95.2	69.6	26.0	104.5
Turkey	86.5	94.5	76.0	24.5	104.3
Venezuela	93.4	105.9	68.6	17.7	104.3
Paraguay	93.9	111.8	63.5	17.7	103.8
Kuwait	83.5	94.3	85.2	20.9	103.6
Samoa	98.7	102.5	74.5	6.5	102.5
Albania	86.5	106.6	78.4	15.1	102.5
Ecuador	92.4	116.9	59.2	17.6	102.3
Sri Lanka	92.3	110.4	80.8	5.3	102.2
Trinidad & Tobago	98.6	105.1	70.4	7.0	101.7
PLANETIA	**82.5**	**99.7**	**69.9**	**25.4**	**101.2**
HYPOTHETICA	**82.5**	**99.7**	**69.9**	**25.4**	**101.2**

	Literacy (%)	Enrolment (%)			Skills
		Primary	Secondary	Tertiary	
	indicator	*indicators*			*index*
Mauritius	85.5	106.0	79.5	11.3	100.2
Vietnam	93.0	103.4	69.7	10.0	99.9
Tunisia	74.2	111.6	79.1	22.8	99.3
China	86.9	113.9	68.2	12.7	99.3
Iran	79.2	92.1	81.0	19.2	98.5
Belize	93.8	117.6	70.7	0.9	98.3
Indonesia	88.4	110.9	57.9	15.1	97.2
United Arab Emirates	77.8	92.2	79.4	10.2	92.8
El Salvador	80.1	111.8	55.9	16.6	92.8
Egypt	57.8	96.6	85.3	36.7	92.6
Saudi Arabia	78.7	67.3	69.2	21.9	91.6
Namibia	84.0	106.0	61.4	7.3	91.0
Botswana	79.7	103.3	72.7	4.7	90.8
Algeria	69.9	108.4	71.6	15.1	90.4
Oman	75.8	82.9	78.5	7.5	88.4
Syria	76.9	111.6	43.3	15.7	86.1
Gabon	71.0	134.4	50.9	6.6	84.5
Zimbabwe	90.7	99.0	42.9	4.2	83.9
Myanmar	85.6	89.6	39.3	11.5	82.5
Nicaragua	67.5	104.7	56.6	11.8	82.0
Lesotho	84.9	124.3	33.7	2.4	81.5
Swaziland	81.6	100.4	45.2	5.2	81.3
Honduras	76.7	105.8	32.0	14.3	80.1
Kenya	85.2	96.0	32.0	3.5	75.5
Lao P.D.R.	67.3	114.8	40.6	4.3	74.3
Cameroon	74.7	106.7	32.6	5.2	74.2
Guatemala	70.5	103.0	33.1	8.4	73.4
India	59.6	98.8	48.5	10.6	73.0
Congo	83.9	85.5	32.0	3.7	72.7
Togo	60.9	124.2	36.5	3.7	70.6
Ghana	74.9	81.4	37.7	3.2	70.0
Cambodia	70.1	123.4	22.2	2.5	69.5
Uganda	69.8	136.4	12.7	3.2	68.6
Nigeria	68.2	96.5	30.3	4.0	67.3
Morocco	51.7	107.0	40.9	10.3	66.8
Zambia	80.7	78.7	25.6	2.4	65.9
Liberia	57.0	105.4	30.5	8.3	65.4
Rwanda	70.5	117.0	14.4	1.7	64.7
Malawi	62.7	131.3	17.3	0.4	64.1
Yemen	50.3	81.0	46.3	10.5	63.7
Nepal	45.2	121.6	43.9	5.4	63.3
Madagascar	68.9	104.2	14.3	2.2	61.4
Haiti	52.9	110.4	29.3	1.2	59.9
Sudan	61.0	58.7	32.0	6.8	58.6
Bangladesh	41.6	97.5	46.9	6.1	58.5
Papua New Guinea	66.0	77.5	22.7	2.1	57.9
Côte d'Ivoire	51.8	80.3	22.8	6.7	54.5
Eritrea	58.7	60.5	27.6	1.5	52.7
Benin	41.0	104.1	26.0	3.6	51.8
Tanzania	78.1	69.9	5.8	0.7	50.7
Pakistan	45.8	73.2	25.8	3.5	49.4
Gambia	40.4	78.9	34.3	1.9	49.3
Mozambique	47.8	98.9	13.3	0.6	48.8
Congo D.R.	65.6	49.6	18.4	1.4	48.3
Mauritania	41.7	86.5	21.0	3.1	47.5
Djibouti	67.2	40.3	19.6	1.2	46.8
Senegal	40.2	75.3	18.7	3.7	44.3
Chad	47.4	73.4	11.5	0.9	43.0
Central African Rep.	51.2	66.1	9.7	1.8	42.8
Guinea	41.0	77.1	13.9	1.3	41.8
Angola	42.0	63.9	19.1	0.7	41.4
Ethiopia	42.7	61.6	17.1	1.7	41.2
Mali	28.0	57.1	13.6	2.5	31.7
Burkina Faso	26.8	47.5	10.2	0.9	27.3
Niger	17.6	40.0	6.5	1.5	20.0

ICT Uptake

ICT uptake is generally another major source of the Digital Divide. Gaps between the top and bottom economies are significantly larger than in the Info-use aggregate - although not as huge as those in networks. As shown in Table 3.5, the top value is 310.7 (U.S.) and the bottom just 1.6 (Chad). Among the changes in the rankings, South Korea is positioned significantly higher than it was in networks, while Planetia is exactly ten points below Hypothetica – which is only ahead in PCs. This denotes that large economies are lower in uptake than in the other components, where the index values for Planetia and Hypothetica were just about identical. The same African economies again populate the bottom of the list, accompanied by Myanmar. Overall, 57 of the 149 economies included in the measurements are above the average, similar to the proportion in wireline telecommunications.

Once again, the gaps in uptake are largely attributable to the newer technologies of PCs and the Internet. The widest gaps are observed in PCs, ranging from an index value of 620.6 (Switzerland) to 1.2 (Mali). This is even larger than the gaps in mobile phones (networks) and Internet users (uptake), and second only to Internet hosts. Only 45 economies are above average, consisting mostly of European and Asian economies, as well as the U.S., Canada, Australia, New Zealand, Costa Rica from Latin America and a few Arab economies (Saudi Arabia, Bahrain). More than 20% of the economies have index values less than 10, largely comprised of African economies, along with Vietnam, Yemen, India, Algeria, Bangladesh, Myanmar, Pakistan, Nepal, Lao and Cambodia.

Internet use is not far behind in terms of its contribution to the Digital Divide. Index values range from a high of 590.2 (Iceland) to only 0.5 (Myanmar). However, a larger proportion of economies are above average (54 of 149) than was observed for PCs, and only 15% register values less than 10. Much progress has been made here in recent years.

Gaps in residential phone lines are relatively smaller. Here, more than half the economies (77 of 149) are above the average. However, the bottom economies continue to register very small values. One-quarter of the economies included have values less than 10 – a few even smaller than those for PCs.

The results are somewhat similar for television households. While not a cause of differentiation among very developed and somewhat-developed economies, it is still a concern in less-developed ones. Even though 93 economies are above average, and several more not far behind, still a sizeable group of economies registered extremely low values, especially Malawi, Chad and Ethiopia.

Table 3.5 **ICT Uptake, 2003**

	TV households	Residential mainlines	PCs	Internet users	Uptake		TV households	Residential mainlines	PCs	Internet users	Uptake
	/100 indicators				index		/100 indicators				index
United States	97.8	100.0	70.0	60.4	310.7	New Zealand	98.1	95.5	43.8	52.6	264.1
Sweden	93.9	100.0	67.8	63.1	308.4	Germany	93.6	100.0	48.5	47.3	263.6
Singapore	98.6	100.0	69.5	50.9	297.7	Luxembourg	94.3	90.5	65.9	37.7	262.9
Denmark	97.6	100.0	61.1	57.2	296.2	Hong Kong, China	99.6	96.3	45.8	47.2	261.3
Korea (Rep.)	98.0	100.0	55.8	61.0	294.4	Japan	99.8	96.9	41.6	48.3	257.2
Australia	96.3	100.0	60.9	56.7	294.2	Taiwan, China	94.4	100.0	47.1	39.1	250.2
Iceland	96.8	100.0	48.4	67.5	290.6	Finland	91.0	71.2	46.5	53.4	245.2
Norway	100.0	100.0	54.7	54.0	285.7	Austria	96.3	76.6	42.0	46.2	238.3
Canada	99.4	100.0	52.0	55.7	283.9	Ireland	96.9	100.0	45.3	31.7	236.5
Switzerland	99.8	100.0	73.7	38.1	281.8	Slovenia	90.5	88.9	31.3	48.8	229.5
Bermuda	97.0	100.0	55.0	51.6	280.7	France	95.3	94.8	36.9	36.6	228.9
Netherlands	98.9	88.5	50.3	52.2	268.2	Belgium	99.3	92.9	31.8	38.6	224.8
United Kingdom	98.5	100.0	44.5	50.9	266.3	Estonia	92.0	61.2	44.0	44.4	223.2

Table 3.5 **ICT Uptake, 2003** *(cont'd)*

	TV households	Residential mainlines	PCs	Internet users	Uptake
		/100 indicators			index
Malta	93.7	100.0	27.9	36.4	215.1
Cyprus	97.0	100.0	28.9	33.7	214.9
Italy	97.3	100.0	26.2	33.7	209.7
Israel	92.6	100.0	23.9	35.0	204.4
Gibraltar	74.2	100.0	40.4	25.6	204.0
Macao, China	94.0	98.9	26.1	26.8	195.6
Portugal	99.8	96.4	13.4	38.0	182.3
Spain	99.5	88.1	22.1	23.9	179.8
Czech Republic	99.2	65.6	20.6	30.8	174.7
Barbados	92.8	94.7	11.5	37.1	170.4
Croatia	93.6	82.3	20.4	23.2	169.2
Costa Rica	84.2	76.9	22.2	24.4	167.6
Qatar	90.7	100.0	18.8	19.7	166.0
Bahrain	95.4	100.0	16.3	21.6	165.8
Latvia	80.0	53.2	18.8	40.4	164.2
Malaysia	92.0	60.6	16.7	34.4	163.9
Slovak Republic	97.8	57.3	20.2	25.6	159.8
United Arab Emirates	85.9	91.5	11.8	27.5	154.7
Kuwait	95.4	64.6	16.3	23.1	151.2
Poland	90.7	77.2	14.2	23.2	151.1
Chile	95.0	57.4	13.5	27.2	145.7
Seychelles	90.1	66.5	16.9	17.6	141.7
Hungary	96.0	67.4	11.8	23.2	141.3
Mauritius	93.0	89.1	17.2	12.3	140.9
Lithuania	97.3	50.2	13.1	20.2	130.5
Greece	97.5	100.0	8.5	15.0	129.4
Uruguay	93.0	75.2	12.1	13.3	126.1
Brunei Darussalam	98.7	100.0	8.0	11.7	120.2
Bulgaria	92.8	81.6	5.7	20.6	118.9
Romania	96.9	50.2	9.7	18.4	118.2
Lebanon	93.2	74.1	9.3	12.9	116.8
HYPOTHETICA	**68.0**	**49.8**	**14.6**	**16.4**	**116.4**
Trinidad & Tobago	87.8	80.3	8.8	12.0	114.1
Argentina	98.9	63.5	8.7	13.1	112.7
Saudi Arabia	98.7	61.4	17.1	6.7	111.7
PLANETIA	**75.3**	**56.5**	**11.0**	**12.2**	**106.4**
St. Vincent & the Grenadines	74.3	80.9	12.6	7.4	105.8
Brazil	89.9	65.5	8.7	10.8	105.5
Mexico	95.4	48.1	9.4	11.8	103.5
Jamaica	71.1	39.1	5.7	27.9	100.0
Iran	76.6	87.9	9.0	7.2	99.8
Turkey	97.7	95.6	4.6	8.5	95.2
Russia	98.0	57.1	10.1	5.2	90.1
Colombia	92.0	76.7	5.6	6.2	86.3
Belize	38.0	38.3	12.7	12.7	85.3
Jordan	93.4	52.1	4.5	8.1	79.4
Maldives	67.7	43.7	8.7	6.8	79.3
Yugoslavia (Serbia & Montenegro)	91.8	82.5	2.9	7.9	79.2
Oman	79.2	55.0	3.9	8.7	76.1
Thailand	93.3	28.2	4.5	11.1	73.7
Venezuela	86.1	35.4	6.8	6.0	72.9
China	91.1	60.2	3.4	6.3	71.9
Cape Verde	40.0	67.5	8.7	4.4	69.6
Tunisia	92.8	36.9	4.0	6.4	66.8
El Salvador	84.5	43.3	2.8	8.4	66.6
Fiji	58.0	44.4	5.1	6.7	66.6
Peru	78.9	23.7	4.4	10.4	66.2
Suriname	66.7	64.2	4.1	4.6	65.4
Panama	77.4	37.6	3.8	6.2	62.8
Moldova	72.0	49.1	2.3	8.0	62.0
Ecuador	90.7	41.9	3.7	4.6	61.7
South Africa	53.8	20.9	7.5	7.4	61.4
Guyana	37.2	28.6	2.8	18.3	59.3
Armenia	91.6	60.7	2.0	3.7	55.4
Egypt	88.6	53.8	2.2	3.9	55.1
Georgia	75.8	35.0	3.6	3.1	50.9
Namibia	40.5	20.9	9.9	3.4	50.3
Mongolia	30.0	19.5	7.7	5.8	49.3
Ukraine	97.3	52.0	2.1	2.5	49.1
Philippines	76.4	14.4	3.2	5.5	45.6
Syria	80.1	58.3	2.1	1.6	43.2
Kyrgyzstan	83.9	28.1	1.6	3.9	42.7
Bolivia	47.0	22.6	2.6	4.1	39.8
Paraguay	69.1	14.0	4.5	2.0	37.5
Morocco	76.1	15.5	2.0	3.3	36.4
Cuba	67.2	16.9	4.2	1.6	36.3
Samoa	96.7	31.2	0.7	3.0	34.8
Guatemala	41.3	21.8	1.6	4.2	34.0
Zimbabwe	27.5	7.6	5.3	5.3	33.9
Viet Nam	86.1	13.4	1.1	4.3	33.3
Algeria	88.1	35.9	0.8	2.0	33.1
Botswana	15.2	18.7	4.3	4.4	33.1
Nicaragua	61.0	14.1	3.0	2.0	32.9
Togo	51.2	5.8	3.2	4.2	30.8
Honduras	47.4	15.9	1.5	3.3	30.1
Gabon	56.3	10.3	2.2	2.6	29.6
Indonesia	56.7	12.6	1.3	3.8	29.6
Albania	67.1	24.6	1.4	1.0	26.5
Kiribati	26.3	23.8	1.2	2.5	25.8
Senegal	28.5	13.4	2.1	2.2	25.1
Gambia	12.4	22.5	1.5	2.3	21.7
India	32.4	18.8	0.8	1.7	21.2
Sri Lanka	31.6	11.9	1.6	1.2	20.0
Côte d'Ivoire	35.9	9.4	1.1	1.4	18.7
Djibouti	42.0	6.1	2.2	1.0	18.7
Sudan	51.3	12.4	0.8	0.9	17.7
Yemen	42.6	16.3	1.0	0.6	17.6
Pakistan	46.5	14.2	0.4	1.2	16.7
Papua New Guinea	9.4	1.6	6.1	1.6	13.4
Solomon Islands	4.1	5.9	4.0	0.5	10.3
Mauritania	22.0	4.2	1.1	0.4	10.0
Kenya	17.1	2.1	0.7	1.6	9.9
Ghana	21.5	4.6	0.4	0.9	9.6
Nigeria	25.6	2.8	0.7	0.6	9.2
Zambia	26.0	2.1	0.8	0.6	8.9
Benin	20.5	3.3	0.4	1.0	8.7
Lao P.D.R.	30.7	4.8	0.4	0.3	7.9
Cameroon	17.7	3.4	0.7	0.4	7.9
Nepal	13.2	8.4	0.4	0.4	7.9
Bangladesh	29.0	2.2	0.8	0.2	6.7
Eritrea	14.4	2.5	0.3	0.7	6.4
Tanzania	14.2	1.3	0.6	0.7	6.4
Guinea	9.8	1.0	0.6	0.5	5.0
Angola	9.0	3.1	0.2	0.4	4.8
Cambodia	42.8	1.0	0.2	0.2	4.8
Madagascar	7.9	0.9	0.5	0.4	4.3
Mozambique	6.2	1.4	0.5	0.3	4.3
Burkina Faso	6.9	2.3	0.2	0.4	4.2
Mali	15.4	1.1	0.1	0.3	3.5
Uganda	6.2	0.4	0.4	0.5	3.2
Malawi	2.3	1.8	0.2	0.3	2.7
Myanmar	3.0	1.9	0.6	0.1	2.5
Ethiopia	2.4	2.3	0.2	0.1	2.3
Central African Rep.	3.0	0.8	0.2	0.1	2.0
Chad	2.4	0.3	0.2	0.2	1.6

Intensity of use

The other component of Info-use is intensity, which includes indicators of broadband use and international incoming and outgoing telecommunications traffic. Although these indicators are not measured independently, their inclusion in the calculation of the overall Info-use index has a somewhat moderating effect on the uptake gaps.

Broadband use remains very unevenly spread. It represents the newest set of technologies and the differentiations between economies are very pronounced. A closer look at the data reveals that one-third of economies do not have any broadband users at all. These include many African, Asian, Latin American, Caribbean, and even some Eastern European and Arab economies. Many more economies have very small levels of broadband.

Moreover, only one-quarter of economies are above the average, led by South Korea, Taiwan and Hong Kong. The index values range between 432.2 and 75. Planetia's index is more than one-and-a-half times greater than that of Hypothetica, emphasizing again the asymmetries - specifically that many economies do not have any measurable broadband. As broadband technologies evolve, it will be interesting to observe their effect on existing technologies, including wireline and mobile networks, cable and Internet use.

Differences in telephone usage, as indicated by international traffic statistics, are not subject to the same wide gaps as the other indicators. Index values range from 264.4 in Luxembourg to 75.1 in Ethiopia.

The component analyses in the preceding sections reveals that while everything matters in the Information Society, not everything matters to the same degree. Much of the Digital Divide observed is due to the newer technologies. Internet hosts and PCs have the greatest impact on the Digital Divide, followed by Internet use, mobile and fixed telecommunications networks. However, many more sources for the large inequalities exist. Even the availability of televisions continues to be a problem in the developing world.

3.2 The Evolution of the Digital Divide

The existence of a Digital Divide is well-known and well-documented. The results from the empirical application so far have provided additional answers to the following questions: how big is the divide in general, what economies are affected, by how much, and what are the contributing factors. From a policy perspective, however, the most important questions come after the quantification of the divide: Is the Digital Divide closing or widening over time? Which economies are making progress, how fast, when and what ICTs are driving the evolution? Essentially, then, the next step is to move on to this next level of questions and examine how the Digital Divide is evolving. By explicitly monitoring economy Infostates, their main components, as well as individual indicators over time, one of the strengths of the Infostate model is that it can also take on questions such as the above and provide concrete answers. This type of work can be very complex and can be performed at various levels of detail, such as economy groupings, by region or income, or focusing on aspects

of individual technologies. Furthermore, in addition to generic benchmarks, individual economies may wish to benchmark their performance against neighbouring economies, economies with similar levels of development, or any other ones they identify. The following sections present findings from analytical work, as well as offer a sample of what analyses are possible.

First, it becomes immediately apparent from Table 3.6 that Infostates for all economies have increased over the 1995-2003 period. Many economies made quite significant improvements, others more modest and, generally, Infostates increased each and every year - with a few minor exceptions. Infostate values for Hypothetica and Planetia increased more than two-and-a-half times over the nine-year period examined. Early signs of relative evolution are also revealed, as some economies have moved from below Hypothetica in 1995 to above it in 2003. This has been the case for Malta, many Eastern European economies (Latvia, the Slovak Republic, Poland, Croatia and Lithuania), Latin American economies (Chile, Uruguay and Argentina), as well as Qatar, Barbados and the United Arab Emirates – all economies in the group with elevated Infostates by 2003. Bulgaria and Malaysia also made substantial progress, approaching the average.

Evidently, the economies with the highest growth rates are those with the most room to grow – that is, economies with the lowest Infostates. The Sudan led economies in Infostate growth, followed by many African economies, including Côte d'Ivoire, Togo, Ethiopia, as well as Bangladesh, Vietnam, Kyrgyzstan, Syria and Moldova. By the same token, economies with comparatively lower growth are typically economies with highly advanced Infostates, including the U.S., Canada, Scandinavian and other European economies. This growth pattern is typical in analyses of digital divides, whether across or within economies, and is largely the product of the initial values. Of course, this is a general rule; there are examples of economies with comparatively low growth rates, despite low Infostates. Given that the Digital Divide is a relative concept, it is useful to observe the relative movements of individual economies over the reference period if we are to understand which economies are making progress, how fast and through what technologies. We already know that Infostates for all economies are moving upwards, but at different speeds. A few cases are of particular interest as they demonstrate relative movements. For example, Côte d'Ivoire and the Central African Republic had similar Infostates in 1995 but, by 2003, Côte d'Ivoire had an Infostate more than three times that of the Central African Republic. Conversely, Yugoslavia and Colombia began in 1995 on very different paths, with Infostates of 8.2 and 26.0, respectively. But by 2003, they had both reached values of about 83; thus, while they both grew fast, Yugoslavia grew faster than Colombia. The example of Sudan and Qatar is also an interesting one: Sudan achieved an Infostate value of 29.1 in 2003, which was the value for Qatar in 1995. Similarly, Nicaragua's 1995 Infostate value was identical to Uganda's 2003 value – it took nearly a decade for Uganda to reach Nicaragua, although by then Nicaragua had moved up to 48.5. Malaysia (110.9 in 2003) is also nearly ten years behind the top economy Denmark (109.7 in 1995), but an almost equal time-distance ahead of India. The timeline of Infostate values reveals that, all things equal, literally decades are needed for the economies with low Infostates to catch up to the top economies.

Table 3.6 **Evolution of Infostates**

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Denmark	109.7	127.6	150.7	176.9	195.1	212.7	219.6	241.2	254.9
Sweden	113.9	136.8	163.1	183.4	203.5	215.7	223.3	240.3	251.1
Switzerland	105.5	119.5	137.9	157.1	181.1	206.0	214.0	237.8	250.7
Netherlands	101.0	116.4	132.4	155.8	185.9	204.9	211.4	228.0	242.5
Norway	113.6	136.5	158.1	175.5	195.9	210.2	213.2	228.4	239.5
Canada	116.9	134.7	157.5	177.9	196.2	210.2	217.0	227.2	235.0
United States	117.1	136.9	155.5	171.4	186.9	200.9	210.6	221.7	231.8
Finland	111.3	132.3	152.2	167.2	181.7	194.1	202.1	217.7	228.4
Hong Kong, China	92.8	110.5	131.7	143.8	164.0	186.2	200.9	212.3	227.9
Iceland	101.0	121.0	139.4	156.3	175.6	188.7	199.8	214.7	226.7
Singapore	87.3	109.3	133.4	146.6	167.6	185.7	191.5	213.1	225.7
Luxembourg	85.2	110.1	122.3	143.8	160.9	178.8	194.5	207.5	218.9
Belgium	79.2	101.5	119.0	138.2	157.0	184.1	193.6	210.3	217.8
United Kingdom	87.2	103.4	118.0	137.8	159.5	173.9	183.3	204.7	214.9
Austria	84.0	107.0	122.0	142.7	163.5	182.2	185.2	197.4	210.6
Australia	91.3	104.2	125.3	147.9	161.6	177.4	188.7	200.2	209.6
Korea (Rep.)	61.1	75.2	92.4	109.8	146.3	172.1	186.1	197.2	208.6
Germany	82.4	95.7	115.5	130.4	151.2	173.5	185.1	194.8	201.9
Japan	69.5	92.6	110.5	126.3	142.8	158.3	173.1	187.3	198.9
Ireland	71.0	87.4	105.2	125.2	140.5	164.4	175.0	187.8	197.7
Israel	69.0	86.6	103.8	122.1	132.5	148.1	159.2	170.1	194.0
France	72.8	84.0	99.5	115.0	131.5	147.8	166.6	178.7	193.7
New Zealand	94.8	108.9	123.0	136.6	158.9	171.2	180.6	187.0	192.1
Estonia	55.6	67.7	83.6	101.9	116.3	137.3	144.8	158.7	175.7
Slovenia	60.5	76.3	92.8	104.7	122.0	133.2	152.8	166.8	174.7
Malta	42.7	61.8	80.0	94.9	109.8	129.7	155.4	167.0	174.6
Italy	54.9	65.6	80.9	96.6	118.0	133.2	144.2	156.6	169.2
Spain	49.4	68.4	82.3	94.3	107.7	126.2	143.1	157.5	168.0
Portugal	56.3	69.8	83.8	100.4	113.9	129.5	142.7	153.7	162.2
Cyprus	48.4	61.0	87.4	104.8	118.0	129.8	142.2	152.0	160.0
Macao, China	49.8	58.7	70.9	87.9	95.1	104.3	124.3	135.8	149.9
Czech Republic	46.9	59.0	71.2	81.4	95.3	109.7	128.8	142.6	149.7
Hungary	47.1	56.0	69.9	81.6	92.7	102.6	123.0	132.0	147.2
Qatar	29.1	45.5	66.6	76.8	84.7	94.1	112.5	126.8	143.8
Barbados	24.3	47.7	54.2	66.6	73.3	84.1	104.1	120.8	139.5
Latvia	28.7	42.0	56.5	70.6	81.3	96.5	108.9	121.5	135.8
Slovak Republic	35.9	45.3	62.5	74.1	87.2	101.6	119.0	125.8	135.6
Poland	34.4	43.3	54.3	67.6	78.5	90.1	107.3	123.6	131.8
Croatia	34.9	43.9	54.8	64.4	74.4	92.1	112.9	123.7	130.2
Lithuania	21.5	36.0	50.1	64.2	72.4	85.8	102.9	119.2	128.1
Chile	37.2	44.8	50.6	61.6	76.0	99.6	110.7	119.0	127.7
Bahrain	44.0	54.0	63.3	75.2	88.7	94.4	114.2	121.5	127.3
Greece	45.5	54.7	63.1	76.4	93.1	104.8	118.2	124.2	127.0
United Arab Emirates	32.9	45.9	63.9	84.5	98.5	114.1	120.8	125.5	126.9
Uruguay	32.3	49.8	66.8	81.7	94.6	103.2	112.3	116.0	118.3
Argentina	30.2	36.5	45.1	59.1	78.0	93.9	107.7	110.3	115.0
Brunei Darussalam	50.5	62.1	68.1	77.7	83.7	95.9	109.5	112.9	114.5
HYPOTHETICA	**43.3**	**52.2**	**61.8**	**71.1**	**81.7**	**91.7**	**100.0**	**107.2**	**113.4**
PLANETIA	**43.4**	**51.5**	**59.8**	**68.2**	**78.2**	**88.2**	**98.0**	**105.7**	**113.4**
Bulgaria	23.3	33.0	40.9	48.0	58.8	74.4	90.8	97.6	111.1
Malaysia	30.6	45.1	55.2	68.6	80.7	91.4	101.1	106.3	110.9
Brazil	24.0	34.4	41.3	49.5	60.0	72.2	90.2	99.4	107.3
Kuwait	41.4	54.7	63.7	69.8	77.4	84.0	93.2	97.8	106.1
Costa Rica	35.9	44.0	50.6	56.8	65.3	75.1	86.8	98.3	104.3
Lebanon	25.7	34.4	51.9	63.0	74.1	82.7	93.8	99.0	103.0
Mauritius	17.5	30.1	39.8	54.7	63.9	79.2	90.7	96.9	102.8
Romania	19.2	26.3	36.1	51.0	59.2	69.1	77.8	93.6	101.5
Trinidad & Tobago	25.3	32.2	45.3	56.0	68.4	81.1	91.5	95.5	99.9
Mexico	26.0	31.3	38.8	48.1	59.7	75.7	87.2	93.2	98.5
Turkey	23.7	30.4	38.6	45.1	59.1	65.8	80.6	85.2	92.9
Russia	24.8	31.6	39.3	44.7	49.3	61.8	74.6	84.0	90.2
Jamaica	21.8	30.3	36.6	46.9	51.3	63.3	71.6	86.0	88.1
Belize	18.2	33.4	44.8	50.5	59.3	67.3	73.6	81.4	86.8
Saudi Arabia	12.3	16.7	19.4	26.4	41.4	55.0	70.0	79.3	83.6
Yugoslavia (Serbia & Montenegro)	8.2	25.3	33.4	39.7	46.2	62.7	75.4	79.6	83.6
Colombia	26.0	33.6	40.2	47.4	54.1	57.6	69.1	75.8	82.8
Venezuela	27.9	33.2	39.0	49.8	61.0	65.6	73.5	76.2	79.6
Thailand	24.2	30.8	38.1	41.4	49.5	57.8	66.1	73.6	78.5
El Salvador	15.4	21.2	26.5	34.8	45.0	52.2	63.4	70.6	76.4
South Africa	38.8	45.1	53.2	62.3	67.8	72.6	73.0	74.5	76.1
Jordan	13.9	17.7	28.2	36.7	45.5	54.4	67.6	72.6	75.8

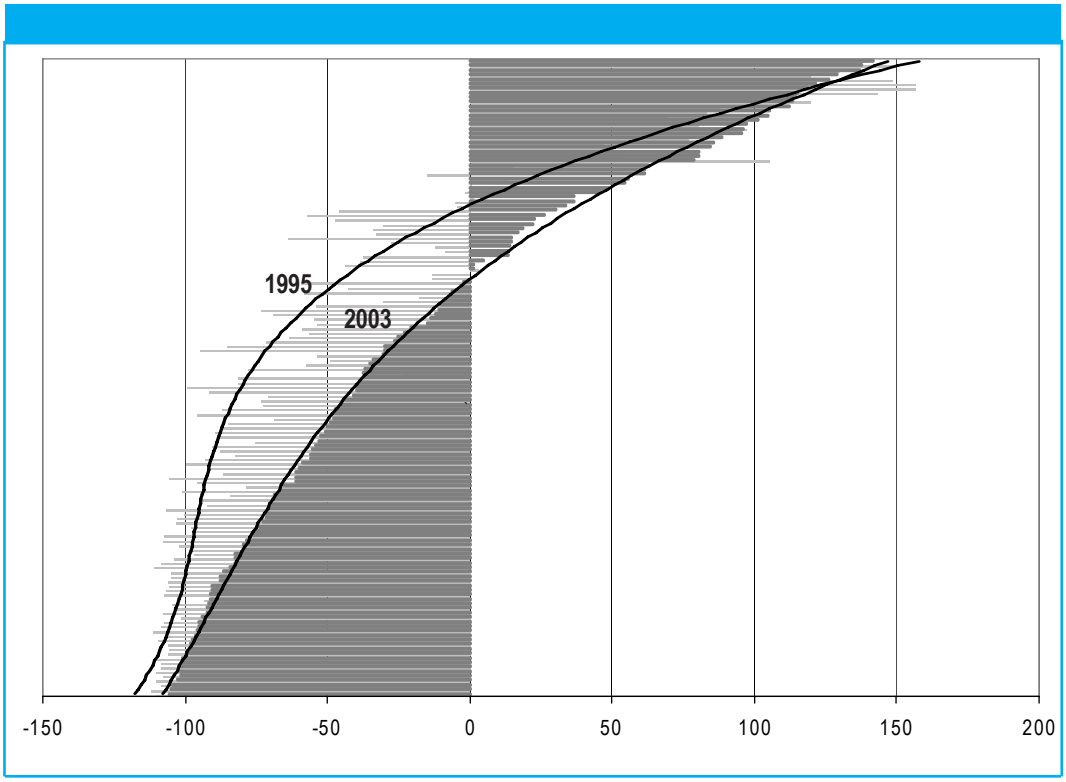
Table 3.6 **Evolution of Infostates** *(cont'd)*

	1995	1996	1997	1998	1999	2000	2001	2002	2003
	indices								
Panama	13.9	28.5	35.6	44.9	52.0	61.5	70.4	72.3	75.0
Moldova	6.1	9.2	16.5	27.9	33.7	45.8	53.5	61.3	73.5
China	9.5	13.4	17.7	24.1	34.7	43.4	52.8	64.4	73.5
Peru	18.3	28.2	33.7	42.2	49.3	54.4	60.9	65.2	72.8
Fiji	17.5	24.4	30.3	37.7	44.1	51.7	59.0	67.5	69.6
Ukraine	17.6	22.4	27.6	31.8	35.9	43.4	58.0	63.7	68.6
Iran	11.4	15.4	20.6	25.1	32.1	39.4	50.4	58.4	66.0
Oman	7.7	17.6	33.1	39.4	46.5	52.1	60.2	63.9	65.9
Ecuador	19.3	22.4	26.1	29.1	39.3	44.7	53.8	61.5	65.6
Guyana	12.3	18.1	20.7	23.1	35.5	47.2	57.2	60.2	64.5
Georgia	11.5	17.5	23.2	28.1	35.9	40.6	51.3	57.1	63.5
Samoa	10.3	12.6	18.1	21.6	25.1	40.1	52.1	54.2	62.5
Namibia	10.7	15.4	23.0	33.3	35.7	48.9	53.7	56.4	60.8
Philippines	16.5	20.5	24.3	34.7	38.8	45.6	50.8	56.7	60.5
Armenia	10.0	14.0	19.4	22.7	32.4	36.8	46.1	52.2	59.1
Tunisia	11.1	13.6	15.3	21.3	31.8	39.0	48.5	52.1	58.0
Bolivia	13.4	19.3	23.9	29.3	36.3	42.2	47.1	50.8	57.6
Paraguay	8.9	16.4	22.9	29.7	34.7	40.4	48.6	53.6	57.5
Mongolia	5.9	10.4	14.5	17.9	25.3	34.7	39.9	43.9	54.8
Botswana	9.3	11.0	23.4	28.2	37.0	42.6	49.8	51.9	53.5
Egypt	11.7	14.1	18.2	21.0	27.2	33.1	41.7	48.1	52.4
Kyrgyzstan	3.5	4.3	7.6	13.6	21.7	33.0	47.3	49.2	52.3
Guatemala	7.6	12.4	17.6	23.7	28.8	34.8	42.1	47.5	52.1
Nicaragua	15.1	20.0	24.0	26.9	31.0	37.1	40.0	43.3	48.5
Albania	5.3	10.2	13.0	15.6	18.7	22.2	36.2	40.8	46.4
Indonesia	12.8	17.4	21.9	23.9	27.9	32.7	38.0	40.9	44.6
Gabon	7.9	8.2	15.8	20.0	22.3	33.2	36.1	38.6	44.1
Morocco	9.2	10.7	14.6	20.5	24.1	32.9	37.9	40.7	43.9
Syria	3.0	3.1	8.3	9.7	16.6	20.9	31.1	39.4	42.8
Zimbabwe	5.6	7.4	13.8	17.7	23.9	29.0	30.6	39.7	41.9
Honduras	4.8	9.8	15.7	20.8	25.1	28.7	33.7	38.6	41.9
Cuba	4.5	12.1	14.5	17.9	21.8	26.9	32.1	37.4	40.6
Algeria	6.8	7.9	10.8	12.6	19.9	24.5	29.7	35.3	39.7
Sri Lanka	6.9	13.9	17.6	21.1	24.0	28.8	32.2	35.7	37.8
Viet Nam	2.7	4.8	9.0	11.7	18.1	22.2	29.3	32.7	37.0
Togo	2.5	4.9	11.7	14.7	18.8	27.1	29.1	33.0	34.9
Gambia	5.0	7.3	9.7	12.0	16.5	18.5	27.8	32.2	33.9
India	7.0	9.5	11.9	14.4	17.6	21.8	27.2	31.0	33.7
Djibouti	7.2	10.3	12.4	12.8	15.3	16.8	23.9	28.7	31.2
Senegal	4.1	7.8	10.5	14.1	19.2	23.2	27.5	28.7	31.0
Côte d'Ivoire	2.0	7.6	10.5	13.6	16.7	20.5	26.3	28.4	30.7
Sudan	1.3	2.0	5.3	7.3	9.9	14.4	18.3	21.9	29.1
Pakistan	3.7	7.3	10.9	13.1	14.2	17.3	21.3	24.4	26.9
Kenya	3.6	6.9	9.4	11.0	14.7	19.1	21.1	24.0	25.7
Yemen	3.0	4.5	7.8	9.2	11.5	12.9	15.9	22.8	25.7
Mauritania	3.3	3.3	4.6	7.3	14.2	16.8	18.7	21.1	22.7
Lao P.D.R.	2.9	3.3	6.1	7.6	9.7	12.2	17.5	19.7	22.7
Papua New Guinea	2.8	5.3	11.7	14.4	21.0	24.3	20.6	21.8	22.5
Zambia	8.6	9.5	10.0	12.5	17.3	20.1	19.0	20.9	22.3
Ghana	3.9	7.4	9.9	11.2	14.3	16.3	16.7	20.4	21.8
Cameroon	4.3	4.9	5.7	6.6	12.0	16.4	18.2	19.9	21.1
Benin	2.5	4.4	6.7	8.1	10.2	14.4	16.7	18.9	21.0
Nigeria	5.3	6.4	8.2	10.2	11.5	12.5	14.1	17.6	19.6
Tanzania	2.6	3.7	5.7	6.8	9.8	13.1	13.9	15.5	18.3
Nepal	2.2	3.1	4.2	5.0	9.6	11.9	15.8	16.8	18.2
Bangladesh	0.8	1.4	3.5	6.2	9.8	12.2	13.5	15.3	17.5
Cambodia	2.8	4.8	7.3	8.9	10.6	12.8	13.4	15.9	16.9
Mozambique	1.6	2.6	5.4	6.8	8.4	11.2	12.9	14.8	15.9
Madagascar	3.1	4.9	6.6	8.8	12.4	14.0	13.3	14.6	15.4
Uganda	3.4	4.5	5.5	9.3	11.0	12.6	11.6	13.8	15.0
Guinea	3.1	3.9	5.0	6.2	11.3	12.7	12.3	14.0	14.6
Burkina Faso	1.2	2.3	4.8	6.4	7.2	8.9	10.3	11.0	12.6
Angola	2.2	3.3	4.7	5.9	7.7	8.7	9.8	11.4	12.2
Malawi	2.1	3.0	3.8	4.7	6.5	8.5	9.7	11.0	12.2
Mali	1.4	3.0	4.1	4.9	7.0	9.5	9.9	10.7	12.1
Eritrea	2.4	2.5	3.9	4.3	5.6	9.3	9.2	10.5	11.9
Myanmar	1.4	1.7	1.9	2.1	4.1	6.8	8.3	10.2	10.7
Central African Rep.	2.0	4.4	5.2	6.0	7.2	7.7	7.8	8.2	8.8
Ethiopia	0.7	1.3	2.2	2.5	4.2	5.1	6.4	7.5	8.6
Chad	1.4	1.6	2.1	2.9	3.7	6.4	6.3	7.4	7.9

A more systematic method of examining the rates at which Infostates are evolving is to compute the differences between the Infostate values of each economy and the average economy, Hypothetica, for each of the reference years. In order to compare the differences between Infostates across time, however, the values must be normalized to one year – 2003 in this analysis – which allows for relative comparisons.[4] Then, the differences between the normalized Infostate values for each economy and Hypothetica can be plotted, providing a first glimpse at the evolution of the Digital Divide. This is seen in Chart 3.2 for 1995 and 2003. The 2003 line lies visibly 'inside' the 1995 line at the bottom end, while it crosses to the 'outside' only at the very top end. This increased steepness is indicative of a generally closing Digital Divide.

Moreover, the gap between the very bottom economy (Chad) and the average closed more than the gap between the very top economy (Denmark) and the average. Alternatively, the average increased by more than the top, which means that the Infostates of economies below average increased proportionately more than the Infostates of highly advanced economies.

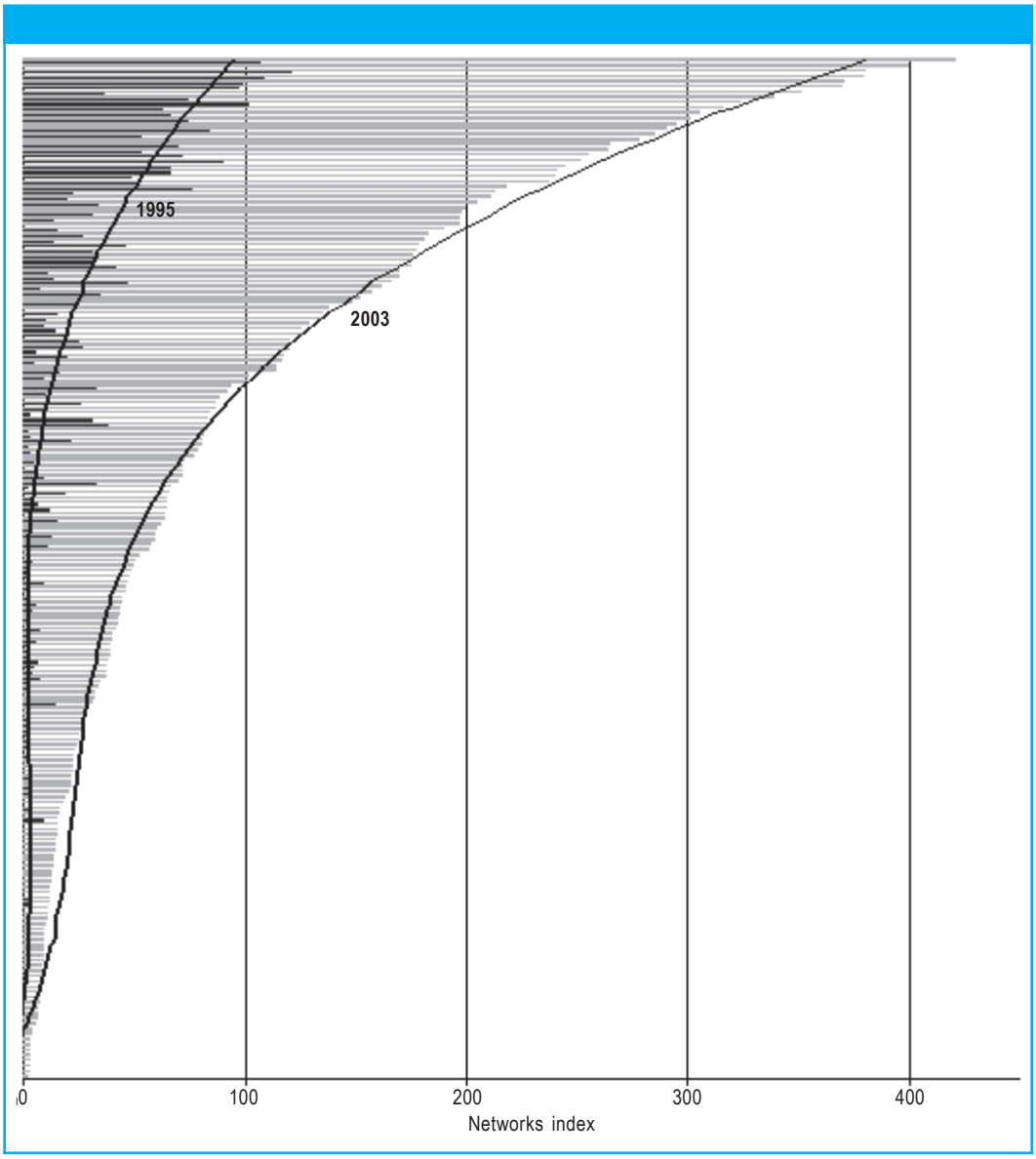
Chart 3.2 **Evolution of the Digital Divide**



[4] *The normalized values are arrived at as the product of a country's Infostate value in a given year with the ratio of Hypothetica's value that year over its 2003 value.*

The dramatic evolution of networks over the 1995-2003 period provides additional evidence of the massive ICT deployment on the planet over the course of the last decade. Chart 3.3 displays a visually strong case. The evolution of the networks index is also presented in Annex Table A.1 Infodensity and Info-use indices for the 1995-2003 period are shown in Annex Tables A.2 and A.3, respectively.

Chart 3.3 **Evolution of the Networks index**



A closer look inside the Digital Divide

Although it is useful to examine the evolution of the Digital Divide in an overall sense, a more detailed analysis is necessary. First, comparisons are made at the level of the five Infostate economy groups defined earlier in this chapter; each group is compared with the others, for each year in the reference period. The results are presented in Table 3.7.

Table 3.7 **Evolution of the Digital Divide, by group**

	1995	1996	1997	1998	1999	2000	2001	2002	2003	change 1995-2003	growth 1995-2003
Group	***(A) Infostates***										
High	92.1	110.4	129.1	147.3	167.0	184.7	194.5	208.9	220.6	128.5	139.6
Elevated	41.4	54.0	67.6	81.2	93.9	107.7	123.4	133.9	143.0	101.7	245.7
Intermediate	22.0	30.5	38.6	47.3	56.4	66.4	76.9	83.8	89.8	67.8	308.2
Moderate	8.9	12.8	17.7	21.9	27.6	34.0	41.2	45.8	50.0	41.1	463.0
Low	2.7	4.0	5.9	7.5	10.2	12.7	13.9	15.9	17.6	14.8	539.5
Hypothetica	**43.3**	**52.2**	**61.8**	**71.1**	**81.7**	**91.7**	**100.0**	**107.2**	**113.4**	**70.1**	**161.9**
	(B) normalized Infostates										
High	241.0	239.6	237.0	234.8	231.8	228.4	220.6	221.1	220.5		
Elevated	108.3	117.2	124.1	129.4	130.3	133.3	140.0	141.7	143.0		
Intermediate	57.6	66.3	70.9	75.4	78.3	82.1	87.2	88.7	89.8		
Moderate	23.2	27.9	32.5	34.9	38.3	42.0	46.8	48.4	50.0		
Low	7.2	8.8	10.9	11.9	14.2	15.7	15.7	16.9	17.6		
Hypothetica	**113.4**	**113.4**	**113.4**	**113.4**	**113.4**	**113.4**	**113.4**	**113.4**	**113.4**		
	(C) Digital Divides										
High-Low	233.8	230.9	226.1	222.9	217.6	212.7	204.9	204.2	202.9		
High-Moderate	217.7	211.8	204.4	199.9	193.5	186.4	173.8	172.6	170.5		
High-Intermediate	183.4	173.3	166.0	159.4	153.5	146.3	133.4	132.4	130.7		
High-Elevated	132.7	122.4	112.8	105.4	101.5	95.1	80.6	79.4	77.5		
Elevated-Low	101.1	108.5	113.2	117.5	116.2	117.6	124.2	124.8	125.4		
Intermediate-Low	50.4	57.5	60.0	63.5	64.1	66.4	71.5	71.8	72.2		
Moderate-Low	16.0	19.1	21.6	23.1	24.2	26.3	31.0	31.6	32.4		
Elevated-Moderate	85.1	89.3	91.6	94.5	92.0	91.3	93.2	93.2	93.0		
Elevated-Intermediate	50.7	50.9	53.2	54.0	52.0	51.2	52.8	53.0	53.2		
Intermediate-Moderate	34.3	38.4	38.4	40.5	40.0	40.1	40.4	40.3	39.8		
	(D) Changes in Digital Divides										
High-Low		-2.9	-4.8	-3.2	-5.3	-4.9	-7.9	-0.7	-1.3		
High-Moderate		-6.0	-7.3	-4.6	-6.4	-7.1	-12.6	-1.2	-2.1		
High-Intermediate		-10.1	-7.3	-6.7	-5.9	-7.2	-12.9	-1.0	-1.6		
High-Elevated		-10.3	-9.6	-7.5	-3.9	-6.3	-14.5	-1.2	-1.9		
Elevated-Low		7.4	4.8	4.3	-1.4	1.4	6.6	0.6	0.6		
Intermediate-Low		7.2	2.5	3.5	0.6	2.3	5.0	0.4	0.3		
Moderate-Low		3.1	2.5	1.4	1.1	2.2	4.7	0.6	0.8		
Elevated-Moderate		4.3	2.3	2.9	-2.5	-0.8	1.9	0.0	-0.2		
Elevated-Intermediate		0.2	2.3	0.8	-2.0	-0.9	1.6	0.2	0.3		
Intermediate-Moderate		4.1	0.0	2.1	-0.5	0.1	0.3	-0.2	-0.5		

The first section (A) of the table shows the average Infostate values for each group and for each year, along with their respective absolute changes and growth rates for the 1995-2003 period. This simple exercise provides some key findings, all of which are consistent with those found in the first empirical application of the Infostate model (Orbicom 2003), and in detailed studies of internal economy divides. Most notably:

- Infostates increase for every group and every year. The growth rates for all five groups are actually quite high: Infostate values in the *low* group more than quadrupled, and the *moderate* group was not far behind. The values of the *elevated* group more than tripled, while those of the *high* group increased by 'just' 139.6%.

- The rates of growth of economies with lower Infostates are greater than those with higher Infostates. This has also been a consistent finding in Digital Divide research (Dickinson and Sciadas 1999, OECD 2001, Sciadas 2002) and can be seen clearly in the last column of section A of Table 3.7.

- Despite this, the absolute change in Infostate values between 1995 and 2003 decreases as we move from the *high* to the *low* groups. Thus, growth in the top groups may be lower than the bottom groups, but the differences in Infostate values are still an increasing function of Infostates. Thus, differences between the the three groups in the middle and the *low* group, in absolute terms, increase over time. (This can be easily verified by subtracting their Infostate values for every year). The average is also increasing throughout the period, though, and before the evolution of the divide can be computed, the values must be normalized. The normalized Infostate values are shown in section B of Table 3.7.

These results are directly related to the often misunderstood interplay between absolute and relative magnitudes involved. The lower rates of growth of the *have* groups still result in a higher absolute increase because they start from a very high level, whereas the high rates of growth of the *have-not* groups yield a smaller absolute increase because they start from very low levels.[5] The highest rates of Infostate growth were achieved by Sudan, Bangladesh, Kyrgyzstan, Côte d'Ivoire, Syria, Togo, Vietnam, Ethiopia, Moldova and Burkina Faso. Economies with the lowest rates of growth were the U.S., Canada, New Zealand, Finland, Norway, Sweden and Iceland. The one exception here is South Africa, which experienced the lowest rate of Infostate growth (96%), despite starting at a relatively low Infostate value in 1995 (38.8).

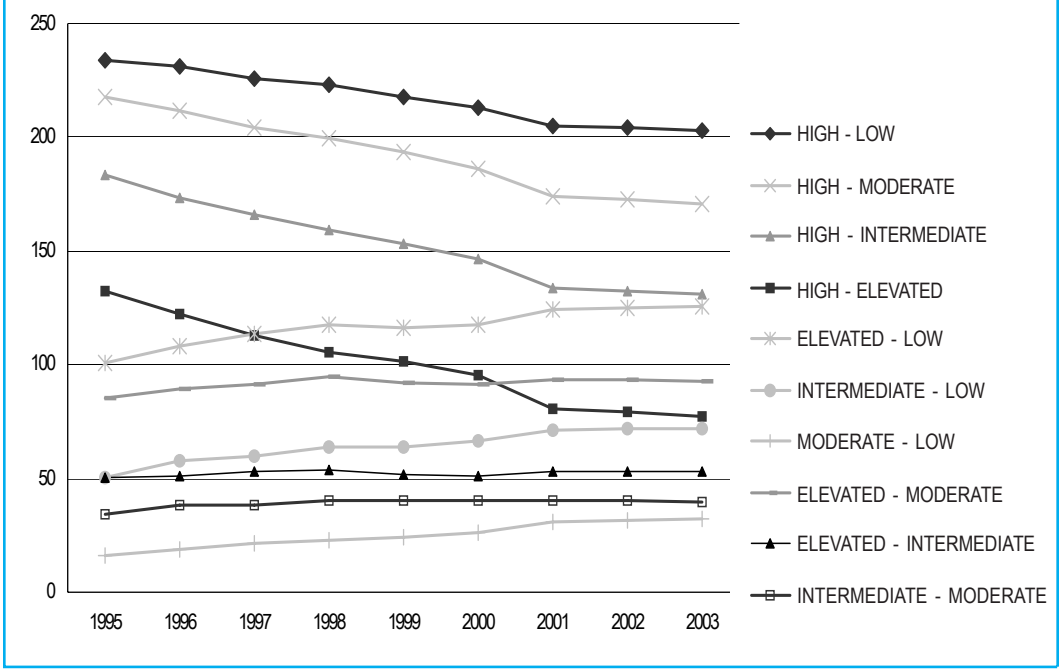
The normalized values allow for meaningful measures of the evolution of the Digital Divide between any pair of the five economy groups (shown in section C of Table 3.7). The direction of these measures over time points to the evolution of the Digital Divide; a downward movement indicates a closing divide between the two groups, and an upward movement indicates a widening divide. Chart 3.4 provides an illustration of the movements. We can see that the divides between the *high* Infostate group and each of the other groups are closing over the period. Moreover, the rates at which the divides are closing are not all the same. The divides are closing faster between the *high* group and the *elevated* (-41.6%), *intermediate* (-28.7%) and *moderate* (-21.7%) groups, than is the case between the *high* and the *low* groups (-13.2%). The interpretation is that economies in the three middle groups are gaining more vis-à-vis the top group than the least-connected, *low* Infostate group. At the same time, we can observe that the *low* group actually loses ground against all other groups (except for the *high*), and most significantly against the *moderate* group. However, the lines begin to level off in 2001, so the rates at which the *low* Infostate group is losing ground towards the end of the reference period are slowing down.

The key messages can be summarized as follows: First, the Digital Divide is closing overall because the middle groups are making good progress against the top. Second, the *low* group is outpaced by middle groups and the only gains are against economies at the very top, with whom they are separated by huge gaps. Third, 2001 marks a leveling-off in both the closing of the divides between the *high* group and all others, and in the *low* group losing ground against all others. This analysis can also be seen in Table 3.7 (D), with the calculations of the changes in the differences between all pairs of economy groups.[6]

[5] *Sometimes the higher rates of growth of the have-not groups are interpreted as indicative of a closing divide. However, it has been documented (Sciadas 2002) that this is not the case. For the divide to close the rate of growth of the have-nots not only must be higher than that of the haves, but must be at least as many times higher as the ratio of their initial difference.*

[6] *In this specification, a negative number indicates a closing divide and a positive number a widening divide.*

Chart 3.4 **Evolution of divides between economy groups**



Economy analysis

Even more detailed insights can be obtained on comparative performances by carrying the analysis to the level of individual economies. Once again, Infostate values are normalized by keeping the average economy, Hypothetica, constant (at its 2003 value). The performances of a number of economies are analyzed in what follows, to demonstrate the changing nature of the Digital Divide over time. For instance, many economies that began at identical Infostate values in 1995 ended up very differently by 2003. Analogously, some economies that were very far apart for much of the reference period ended up with very similar Infostate values.

Chart 3.5 **Patterns of Infostate evolution, I**

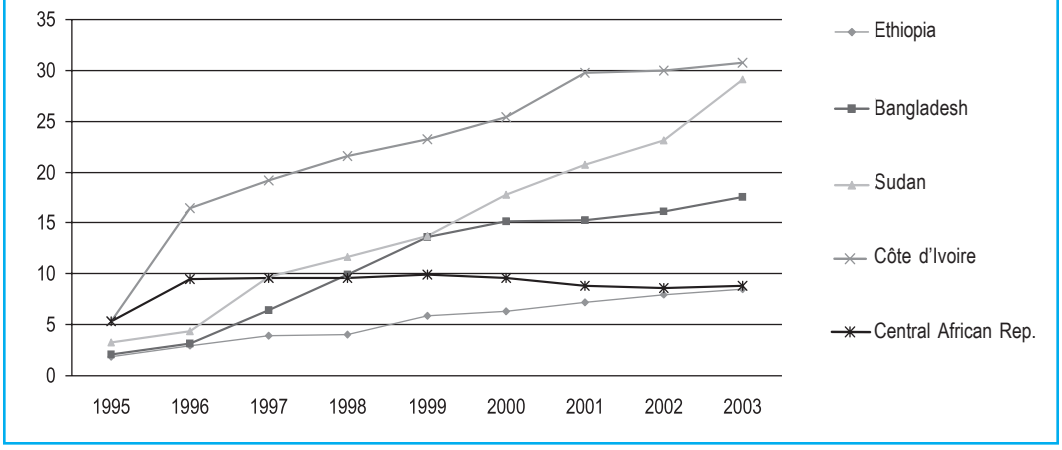


Chart 3.5 depicts a group of economies with very low Infostates. It shows that the Sudan started slightly ahead of Bangladesh but, by 1999, Bangladesh had caught up. Nevertheless, the two economies followed very different paths afterwards. In particular, while Sudan continued to grow rapidly, Bangladesh began to flatten out. At the same time, Ethiopia and Bangladesh started at roughly the same Infostate values in 1995 but, almost immediately, Bangladesh pulled ahead and was significantly higher in 2003. Another interesting pattern of evolution can be seen by comparing Côte d'Ivoire with the Central African Republic. Although both began with identical Infostates in 1995, Côte d'Ivoire experienced phenomenal growth from the first year of the reference period, leaving the Central African Republic well behind with a very flat - even declining - Infostate. In fact, in 2003 the Central African Republic ended at about the same level as Ethiopia, which started from much further behind.

Chart 3.6 **Patterns of Infostate evolution, II**

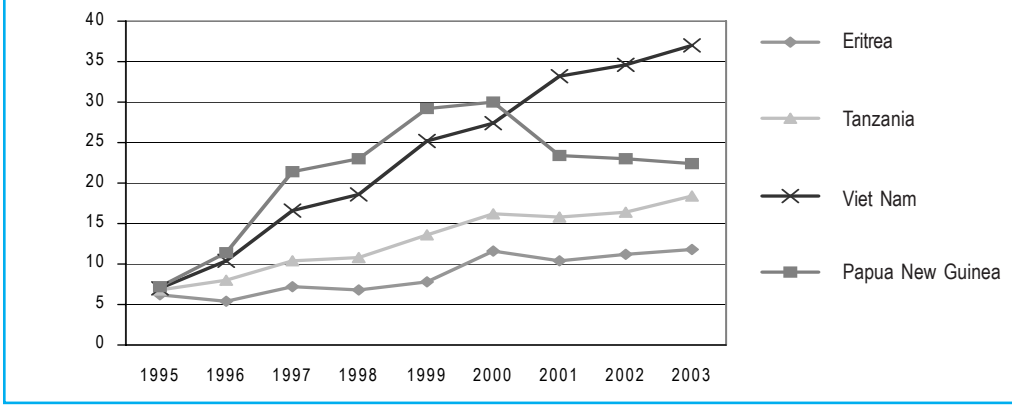
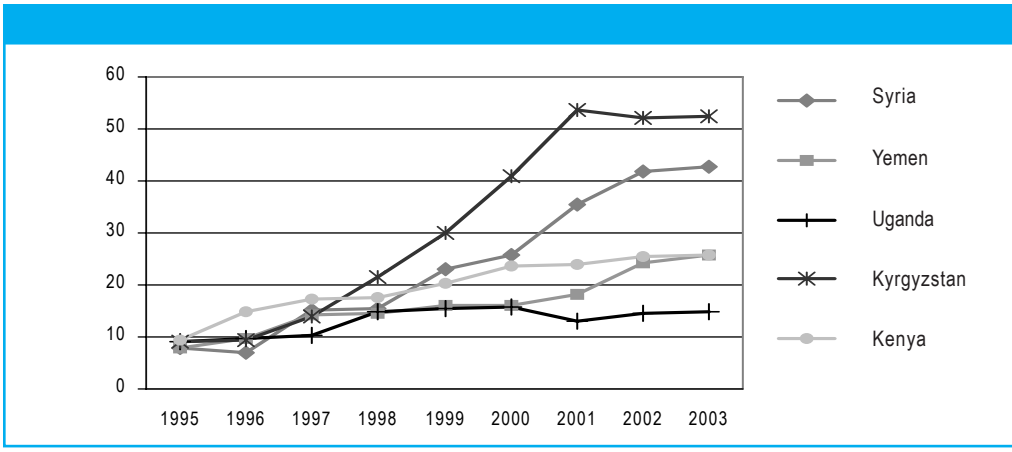


Chart 3.6 follows a few economies with slightly higher, but still low, starting Infostate values. These economies all started from comparable levels in 1995 but finished very differently by 2003. While Papua New Guinea grew faster than the others from 1995 to 2000, its path was characterized by short growth spurts followed by periods of relatively flat growth. Beginning in 2001, that economy experienced declining normalized Infostate values and finished substantially below Vietnam, which experienced high growth over the whole reference period. By contrast, Tanzania finished well below Vietnam and below Papua New Guinea, while Eritrea was not able to sustain more than two years of successive growth over the nine-year period and ended behind all economies in this group.

Chart 3.7 **Patterns of Infostate evolution, III**



The evolution of a group of economies with somewhat higher Infostates is analyzed in Chart 3.7. The very rapid growth in Kyrgyzstan, at least up until 2002, becomes evident. Uganda started at the same level, but its growth has been extremely slow, even negative in 2001. Syria also experienced high Infostate growth, coming from behind Kenya to surpass it in 1999. Moreover, Syria and Yemen started out on the same path, but Syria pulled ahead slightly in 1997 and much more after 2000, while Yemen continued with steady but slower movement.

Chart 3.8 **Patterns of Infostate evolution, IV**

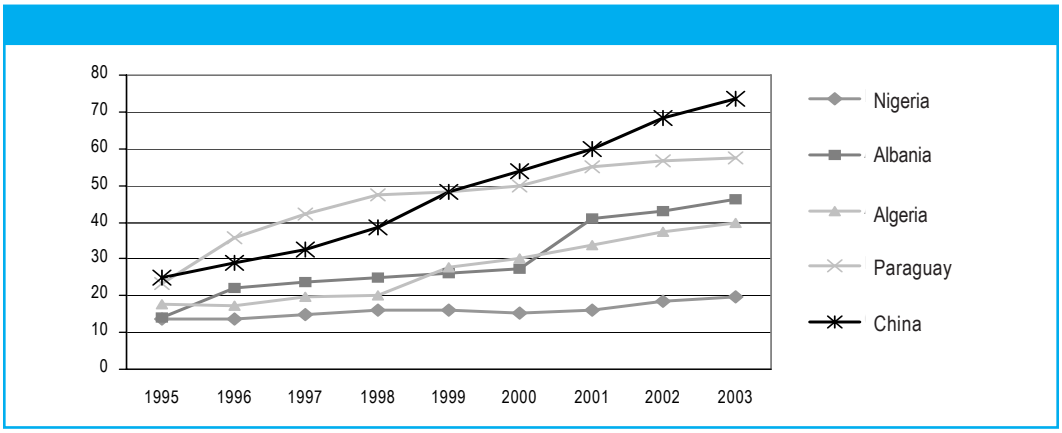
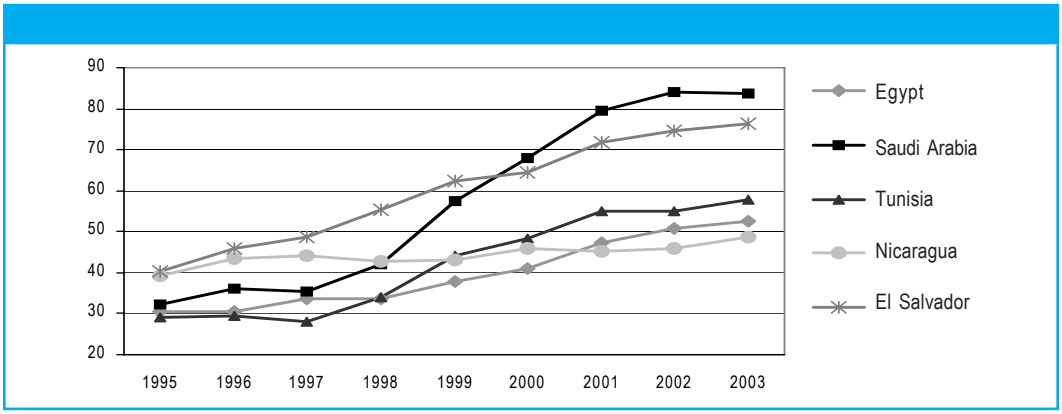


Chart 3.8 contains economies with higher Infostates, the movements of which are also revealing. The Infostates of Albania and Nigeria were identical at the start of the period but, thanks to growth spurts in 1996 and again in 2001, Albania easily outperformed Nigeria, whose growth was small throughout the period. By contrast, Algeria started ahead of Albania in 1995, but found itself behind from 1996 to 1998. In 1999-2000, Algeria caught up and even surpassed Albania, but Albania pulled ahead again in 2001. Similarly, China started marginally ahead of Paraguay, but Paraguay's growth from 1996 to 1998 was such that it quickly surpassed China. Paraguay's sluggish growth in the 2000-2001 period, though, combined with China's very rapid and continuous growth meant that China ended up much higher by 2003.

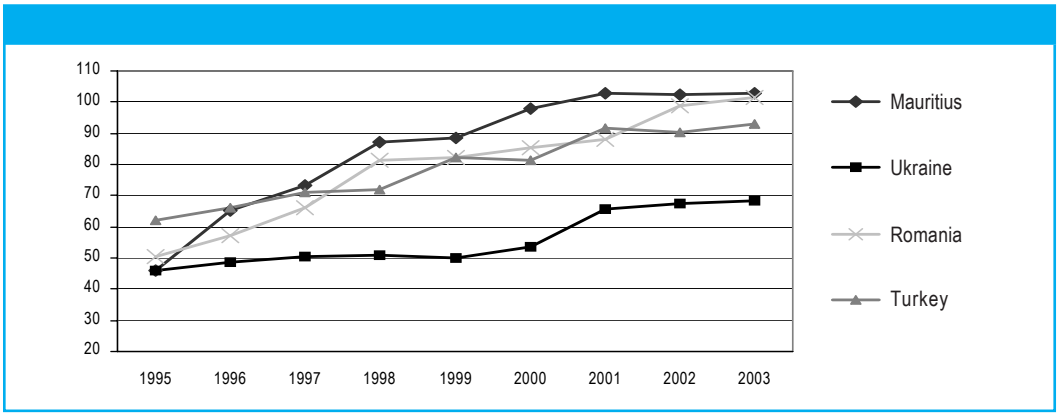
Chart 3.9 **Patterns of Infostate evolution, V**



More interesting patterns among economies with higher Infostates emerge in Chart 3.9. Egypt, Saudi Arabia and Tunisia had comparable Infostates in 1995. Then, Saudi Arabia experienced very strong growth from the beginning, despite a slight drop in 1997 and again in 2003. By the end of the period Saudi Arabia was well in front of the other two. It also exceeded El Salvador that started

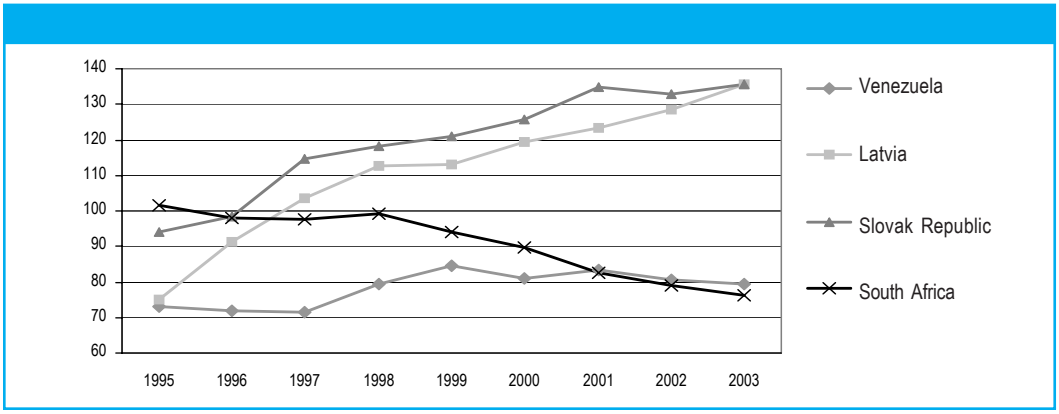
from a much higher level. Egypt's growth, albeit slow early in the period, picked up considerably after 1998 but at the same time Tunisia's did so even more. Nicaragua and El Salvador also started from comparable Infostates in 1995. However, Nicaragua experienced a lackluster growth performance ending up well below El Salvador by 2003. As well, it ended up below Tunisia and Egypt, even though it started quite a bit further ahead.

Chart 3.10 **Patterns of Infostate evolution, VI**



Some other economies with yet higher Infostates are shown in Chart 3.10. Mauritius and Ukraine started together, but the two economies could not have more different patterns of evolution. Infostate levels in Mauritius increased sharply between 1995 and 1996, and again from 1999-2001. By contrast, Ukraine experienced very slow growth and only picked up from 1999-2001, when it finally reached the level Mauritius had achieved in 1996. For much of the period, Mauritius even surpassed Romania, which started higher, but Romania rallied with large jumps in 1998 and 2002. Both economies surpassed Turkey, which started ahead of them. In fact Mauritius made up the 15 points difference with Turkey as early as 1996.

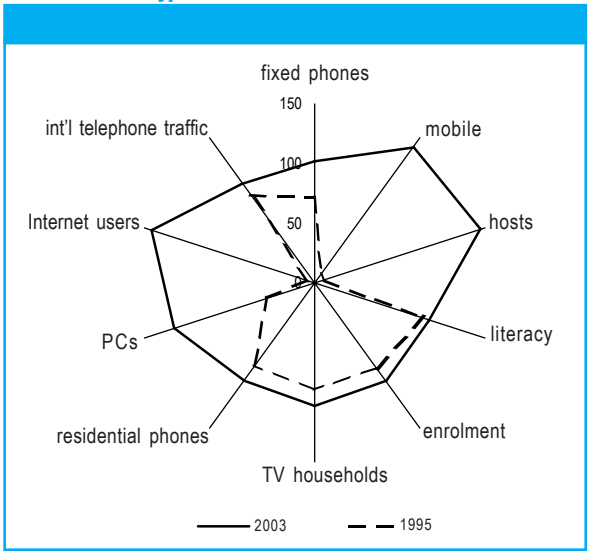
Chart 3.11 **Patterns of Infostate evolution VII**



Finally, Chart 3.11 analyzes the movements of economies with even higher Infostates. In 1995, South Africa started at a level above the Slovak Republic and substantially higher than Latvia and *Venezuela.* However, the performance of Latvia and the Slovak Republic was impressive, whereas South Africa ended up even behind Venezuela, despite the latter's mediocre performance.

The results of the empirical application also make possible the detailed analysis of progress by individual economies, for all indicators and on an annual basis. A visual example of Hypothetica's evolution between 1995 and 2003, and for a number of indicators is shown in Chart 3.12.

Chart 3.12 **Hypothetica's evolution**



This analysis of different patterns of Infostate behaviour has been useful in addressing some of the key policy questions, such as whether the Digital Divide is closing or widening over time, and which economies are making more progress and how fast. However, in order to answer the all-important **why** questions, the linkages between Infostate performance and underlying policies and business strategies for individual economies is critical. This is dealt with in Chapter 5, where a series of regional and economy profiles will provide the much needed context.

Drivers of the evolution

To uncover the main drivers of the movements identified above, an even more detailed analysis examines specific Infostate components and indicators of interest. It does so separately for each of the five economy groups, as well as Hypothetica.

As seen in Table 3.8, each component contributes something to the Digital Divide, but the relative importance of each contribution is very different. Consistent with earlier findings, growth was consistently higher among the *have-not* (or *have-less*) groups. This is even more pronounced within specific components, in particular networks and uptake. These movements account for the slowly narrowing divide between the *high* and *low* groups. On average, between 1995 and 2003, Infodensity increases by about 125%, while Info-use triples. This is largely due to the strong effect that PCs and Internet use exert on Info-use. Although the impact of Internet hosts (part of networks) has the greatest impact on the divide, it was moderated by the skills indicators, resulting in lower overall growth in Infodensity.

Table 3.8 **Detailed component analysis, by group**

Group	Networks		Skills		Infodensity		Uptake		Info-use		Infostate	
	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003
High	76.5	302.8	132.5	137.7	99.7	203.1	104.4	268.1	85.6	240.6	92.1	220.6
Elevated	21.9	146.3	114.6	125.7	48.9	134.3	41.1	168.0	35.4	154.8	41.4	143.0
Intermediate	8.7	66.5	98.0	109.2	26.7	84.5	18.3	98.7	18.6	96.5	22.0	89.8
Moderate	2.1	29.3	87.4	96.8	12.3	52.0	5.1	43.1	7.2	52.4	9.3	51.7
Low	0.4	9.1	47.3	56.0	4.3	21.6	0.8	8.5	2.2	16.9	2.9	18.8
Hypothetica	26.1	120.3	92.0	101.2	49.0	110.3	37.7	116.4	38.3	116.6	43.3	113.4
	growth, 1995-2003 (%)											
High	295.6		3.9		103.8		156.8		181.1		139.6	
Elevated	568.8		9.7		174.9		308.6		336.7		245.7	
Intermediate	661.6		11.4		216.5		438.3		418.7		308.2	
Moderate	1315.6		10.8		323.5		738.4		622.8		457.4	
Low	2025.5		18.3		406.5		1003.5		654.2		547.4	
Hypothetica	360.4		9.9		125.0		208.8		204.8		161.9	
	normalized values											
High	332.0	285.3	163.3	154.3	230.4	208.7	314.1	261.1	253.7	234.0	241.0	220.5
Elevated	94.9	137.9	141.2	140.9	113.0	138.1	123.7	163.6	105.0	150.5	108.3	143.0
Intermediate	37.9	62.7	120.7	122.3	61.7	86.9	55.1	96.1	55.1	93.8	57.6	89.8
Moderate	9.0	27.6	107.6	108.5	28.4	53.4	15.5	42.0	21.5	50.9	24.3	51.6
Low	1.8	8.5	58.3	62.7	9.9	22.2	2.3	8.3	6.6	16.4	7.6	18.8
Hypothetica	113.4	113.4	113.4	113.4	113.4	113.4	113.4	113.4	113.4	113.4	113.4	113.4
	divides											
High-Low	330.2	276.8	105.0	91.6	220.6	186.5	311.7	252.8	247.0	217.6	233.4	201.7
	change in differences, 1995-2003											
High-Low	-53.4		-13.4		-34.1		-58.9		-29.5		-31.7	

With an increase of 360.4% over the 1995-2003 period, ICT networks experienced the most growth. Here, the strong effect of Internet hosts, mobile and fixed networks is apparent. Uptake accounts for a substantial 208.8% of growth, with the impact of Internet use coming through. It is clear that most of the progress in networks came from the *low* group, where growth exceeded 2,000%. The *moderate* group too experienced extraordinary growth, compared with a 'modest' rate of 295.6% for economies in the *high* group. Yugoslavia, the Sudan, Côte d'Ivoire, Moldova, Honduras, Mozambique and Syria are a few examples of economies that made remarkable progress, having started from next to nothing. Canada, New Zealand, Sweden and the U.S. made the least progress, since their networks are already highly-advanced and close to saturation.

Comparisons are again made based on normalized values, so that the Digital Divide between groups (*high* and *low* only this time) and for each component can be measured. We can see again from Table 3.8 that the divide between the *high* and *low* groups narrowed over the 1995-2003 period for all components. The change in differences based on the normalized data indicates a closing Digital Divide. Uptake contributed the most to this, followed closely by networks.

Extending the analysis to the level of individual indicators, we see that most of the gains came from Internet use, followed by Internet hosts and mobile networks (Table 3.9). As we move across the columns from the *have* to the *have-less* Infostate economies, this becomes even more apparent, with the growth rates reaching extraordinary levels. The *low* group experienced the highest rates of growth in all indicators, with the exception of PCs. Here, it was the middle groups – the *moderate*, *intermediate* and *elevated*, respectively – that made the most progress. Moreover, it was in Internet use that the *low* group outgrew each of the others most substantially. Yet, its rate of use is still very low.

Table 3.9 **Analysis by indicators and group**

	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003	1995	2003
	High		Elevated		Intermediate		Moderate		Low		Hypothetica	
wireline	205.5	260.5	99.6	157.5	38.2	75.5	12.0	30.0	1.4	3.7	71.1	101.7
mobile	36.6	350.3	13.1	282.6	4.9	125.7	0.5	51.9	0.1	11.6	8.7	140.3
Internet	54.9	756.4	5.6	130.8	1.0	28.2	0.1	13.4	0.0	0.8	8.2	145.6
literacy	120.1	120.5	115.8	117.4	108.1	111.5	95.0	100.8	60.5	69.8	96.3	101.1
enrolment (combined)	147.2	158.5	113.9	135.2	89.4	107.4	81.2	93.9	38.0	46.1	87.9	101.3
enrolment (tertiary)	249.6	218.8	140.1	164.5	98.7	97.6	67.0	70.2	12.8	13.2	100.0	100.0
TV households	138.2	146.8	132.0	142.9	110.7	130.3	74.5	94.7	18.1	29.6	88.7	102.8
residential phones	193.6	193.6	149.0	165.8	85.2	116.0	34.9	57.7	3.8	8.4	84.7	100.7
PCs	175.2	432.4	40.2	157.3	17.2	72.2	5.7	26.4	2.0	6.6	42.3	123.4
Internet use	29.7	434.3	6.0	240.0	1.1	110.2	0.2	36.4	0.0	5.7	6.4	143.9
	growth, 1995-2003 (%)											
wireline	26.8		58.0		97.9		150.8		157.6		43.1	
mobile	856.4		2,064.7		2,478.0		9,780.8		19,493.2		1,505.8	
Internet	1,278.3		2,241.1		2,657.1		16,714.5		20,418.5		1,675.9	
literacy	0.4		1.4		3.2		6.1		15.4		4.9	
enrolment (combined)	7.7		18.7		20.1		15.6		21.2		15.2	
enrolment (tertiary)	-12.3		17.4		-1.1		4.9		3.3		0.0	
TV households	6.3		8.2		17.6		27.1		62.9		16.0	
residential phones	0.0		11.3		36.1		65.2		122.4		18.9	
PCs	146.8		291.6		319.4		361.9		227.0		191.6	
Internet use	1,360.4		3,905.2		10,041.2		20,585.7		46,520.3		2,163.5	
	normalized values											
wireline	327.7	290.4	158.9	175.5	60.9	84.2	19.1	33.5	2.3	4.1	113.4	113.4
mobile	475.3	283.1	169.4	228.4	63.2	101.5	6.8	41.9	0.8	9.3	113.4	113.4
Internet	759.1	589.2	77.3	101.9	14.1	22.0	1.1	10.5	0.1	0.6	113.4	113.4
literacy	141.3	135.1	136.3	131.7	127.2	125.1	111.9	113.1	71.2	78.3	113.4	113.4
enrolment (combined)	189.8	177.4	146.9	151.4	115.3	120.2	104.8	105.1	49.0	51.6	113.4	113.4
enrolment (tertiary)	283.0	248.1	158.9	186.5	111.9	110.7	76.0	79.7	14.5	15.0	113.4	113.4
TV households	176.7	161.9	168.8	157.6	141.6	143.7	95.3	104.5	23.2	32.6	113.4	113.4
residential phones	259.2	218.1	199.6	186.8	114.1	130.7	46.8	65.0	5.1	9.5	113.4	113.4
PCs	469.5	397.5	107.7	144.6	46.1	66.4	15.3	24.3	5.4	6.0	113.4	113.4
Internet use	530.6	342.3	106.9	189.2	19.4	86.9	3.1	28.7	0.2	4.5	113.4	113.4

In mobile networks, phenomenal growth was experienced by Yugoslavia, Albania, Côte d'Ivoire, Panama, Sudan, Botswana, Moldova and Syria, all economies that started from next-to-nothing levels. These economies were dispersed among the *low*, *moderate* and *intermediate* groups. In Internet hosts, growth was led by Yugoslavia, Qatar, Samoa, Paraguay, Kyrgyzstan, Bangladesh and Tanzania, accompanied by other African, Asian and Latin American economies where, again, many barely registered positive values at the end of the reference period. These economies were a mix from all groups, with the exception of the *high* group.

The highest growth in fixed networks was experienced again by the *low* group, which grew almost four times the average. Growth here was led by the Sudan, followed by Albania, Sri Lanka, Vietnam, Ethiopia, Cambodia and China. Declines were registered in Belize and the Central African Republic, while some economies with already highly-advanced networks lost some ground due to substitutions of cell phones (e.g. Luxembourg, New Zealand and Finland).

The growth in skills was low both for inherent reasons, as skills improve slowly, and for reasons related to their measurement, as previously discussed. Literacy rates and enrolment in primary education in particular are subject to less variability than other Information Society indicators and they have little room to grow among a good number of economies. Again, as we move to higher skills, growth was significant and even more so among economies in the *low* group, which outgrew the *high* group by a factor of five. This was true for both literacy and enrolment. In literacy the gains came primarily from African economies with Chad, Burkina Faso, Gambia, Benin, the Central African Republic, Ethiopia and Mali topping the list. A more mixed group of economies led growth in overall enrolment - Ethiopia, Brazil, Mozambique, Uganda, Jordan, Bangladesh, Bolivia, Benin, Yugoslavia and Thailand. As a group, it was the *elevated* that led the growth in tertiary education, but a mix of economies from various groups had the strongest growth – Djibouti, Vietnam, Kyrgyzstan, Latvia, China, Mongolia, Mali, Macao and Yemen.

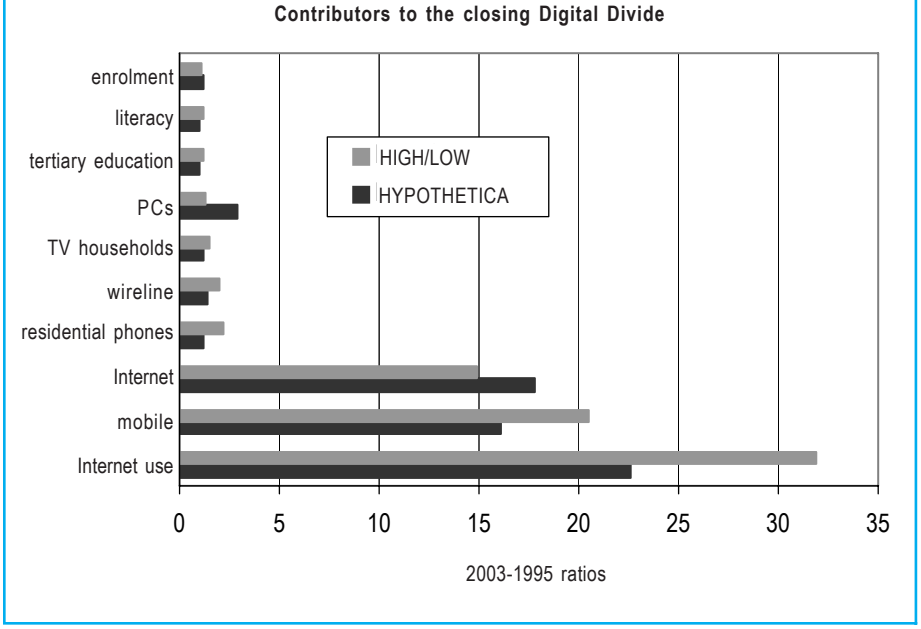
Growth in ICT uptake was 908.3% for the *low* group compared to 156.8% for the *high* group. As we have seen, Internet use was overwhelmingly responsible for this explosion of growth, which is experienced by all groups to varying degrees. Over the reference period, Internet use increased on average by a whopping 2,164%, substantially more than any of the other indicators. The bottom three groups were the driving force behind this phenomenon, with many economies starting from nothing in 1995. Leading economies were Vietnam, Sudan, Syria, Bangladesh, Oman, Cuba, Togo, Pakistan, Yemen, Papua New Guinea, Côte d'Ivoire and Ethiopia. However, as has been explained, the breakneck growth speed experienced by the *low* group has not led to commensurate absolute usage rates. Moreover, Internet use was leading even in the *high* and *elevated* groups, indicative of the technology's widespread appeal and continuous permeation.

Growth in PCs is observed mainly in the three middle groups. The *low* group also made progress, whereas the *high* group was relatively weak in this area. Leaders here were Bangladesh, Kyrgyzstan, Myanmar, Honduras, Gambia, Latvia and Armenia.

Residential phone lines grew more modestly, with growth in the *high* group remaining flat, indicating a situation close to saturation. The *low* group was again the leader, with Sudan, Albania, China, Ghana, Vietnam, Mauritania and Lao at the front. Even less was happening with the TV households indicator. Nonetheless, economies which started with very low levels made considerable progress, including Nepal, Togo, Papua New Guinea, Lao, Mozambique, Ethiopia and Bangladesh.

A summary of the relative contributions of individual indicators in the overall slow closing of the Digital Divide between the *high* and *low* groups is illustrated in Chart 3.13. Here, the ratios of the *high* and the *low* groups were computed for each indicator and for the years 1995 and 2003. Then, for each indicator, the 2003/1995 ratio was plotted, together with the 2003/1995 ratios of the average. The extent to which each factor had an impact on the narrowing gap between the *high* and *low* pair of groups is observed, as are the average movements over the reference period. Clearly, much of the upward movement is accounted for by Internet use, along with Internet hosts and mobile networks. Perhaps ironically, but not surprisingly, the same factors that created the Digital Divide in the first place are the ones accounting for much of its slow narrowing.

Chart 3.13 **Hypothetica's evolution**



Chapter 4

MACROECONOMIC IMPACTS

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The economic impacts of ICTs on the firm, industry and macro levels have been the subject of intense investigation for some time, but research has mainly focussed on developed economies. This chapter contributes to such research by providing an empirical analysis at the macro level of the impact of Infostates on economies' economic growth. The dataset used covers up to 147 economies at very different stages of development, and extends over the 1995-2003 period. First, the chapter illustrates the relationship between Infodensity[7] and per capita GDP, identifies interesting divergences from the general pattern, and discusses possible explanations. Then, based on a more comprehensive growth accounting model, which includes data on investment, trade, population growth and inflation, it measures the impact of Infodensity on economies' economic growth, including the marginal effects of an additional Infodensity point on per capita GDP. Based on the assumption that economic growth is not equally sensitive to Infodensity changes across economies at different stages of development, further insights are revealed when the empirical estimation is extended to five different country groups with very different Infodensities.

4.1 The relationship between Infodensity and per capita GDP revisited

As in previous research (Orbicom 2003), Infodensity is found to be highly correlated with per capita GDP (expressed in $US and in PPP terms), with a correlation coefficient of 0.95[8]. At the same time, the relationship between the two variables has grown more robust over the period, during which Infodensities increased substantially, with the 2003 values more evenly distributed along the regression line than the 1995 values. Chart 4.1 displays the estimated relationship between Infodensity and per capita GDP for the extreme years in the data[9]. (The relationship between per capita GDP and Infostates is largely the same and not shown). The results of the regression show that 80% of the variation in the rates of growth of per capita GDP

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* *The opinions expressed in this article are the author's own and should not be attributed to UNCTAD.*

[7] *According to the conceptual framework in Chapter 1, Infodensity refers to the stocks of ICT capital and labour and is directly related to a country's productive capacity. Thus, in principle, it is a better aggregate to use in such work than Infostate, which includes ICT usage by individuals as well. While both aggregates were included throughout the empirical work, the presentation of the results is based on Infodensity, but references are made to results associated with Infostate whenever appropriate.*

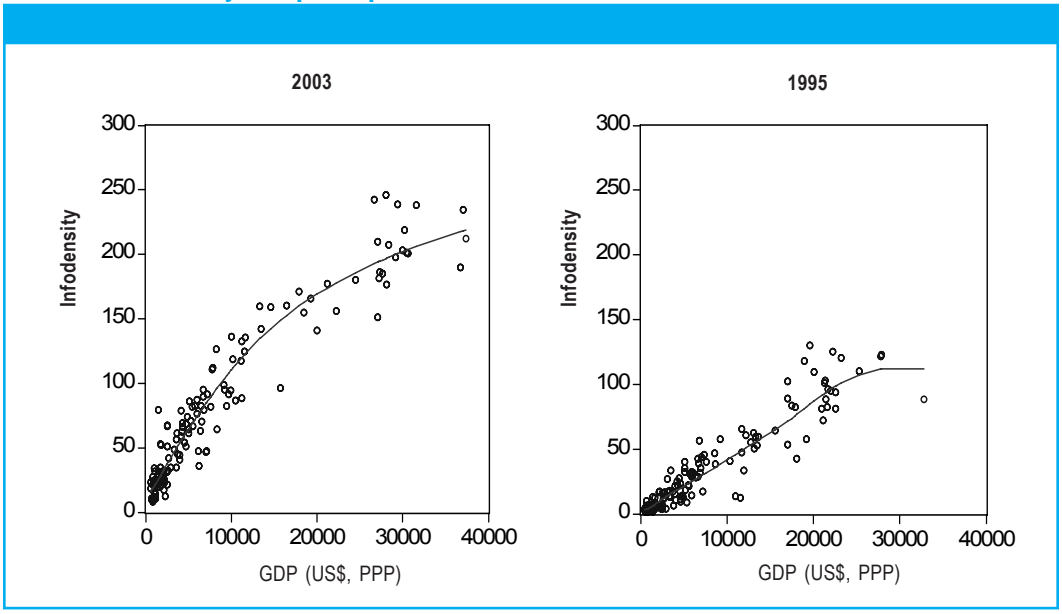
[8] *The correlation coefficient between per capita GDP and Infostate was almost identical (0.94). There was a small and gradual decline in both correlation coefficients over time.*

[9] *The estimation is based on a nearest neighbor regression fit with a bandwidth span of 1, tricube local weighting, a polynomial degree of 2, 4 robustness iterations and symmetric neighbours.*

is explained by the variation in the growth rate of Infodensity[10]. This confirms the strong linkage between the level of ICT advancement of a country and its level of income. The chart also shows that the fitted line for 2003 is steeper than for 1995. This suggests that, on average, economic growth is more responsive to ICT changes today than it was a decade or so ago.

Research on the digital divide, whether within or across economies, has demonstrated that a strong relationship exists between rates of adoption and use of ICTs and levels of income, whether personal or national. While this is so on average, it is instructive to investigate deeper where, when and why the degree of this relationship differs. As shown even by the simple regressions in Chart 4.1, two groups of economies can be identified: those that lie above the fitted line, with Infodensity values higher than their income levels would suggest; and those that lie below the fitted line with levels of per capita GDP higher than their Infodensity levels would suggest[11]. This section sets out to examine in more detail those economies that lie further away from the average, and whose values diverge more from the estimated relationship in 2003. It identifies economies in each group, as well as incorporates further analysis on the basis of their Infodensity and per capita GDP rates of growth. This sheds more light on why certain economies with similar Infodensity levels have different GDP levels, and vice versa.

Chart 4.1 **Infodensity and per capita GDP**



Countries with higher than proportional Infodensity: Table 4.1 presents information for a selected number of countries, sorted according to their 2003 Infodensity levels. All of them have Infodensity values higher than would have been predicted by their per capita GDP levels, as per the previous regression. Clearly, the list includes both rich and poor economies. Combining this information with the economies' growth performance over the 1995-2003 period, helps to identify where ICTs have been a relatively major driver of growth.

[10] *This is the R-squared of the regression and is conditional on the omission of other relevant variables.*

[11] *Such divergences are measured by the difference between the actual 2003 Infodensity values and the values predicted by the simple regression of Infodensity on per capita GDP. Overall, there were 74 economies with higher than 'expected' Infodensity, and 68 economies with higher than 'expected' per capita GDP (out of the available sample of 142 economies for which data on both per capita GDP and Infodensity were available). The country examples selected are the most extreme values (positive and negative) of the residuals captured.*

Table 4.1 **Infodensity higher than predicted by per capita GDP**

Economies (above the fitted line)	ID 2003 (index)	per capita GDP 2003 ($US, PPP)	average annual rate of growth (1995-2003) ID %	average annual rate of growth (1995-2003) per capita GDP %	Predicted ID 2003 (index)
Mongolia	52	1,802	36.4	4.3	29
Kyrgyzstan	53	1,714	36.5	5.5	28
Bolivia	67	2,546	20.3	2.5	38
Georgia	67	2,569	24.8	8.0	38
Jamaica	79	4,184	11.6	2.2	56
Moldova	79	1,505	37.4	0.9	25
Lebanon	86	5,073	12.3	3.8	65
Bulgaria	112	7,807	17.5	3.9	91
Uruguay	126	8,280	16.0	1.3	95
Latvia	136	9,981	16.7	8.8	110
Estonia	160	13,348	14.2	8.9	135
Sweden	242	26,656	8.2	3.9	193
Finland	238	31,630	9.3	3.9	206
Netherlands	238	29,412	11.5	4.2	201
Denmark	246	28,027	9.4	3.4	197
sample average annual growth rates (1995-2003) (%)			20.1	3.8	

Four situations illustrate the different dynamics at work:

- Above-average growth rates in both Infodensity and per capita GDP (Mongolia, Kyrgyzstan and Georgia);
- Above-average growth rate in Infodensity only (Moldova and Bolivia);
- Above-average growth rates in per capita GDP only (Lebanon, Bulgaria, Latvia, Estonia, Sweden, Finland, the Netherlands), and;
- Below-average growth rates in both per capita GDP and Infodensity (Jamaica, Uruguay and Denmark).

In some economies, higher-than-average per capita GDP growth is matched with higher-than-average Infodensity growth; in others, this is not so. The case of Moldova is particularly salient: while its high growth rate in Infodensity is one of the best performances in the sample, it has not been matched by a similarly good economic performance – just a 0.94% average annual per capita GDP growth rate over the period. Thus, at least up to 2003, the economy's solid performance in ICTs has not translated to significant economic gains. By contrast, Georgia, Mongolia and Kyrgyzstan appear to have leveraged ICT investments more for their economic growth. On the other hand, in economies like Latvia and Estonia, while growth was definitely aided by ICTs, it was also driven by other forces.

Among the richer economies in this group, the rates of Infodensity growth were much lower during the period. As well, the differences between their per capita GDP and Infodensity rates of growth were considerably smaller than those of poorer economies. For the richest economies there were no cases of extreme Infodensity growth rates. By contrast, among some developing economies, slow economic growth was coupled with huge increases in Infodensity. These findings are not surprising and are largely explained by the economies' starting levels of Infodensity - which were considerably higher among richer economies. As was explained in Chapter 3, Infostate growth is much higher among the *have-not* economies, which start from very low initial levels (which may still translate to lower absolute improvements than in *have* economies despite lower Infostate growth in the latter). However, no country experienced per capita GDP growth higher than growth in Infodensity during the 1995-2003 period. Even among the richer economies, the growth rates of

Infodensity were always higher than the corresponding growth rates of per capita GDP. This attests to the continuing dynamism of those parts of the economy associated with the production, diffusion and use of ICTs compared to the rest of the economy even in highly developed economies.

In developing economies, the phenomenon of relatively low per capita GDP growth coupled with high Infodensity growth might be explained by inefficient ICT uptake, the absence of 'positive externalities', or the overall policy environment. The take-up problem could be due to inefficient investments, which hinder a country from reaping the benefits of ICT inputs. The lack of 'positive externalities' might be due to the need for a critical threshold of Infodensity – in absolute terms. Moreover, it takes time for experience to accumulate; therefore, the response of developing economies to the introduction of new ICTs may suffer from a certain degree of inertia. There are also a number of other reasons why an economy is held up from growing, such as all kinds of other economic policies (investment, trade, monetary policy, etc.) and geopolitical factors.

Economies with higher than proportional GDP: Similar information for a second group of economies, with comparatively better performances in terms of their per capita GDP levels than would have been suggested by their Infodensity levels, is contained in Table 4.2. (These are the observations lying below the fitted line in Chart 4.1. Again, the list includes both developed and developing economies. In this group, however, economies had below-average Infodensity growth – with the exception of Botswana and Mauritius. Moreover, no country experienced above-average Infodensity growth, and at the same time below-average per capita GDP growth.

Table 4.2 **Infodensity lower than predicted by per capita GDP**

Economies (below the fitted line)	ID 2003 (index)	per capita GDP 2003 ($US, PPP)	average annual rate of growth (1995-2003) ID %	average annual rate of growth (1995-2003) per capita GDP %	Predicted ID 2003 (index)
Angola	12	2,319	12.4	4.5	35
Algeria	36	6,248	18.4	3.8	77
Tunisia	47	7,083	16.7	5.3	85
Gabon	47	6,134	16.9	0.6	75
Iran	47	7,145	16.5	4.9	85
Botswana	64	8,359	40.7	5.8	96
Costa Rica	82	9,490	9.9	4.7	106
South Africa	87	10,492	8.1	2.6	114
Mauritius	89	11,258	25.8	5.7	120
Barbados	96	15,714	14.6	3.5	149
Greece	141	19,973	12.6	5.7	169
Italy	151	27,050	2.4	9.8	194
Spain	156	22,264	11.9	4.6	178
Japan	177	28,162	10.4	2.8	197
Ireland	190	36,775	10.9	9.8	218
sample average annual growth rates (1995-2003) (%)			20.1	3.8	

The following behaviours are observed:

- High per capita GDP growth was matched with a rather moderate (below average) Infodensity growth (Angola, Algeria, Tunisia, Iran, Costa Rica, Greece, Spain, Ireland);
- Economies experienced above-average growth rates for both GDP and Infodensity (Botswana and Mauritius);
- Some economies had below-average growth rates for both GDP and Infodensity (Italy and Japan among developed economies, but also Barbados, Gabon and South Africa among developing economies).

Therefore, it appears that while the growth of some economies was largely ICT-driven, some economies grew through forces not relying excessively on ICTs. An alternative interpretation may be related to how ICT investments are leveraged, rather than how extensive they are. This, however, depends on many factors, including the actual magnitudes of both Infodensity and GDP and economy-specific contexts, so no definitive conclusions can be drawn. In addition to the nuances alluded to here, future work could also look closer at the issue of causality between the two aggregates.

These results capture once again clearly, though, the pervasive dynamism brought about by ICTs everywhere over the last decade. Even among economies with 2003 Infodensity levels lower than what their income levels would suggest, Infodensity growth rates were always higher than per capita GDP growth rates. This suggests that, if this trend continues, these discrepancies are likely to disappear eventually – obviously, with different speeds among different economies. At the same time, the results from this analysis could be taken as a warning that Infostates alone cannot explain the enormous income gaps between economies. Put differently, a closing of the digital divide will not fully solve big global income disparities. Some economies will continue to be very rich and have relatively lower Infostates, while others will remain very poor despite above-average Infostate progress. ICTs represent the newest addition to the kit of development tools, but they must be seen within the context of overall development efforts. In that sense, these findings provide support to the mainstreaming of ICTs for development.

4.2 Measuring the impact of Infodensity on economic growth

The previous analysis, as well as empirical work carried out elsewhere (e.g. European Commission 2001, OECD 2003), suggest a positive impact of ICTs on economic growth. Broadly speaking, the main theoretical frameworks for interpreting the impact of ICTs on growth at the macro level argue that the incorporation of ICTs can make the production processes more cost-efficient leading to productivity improvements, and ICT-related investments are likely to further technological progress. A complementary interpretation is that better ICT infrastructure lowers transaction costs and therefore boosts the volume of trade between better-connected regions (Freund and Weinhold 2002).

This section takes a macroeconomic approach, looking for evidence on how ICTs contribute to productivity gains. For this purpose, following a basic initial analysis, a more complex growth accounting model is used, along with the previous finding that GDP's responsiveness to Infodensity has significantly changed over time. Then, the analysis is further deepened by focussing on country groups with different levels of Infodensity, to examine how ICTs impact on the growth of economies at different levels of development, including the least advanced economies.

A basic model and early findings: In addition to identifying the correlation between Infodensity and per capita GDP, Chart 4.1 demonstrated that their relationship is not linear. This is so because the income divide is bigger than the digital divide among economies. Higher GDP levels are coupled with proportionately lower (albeit still high) Infodensity levels, making the slope coefficient decline at the upper end. In other words, the marginal effects of Infodensity on GDP are declining as Infodensity increases. A real life example would be that one more Internet provider in an ICT-rich country does not make as much difference as an additional Internet provider in an ICT-poor country - all other things constant. Therefore, the econometric model that follows (equation 1) uses a

logarithmic transformation for the estimation. Such a functional form also has the advantage of easy interpretation, relating one growth rate to the other.

$$\log (GDP_{i,t}) = c + a \log(ID_{i,t}) \quad (1)$$

In this model, GDP refers to per capita GDP (PPP) and ID to Infodensity. The a coefficient is the elasticity, and measures how sensitive per capita GDP is to changes in Infodensity. For example, if a is 0.9, a 1% increase in the Infodensity index of a country would, on average, result in about a 0.9% increase in its per capita GDP. The estimation results are presented in Table 4.3.

Clearly, the results show that not only the sensitivity of per capita GDP to changes in Infodensity is large, but also that it has increased progressively over the period (see column with elasticity values). The marginal effects indicate that, on average, a 1 point increase in the Infodensity index would increase per capita GDP by $139-$193 dollars per year. These effects, while sizeable, exhibit a decreasing trend.[12]

Table 4.3 **Estimation results from basic model**

Year	economies in sample	c (t-stat)	a elasticity (t-stat)	R-squared	per capita GDP mean ($US, PPP)	ID mean index	marginal effects($)
1995	146	5.9 (56.0)	0.85 (29.9)	0.86	7,356	32	193
1996	146	5.6 (50.2)	0.88 (30.0)	0.84	7,670	40	168
1997	146	5.2 (39.0)	0.96 (27.5)	0.85	8,059	48	162
1998	146	4.9 (32.0)	0.99 (25.0)	0.85	8,308	55	151
1999	145	4.5 (28.1)	1.07 (26.8)	0.87	8,562	62	147
2000	145	4.1 (24.5)	1.15 (29.2)	0.86	9,088	71	148
2001	145	3.7 (19.1)	1.21 (26.7)	0.87	9,418	77	147
2002	142	3.5 (16.6)	1.23 (25.9)	0.87	9,601	82	144
2003	134	3.4 (15.4)	1.24 (25.1)	0.87	9,796	87	139

An extended model: Although the basic estimation method above accurately captures the direction of Infodensity's impact on per capita GDP, it is very likely to overestimate the extent of the impact because a number of important variables are not taken into account. Thus, the model was extended in order to control for other variables that have an impact on the growth rate of a country, as follows:

$$\log(GDP_{percapita\ t,i}) = a_0 + a_1 Population\ Growth_{t,i} + a_2\left(\frac{GCF}{GDP}\right)_{t,i} + a_3 OPENNESS_{t,i} + a_4 Inflation_{t,i} + a_t \log(ID)_{t,i} \quad (2)$$

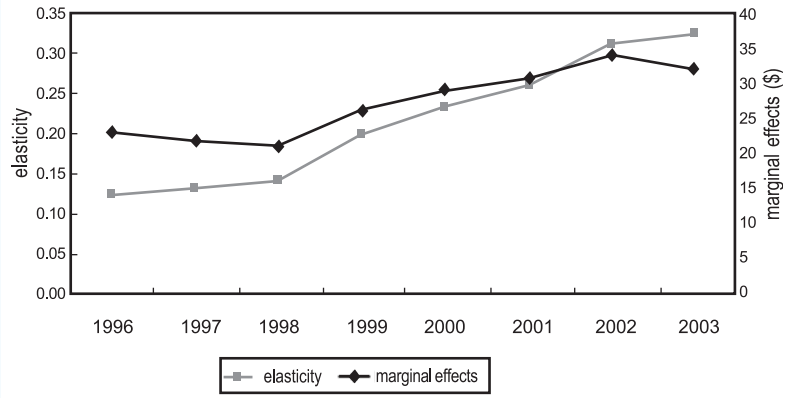
[12] *This is so because of the exceptional Infodensity growth over the period, which results in a lower GDP/Infodensity ratio in the formula for the calculation of the marginal effects of Infodensity on per capita GDP, which is given by:*

$\frac{\partial GDP}{\partial ID} = elasticity_{GDPtoID} * \frac{GDP}{ID}$, *where the GDP/ID ratio is evaluated at the mean of the variables.*

The per capita GDP growth rate is represented here as a function of the annual population growth rate, the gross capital formation (GCF) as a percentage of GDP (proxy for investment), a classical index of the openness of the economy[13], an annual inflation index (calculated from the GDP deflator), and Infodensity. The most reliable results of this model specification are those related to the entire sample. Here, the model explains 73% of the variation in per capita GDP growth rates across time and economies[14]. Furthermore, the graphical results in Chart 4.1, where the slope of the estimated function seemed to be increasing between 1995 and 2003, are validated by the econometric output of this more complex model. The estimated elasticity coefficients (a_t) exhibit the upward trend found there, increasing from 0.1 in 1996[15] to 0.3 by 2003 (Table 4.4 and Chart 4.2). That is, a 1% increase in the Infodensity index of a country would, on average, have resulted in a 0.3% increase in its per capita GDP in 2003. Merely having a satisfactory performance in an Infostate aggregate, does not mean that a country already benefits from the positive effects of ICTs. The elasticity coefficients are a good measure of the degree to which ICT-related inputs have been incorporated into the production processes of a country. The higher the elasticity, the higher the productivity gains that are likely to accrue from increases in the Infodensity.

The elasticity values, together with the values of the Infodensity and per capita GDP aggregates, can be used to compute the marginal effects of Infodensity on per capita GDP on a yearly basis. Rather than measuring the relationship between the *growth rates*, as in the case of the elasticities, marginal effects measure the relationship between the *levels* of the analyzed variables. They evaluate by how much would the level of per capita GDP increase following a one-point increase in the Infodensity index. The results are presented in the last column of Table 4.4 (and also plotted in Chart 4.2)[16].

Chart 4.2 **Elasticities and marginal effects**



[13] *Openess = (exports + imports)/GDP*

[14] *As for the control variables, the model returns significant and of the right sign estimates for the investment proxy. A 10% increase in the the GDP share of the gross capital formation of a country results in a 4% increase in its per capita GDP. The variables for the population and inflation growth rates also had the expected signs, but were not statistically different from zero. The openness index was only significant when the Infostate specification was run - and in that case it had a very small but positive impact on economic growth (a 10% increase in the openness index would lead to a 0.6% increase in per capita GDP).*

[15] *In this estimation, 1995 estimates are not returned statistically significant.*

[16] *As explained in footnote 12, the computation of the marginal effects involves a combination of the estimated elasticity values from the model and the quotient of sample averages for per capita GDP and Infodensity. Therefore, considering the extremely high growth of Infodensity during the period of the study, marginal effects must be interpreted with caution; more emphasis is placed on the time trend analysis rather than on the absolute values.*

Marginal effects declined somewhat between 1996 and 1998, but as of 1999 they picked up until 2003. The reason for the decline was the very high increase in Infodensity during that period, which resulted in greatly reduced per capita GDP over Infodensity ratios. Two factors account for the subsequent increase: the first is the accelerated increase in the elasticity coefficients as of 1999, and the second a slowdown in the continuous reduction of the GDP-to-Infodensity ratio. As has been explained throughout this publication, this second phenomenon is more common among economies with higher levels of Infodensity – with less room to grow given their high ICT levels. One interpretation of this is that the impact of Infodensity on the income/productivity levels is not likely to dampen out in the near future even among developed economies, despite that over the long-term Infodensity can be expected to match overall GDP growth.

Table 4.4 **Global estimation of the model**

Year	number of economies	per capita GDP elasticity	per capita GDP mean ($US, PPP)	ID mean (index)	marginal effects ($)
1996	147	0.12	7,654	41	23
1997	147	0.13	8,039	49	22
1998	147	0.14	8,284	56	21
1999	146	0.20	8,537	65	26
2000	146	0.24	9,060	73	29
2001	146	0.26	9,386	80	31
2002	143	0.31	9,565	87	34
2003	135	0.33	9,572	97	32

Analysis by country groups: A key research question has been how ICTs facilitate economic growth at different stages of development. In other words, if some level of ICTs contributes to growth, does a higher level contribute more? And, are there critical thresholds both at the low end, before ICTs start to make a dent on productivity, and at the high end, when their continuing increase may be subject to diminishing returns? Partial answers to such questions were offered earlier, through the increasing elasticity values over time. In order to delve more into these issues, this section examines how the results vary across the spectrum of economies, and the analysis turns to separate estimations of the model for groups of economies with different Infodensity levels. Economies were sorted according to their 2003 Infodensity values and categorized into five groups[17]. These are shown in Table 4.5, together with their per capita GDP and Infodensity shares[18].

Table 4.5 **Country groups**

	high	elevated	intermediate	moderate	low
2003					
ID range (index)	171-246	103-166	70-99	34-69	8-32
per capita GDP share (%)	47.0	24.8	13.8	10.7	3.7
ID share (%)	36.0	25.5	17.6	14.9	14.9

These groupings immediately reveal different stages of the per capita GDP-Infodensity gap. For example, the *high* Infodensity group has a higher than proportional per capita GDP share in the total sample, reflecting the inclusion of many rich economies. The group of economies with *elevated* Infodensity has very similar shares of Infodensity and per capita GDP, while all the other groups have a lower per capita GDP share than Infodensity share, reflecting the inclusion of economies with low incomes. Moreover, this corroborates the earlier finding that the income gap is much larger than the Infodensity gap. While the average Infodensity level for the *low* group of

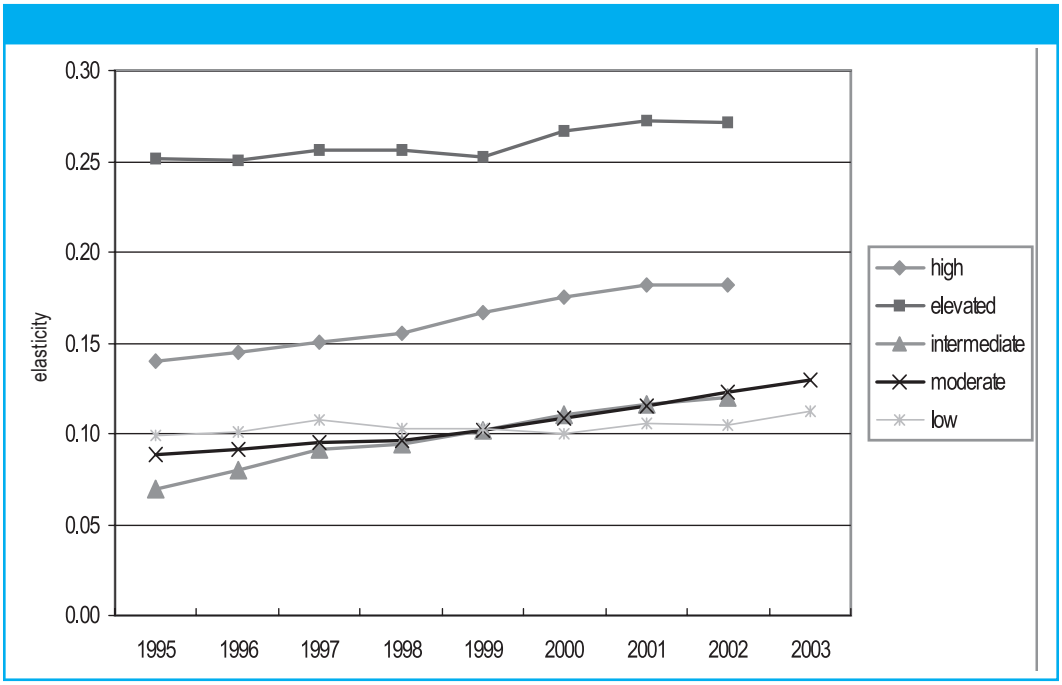
[17] *These groupings are **not** the same as those in Chapter 3; here, they are based on 2003 Infodensity values rather than Infostate values. Thus, more economies are included, and although most common in both groupings, the lists differ.*

[18] *Group shares are arrived at as: shareX = (Σ Xgroup i / Σ X sample)*100, with X=GDP or ID and i=5 groups.*

economies stands at more than 10% of the *high* group's average level, its average per capita GDP only amounts to less than 5% of the *high* group's average. In general, economies in the *low* group have below-average per capita GDP group growth (with the exception of Georgia, Kyrgyzstan and Tanzania), whereas they are characterized by impressive Infodensity growth – starting from very low levels as has been explained extensively.

The elasticity coefficients obtained from the regressions[19] performed for each group are displayed in Chart 4.3. In each group, they exhibit the same upward trend found in the global estimation, but they are considerably higher for the group of economies with *elevated* Infodensity. This indicates that the impact of the increased Infodensity on economic growth has been larger in this group, which benefited more than the others over the 1995-2003 period. (As was shown in Chapter 3, the elevated group made significant progress in closing the digital divide vis-à-vis the top). The elasticity values of the group with *high* Infodensity were lower, but continued to increase over the period. This is indicative of the continuous positive impacts on economic growth of ICTs even among economies with already very high levels – albeit proportionately lower to the previous group. By contrast, the groups with *intermediate*, *moderate* and *low* Infodensity, had relatively low coefficients, indicative of a lesser impact from ICTs on economic growth. The *low* group in particular, experienced a rather 'flat' performance, with some increases in elasticity values only at the end of the period. (This group comprises mostly African economies with very low Infodensity).

Chat 4.3 **Elasticities by country group**



These results are indicative of the insufficient and/or inefficient incorporation of ICTs in the production processes of economies in the last three groups. Although they have started to invest in ICTs, and their investments are growing, they have not been able yet to take full advantage of ICT-related opportunities. It may be that the needed critical mass has not been reached yet. Furthermore, it is known that many economies face a series of problems, including market rigidities (such as difficult

[19] *Compared to the results for all economies in the global estimation earlier, group estimates are less efficient (they have lower R-squared).*

access to credit, lower and asymmetric diffusion of technologies, lower enrolment in high-level education and limited high-skilled labour etc.) which limit a more efficient inclusion of ICTs in their production processes.

As far as marginal effects are concerned, much like the elasticity coefficients, they were higher in the group with *elevated* Infodensity, followed by the *high* group; they were lowest in the group with *low* Infodensity. As was the case in the global estimation earlier, there was again a decline across all groups early in the period (1995-1998). Afterward, however, marginal effects remained rather stable for all groups, with the exception of the *low* group where they continued to fall until 2000 (then they stabilized there too). The reason for this was the tremendous Infodensity growth experienced over the period by the *low* group in conjunction with the very slow evolution of its elasticity coefficients. (This group started the period with next to nothing Infodensity which, combined with the very slow growth of per capita GDP, led to a freefall of the per capita GDP-Infodensity ratio over the period).

A comparative analysis of the best and the least performing groups, the ones with *elevated* and *low* Infodensity respectively, solidifies earlier findings (Table 4.6). The *low* group starts the period with insignificant ICT productive capacity (its Infodensity value was 12 times smaller than that of the *elevated* group). Then, its Infodensity increases nearly 5-fold between 1995 and 2003 (at an annual average rate double that of the *elevated* group, which cut in half their proportional gap), and some gains in growth become visible – as evidenced by the positive elasticity coefficients. Moreover, such gains started to become bigger towards the end of the period. Apparently, though, compared to the *elevated* group this is still not sufficient to achieve the necessary critical level that would trigger higher productivity gains, or the use of the available ICTs to date has not been very effective. The starting level of Infodensity of the *elevated* group yielded much higher elasticities, which also increased faster. At the same time, as a result of the initial conditions, the per capita GDP/Infodensity ratio decreased by a factor of 4 in the *low* group (proportionally faster than its elasticity coefficients increased), while it only halved in the *elevated* group. These developments explain the different time trends in the two groups' marginal effects; following the early decline, these remained rather stable in the *elevated* group, whereas they experienced a sharp decline in the *low* group – at least until 2000.

Table 4.6 **Comparisons between the low and elevated groups**

Year	GDP per capita mean ($US, PPP)		ID mean (index)		GDP to ID ratio		elasticity		marginal effects($)	
	low	*elevated*	*low*	*elevated*	*low*	*elevated*	*low*	*elevated*	*low*	*elevated*
1995	1,114	11,480	4	49	267	233	0.10	0.25	27	59
1996	1,155	12,073	6	61	195	197	0.10	0.25	20	49
1997	1,208	12,797	8	73	157	176	0.11	0.26	17	45
1998	1,215	13,250	9	85	131	156	0.10	0.26	13	40
1999	1,259	13,362	12	97	107	138	0.10	0.25	11	35
2000	1,290	14,182	15	109	89	130	0.10	0.27	9	35
2001	1,349	14,744	18	120	77	123	0.11	0.27	8	34
2002	1,372	14,740	20	127	70	116	0.10	0.27	7	31
2003	1,437	14,979	21	133	67	113	0.11	n.a	8	n.a
annual avg. growth rate (%)	3.5	4.8	26.3	13.8						
total sample (%)	3.8		20.1							

low group: unbalanced panel, 280 observations, 38 economies, 9 years, c=6.86, R-squared=8.4.
Pooled SUR estimation with an AR(1) process, convergence achieved after 40 iterations.
elevated group: unbalanced panel, 99 observations, 21 economies, 8 years, c=8.35, R-squared=31.4.
Pooled SUR estimation with AR(1) and AR(2) processes, convergence achieved after 40 iterations.

The comparative performance of the two groups suggests that as Infodensity reaches a certain height, elasticities are high and, as Infodensity growth stabilizes, marginal effects do not decline, thus, productivity gains are higher. The superior performance of the *elevated* group, compared not only to the *low* group but to all other groups, including the *high*, is totally consistent with the finding in Chapter 3 that the biggest closing of the digital divide occurred when the *elevated* group closed the gap against the *high* group.

While the preceding analysis seems to be consistent with some needed ICT scale for significant productivity gains to happen, many more issues are involved. A future examination of such issues, when more detailed data become available, could include sectoral analyses in various economies - for example, rich economies' ICT investment might be more capital-intensive and/or skills-intensive.

Conclusions

The results presented in this chapter confirm the strong relationship between ICTs and economic growth, which has grown stronger over the past few years. Taking into account a number of macroeconomic variables (such as investment, population growth and trade), the model revealed a strong positive impact of ICTs on the growth of per capita GDP. Moreover, it found that this responsiveness is increasing over time, at higher ICT levels.

More detailed econometric analysis also revealed that the impact of ICTs is unequal among economies, depending on their stage of development. The strongest impact was found among economies with sufficiently high levels of Infodensity (and similar levels of GDP and Infodensity shares) compared to others – mainly Eastern European and some emerging economies. Even though some of the poorest economies experience relatively high Infodensity growth, they benefit less from it. This is mainly explained by the still-low absolute levels of ICT uptake (and implicitly inadequate diffusion among economic sectors, including small businesses), and the less efficient incorporation of ICTs in their production processes. These are not independent from market rigidities and unfavourable ICT policy environments.

Chapter 5

REGIONAL PERSPECTIVES

The results from the empirical application in Chapter 3 can answer well questions of the type: ***which*** country's Infostate improved, ***how much***, ***when*** and from ***what*** ICTs. This Chapter takes the analytical potential of the model even further by going behind the numbers to answer the all-important ***why*** questions. What government policies, business strategies, macro environments and other factors were driving the movement of the numbers? The data 'don't know' whether there was a new and influential Telecommunications Act, a significant regulatory change, a new mobile operator, lower prices or new pricing schemes, education initiatives, targeted ICT training or specific plans create awareness. Clearly, such policy work can confront different approaches and identify policies and strategies that work (or work better), best practice, and critically link ICTs to overall development efforts.

This detailed work was undertaken for several countries in Africa, Asia, and Latin America and the Caribbean. The analyses of the evolution of Infostates, their components and individual ICTs for each country aims at identifying specific causal influences, whether drivers or impediments, as well as link them to underlying policies, regulatory environments and/or business strategies - to the extent possible. This goes hand in hand with the discussion of country-specific and time-specific contexts, involving macro socio-economic, institutional, cultural and even geographical influences that impact on the diffusion and use of new technologies and services. Therefore, efforts have been made to enrich the analysis by sketching possible causes for the changes captured by the data, with the view of drawing useful policy lessons.

A wealth of findings emerged. Successful policies and strategies, and others less-so, are identified and contrasted with hesitant or comparatively mediocre approaches - and even inertia. Overall, the geopolitical, macroeconomic and governance issues are shown to matter tremendously. Some common threads in the findings across regions, include:

- The importance of modern Telecommunications Acts and their implications come out loud and clear. Similarly, the catalytic role of proper regulation is highlighted and the limitationd imposed from conflicts of interest when they exist.
- The emphasis on overall education and specific ICT training, as well as their many linkages with the Information Society, could not have been clearer.
- The importance of pricing and affordability, taxation, information and awareness are all found to exert powerful influences on comparative performances.

- Distinctions between urban centres and rural areas emphasize the need for broader developmental efforts and away from one-size-fits-all approaches.
- Competition is a formidable force; the number of firms, the rules of engagement, and pricing plans all make a difference. For instance, the introduction of pre-paid cards has been a major innovation with big impact, and the same is true for the impact that 'calling party pays' schemes have had in some countries.

The overall thrust of this work helps to identify not only environments and policies conducive to progress, but zero-in among those that lead to more progress.

5.1 The Development of Information Societies in Africa

Prof Alison Gillwald, Research ICT Africa!*

This section reviews the Infostate development of eight African countries over the 1995-2003 period, and provides insights into their evolution. Among these countries, South Africa stands out with a much higher Infostate level; in fact, as was shown in Chapter 3, it leads the entire continent. The other seven countries lag considerably behind and are largely grouped together (Chart 5.1). Several other observations are supported by the data. First, the Infostates of all African countries, including South Africa, are lower than the global average (Hypothetica). Second, progress was made throughout the period but the gaps persist; indeed they intensify by the end of the period, indicative of a growing digital divide. Third, the evolution of countries is marked by significant variations. What follows will shed light on the driving factors behind these developments, as well as try to provide answers for the relative evolution among countries.

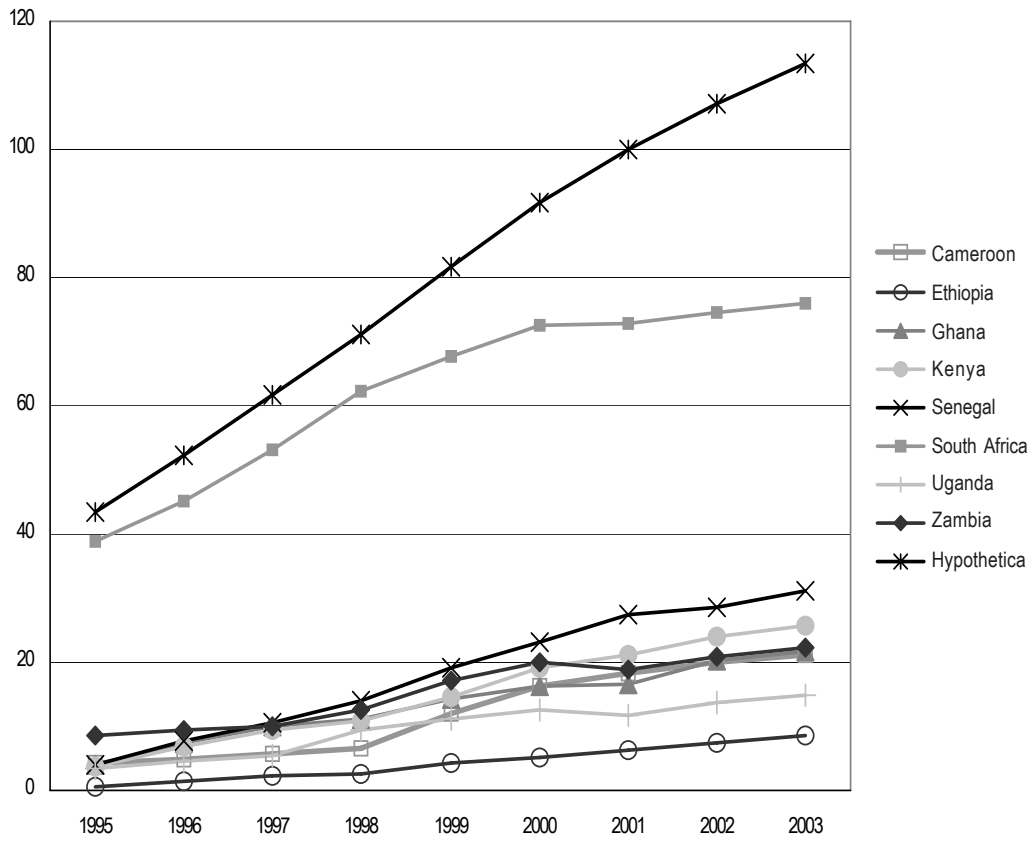
The following eight countries are included: Cameroon, Ethiopia, Ghana, Kenya, Senegal, South Africa, Uganda and Zambia.

In 1995, the year that marks the start of the telecommunications reform process across the African continent, South Africa's Infostate (38.8) was way ahead of other African nations – and not far behind Hypothetica's. Zambia followed from a distance with an Infostate value less than one-quarter that of South Africa's (8.6), but still double that of Cameroon (4.3), which was grouped closely together with Senegal (4.1), Ghana (3.9) Kenya (3.6) and Uganda (3.4). Ethiopia's Infostate was nearly non-existent (0.7). Between 1995 and 2003, growth occurred in all countries to varying degrees.

Senegal's Infostate grew relatively faster (31), outperforming both Cameroon (21.1) and Zambia (22.3) by the end of the period. Zambia lost ground also to Kenya (25.7). Uganda's Infostate (15.0) increased, but proportionately less than the other countries. Despite high growth, Ethiopia (8.6) continued to have the lowest Infostate, as its initial level was very small. In South Africa growth was higher early in the period but subsided after; the growth slowdown was particularly visible in the 1998-2003 period. The country's level of Infostate doubled (76.1), but so did the gap against Hypothetica (113.4). Thus, there is a growing Infostate gap between even the more developed African Infostates and the rest of the world.

* *RIA! is a network of African universities researching ICT policy and regulation, hosted at the LINK Centre, University of Witwatersrand, Johannesburg.*

Chart 5.1 **Evolution of Infostates, selected countries in Africa**



5.1.1 Regional Overview

South Africa's high Infostate relative to the other seven countries reflects its considerably higher GDP per capita (US$2,293), generally associated with more developed economies and higher level of skills.[20] However, the distribution of income is racially skewed in favour of the white population, primarily in urban areas.[21] Thus, unlike the aggregate Infodensity and Info-use components, access to and use of ICTs by the black population, especially in rural areas, is very much in line with the rest of the continent.

South Africa's Infostate progress between 1996 and 1998 reflects the political commitment to affordable access for all citizens, following the first democratic election in 1994. By 1996 a legislative reform process was underway which, in 1997, resulted in the partial privatization of the fixed line incumbent Telkom and the introduction of the first independent regulator, the South African Telecommunications Regulatory Authority, SATRA. In exchange for a five-year extension of the monopoly on the fixed network, the incumbent was required to ensure the rollout of another 2.8 million lines. This target was almost reached by 1999, but between 2000 and 2003 Telkom lost 728,000 subscribers following substantial price hikes in the final phases of tariff rebalancing. This was due in large part to residential subscribers' inability to afford the fixed rental and relatively high charges for basic voice services (Gillwald and Kane 2003).

[20] *Skills is the only indicator for South Africa that remained above Hypothetica throughout the period, although the gap closed somewhat after 1997.*

[21] *GDP per capita figures for South Africa mask one of the highest Gini coefficients in the world.*

South Africa's relatively high Infostate value in 1995 also reflects the introduction of mobile services. Two mobile operators became operational during 1994, and by 1995 the number of subscribers had exceeded all expectations. The real growth in mobile, however, occurred between 1999 and 2001 when the threat of further competition from a third mobile network operator stimulated the introduction of pre-paid services. The success of pre-paid mobile services undoubtedly contributed to the churn from fixed services from 1999 onwards. The importance of mobile phones is common to most other African countries reviewed.

The Infostate of Zambia in 1995 was one-quarter the level of South Africa, and its evolution over the period reflects a far slower increase off a much higher base than most of the other countries. Zambia's position was influenced by the development of communication networks, particularly mobile, outward from the capital of Lusaka. However, there continues to be little penetration beyond the main road connecting Lusaka to the mining town of Ndola and the city of Kitwe. Infostate improved steadily until 2000, following the introduction of mobile in 1992, but then flattened out. By 2003 Zambia was behind both Senegal and Kenya. The slow growth of mobiles could be due to the fact that the mobile networks in Zambia are based on the GSM and on the AMPS (Analogue) systems, thus forfeiting the economies of scale on equipment obtainable from having a single system. The penetration of PCs and telephone services has been severely constrained by the combination of high prices, a stagnant economy, and low average household income, particularly in rural areas.[22] Furthermore, although the relatively high literacy level (77%) is not far behind Hypothetica's, enrolment at schools is low and there is only a remote prospect of Zambia having the critical skills needed to make the quantum leap needed to bring it closer to international Infostate averages.

Kenya's Infostate was towards the bottom end of all countries in 1995, with a value less than half that of Zambia. It increased steadily from 1995 to 2003, and with an average annual growth rate of over 90%, ended up above Zambia in 2003. Like many other African countries this has been driven by mobile growth. Kenya's steady growth in cellular and to a lesser degree Internet services was primarily due to reforms that started in 1998, after a long period of monopoly restrictions characterised by huge waiting lists for fixed lines and high costs of cellular services. These in turn led to low demand for cellular services and encouraged the use of illegal channels to avoid the high costs of conventional communications. The high pent-up demand for communications during the monopoly period could not be satisfied because the monopoly provider did not have the capacity to provide sufficient services.[23] This was acknowledge by the state which sought unsuccessfully to privatize Kenyan Telkom in 2000 and had to abort their attempt to introduce competition through regional (rural) licences to which there was negligible response. Consequently, with stagnant fixed line growth, growth of the mobile market was dramatic.

Local sector commentators believe that some of the mobile success can be attributed to the government's decision to manage the level of competition in Kenya's cellular market by limiting competition to two cellular operators, and thus guaranteeing their market over a specific period enabling the operators to develop and implement long-term strategies and invest heavily in infrastructure. Safaricom, for example, re-invested all its profits and both networks had covered close to 50% of the population by 2003. Government and the operators were proactive in reducing the entry costs for subscribers: the government eliminated taxes on handsets, while the operators made them even cheaper by subsidising them, reduced connection fees and introduced small-

[22] *Average household income in the rural parts of the country is as low as US$60 (Gillwald 2005).*

[23] *Kenya's pent-up demand was triggered by a number of factors. Firstly, a fast growing tourism industry demanded high quality international as well as local communications. Other sectors included the exports of horticulture and primary products. Kenya is also a regional centre for transport and communications as well as a regional business centre. Finally, the informal sector was growing fast due to the collapse of the formal economy.*

denomination airtime packages. Civil society helped by sensitising potential consumers on new applications of communications. These efforts continue to drive the development of the Infostate compared to neighbouring countries.

Senegal experienced the most phenomenal increase in Infostate values, from 4.1 points in 1995 to 31 points in 2003, slowing down marginally with the global recession at the turn of the century. This advance resulted primarily from the reform of the telecommunications sector, starting with the split between national and international telephony within the government-run system (as far back as 1981), followed by the privatization of the incumbent operator in 1997 and full liberalisation of the sector by 2004. With a 3000-km optic fibre loop, a 100% digitized network, a connection to the SAT3 submarine cable and ADSL available in all primary and secondary cities, Senegal today has good telecommunication infrastructure and services.

Senegal has long benefited from a relatively skilled work force, and a well managed incumbent operator with the stability to create and implement a long-term strategy. The high levels of immigration and critical maritime position have been drivers of economic development in the country. Senegal's education system is of a high-quality compared to most other African countries, with a regional telecommunications school created at the beginning of the '80s. Finally, since 2000 a national development strategy ("e-Senegal") has created a new telecommunications law, an independent regulatory body and an IT department, both linked to the Presidency, and firm steps to attract international capital investment in IT.

Cameroon started the period with an Infostate similar to that of Senegal but its growth, although quite significant, did not match that of Senegal. It grew steadily until 1998, then almost doubled in 1999, with a further sizeable increase in 2000. These spikes tend to reflect developments in the mobile market, though the rapid overall growth of mobile communications masks two facts. First, around 90% of the rural population remains uncovered for even basic access. Second, there is a growing digital divide between towns and local areas: only about 120 local areas out of more than 3,000 have access to fixed and mobile telephony.

Cameroon's relatively good Infostate in 1995 resulted from sound policy and infrastructure investments prior to 1995. Infostate changes since then reflect the behaviour of a sector without direction. Although there was a partial opening of the market to mobile operators, lack of political commitment to reform has created uncertainty, in a market that lacks a stable regulatory environment conducive to investment. The transition from full monopoly to partial competition was poorly handled and the three privatization attempts failed, worsening the situation and leaving the development of the sector to the two mobile operators. The ICT sector has become characterised by poor management, a weak and ineffectual regulatory authority, political interference, and the prevalence of hidden agendas. Even so, there are promising signs. There has been a rollout of 1,000 km of fibre optic cable along the Doba-Kribi oil pipeline and extensions are envisaged. To raise the capital needed for investment, the government plans again to put the incumbent on the market. The combined results of these various actions could improve Cameroon's situation.

Uganda showed unremarkable growth in the telecommunications, broadcasting and IT sectors despite an apparently greater political will than many other countries in the region. Infostate growth has been relatively sluggish. The introduction of mobile telephony in 1993 prompted the only major increase in the rate of Infostate growth, from 5.5 in 1995 to 9.3 in 1998. Subsequently, Infostate increased by only one to two points per annum, with a one-point drop in 2001 (like Zambia).

Traditional main lines were not made a priority, so by 2003 there were barely 61,000 main lines in use for a population of 25.6 million, while xDSL has not been deployed; Internet access and use, therefore, were negligible. Furthermore, the combination of high prices and low incomes makes affordability a very important barrier to uptake: annual income per capita is very low, and more than 40% of the population live below the poverty line. Local calls are very expensive due to time-based billing, and computer costs are high relative to income despite the government's removal of all taxes, except VAT. Bandwidth costs of access to the international Internet backbone via VSAT are almost 30 times the cost in more industrialised countries. Since 2003 the regulator introduced a programme of universal access following withdrawal of government funding, the effects of which will only be seen in data after the period under review.[24]

Despite high hopes from the early introduction of competition in the fixed lines market, Ghana's Infostate evolution was steady but not spectacular. The most noticeable growth took place between 2001 and 2002, with a nearly 4-point increase. This jump was primarily due to a government policy to drastically increase the stock of main lines 700,000 by 2005, reflected in a contractual obligation with the new management of Ghana Telecom (Telenor of Norway). Factors influencing Ghana's performance, particularly in the fixed line telephone service, included an ineffective strategic investor, management problems, interconnection problems and a weak regulatory regime. Telekom Malaysia, acting as the strategic investor in Ghana Telecom, failed to raise the necessary capital to undertake the major network expansion needed to meet its rollout obligations. The second national network operator, Westel, has not provided effective competition for the highly entrenched incumbent, and management problems have made it unattractive in domestic and international capital markets. As a result, since starting operation in 1999, Westel has rolled out only about 3,000 lines out of its mandatory target of 50,000 by 2002. Difficulties in interconnection negotiations with the incumbent not only delayed the launching of Westel's services by one year, but also adversely affected the penetration rates and service quality. Thus, rather slow progress was registered between 1996 and 1999. Political interference in the regulatory regime and an ineffectual regulatory authority also contributed to this.

Ethiopia's Infostate remained one of the lowest in the world. It has not undertaken the orthodox neo-liberal reforms seen in the other countries. The state-owned monopoly was corporatized in 1996 as the Ethiopian Telecommunications Corporation (ETC), and remains the sole provider of fixed, mobile, public phone and Internet services. A regulator was also established in 1996 to control the behaviour of the monopoly operator, promote the expansion and maintenance of a good quality telecommunications service, license operators, and advance research and education in the telecommunication sector. However, very limited progress was made on the regulatory front due to the conflict of interest resulting from the government acting both as an operator and a regulator. The number of mainlines grew at about 8% per year between 1995 and 2001, but Infostate seldom grew by more than 1 point per year. Noticeable progress was made when mainlines grew by 19% between 2002 and 2003, albeit from a very low base, following a substantial rise in public investment.[25] While undoubtedly influenced by its large population size and low GDP per capita, Ethiopia's performance reinforces the scepticism about the effectiveness of public monopoly operators to provide communication services at affordable and efficient levels.

[24] *Our data cover the period up to 2003.*

[25] *Capital investment jumped from US$29.1 million in 2002 to US$128 million in 2003.*

In summary, African countries have made gains in Infostate development over the period. Excluding South Africa, the average Infostate of the other seven countries grew by about 400% between 1995 and 2003, but given the very low base in 1995 the absolute increase was relatively small and insufficient to close the gap between these countries and both South Africa and Hypothetica. The gap between South Africa and Hypothetica also increased, indicating that even South Africa's evolution, despite its relatively high Infostate on the continent, has lagged behind global averages. In short, the digital divide between these selected African countries and the rest of the world has increased over the review period.

5.1.2 African Country Reports

CAMEROON

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The country's overall Infostate performance is very disappointing. ICT networks, skills, uptake and usage are all still in need of some critical mass. While this partly requires the resumption of public investment in communications, which stopped in 1999, it cannot be achieved without a further substantive shift to private sector participation. Such a shift can only be successful if a policy and regulatory framework is introduced that promotes private sector participation and competition in mobile telephony, Internet and other value-added services, along with an aggressive universal access strategy.

Infodensity: Once one of the best network infrastructures in Africa, telecommunications in Cameroon has suffered from years of poor planning, incoherent policies and lack of investment. The stimulus for change came in 1999 as the country finally agreed to abide by some of the requirements of the Structural Adjustment Reforms policies imposed by the World Bank and the International Monetary Fund (IMF) and telecommunications was partially opened up to competition. By then, however, the damage to sector progress was already done, something reflected in the relatively slow increase in mainline penetration from 0.2% of the 16 million inhabitants in 1995 to 0.7% in 2003. The 116,000 subscribers in 2003 were a far cry from the 2003 target of 850,000, set in 1999 for CAMTEL (Cameroon Telecommunications Corporation), the incumbent state-owned company which has a monopoly on fixed line services until 2006.

The telecommunications market as a whole has increased more than 30% on average per year to almost US$275 million in 2002, and since the partial opening up to competition CAMTEL has seen a continuous drop in its market share and revenues. In the face of this, it unilaterally doubled the prices for fixed services in 2002-03, but the subsequent outcry obliged the government to step in and reduce the increase to 20%. In December 2003, CAMTEL decided to reduce prices for international calls by 50% and increase the price of local calls by 20%. Although long distance prices were slashed by 50% in 2002, they remain very high for the average Cameroonian, particularly compared to the aggressively priced offers of the mobile and VoIP operators.

Overall, the poor coverage by fixed lines is the result of equipment obsolescence, high connection fees (US$236 for commercial use and US$94 for households), the administrative hurdle (2 years to get services), and the high cost of use. The fall in waiting lists (from 42,000 in 1995 to 19,000 in 2003) was not the result of satisfied demand but the high demand for mobile phones and disaffection with the very long waiting time for fixed lines.

The landscape for mobile telecommunications, and to some extent the Internet, was dramatically changed by the partial opening of the market to competition among three operators.[26] In less than 4 years, total mobile subscribers increased from 6,000 in 1999 to more than one million by the end of 2003. The surge in the mobile sector growth has, in a way, compensated for the disappointing performance of the incumbent. Even so, the combined efforts of the three operators have not done much to improve the national deployment of services, since there is coverage for only 10% of the territory containing 55% of the population. In 2003, 6.6% of the population had mobile phones, while fixed line penetration was a disappointing 0.5%. About 90% of the rural population remains uncovered for even basic access, and the rapid increase in mobile subscribers has actually increased the digital divide between towns and local areas: only about 120 out of more than 3,000 local areas have access to fixed and mobile telephony services.[27]

Despite the considerable progress in regulatory and institutional reforms over the last five years, much remains to be done. Three failed attempts to privatize CAMTEL have made people sceptical about the genuine willingness of the government to proceed. The country is often described as having a business environment that is not conducive to investment, since it is difficult to navigate through the government bureaucracy and take advantage of all the provisions of the law. Particularly problematic have been the regulations governing interconnections between the state-owned company and other networks, so that the latter's customers can reach subscribers on the incumbent's network (Gillwald and Kane 2003). Although the two mobile companies' subscribers exceed by more than tenfold those of the incumbent, anti-competitive behaviour by the incumbent still permeates the sector. The regulator does not have the technical capacity or expertise to oppose many of the incumbent's moves.

Six years after the introduction of competition, the incumbent is still not meeting the needs of the populace, with persistently large unmet demand for fixed line connections, poor service quality, high costs, limited territorial coverage and difficulties in setting up viable Internet businesses. A major shift in the policy and a clear separation of roles amongst the various key governmental players is needed to address these problems. Some steps have been taken to shorten the processing time for satellite and VSAT licences, and to create an investment climate attractive to foreign investors.

In the education sector only 2,209 of the 13,336 nursery, primary and secondary/high schools in the country have electricity, hence the potential to use computers and the Internet. While a number of initiatives do exist, the need to build capacity in the country remains tremendous.

Info-use: Access to telephony has increased more than tenfold thanks to the mobile operators, and more than 10,000 call boxes have been created throughout the country in less than three years, mainly in the informal sector. Most rural areas are not served, however, and may remain so for a long time if the government does not take serious action. Since private operators generally target the most densely populated areas, more than 90% of the covered population lives in urban centres. The prices of fixed and mobile telephone services remain high compared to other African countries at the same level of development.

Digital household equipment has increased since 1995, and in 2001 taxes and customs duties on computer and computer network equipment were eliminated. There has also been some reduction

[26] *The state-owned incumbent, CAMTEL, and two mobile operators, ORANGE and CAMTEL.*

[27] *The high telecommunications costs have laid the ground for a booming underground market consisting of VoIP and VSAT services. Despite the difficulties associated with assessing the size of this market, a sense of its importance can be had by considering that of the 2Mbps incoming Internet capacity today, only 500 kbps are officially accounted for by the incumbent, which has a monopoly over Internet services distribution in Cameroon.*

in tariffs for access to satellite and wireless communications. Cybercafés are the chief mode of Internet access for the vast majority of Cameroonian users, but despite an increase in Internet hosts the actual use of the Internet is still far behind countries of comparative size and market development. For example, around 8,000 people use the Internet per day in Yaounde - less than 1% of the population. Fibre optic cable is now being installed, but the business plan to make the best use of such infrastructure is still being awaited.

ETHIOPIA

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While both Infodensity and Info-use have shown a healthy upward trend and modest progress, particularly since 2002, they started from such low levels that Ethiopia's Infostate remains one of the lowest in the world. ICT networks, skills, uptake and usage are all very small, although they are expected to increase over the next few years following a jump in public investment since 2002. However, the digital divide cannot be bridged by public investment alone. To reach at least a minimum level of ICT penetration needed for the development of an information society requires a policy and regulatory framework that promotes private sector participation and competition in mobile, Internet and other value added services, and an aggressive universal access strategy driven by entrepreneurs.

Infodensity: The development of the telecommunications sector between 1995 and 2003 was largely influenced by a 1996 regulation that corporatized the state-owned incumbent, as the Ethiopian Telecommunications Corporation (ETC), as a sole provider of fixed, mobile, public phones and Internet services. However, very limited progress was made on the regulatory front during this period, mainly due to the conflict of interest caused by the government acting both as an operator and a regulator. The regulatory body remained rather weak compared to the monopoly operator. Following the withdrawal of support from international financial institutions, fixed telephone mainlines grew steadily but modestly at about 8% per year between 1995 and 2001. Following a rise in public investment, mainlines grew by 19% between 2002 and 2003 to exceed 435,000, though, network digitization improved significantly, from 35% in 1995 to 90% by 2003, and waiting lists, as a proportion of fixed lines, were reduced from 1.25 in 1995 to 0.41 in 2002 and 0.22 in 2003.

Mobile services were introduced in 1999. The late introduction, a very slow network rollout, and a business model that bundled both fixed and mobile services together, hampered the widespread use of cellular phones in Ethiopia compared to other African countries. Modest progress was made after 2002, following a rise in investment, the introduction of pre-paid services, and the extension of the network outside the capital. The contribution of the mobile sector to overall telecommunications revenues jumped from 2.4% in 1999 to 17% in 2003. Although availability of pre-paid service and relatively cheaper rates raised the demand for mobile services, the penetration and geographic coverage remained very low. The ETC launched another aggressive plan to improve the penetration and geographic coverage in 2003, the effects of which are staring to become visible today.

Since 1991 there had been extensive use of low-cost store-and-forward email services, provided by the Pan African Development Information System (PADIS) of the United Nations Economic Commission for Africa. Internet connection was established by ETC only in 1997, and the few Internet hosts appeared in 1998. The service became unreliable by March 2001 and no more subscribers were accepted until bandwidth was upgraded in 2002. The bandwidth again proved

insufficient in 2003, and another project for improving bandwidth was initiated. This explains why Internet hosts did not show any noticeable increase until 2003, when the ETC introduced a fee structure for registration and maintenance of sub-domains.

Education significantly improved between 1995 and 2003, following pro-competition economic reform under the current government that overthrew a socialist regime in 1991. Primary, secondary and tertiary education enrolments more than doubled between 1995 and 2003, and although enrolment in tertiary education remains very low, the overall gross enrolment ratio jumped from 9.2 in 1995 to 16.8 in 2003.[28] The introduction of ICTs in the education sector was slow before 2003. In 2003, the government's SchoolNet project was launched to connect 560 secondary schools in order to facilitate ICT teaching and learning, of which around 370 were connected today, and ICT training programs were introduced in secondary and Technical and Vocational and Educational Training (TVET) schools. However, the government's commitment to promote adult literacy declined during the period, so the overall increase in literacy is mainly due to improved enrolment of the school age cohorts.

Info-use: Households equipped with a TV rose threefold, from under 100,000 in 1995 to 319,000 in 2003, mainly due to the availability of cheap television sets, the easing of regulations on imports of TV Receive Only (TVRO) dishes (prohibited under the previous socialist government) and higher incomes (per capita GDP, in PPP terms, rose from US$599 in 1995 to US$710 in 2003). Residential mainlines increased from 0.6 per 100 households in 1995 to 2.3 by 2003.

The penetration of personal computers in Ethiopia remains among the lowest in the world. Some progress was made following a reduction in import taxes on computer equipment in 2002[29], and there has been noticeable progress since 2003 due to the availability of cheaper machines imported from the Middle East. The proliferation of computer colleges and cybercafés also contributed to the demand, which led to a modest improvement in the number of personal computers.

Internet uptake is even lower, mainly due to the lack of competition and the low level of literacy. Penetration outside the capital is limited due to the poor quality of phone services and lack of access to computers.[30] The modest increase in the number of Internet users coincided with the easing of the rules governing cybercafés since 2002, and reduced Internet tariffs in 2003. Cybercafés were originally discouraged because they contravened the government's policy that makes ETC the sole provider of services. Nonetheless, the number of Internet users remained insignificant compared to the size of the population and Ethiopia has one of the lowest indicators for Internet users per capita in the world.

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[28] *The public tertiary education system comprises 6 national universities and 3 polytechnics with a total of approximately 75,000 students. Addis Ababa University (AAU) is the largest tertiary institution that hosts the African Virtual University (AVU) facilities. AAU has developed a campus-wide network with access to Internet. Most other institutions have limited access to computer networks and the Internet. Efforts to build ICT skills and carry out advanced research in ICT applications by these tertiary education institutions were rather limited. Conversely, the proliferation of private ICT colleges has contributed to improvements in general ICT skills.*

[29] *The ICT equipment tax was reduced to a 5% import tax plus a 15% value-added tariff. Traditionally, personal computers were available only in organizations (work places) through donations, and the tax was as high as 45%. Only a few people could afford to buy them for home use.*

[30] *Internet service began with a 256 Kbps connection via existing ETC earth station in 1997. The link was upgraded to 1 Mbps in June 2000. However, the service became unreliable by March 2001. An upgrade of the bandwidth to 10 Mbps and establishment of Internet Points of Presence (PoP) in major towns took place in 2002 and the penetration improved slightly. PoPs were available in major towns like Mekele, Nazreth, Bahr Dar, Awassa, Jima, Dessie, Gondar, Nekempte and Dire Dawa, where users can make local phone calls to get access to the Internet since 2002.*

The introduction of broadband networks has been very slow in Ethiopia. The incumbent introduced its first five leased lines to customers in 1999, followed by an additional five in 2000. The capacity of these was limited to 64 Kbps and, despite ETC's subsequent upgrading to 512 Kbps available to subscribers in the larger towns, there were only 57 customers in 2003. A plan to introduce a broadband multimedia network was launched in 2003.

In Ethiopia, incoming international telephone traffic significantly exceeds the volume of outgoing traffic. Outgoing telephone traffic was almost constant between 1995 and 1998, followed by a slight increase between 1999 and 2001; a drop in 2002 was followed by an increase in 2003. Factors such as improved network rollout, introduction of mobile phones in 1999 and better economic activity may have contributed to the upturn in the outgoing traffic. Incoming traffic increased until 2001, then declined noticeably - likely due to people outside Ethiopia using other methods, such as e-mail, to reach relatives and business counterparts. The drop in traffic in 2001 mirrors the proliferation of the grey market that bypasses the incumbent's network, including call back services, and the proliferation of illegal international long distance service operators. In 2003, the international long distance tariff was reduced and, rather than vary by continent, was made constant regardless of destination (equivalent to US$1.16). While it is difficult to isolate the impact of the reduced tariff alone, it may have contributed to the increase in outgoing traffic in 2003.

GHANA

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The liberalization of Ghana's telecommunication sector began in 1996 with the privatisation of 30% of the incumbent, Ghana Telecom. This was followed in 1997 by the licensing of a second national operator (Westel), and a local telecom company (Capital Telecom) to provide telephone services in the rural areas in the southern part of the country. Four mobile operators were licensed between 1992 and 2000, making Ghana one of the most liberalized telecom markets in Africa. The National Communications Authority (NCA) was established in 1997, while the National Media Commission with regulatory responsibility over electronic and print media had been established in 1993.

Policy changes in the telecom sector were underpinned by the 1994 Accelerated Development Plan, whose objective was to liberalize the market through private-sector participation and meet the changing needs of Ghanaians' social and business life. However, ineffective strategic investment, management problems, interconnection problems and political interference in a weak regulatory regime have all contributed to Ghana's poor Infostate performance. The NCA was not adequately equipped to resolve fundamental problems in the telecom industry, and failed woefully to enforce contractual obligations such as quality of service and rollout targets, and to develop general rules, regulations and tariff guidelines for the industry. Critical to the non-performance of the NCA was political interference when the Minister of Communication assumed direct responsibility for the sector from 1997 to early 2003. Telecom operators had to take their business problems to the Ministry instead of first to the NCA as stipulated by law. Consequently, the NCA lost credibility and never created the regulatory certainty required for increased investment or the competence to propel development of the country's Infostate.

Infodensity: Despite the state of the infrastructure in the pre-reform era, there were increases in all ICT indicators between 1995[31] and 2003, albeit moderate compared to other countries. The number of fixed lines increased from 0.4 per 100 inhabitants in 1995 to 1.35 in 2003, despite a boom in mobile phones during the period. However, unsatisfied demand remains and the waiting list is long.

Since the introduction of mobile phone service in 1993, mobile service grew fast. In 2002, the number of mobile subscribers exceeded the number of fixed lines thanks to a particularly strong growth spurt between 2001 and 2002, when the number of mobile subscribers more than doubled from under 200,000 to 450,000; by 2003 there were 775,000 subscribers.

Ghana was connected to the Internet in 1993.[32] The potential of the Internet market stimulated private sector investment, and the number of Internet service providers reached about 25 in 2003. Internet access has improved somewhat through the marketing strategies of service providers; it is also being helped by the government's emphasis on ICTs, and the infrastructure that is being developed to increase training in ICT skills. Computer laboratories for rudimentary training have been set up in many well-endowed basic schools, especially private ones, and in many second cycle educational institutions. The government aims to extend Internet access to every town where there is a second cycle educational institution.

With the exception of basic primary education, where the national gross enrolment ratio is relatively high (81.4% in 2003), enrolments in secondary and tertiary education were inadequate. Moreover, in tertiary education the enrolment rate has stabilized at about 3% since 2001, due to constraints imposed by the inadequate facilities in public universities. The enrolment rate might increase in coming years through the eight private universities currently in operation, with more waiting for accreditation.

Info-use: Television-equipped households rose from 15.7% of households in 1995 to 21.5% by 2003. The growth in TV households accompanied the liberalization of broadcasting, which resulted in the licensing of four companies for free-to-air services and another four on a subscription basis.[33] Since 2003 penetration might have improved considerably due to the influx of comparatively cheaper used TV sets from Europe and other parts of the world.

Fixed residential phone lines grew strongly during the period raising the penetration rate from 0.8% of households in 1995 to 4.6% in 2003. The continued increase is in part due to the government's policy to extend fixed lines to unserved urban and rural areas. It was also helped by the construction of housing estates as part of Ghana's housing development plan, making it easier for telecom companies, especially Ghana Telecom, to target and deploy services. The middle class, who could afford residential telephones, bought many of the houses in these estates. Other companies also took advantage of the development of housing estates: Cable Gold Television targeted its pay-view television services on these sprawling estates.

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[31] *The period just before liberalisation.*

[32] *The initial method of connection was by dial-up to Pipex System using a DEC station 5000, but lately many ISPs have acquired Very Small Aperture Terminal (VSAT) equipment, which enables direct links to Intelsat, Integlobe or any international organisation providing satellite services.*

[33] *With the exception of one TV station (Television Service (GBC-TV) of Ghana Broadcasting Corporation) which commenced broadcasting in the 1960s, the rest (Metro TV, TV3, Crystal TV, TV Africa, Multichoice, Cable Gold etc.) were licensed between 1995 and 2002.*

Generally, uptake of ICT services has not been dramatic in the country, at least in part due to the poor economic situation[34] and problems of infrastructure development. Individual ownership of PCs is minimal because of high prices relative to incomes, although since 2002 it has been improving with the global fall in PC prices, competition among computer vendors, and burgeoning imports of relatively cheap used computers. The public sector had been the leader in computer acquisitions, although in the 2000s the private sector, especially banks, contributed by modernizing operations through the establishment of local and wide area networks. Although the government grants tax holidays on imported components for local assembly, the supply of locally assembled computers is negligible. One could conclude that government policy on PCs might not have significantly influenced their growth. On the other hand, as noted earlier, computer laboratories in the various educational institutions are contributing towards computer literacy and use among the youth by giving hands-on experience, although data on the exact number of computer laboratories are not readily available.

Although Internet use has been low, at less than 1% in 2003, there are indications that it is growing helped by the proliferation of Internet cafés that provide access to people without service elsewhere, and government policies that contributed to Internet "hype" among the youth, who mostly go Internet cafés to search for foreign schools and download music. The number of Internet cafés in 2003 was conservatively estimated at 2,000, mostly found in the national capital (Accra) and important cities (such as Kumasi and Takoradi).

There was a general growth in international telephone traffic especially after 1999, although incoming traffic continues to exceed outgoing by a wide margin. Reasons for the increase include improved infrastructure, the increasing number of foreign companies in the country, the increasing use of ICTs for business purposes, and the interaction between the large numbers of Ghanaians living outside the country and their domestic relatives. Tariff rebalancing in the last quarter of 2003 should also have an effect that will be seen later. The country's two international gateways and four cellular mobile companies (since October 2000) have increased the rate of successful termination of international calls, resulting in significant increase in revenues for local operators. Increased access to services with international direct dialling (IDD), including payphones and the numerous private telephone call centres, also contributed to increases in outgoing traffic.

KENYA

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The multi-party system introduced in 1992 politicized the evolution of ICTs during the period under review. Opposition parties fought to liberalize telecommunications, broadcasting and Internet services; the government of the day sought to control information channels, especially broadcasting. When a new party came to power in 2003 on a platform of full liberalization, ICTs ceased to be a political issue and became an economic issue like other national infrastructure.

Infodensity: The Kenya Post and Telecommunications Corporation (KPTC)[35] was established in 1978 as a state-managed monopoly to provide both telecommunications and postal services. Internet services were first introduced in 1995, but there was no framework to provide services by any entity other than KPTC and the harsh business environment stifled uptake. The government strategy changed after 1998 when the Communications Commission of Kenya (CCK) was

[34] *The country's average real GDP growth between 1995 and 2003 was 4.5%. Recently, real per capita GDP growth rate has modestly improved from 1.6% in 2001 to 2.6% in 2003.*

[35] *Before 1978 post and telecommunicatins services were offered by East African Post and Telecommunications Corporation- that provided services to Kenya , Uganda and Tanzania.*

established to regulate and promote the growth of multi-operator telecommunications services. Despite the spirit of the reform process, however, Telkom Kenya (TKL), the telecommunications company that was established to take over operations from KPTC, was granted exclusivity for a number of services over a five-year period, from 1999-2004.[36] The CCK did introduce competition in other market segments, licensing two cellular operators and 75 new Internet service providers (ISPs) - though few became operational - plus a few data operators and a national satellite operator. Only after the political change in 2003 were ICTs recognized by the government as a development tool.

Overall, Kenya has shown uneven growth among the various components of Infostate. The period under review starts with huge challenges and a lack of proactive strategies for policy and regulation. Between 1995 and 2003, Kenya's Infostate index increased by a factor of seven, yet the country's gaps from the global average remain huge. Government intervention and proactive measures are needed. Market forces alone do not seem able to narrow this kind of digital divide, and the measures taken to date to liberalize the market and improve affordability do not go far enough.

Fixed main lines grew slowly from 256,000 in 1995 to 328,000 in 2003, leaving the penetration rate unchanged at 1 per 100 individuals. Over the entire period, the waiting list for fixed lines only fell from 68,000 to 61,000. Even worse, rural penetration is negligible. It was estimated that in 1997, urban teledensity was 4% while rural was 0.16% (MoTC 1997). Given this scenario, and recognising that the government did not have sufficient resources to invest, in 1999 the government decided to privatise TKL and invite a strategic investor to invest in resources and skills – neither of which actually happened![37] In 2000, CCK invited tenders for rural area licenses to compete with TKL outside Nairobi, but the only operator that was granted a licence was operational only by end of 2003. Despite the government's stated intentions, therefore, its policies did not work. Rural licenses were not taken up, TKL was not privatized, and the network infrastructure remained almost static despite high demand for fixed lines.

In 1995 Kenya had an analogue cellular service with 2,279 lines connected. By 1999 uptake had increased to only 23,757 lines, constrained by low coverage and extremely high prices – the total cost of connection was approximately 17 times the GDP per capita! Following the introduction of competition in October 2000, however, national coverage was rapidly achieved due to a dramatic reduction in prices and the introduction of pre-paid services. By 2001 cellular connections were twice the number of fixed lines, and by 2003 cellular service was the most important communication tool for Kenyans, both in rural and urban areas.[38] Initially viewed as a 'value-added' service, by 2003 the government was incorporating cellular as part of its universal service strategy (Kirui 2004).

Internet access was initially restricted to *off-line* service through foreign-based providers.[39] Full Internet service was launched in October 1995, but KPTC declared independent providers to be an illegal intrusion on its monopoly rights, and until 1999 Internet was banned from being used in government because it was seen as a security threat. International leased circuits were expensive even for business, and access was only through fixed lines because TKL had a monopoly on gateway services. Things changed in 2003 when the newly-elected government supported the

[36] *In turn, the company was to increase the capacity of the fixed line network from 400,000 to 800,000 by 2004.*

[37] *The government turned down offers by a potential strategic investor as being too low. The highest bidder had offered to pay a licence fee of US$350 million and invest up to US$500 million over a five year period.*

[38] *One of the operators, Safaricom Kenya Ltd. introduced a tariff package targeting residential users known as Tariffica. The package has no monthly standing charge and the tariffs at night are considerably lower than daytime tariffs. This package had a great impact on residential use considering that the fixed lines were unavailable and where they were, were unreliable.*

[39] *Due to the high cost of international calls, providers periodically initiate a call to deliver and collect mail from local servers.*

Internet as a tool for governance and development, and was waiting for the TKL exclusivity to end so that it could begin licensing other operators.[40] Despite all the problems, Internet use did increase over the 1995-2003 period through a combination of increased acceptance, lower subscription costs[41], falling costs of computers, and increased skills. The big increase in Internet hosts, from 17 in 1995 to 8,325 in 2003, is one result of relentless lobbying by civil society organizations and industry to change policy and regulations (Mureithi 2002).

Subscription TV is not a significant service in the market principally due to costs. Signal distribution is via coaxial cable on hoisted on electricity pylons. Other operators distribute the signal through terrestrial microwave. The market is small and has not changed significantly over the period, rising from 12,000 to 23,000 connections. With the introduction of competition in television and with the demand by the government to increase local content in 2003, subscription television, which broadcasts foreign programmes, is not likely to be a significant contributor in the communications sector.

Education, consistently the largest component in the government's budget, is one of the areas worst hit by economic recession during this period. Enrolment in primary education stagnated, and between1995 to 1997 it actually fell from 86.9% to 83.7% as parental costs rose when state support dwindled and fees went up.[42] In 2003 the new government introduced free primary education, and enrolment subsequently increased to 96%.[43] This has not affected other levels of education because of limits on capacity, but university enrolment has increased somewhat since the government set up a framework to encourage the establishment of private universities. Although the number of private universities has increased to 13, the opportunities for higher learning remain inadequate.[44] Adult literacy is an ongoing project, with all public universities now running parallel degree programmes targeting adult learners. Even so, efforts to improve adult literacy lack momentum.

Compared to Hypothetica, therefore, Kenya continued to perform well in primary level enrolment but poorly in secondary and university levels. In 2003, Hypothetica had a secondary level enrolment of 70% against Kenya's 32%, and university enrolment was worse off by a factor of seven. Thus Kenya needed to enrol twice as many students in secondary schools and seven times the number of university students to match Hypothetica. The skill capacity needed to use ICTs has been rising, albeit very slowly, and ICTs is now an examinable subject in secondary schools.

Info-use: While availability and affordability have affected the use of most ICT services, the non-availability of power has retarded growth and significantly affected the use of television, PC, cellular telephones and the Internet, particularly in rural areas. Since 1995 the government has taken proactive steps, reducing the tax on solar panels, eliminating the tax cellular phone handsets, reducing the tax on PCs (and eliminating it in 2003). Moreover, market forces are bringing prices down. Broadband is not yet a feature in planning. The combination of government initiatives and market forces resulted in Info-use rising by a factor of 10 over the period. Even so, the digital divide between Kenya and Hypothetica has widened.

Television-broadcasting policy evolved from the Kenya Broadcasting Corporation (KBC) monopoly and tight government control in 1995 to liberalization by 2003. Until 1999 there was one government

[40] *At the time of writing, Spring 2005, the Internet market is fully liberalized, with multiple Internet gateway operators, as well as local loop operators.*

[41] *Costs of subscription fell from Ksh 12,000 (US$240) per month in 1997 to Ksh 1,000 (US$13) in 2003.*

[42] *According to a survey in 1997, 30.7% of poor children were out school due to affordability. This was worst felt at the primary school level.*

[43] *The government's target was to achieve 100% primary enrolment by 2007.*

[44] *Kenyan parents still send the highest number of students from Africa to U.S. universities.*

broadcasting station and only one private station, with the latter's coverage limited to Nairobi and its environs. The stifling of active competition was a government strategy to reduce access to alternative political opinions: unless operators conformed to government expectations they were prevented from broadcasting in areas where there was opposition to the government. The competition that followed the introduction of more channels after liberalization resulted in high quality programming, contributing to the rapid increase in TV-equipped households, the proportion of which doubled from 8.6% in 1995 to 17.1% in 2002. However, growth appears to have come to a halt over the last couple of years, possibly due to three factors. First, most households with the ability to pay had already acquired a set. Second, coverage in rural areas is limited to fewer broadcasters, hence less programming choice. Third, and the greatest challenge in rural areas, lack of power requires expensive investment by households in alternative power in addition to the cost of the TV itself. Rural households use solar and lead acid batteries to view television programming, so further growth is predicated on making power available to rural households. Kenya's TV household penetration rate needs to be increased by a factor of four to reach Hypothetica's level.

Given the operator's capacity constraints and lack of competition, the residential penetration of fixed telephone lines has remained at 2.1% of households over the period. Residential communications has been taken over by cellular phones. No data is available on the number of cellular phones in residential areas, but, just like television, their use in rural residences is affected by the lack of power. Users must travel to the nearest town to charge their cellular phones, and in some cases the cost of charging exceeds the cost of usage. Obviously this has a negative effect on use.

Personal computers grew by a factor of seven to a penetration of 0.7% of the population by 2003. This growth has been aided by an increasing use of computers in schools, which has also increased the skills base. Cost is no longer the major constraint as tax measures have progressively increased affordability, and importation of lower-cost clones and used computers has increased both availability and affordability. The challenge is to derive applications to suit user needs. Greater use of computers in business has increased the demand for skills. In 2003, Kenya would have had to increase the number of PCs by a factor of 25 to close the digital divide with Hypothetica. At the current growth rate, this is generations away.

Internet usage increased to a penetration of 1.6% of inhabitants by 2003 due to competition amongst suppliers, reduced licensing costs by the regulator, and strategies that increased the number of cybercafés. Efforts are being made to introduce Internet use in the rural and poorer areas using telecentres. However, lack of skills and telephone lines are great constraints on Internet use. Basic telephone services are inadequate, and as yet there is no strategy to develop a broadband network. International bandwidth is also limited, because Kenya uses the Intelsat satellite system and has no submarine cable landing. Only in 2003 were private sector data operators licensed to offer competing services, and TKL started offering ISDN and ADSL in selected Nairobi sites, but the impact is still small.

Incoming traffic is still much higher than outgoing, but their difference became smaller by the end of the period. International telephone traffic is affected by the high tariffs on outgoing traffic, which largely determine calling patterns. By 2003 outgoing traffic had decreased significantly - it fell from 3.3 minutes per inhabitant in 1995 to 1.7 minutes by 2003, as measured by the TKL network. Much of the incoming traffic was generated from Kenya using call back services.

SENEGAL

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In Senegal, ICTs contribute 6% to GDP and are viewed as a priority for economic and social development. There is a strong political will to build an "E-Senegal", reflected in the adoption of a new telecommunications law in December 2001 and the creation of state telecommunications agencies to regulate the sector and disperse information. At the international level, Senegal is coordinating NEPAD's ICT activities and has been the initiator of the Digital Solidarity Fund.

Infodensity: In Senegal, telecommunications reform began as early as 1981 with the split between national and international telephony within the *Office des postes et télécommunications* and the creation of *Télésénégal*. In 1985, Sonatel was formed as the national telecommunications company in charge of both telecommunications services and the regulation of the sector. It was subsequently privatized, in 1997. However, unlike many public telecommunications operators in Africa, Sonatel performed well even as a monopoly. It achieved full network digitization, a fibre optic loop connecting major cities, notable improvements in access in urban and rural areas, major investments in submarine cables, and a regional satellite project. Until its monopoly expired in 2004, however, market competition was restricted to two operators for mobile telephony and full competition only for value-added services. Full liberalization, therefore, began only after the period under review here, and the results have yet to be evaluated.

Since privatization, the number of fixed telephone lines has grown, but not very fast (from 110,000 in October 1997 to 240,000 in 2004). In 2004, only 1,000 of the 142,000 Senegalese villages were connected to the network, and most fixed lines (63%) were concentrated in the Dakar area, which represents only 24% of the population in 3% of the country's geographic area. Tariff rebalancing significantly reduced the price of international calls, which are now among the cheapest in Africa. On average, between 1995 and 2000 international calls were 28% of Sonatel's income, but fell to 20% by 2003. Local calls, which were internally subsidized by Sonatel before privatization, have not seen any price cut, except for some special offers; the rate per minute actually increased in 1998 when Sonatel reduced the time unit from three minutes to two.

Mobile telephony, on the other hand, experienced extraordinary growth, from a handful of subscribers in 1995 to 576,000 in 2003 (and an estimated 1,235,000 by March 2005, of which 97% use pre-payment). This expansion is partly due to the fact that since 1999 there has been a second mobile telephony operator, Sentel, in addition to Sonatel's Alizé network. Sentel controls about 33% of the market and provides only pre-paid telephony. The price of mobile calls fell[45], and since 2001 there have been more mobile subscribers than fixed lines. Even so, in 2004 fixed telephony accounted for 60% of revenues and had a traffic volume three times higher than that of mobiles. Total fixed plus mobile teledensity slightly exceeds 10% by now, and significant progress towards improved access has been made with the help of 17,000 telecentres.

Over the last few years, efforts were made in various sectors to modernize the Senegalese administration and reduce the government's communication costs. Customs transactions are now fully automated, and there is a governmental Intranet using a fibre optic network to interconnect the Presidency, all the ministries, the national Assembly and some other public institutions. All the ministries now have one-way non-interactive Web sites giving citizens access to services, such as the supply of administrative forms. The governmental Intranet will, in the future, be extended to

[45] *From an average of 213 francs CFA (US$0.42) in 2002 per minute to 150 francs CFA (US$0.30) in 2004.*

include all operational departments of the ministries and all diplomatic missions abroad. In preparation for forthcoming elections the government also decided to equip all the citizens with a digital identity card. Senegalese legislation will soon be audited to find all the points where it is obsolete, unsuited or non-existent. It is also envisaged that, by ensuring individual data protection, cyber crimes will be reduced and electronic documents and signatures will have legal power. Finally, a technological park ("cybervillage") will be built to attract national and international IT companies.

The private sector is also very conscious of the need to modernize its activities and increase its competitiveness on the international and domestic markets. Private companies involved in the production of ICT goods and services have created various professional organisations to lobby for their favourable design and implementation of public policies, as well popularize ICTs among the general public. Also, international aid agencies have implemented a range of initiatives.

The SAT 3 submarine cable created a very significant increase in bandwidth over the last few years, which improved capacity and had a positive effect on Internet growth[46]. Some 84% of Internet subscribers are connected via narrow band (dial-up) and 16% via broadband (ADSL, launched in April 2003).[47]

Since the political changes in 2000, significant efforts have been made in education that currently absorbs 40% of the national budget. The enrolment rate for primary education approaches 80% for the 1st and 2nd forms but drops to 30% for 3rd and 4th forms, then falls to 10% for secondary education and, in 2003, to 3.7 % for tertiary education. The two national universities enrol nearly 45,000, with approximately another 15,000 registered in private higher-education schools. The illiteracy rate was 64.4% in 1998, falling to 59.8% in 2003 (50.1% for men and 69.2% for women). Further advances in tackling illiteracy have been made following a state initiated project in 1995 aimed at recruiting, training and appointing up to 1,200 young men and women between the age of 18 and 35 each year for four years to serve as teachers in schools throughout the country. Another program is specifically aimed at increasing school enrolment among girls. International aid agencies initiated several projects to introduce ICTs into the educational system, the most significant being the World Links project, originally funded by the World Bank, and which facilitated the Internet connection of all Senegal's colleges. Another program funded with French co-operation trained many teachers and created a resource centre to produce multimedia teaching materials.[48] Overall, relative to a number of sub-Saharan countries, Senegal has good capacity in human resources.[49]

Info-use: The audio-visual sector is still relatively weak but its growth has been remarkable. The progressive liberalization of television since 1991 (and radio since 1994) has allowed the private sector to enter these markets. Radio is the most popular medium, owned by approximately 80% of households in urban areas and 65% in rural areas.[50] By contrast, the television penetration rate is

[46] *Capacity went from 64 kbps in March 1997 to 465 Mbps in October 2003. During the same period, the cost of dedicated lines dropped sharply from 1,064,000 francs CFA (US$2,128) per month for a 64 kbps line in 1996 to 203,700 francs CFA (US$407) in 2003, while the 2 Mbps line dropped from 3,600,000 francs CFA (US$7,200) in 2000 to 962,500 francs CFA (US$1,925).*

[47] *A subsidiary company of the incumbent operator, Sentoo, dominates the ISP market maintaining high prices. It should be mentioned that WiFi has been available since July 2004, and digital television and video on demand through ADSL since December 2004. It is too early to assess the uptake but there appears to be considerable interest.*

[48] *The connection of the educational sector to the Internet was really made possible through the MOU signed between Sonatel and the Ministry of Education according to which schools and tertiary education establishments benefit from a free telephone connection to the Internet, a reduction of 75% on communication calls, 50% on dedicated lines and 30% on Internet subscription fees.*

[49] *One college trains technicians and telecom engineers for 17 countries in sub-Saharan Africa. Others train computer technicians and engineers, media specialists, and information management specialists.*

[50] *In addition to the public broadcaster there are currently 11 private radio stations, 44 community radio stations and 3 foreign radio stations in all the large cities.*

under 30% of households. There is a substantial urban-rural difference, however, with the penetration rate of over 50% of households in Dakar (which has a quarter of the population), falling to approximately 40% in other cities and around 3% in rural areas. Only the public broadcaster is free to broadcast nationwide, and only in Dakar there is also a private broadcaster.

The number of Internet users has increased significantly in recent years due to the development of cybercafés, although the number of actual subscribers has stagnated for several years around 15,000 due to the high cost of computer equipment and Internet subscription and communications fees. Particularly in cities there was a strong increase in the number of cybercafés with the arrival of ADSL, which allows users to benefit from broadband at an affordable cost. The hourly connection rate in most cybercafés (around 300 francs CFA, or US$0.6) is substantially less than for people using the fixed network from home (1,800 francs CFA, or US$3.6 per hour). In 2003 approximately 225,000 people were Internet users, 90% in Dakar and 10% in the other cities.

There are some experiments to produce IT equipment and develop capacity for domestic assembly of computers from imported components, but generally the sector suffers from a lack of competition. However, these projects are intended to create an enabling environment and create a more qualified labour force in the long-run. By contrast, the service side of the telecommunications market has become more economically important in the last few years, with 30,000 jobs created by the 17,000 telecentres and the 800 cybercafés, and there are plans to create many jobs by developing call centres. Also, many jobs were created in the informal sector around the sale and maintenance of cellular phones and computer equipment, development of applications, creation of websites, sale of pre-paid cards and the like.

A study completed in March 2004 estimated that there were 637 Senegalese websites online. The Senegalese media has good presence on the Web, with six newspapers online, the national news agency, five radio stations and the public broadcaster. Private companies, in particular in the tourism sector, are also on the Internet; Trade Point Senegal plays a significant role in the promotion of electronic commerce. The use of ICTs in all the spheres of economic activity has been increased by, for example, information systems on fruit and vegetables markets (Manobi), a fleet management system, externalization of customer services towards call centres, online banking services, distance education, call centres, FM radio stations, electronic government, and online newspapers.

Successive cuts in international calling rates have reduced the popularity of call-back systems, with more international calls now being made from Senegal. The development of telecentres and international telephony is explained by the weak progression of fixed telephony. Some households prefer cellular phones even though prices are three times higher than fixed lines, since calls are available without delay at a low subscription cost (2,500 francs CFA or US$5), and allow strict control over the household communications budget. Moreover, many subscribers, the youth in particular, communicate at lower cost using SMS or “missed call” and “call me” services. Since 1996 SMS were free on *Alizé. Sonatel mobile* did start charging for SMS because of extensive use, but the resulting protests by consumers, particularly the youth, resulted in the regulatory agency cutting the SMS price, particularly for the youth.

SOUTH AFRICA

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The South African Infostate development has been heavily affected by an overly cautious liberalization policy and regulatory uncertainty resulting from the co-jurisdiction of the Ministry of Communications and the regulator over licensing and other regulatory matters. The recent further liberalization of the market and the revised licensing and regulatory framework proposed in the convergence legislation currently before Parliament, together with positive economic growth, bodes well for an upward trend in info-use and info-density from now on. However, the dominance of the incumbents in the market and the delays in licensing alternative network operators present a major limitation to a serious lift off.

Infodensity: The reform process began in 1992 when the incumbent network operator was separated for the Department of Posts and Telecommunication and was incorporated into a limited company (Telkom), which was subsequently partially privatized in 1997. The reform process culminated in the 1996 Telecommunications Act that marked a watershed in the industry. It signalled the start of a massive capital expenditure programme of R50 billion that ended in 2003 with the legal termination of the extended monopoly (though spending was reduced dramatically since 2001). As part of the privatization process, Telkom committed to rolling out 2.8 million lines to under-serviced areas, resulting in an increase in main lines from 4.3 million in 1996 to a high of 5.5 million in 1999. Nevertheless, even after a reduction in charges for connection and local calls that accompanied tariff re-balancing in 1997[51], Telkom used its monopoly position to increase local call costs by over 25%, in real terms, between 2002 and 2003 (Gillwald and Esselaar 2004). As a result, the majority of the new customers could not afford the telecommunications costs and were disconnected, explaining the fall in the number of main lines from just under 5.5 million in 1999 to 4.8 million in 2003. The start of the disconnections in 1999 coincides with the sharp divergence in Infodensity between South Africa and the international average (Hypothetica).

Given the drop in fixed lines, much of the increase in Infodensity after 1999 was due to mobile networks. Major liberalization of the telecommunications market started in 1993 with the licensing of two mobile operators (Vodacom and MTN) which, as a condition of their licences, were committed to covering the majority of South Africa. South Africa's relatively high proportion of contract subscribers is partly attributable to the high level of disposable income in South Africa compared to other countries in the region.[52] Even so, the mobile market really took off in 1997 with the introduction of pre-paid cards, and in 2000 the number of mobile subscribers exceeded the number of fixed line subscribers.[53] Growth was further spurred when a third mobile operator (Cell C) entered the market in 2001: by focussing on low cost contracts (as low as R9) and the upper end of the pre-paid market (Gillwald and Kane 2003), this operator had one million subscribers by February 2003 and two million by the end of 2004. In 2004 there were a total of 19 million mobile subscribers out of a population of about 46 million.

As a legacy of South Africa's racially based, inequitable education system, there is now a severe shortage of skills - even though the skills category is the only one in which South Africa is above Hypothetica. Economic growth between 1996 and 2003 has been considerably lower than needed to address the growing number of unemployed people, creating a barrier to accessing education

[51] *Re-balancing was based on South Africa becoming a signatory to the WTO basic agreement on telecommunications.*

[52] *Around 20% of subscribers are on contract, compared to fewer than 5% in other countries in the region, such as Zambia and Uganda, where services are 98% and 97%, respectively, prepaid.*

[53] *Subscribers and users are not strictly comparable because the household is the unit of measurement for fixed line subscribers, while it is the individual for mobiles.*

- reflected in the declining enrolment at the primary, secondary and tertiary levels. There remains a shortage of specialist skills despite employment in the telecom sector dropping from a high of over 60,000 in 1999 to just over 35,000 in 2003. The fall in employment is attributable to a decline in staff at Telkom, to massive improvements in productivity from technological advances over the last decade, and to the relatively low numbers of staff required by the mobile operators.[54] Although the skills level in 2003 remains lower than in 1995, there has been some improvement since 2001 when some of the measures to enforce compulsory education began to take effect.

The government's reform policy of managed liberalization contributed to slow network expansion and the divergence between South Africa and Hypothetica by allowing Telkom to exercise its dominance in the competitive services market. Ministerial involvement undermined the ability of the sector's regulator to curb the monopoly behaviour of the incumbent, in both wholesale and retail markets, leaving the regulator with inadequate capacity to exercise its powers effectively. Telcom also benefited from owning 50% of the dominant mobile network operator (Vodacom). The overall effect has been the decline in network access and affordability.

Infodensity is likely to be positively affected in the future by actions to significantly liberalize the telecommunications sector, effective February 1, 2005. Most significant is the announced policy that allows mobile operators to provide their own facilities and use VoIP over any network, not just the incumbent's as in the past. However, facilities-based competition is still premised on licensing of the Second Network Operator (SNO), which has been stalled to date. If the incumbent continues to enjoy a *de facto* monopoly, it may adversely affect Infodensity.

Info-use: Reflecting Telkom's roll-out of fixed lines until 1999, and the subsequent disconnections from 2000 to 2003, Info-use nearly doubled between 1995 and 1999 but then remained basically unchanged until 2003. High call charges have contributed to both churn and the low usage of main lines, particularly in residential areas.

Internet penetration increased strongly between 1995 and 2001, with growth rates between 24% and 92%. Growth rates then tapered off and between 2001 and 2003 Internet penetration remained fairly stable around an average of 7% of inhabitants. This may be following the standard *S*-curve path of technological adoption[55], since the high prices of local calls mean that the market saturation is likely to occur at a lower penetration rate than otherwise.

Although broadband (via ADSL) has been available since 2002, there has been no incentive for the incumbent to promote access to it. While South Africa dominates the continent in terms of all other forms of communications access, it lags countries such as Senegal in terms of broadband access. The threat of competition in 2004, as well as the liberalization of the market early in 2005, has jump-started strong growth in broadband subscribers and prompted Telkom to market and price ADSL access more aggressively.[56] The subsequent broadband growth has been dramatic, though off a low base, but the slowdown that will accompany market saturation is likely to occur more quickly because pricing is still relatively high.

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[54] *The number of subscribers per employee for mobile operators is around 2,200 compared to 149 for Telkom. Also, in the telecom sector as a whole, the shortage of appropriate skills has resulted in an increase in the levels of remuneration (Gillwald and Esselaar. 2004).*

[55] *That is, slow growth until a critical mass is achieved, followed by rapid growth until the market starts to get saturated, and slow growth again thereafter.*

[56] *In early 2004, the state-owned carrier of carriers (Sentech) began to offer wireless broadband and, in late 2004, the company that operates the lottery communications network began to offer its own wireless broadband access. Vodacom, in partnership with Vodafone, also began to roll-out its 3G network.*

PC purchases mirror the same trend as Internet penetration. Between 1995 and 2000 the growth in PCs averaged between 10% and 25% per year. Since 2001, which coincides with price hikes in local call tariffs, this began to taper off to an average of around 4%. The lack of incentives for computer purchases in this period, combined with the high cost of Internet access, has largely restricted the purchase of PCs to those with high disposable income. The retail boom since 2003, fuelled in large part by easy access to credit and low interest rates, has reportedly resulted in local PC retailers seeing significant increases in sales.

UGANDA

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The worst period of governance in Uganda's history was from 1977 to 1986, during which telecommunications infrastructure actually dwindled due to lack of maintenance and there were no social targets whatsoever. Indeed, ownership of a telephone was a basis for political suspicion about involvement in subversive activities. By 1986, when the current government came into power after a protracted guerilla war, all existing lines (many of which were defective) were effectively in the capital city and three other major towns. The public call box infrastructure had totally broken down. The real process of change relevant to the 1995-2003 period under review began in 1993 when the Inter-ministerial Committee on Investment in Telecommunications made recommendations that formed the basis for subsequent reforms. Due to an increasing demand for services, especially by investors, the first mobile service provider (Celtel) was licensed in 1993 to provide nationwide mobile services.[57] The period after the licensing of Celtel and two additional national operators (MTN and UTL), placed the focus on mobile rather than fixed lines, which were almost non-existent.

Infodensity: The current telecommunications policy and regulatory environment in Uganda was established with the Communications Act of 1997. Key components of the policy strategy were the creation of an independent regulator, introduction of competition in the sector, and the splitting of the then monopoly provider (the Uganda Posts and Telecommunications Corporation) into separate corporations for telecommunications and postal services. Licenses were classified according to major and minor services, with initially limited competition in the former and unrestricted competition in the latter. The major licence services include local, long distance or international telephone services, trunk capacity resale, rural telecommunications, store and forwarding messaging, and cellular or mobile services. During the period of limited competition (exclusivity), the provision of certain services was restricted to major licensees and holders of licences granted prior to the exclusivity. Only three major licences have been issued in the sector during the past eight years, although there has been considerable growth in the number of licenses issued in the minor category.

Nevertheless, in the early 1990s the government invested heavily in mainline services, and main lines grew steadily from less than 40,000 in 1995 to almost 62,000 in 2000. This growth was almost solely in the major urban areas, with very limited deployment in minor urban areas and none in rural areas, where about 85% of the population live. After the privatisation of one of the national operators (UTL) in 2000, the new owners eliminated accounts that were obviously non-operational or illegal, which explains the fall in the number of main lines by almost 10%

[57] *Another operator, Starlight Communications, was licensed to provide trunked mobile radio communications services, but this failed to get sufficient customers and eventually closed down.*

between 2000 and 2002. The steady increase in lines then continued, but by 2003 there were still only about 61,000 lines for a population of almost 26 million (an almost insignificant penetration compared to Hypothetica). The waiting list for main line telephones was comparatively low in 1995, mainly because of the general air of resignation to the fact that getting services was next to impossible and not worth the bother.[58] After peaking at 9,000 in 1998 and 1999, the waiting list for fixed line service dropped rapidly when a newly licensed mobile operator (MTN, with experience in South Africa) introduced the first low-priced services that brought mobile use within reach of a large section of the population.[59] Digitization increased slowly but steadily from about 63% of lines in 1995 to 80% in 2003. Growth was slow not only because of the focus on expanding mobile services, but also because of the continued reliance on old exchanges and equipment not suited to digital networks.[60]

The first company with a cellular licence (Celtel) signed up less than 5,000 customers between 1993 and 1998 because it targeted only the elite, setting prices out of reach of even the middle class in Uganda. This changed in 1998 after the second mobile operator (MTN) introduced services with low entry costs and pre-paid calls, something reflected in a jump in both the number of mobile phones and their rate of increase.[61] Another significant jump came in 2001 when true competition was created in the cellular market with the privatisation of one of the two national operators (UTL). With active competition the number of mobile customers almost doubled every year since 1998.[62] A major benefit of cellular coverage is that a large portion of rural Uganda, as well as major and minor urban areas, now has access to telephony services (and SMS) through public payphones and individual owners who sell services through informal sector arrangements. Even so, despite the modest achievements of the sector, a significant portion of the population of the country still remains without access to basic telephony services. The existing backbone infrastructure capacity is also not adequate, and service tariffs are still too high for the majority of citizens.

The number of Internet hosts in Uganda is very low, partly as a result of the insufficiency of bandwidth. In a sense, however, the number of local hosts understates the effective number of hosts because many organisations with audiences outside Uganda contract hosting services to companies in the U.S., Europe, and Asia. This assures high-speed access and minimises the crippling cost of bandwidth that would be required in Uganda for international high-speed access.

Uganda's educational system had collapsed between 1971 and 1979 due to the disregard and total scorn for education shown by the Idi Amin dictatorship. Initial attempts to remedy this did not achieve much because of a permanent state of insurgency in the country between 1980 and 1985, and the educational system did not start recovering until the late 1980s. Two key enablers that have driven the recovery in recent years are the total opening up of the education sector to private investment and the government's Universal Primary Education (UPE) strategy. Ugandans now put a high premium on good education, and Uganda is a recognized educational hub in the region.Up to the late 1990s, private investment in the education sector was largely confined to primary and secondary levels. Subsequently, the demand for tertiary education, combined with limited

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[58] *During 1995, many corporate customers were paying as much as $2,500 (plus a per minute cost of $0.45 for local calls) to get connected to the only mobile service as an alternative to the impossibly long waiting time for fixed services.*

[59] *MTN also introduced the fixed wireless service for corporations, offering direct competition to the main line services.*

[60] *To date there has been no effort to enhance fixed line capacity by using xDSL, as this would necessarily mean upgrading the exchanges first.*

[61] *While MTN expected to get 10,000 customers in its first year, it actually got 7,000 on the first day and the network collapsed due to overload.*

[62] *All the mobile service providers are owned by foreign investors, even though the government still holds 49% of the equity in UTL for planned disposal to the public through a share issue.*

government funding, led to private investment in university level institutions, which began to have an impact on enrolment and skills in 2003. Government has now made legal provisions for regulating public and private tertiary institutions to ensure adherence to minimum standards. Since 1998 the government's UPE strategy increased primary school enrolment from less than 2 million to more than 6 million. By 2003 this increase was just beginning to feed through to secondary schools, where private sector investment has grown to take advantage of the opportunity, especially since the government has not significantly expanded secondary school facilities. The combined effects of the UPE, the fact that the majority of Ugandans are below age 15, and the growing investment in secondary and tertiary education, means that Uganda is poised to achieve very high levels of education and literacy in the near future.

Info-use: The only TV station operating in 1995 was government-owned. By the end of 2003, however, there were more than 20 private stations, with two companies running pay-TV channels to which 2.5% of households with TV sets subscribed.[63] There was only a small, though steady, increase in subscribers from 1995 to 2000, mainly because the government station had poor programming that did not attract those who could afford to buy TV sets. There was faster growth after 2000, mainly due to the proliferation of private stations with more attractive programming and the introduction of pay channels, broadcast via satellite, which provided immediate access to a wide range of popular international programs. Even so, by 2003 only 6.2% of households had a TV set. Television is still limited to the elites in the population, and remains largely an urban service because the low incomes in rural areas and the limited power distribution grid has kept power (and thus TVs) out of reach for the majority of the population.[64] Only about 240,000 households out of almost 5.5 million are connected to the power distribution grid, which sets a ceiling to the number of households with TVs.

FM radio has the highest penetration, with 125 private broadcasting stations in 2003 providing almost total national coverage in the local languages, and a forum for lively public debate via phone-in programmes (enabled by access to mobile services).

The absolute number of residential mainlines increased from about 14,000 in 1995 to 21,000 in 2003, with a dip in 2001 and 2002 mostly due to cleaning up the customer data base, but also partly due to migration to cell phones by residential users. Because of the increase in the number of households over the period, however, the penetration rate has remained constant since 1996 at 0.4% of total households.

The use of PCs in Uganda is largely limited to offices, as is Internet access. Until very recently, there was no coordinated national framework to promote access to and use of ICTs, especially computers. With only four computers per one thousand people in 2003, there is hardly any computer usage. Key challenges stopping the rapid penetration of computers include very limited ICT literacy, very limited appreciation of the benefits and opportunities provided by computer use, and very limited access to the power distribution grid. Internet penetration remains very low and, on a national scale, is insignificant at 0.5% of inhabitants in 2003. Key barriers to Internet use are the same as for PC penetration, plus lack of relevant content and the very high cost of satellite-based access relative to the more technologically developed countries, especially when the low per capita income is taken into account.[65] Furthermore, until 2003 there were no broadband Internet users in the

[63] *Kampala Siti Cable is a cable TV company; and Multichoice Uganda Ltd has the local agency for VHF and UHF pay channels, as well as digital satellite broadcast TV.*

[64] *While the transmission grid is nationwide, users have to meet the full cost of access and connections.*

[65] *In 2003, the cost of 1 Mbps per month was about $16,000 compared to about $500 for a T1 in the more technologically developed countries. Factoring in per capita income, even with PPP adjustment, means that Ugandans were paying several thousand times more than people in the U.S. for internet access.*

country except for one university[66], contributing to the low utilization of the Internet for data-intensive transactions. Most Internet users during the period under review were only interested in e-mail.

International incoming traffic increased, especially in the late 1990s and early 2000s when tariff rebalancing and competition led to more rational cost-based termination rates for traffic into Uganda. Despite the drop in prices, outgoing traffic has not increased as much as incoming traffic - incoming traffic was almost three times outgoing traffic in 2003, consistent with the fact that Uganda buys much than it sells abroad. There is general agreement that this situation needs to be changed, while avoiding the danger that more efficient communication and greater Internet use could actually compound the problem by generating a more "efficient" outflow of resources.

Thus, numerous economic, social and cultural factors have contributed to the relatively low Infostate[67] in Uganda, including: low per capita income and the large percentage of the population living below the national poverty line (44% in 1990 – 2001);[68] inadequate consumer empowerment resulting in a lack of understanding of benefits and opportunities (investment and otherwise) presented by the telecommunications services; the low level of integration of ICTs in the population's daily activities, and in service delivery in areas such as local government, banks, health and the like; the still strong culture of "face-to-face" contact before any business can be concluded, and; inadequate availability and accessibility of telecommunications facilities, particularly in the rural areas.

However, recent policy initiatives taken after 2003 are hopeful to influence PC penetration and Internet use. These include computer courses in primary and secondary schools; the approval of the National ICT Policy framework by cabinet, the bill before parliament to establish a National Information Technology Agency; the waiver of all taxes (except VAT) on computers, and an increasing number of tertiary institutions making computer literacy compulsive. Additionally, all licensing requirements on Internet kiosks have been waived, as have the license costs for internet service providers that do not have their own gateways. The ISM band has been deregulated for wireless Internet access, and content development is encouraged under the rural communications development programme. Even so, substantive increases in PC and Internet penetration will not be achieved without first meeting technological and economic challenges. Technological challenges are posed by the low penetration of residential main lines able to support Internet use, which mobile technology cannot do at decent speeds, and by the failure to introduce xDSL. The major economic challenges of low income and the high costs of Internet access remain.

ZAMBIA

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Infodensity: The 1994 Telecommunications Act established the Communications Authority of Zambia (CAZ) to supervise and regulate the provision of telecommunication goods and services, to promote competition, and to ensure that the sector's benefits accrue to the citizens of Zambia and its economy. The government-owned Zambia Telecommunications Company (ZAMTEL) still has a monopoly on PSTN and the International Gateway, although efforts have been made to

[66] *Makerere University is a private ISP serving the university community, with a dedicated leased line having throughput to the Internet of 2.5/1.25 Mbps.*

[67] *This report is based on the data used in the Infostate model (Chapter 3) and cover the period 1995–2003. Since they do not reflect developments at the date of the writing (Spring 2005), they are complemented with insights and background from the author's experience and research related to ICTs in Uganda.*

[68] *Per capita income in 2002 was US$1,390 (PPP) (UNDP 2004).*

liberalize the latter. The monopoly has created high prices, insufficient network capacity and long waiting lists, all of which have been compounded by high theft of copper lines that are very expensive to replace. Since the establishment of CAZ, however, liberalization opened up the market to competition in other segments of the telecommunications industry. There was steady growth in mainlines between 1995 and 2003, albeit slow mainly because of the emergence of mobile phones in the market. The reduction in the waiting list for fixed lines between 1997 and 1999 may also be attributed to a shift to mobile services, which are more accessible and easier to acquire.[69] The waiting list increased gradually since 1999 due to the introduction of the Internet, as people started re-applying for fixed lines.

The three mobile operators, one of which is owned by ZAMTEL, are based on the GSM system. Pre-payment systems allow users to get mobile services where they may not qualify for a fixed service or a post-paid mobile service because of low or irregular income or lack of known and fixed address. The functionality and convenience of mobile phones resulted in an increase in penetration from almost zero in 1995 to 2.2% of inhabitants in 2003.

Zambia's combined index of enrolment in primary, secondary and tertiary education in 2003 is 22.9, which is far lower than the 52.6 for Hypothetica. There is little or no training on computers in some primary and secondary schools, and penetration and particularly networking remain low in tertiary education. There is, however, considerable demand for Internet access at all education levels, and the government together with other stakeholders has shown a commitment to improving school connectivity and introducing computer lessons in some schools. The University of Zambia, the main university in the country, introduced a degree program in computer science in 2001. To date there has been two cohorts of graduates who have been absorbed into the industry. Many private colleges and IT training centers have also opened. The literacy indicator increased significantly since 1995 to reach 80.7% in 2003, which is only slightly lower than the 82.5 for Hypothetica.

Info-use: After Zamtel first introduced mobile phones in 1995 the number of subscribers initially grew at a slow rate due to problems of awareness, coverage, affordability, availability and attitude towards having a cell phone. At first, mobile phones were viewed as items for companies and the elite. This trend was short lived, and since private operators entered in 1996 (Telecel) and 1998 (Celtel) there has been a drastic increase in the number of subscribers. In 1995 there were almost 50 mainlines for each cell phone; the numbers reached equality in 2001, and by 2003 there were 2.7 cell phones for each main line. Nevertheless, teledensity remains very low: in 2003 there were still only 2.2 cell phones per 100 inhabitants in Zambia, and only 0.7% of households had a residential fixed line. Mobile phone coverage is particularly poor in rural areas because of the unattractive rate of return on investment due to low population density; as well incomes are lower than in rural areas. As a result, investors concentrate in urban areas where they are likely to recoup their investments faster. Another probable reason is the absence of a comprehensive strategy enabling operators to share their network infrastructure in rural areas and thereby optimize its utilization.

As demand for broadband Internet access increases in Zambia, there is also a danger that the rural areas will be even more neglected, despite the fact that national policy objectives are aimed at reducing the urban-rural divide. The urgency of taking basic Internet services to rural areas seems to be overshadowed by the race for high capacity among those that already have access to services.

[69] *Data from the Africa e-Index 2004 showed that the waiting period ranged between two months to about two years to get a phone installed in Zambia.*

New Internet service providers are providing only broadband and no dial-up at all. This scenario certainly posses a big challenge to the country as there is an urgent need to increase penetration of ICT services in rural areas. The government may play a role by developing incentives for operators to invest in rural areas.[70]

The three main factors retarding the growth of the Internet in Zambia are the limitations imposed by the communication infrastructure, the high cost of delivering Internet bandwidth, and the high cost of computers and related communication accessories. The cost of delivering the Internet to the user is high due to the charges incurred through satellite communication, a prohibitive tax regime of about 32.5%, and poor economies of scale. The cost of Internet is many times higher than it is in the West. Costs are affected by the high cost of bandwidth, by that each Internet service provider has its own gateway satellite, and by the fact that Zambia has no direct link to cable networks to the outside world due to its geographical position. Distance and costs are particularly problematic in rural areas, where more networks or mobile subscribers are currently found alongside railway lines than elsewhere.

In addition to the poor infrastructure rollout, penetration of computers is very low because of prohibitive costs. The cost of an entry-level computer is way out of reach for most working Zambians. In fact, the cost of a computer is higher than the annual income of most citizens. Access to Internet services therefore still remains very low, with only about 68,000 users at the end of 2003 out of a population of 11 million.

5.2 Monitoring and Evaluating Infostates in Asia

Coordinator: Ramasamy Ramachandran, MIMOS Berhad

5.2.1 Overview of salient facts

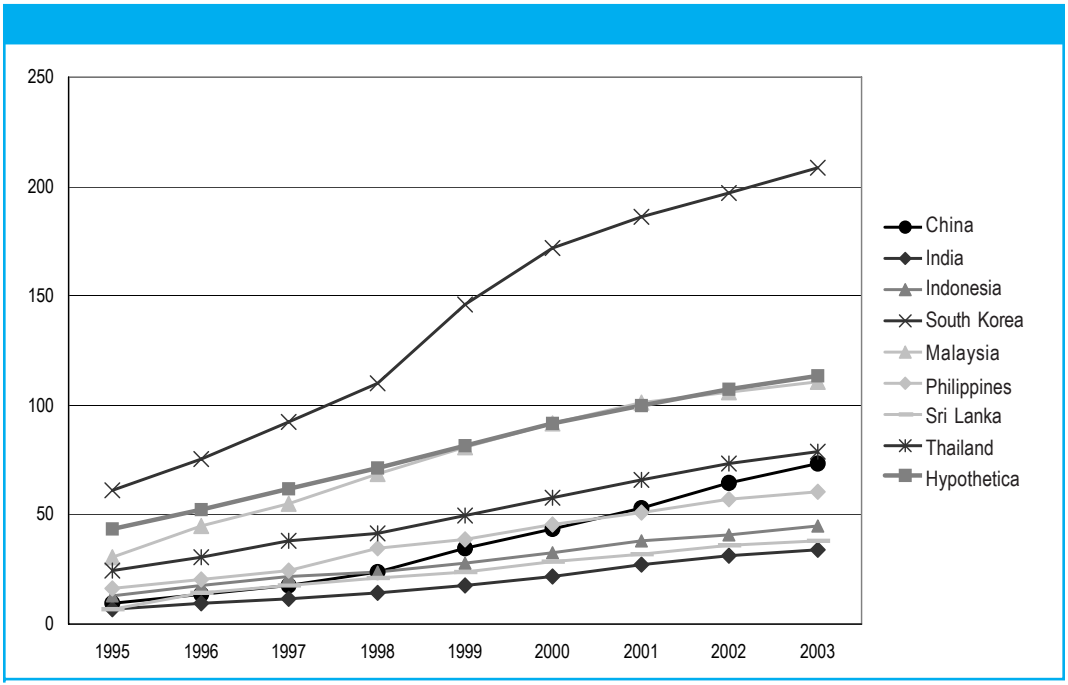
This section monitors Infostate developments in selected Asian countries over the 1995-2003 period, as well as assesses and evaluates factors contributing to their evolution. It starts with a brief overview of important recent developments, and continues with detailed country reports.

The following eight countries are included: China, India, Indonesia, Malaysia, Philippines, South Korea, Sri Lanka, Thailand.

Chart 5.2 displays the Infostates of the selected countries. Clearly, South Korea has the highest Infostate and its growth peaked from 1998 to 2000. As a result, not only its Infostate is much higher than the global average of Hypothetica, but the gap between the two has widened. Malaysia's Infostate is comparable to the global average, whereas those of the other countries are significantly below. All countries experienced significant Infostate growth over the period, albeit to varying degrees.

[70] *For example, the CAZ has proposed a rural telecommunications fund to deploy ICT infrastructure in rural areas (E-Access and Usage Index 2005).*

Chart 5.2 **Evolution of Infostates, selected countries in Asia**

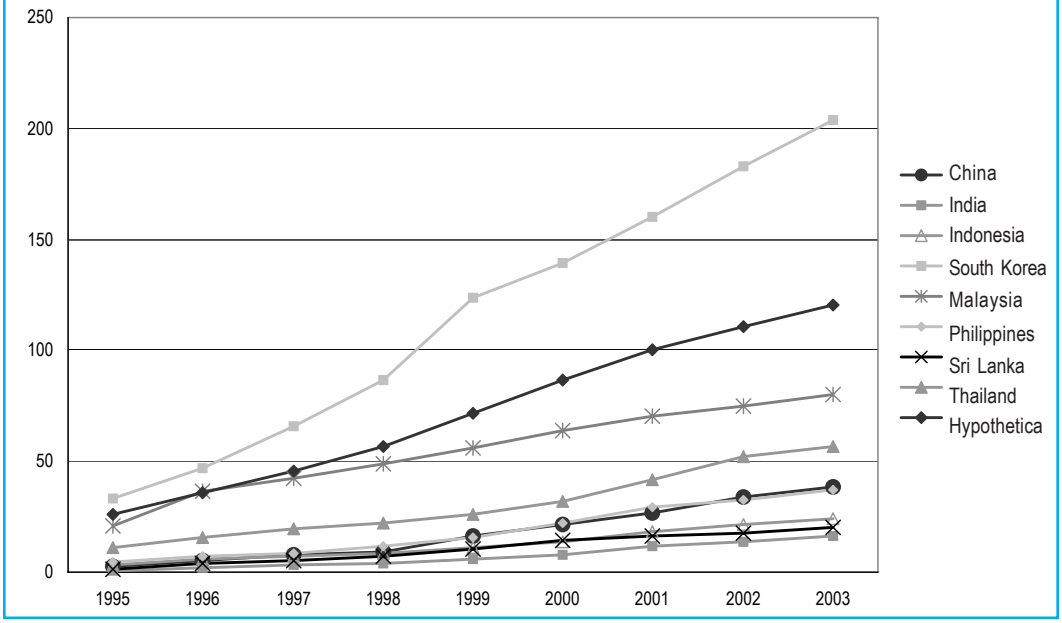


The pattern in Chart 5.2 is generally similar among the countries' Infodensity and Info-use aggregates. Interestingly, between 1995 and 1998 Malaysia's Info-use was lower than that of Hypothetica, but due to high growth from 1999 onwards it had surpassed the global average. China also experienced a strong growth in Info-use from 1999 to 2003, surpassing Thailand, the Philippines, Indonesia, India and Sri Lanka.

To understand the policies and strategies that have contributed to these movements, a detailed analysis of Info-density and Info-use indicators is carried out. Recognizing the complexities involved, especially in inter-country comparisons, the analysis follows a standardized approach based on individual components and indicators of the Infostate aggregates across countries. In Infodensity the analysis covers ***networks***, with particular attention paid to digitization, growth and decline of fixed-lines, including waiting lists, and the increasing popularity of mobile phones. Special attention is given to ***skills*** and the associated education environments across countries. In Info-use, ***ICT uptake*** and ***intensity of use*** are examined, with emphasis on the continuing role and popularity of radio and television, PC and Internet growth patterns, broadband roll-out and international traffic patterns.

Evolution of Networks: The trends in the evolution of networks are shown in Chart 5.3. South Korea again leads all other selected Asian countries, with index values ignificantly higher than Hypothetica. The evolution of networks for most other countries was lower than Hypothetica's.

Chart 5.3 **Evolution of Networks, selected countries in Asia**



Digitization: To improve the voice signals, all countries went through a process of digitization of telephone lines, converting the analog based system to digital mode. By 2002 all countries had achieved complete network digitization (Table 5.1).

Table 5.1 **Evolution of digitization**

	1995	1996	1997	1998	1999	2000	2001	2002	2003
China	99.2	99.5	99.7	99.9	99.9	100.0	100.0	100.0	100.0
India	93.0	98.7	99.0	99.5	99.8	100.0	100.0	100.0	100.0
Indonesia	63.4	96.0	99.0	99.2	100.0	100.0	100.0	100.0	100.0
Korea	87.0	65.2	66.7	68.9	73.9	79.9	88.0	97.3	100.0
Malaysia	95.0	96.0	97.0	100.0	100.0	100.0	100.0	100.0	100.0
Philippines	70.0	85.0	87.0	88.7	99.5	99.9	99.9	99.9	99.9
Sri Lanka	90.8	94.7	96.9	99.9	100.0	100.0	100.0	100.0	100.0
Thailand	86.9	89.4	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Fixed vs. Mobile: During the 1995-2003 period, growth in mobile phones was much larger than in fixed lines, in all selected countries (Table 5.2). This clearly demonstrates that in these countries mobile phones were much-preferred means of communication than fixed telephones due to cost considerations, as well as the flexibility and portability of the technology. The countries that experienced the highest growth in mobile phones were South Korea and India, registering average annual growth rates of 76% and 60.3%, respectively.

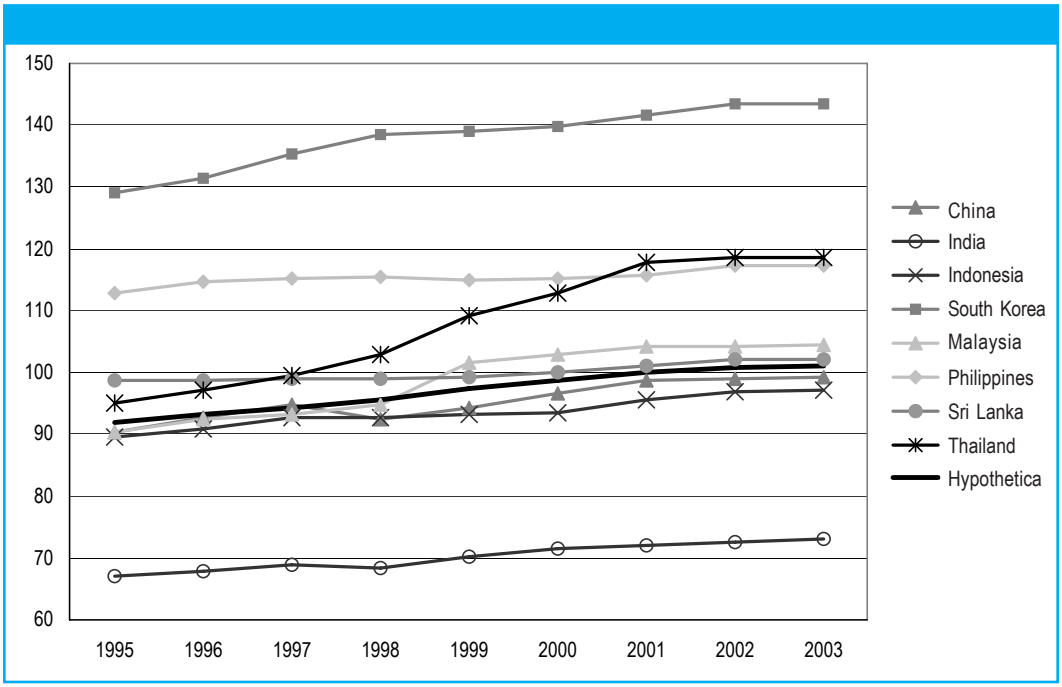
Evolution of Skills: The evolution of skills in all countries for the period 1995-2003 is displayed in Chart 5.4. In general, all countries experienced an upward trend – with minor exceptions for China and India in 1997-1998 and Sri Lanka in 1998-1999. South Korea leads all other countries in this index.

Table 5.2 **Growth in fixed and mobile phones**

	annual growth rate, 1995-2003 (%)	
	fixed lines	mobile phones
China	23.3	53.9
India	33.7	60.3
Indonesia	11.8	30.5
Korea	9.6	76.0
Malaysia	3.9	30.1
Philippines	10.8	47.4
Sri Lanka	19.0	41.3
Thailand	8.0	34.2

Philippines was second from 1995 to 2000. From 2001 to 2003, Thailand had the second highest skills development. Sri Lanka's skill development was higher than Hypothetica and Planetia. However, the skills gap between Sri Lanka and Hypothetica and Planetia improved from 1999 onwards. Malaysia's skills index was lower than Hypothetica and Planetia from 1995 to 1998. However, from 1998 to 1999, there was a significant increase in the index for Malaysia, even surpassing Sri Lanka, Hypothetica and Planetia. All the other selected Asian countries have lower levels of skills development than Hypothetica and Planetia with India registering the lowest skills level among all the Asian countries.

Chart 5.4 **Evolution of Skills, selected countries in Asia**



Evolution of ICT uptake: For today's needs and lifestyles television, radio, residential phones, PCs and the Internet are considered crucial items at the household level for sourcing leisure, entertainment, information, knowledge, communication and networking. As in many parts of the world, these ICTs have gained substantial footage among Asian households. The growth in residential mainlines has been slowed down due to the surge in the popularity of mobile phones. The trends for radio and television penetration largely follow a course of growth that typically matches the growing number of households. The uptake of PCs and the Internet has grown steadily in most countries, particularly in China (Table 5.3). However, they are still considered a luxury for many households, especially poor families.

Broadband: South Korea is the world leader in broadband Internet. It experienced phenomenal growth, with subscriptions increasing by a factor of seven, from 5.4 million in 2001 to 37 million in 2003. Such growth was made possible by a successful demand-creation strategy. Before the introduction of broadband Internet,

Table 5.3 **Growth in PCs and Internet use**

	annual growth rate, 1995-2003 (%)	
	PCs	Internet users
China	34.1	89.9
India	25.1	53.8
Indonesia	12.8	63.3
Korea	21.3	54.7
Malaysia	24.1	70.8
Philippines	16.9	67.6
Sri Lanka	34.2	67.7
Thailand	15.7	60.5

South Korea followed a traditional network development model, providing Internet service based on ISDN. However, ISDN was too slow for multimedia Internet content. The Internet speed issue was especially critical to the government because of its promotion of Internet use as a new IT strategic goal after the 1998 economic crisis. The government decided to introduce xDSL service as an alternative to ISDN and induced the service charge to below US$40 per month. The combination of low price with high speed proved sufficient to create effective demand. Among the other selected countries in the study, Malaysia leads with subscriptions almost doubling from 733,000 in 1995 to 1.4 million by 2003. This increase was due to an increased rollout of broadband using local access networks (LAN) based on wireless technology. Further, ASPs can increase the number of WiFi users using wireless hotspots without requiring additional licenses. To accelerate the use of ADSL, service providers increased the number of ports, which resulted in lower user charges. In India, broadband subscriptions almost tripled in recent years, from 50,000 in 2001 to 140,000 in 2003, but broadband access has been popularized only since 2003 and much consumer usage remains at the dial-up stage. In other Asian countries the broadband uptake has taken footage but is growing at a slower pace.

International incoming and outgoing traffic: International telephone traffic was unmistakably on an upward trend for all Asian countries under study. As can be seen in Table 5.4, the volume of outgoing traffic is lower than that of incoming traffic, with the exceptions of South Korea, Malaysia and Thailand. The outgoing/incoming traffic ratios decreased for these countries at different rates. Notably, the Philippines registered a significant drop, which came down from 0.32 in 1995 to near equalization later in the period. The other countries that registered substantial drops in the ratio were China (from 0.74 in 1995 to 0.15 in 2003), India (from 0.42 to 0.26) and Indonesia (from 0.79 to 0.64). It must be duly recognized that a large number of their citizens are working abroad in various capacities and they are expected to pay for communication services through making calls back home. On the other hand, countries like South Korea, Malaysia and Thailand are economically more advanced and they have less of an affordability issue in making business and social calls abroad.

Table 5.4 **Evolution of digitization**

	1995	1996	1997	1998	1999	2000	2001	2002	2003
China	0.74	0.72	0.68	0.68	0.55	0.44	0.29	0.21	0.15
India	0.42	0.39	0.33	0.29	0.27	0.31	0.21	0.27	0.26
Indonesia	0.79	0.76	0.71	0.76	0.76	0.74	0.86	0.67	0.64
South Korea	0.83	0.93	1.13	0.83	1.45	1.44	1.18	1.12	1.12
Malaysia	0.84	0.81	0.82	0.83	0.89	0.90	0.84	0.94	0.90
Philippines	0.32	0.35	0.35	0.22	0.15	0.07	0.07	0.06	0.06
Sri Lanka	0.31	0.31	0.27	0.27	0.30	0.23	0.21	0.18	0.17
Thailand	0.84	0.83	0.81	0.97	0.91	0.92	0.97	1.02	1.08
Hypothetica	1.04	1.01	1.01	1.04	1.10	1.02	1.03	1.06	1.06

5.2.2 Asian Country Reports

CHINA

Jian Yan Wang and Seow Hiong Goh

China is the most populous country in the world, and had a steady increase in its population from 1995 to 2000. However, since then, the population started to decline - attributed to China's one-child policy which has curbed birth rates significantly. This trend is noteworthy when considering the Infostate indicators discussed below, particularly in areas where absolute growth occurred despite the decline in population.

Networks: Fixed and mobile telephony in China grew by leaps and bounds between 1995 and 2003. The number of mainlines increased from 40.7 million in 1995 to 262.2 million in 2003, registering an average annual growth rate of 23.3%. Mobile phone subscriptions increased even more dramatically, from 3.6 million in 1995 to 270 million in 2003, at an average annual growth rate of 53.9%. As of 2003, the number of mobile phones began to exceed fixed mainlines.

The competition between the mobile operators has been a key factor in driving the development of communications. In 1994, the entry of China Unicom brought about competition in the telecommunication market, which until then was monopolized by China Telecom[71]. A number of institutional factors have also contributed significantly to the changes. In 1995, China Telecom was split from the Ministry of Post and Telecommunications in response to the need for separating government administration from enterprise management. In 1998, the Ministry of Post and Telecommunications was abolished and the Ministry of Information Industry was created to take charge of policy-making and implementation of ICT matters. A series of laws were brought into effect in 2000, including telecommunications regulations, Internet safety, provisions on Internet information services, and regulation on the management of ISPs.

Accession to the WTO[73] required China to speed up the further opening-up of the telecommunications market to foreign companies, something considered by the Chinese government to be particularly sensitive. The WTO obligations also required China to undertake institutional reform to move towards a society based on the rule of law. The 15-year long negotiations on China's WTO membership have turned out to be a necessary learning process through which Chinese leaders obtained a clearer understanding of market dynamics and increasingly adopted market-oriented policies.

To further enhance the competitiveness of the market, in 1999-2000, China Telecom was restructured into four separate companies.[73] One of these, China Mobile, is authorized to operate mobile telephone services together with China Unicom. These two companies have been also successful in promoting their SMS (based on different tariff policies), which has grown rapidly since 1999 to become the mainstream of mobile Internet services in China. In 2001, consumer uptake of mobile services was further boosted when the government waived the mobile connection fee of 100 yuan per new subscriber. As cellular phones increasingly substituted mainlines, the

[71] *China Unicom initially decided to forego the analogue cellular network and started to build a GSM network. Later, it took over the CDMA network from the former Great Wall Telecom. China Unicom has been able to attract many more new subscribers by lowering prices and offering more choices.*

[72] *China officially became a WTO member in December 2001. China has obligations under the WTO to further remove its restrictions on the paging and value-added services, mobile phones and domestic telephone lines in accordance with the WTO implementation schedules.*

[73] *The four new operators were China Telecom, China Mobile, China Netcom and China Satcom, together with China Unicom, China Jitong and China Tietong (formerly China RailCom).*

growth in mainlines slowed down. However, China Telecom made efforts to mitigate this by offering customers various attractive fee plans and product packages, and leveraging its extensive distribution networks – since after the restructuring of 1999-2000 it no longer had a mobile license and experienced revenue shrinkage.

Changes in the relative market shares of the telecommunication service providers were largely the result of intense tariff competition. In recent years, the major players have improved service quality and strengthened their respective competitive positions. Their core competitive competencies include establishing reliable networks, providing extensive coverage, enabling high capacity, upgrading network intelligence through digitization, and optimizing network infrastructure. China's leading telecommunications manufacturers and network solutions providers, such as ZTE Corporation and Huawei Technologies, are strong examples of how companies innovate to succeed. ZTE Corporation's strategies include product differentiation and branding, while Huawei Technologies' approaches include a strong focus on research and development to meet the demands of a sophisticated customer base. As the operator fully dedicated to mobile business in China, China Mobile has similarly succeeded in building nationwide household brands. "GoTone" has gained a massive take-up among high-value customers due to the superior value of its service, while innovative brands like "M-Zone" are popular among the youth due to SMS. The company has also forged partnerships with equipment providers, content providers, system integrators and terminal providers to extend the telecommunication services value chain.

Over the past decade, China's economy has grown at an average annual rate of 8%. However, such strong growth has taken place only in the coastal regions and urban areas. Since the 9th Five-Year Plan period (1996-2000), information industry has been acknowledged as the strategic industry for China's economic and social development. The 10th Five-Year Plan (2001-2005) set forth two strategic objectives: achieving overall economic and social development, and providing the people with a good standard of living. With this objective in view, the government endeavors to accelerate the construction of information infrastructure and develop the IT industry. Aiming toward the goal of "national informatization" by 2015, a number of "Golden Projects" have been undertaken to electronically enable the government, enterprises and households. By the end of 2004, 10,260 government websites had been set up and deployed to deliver information and services online so that citizens can be online and not in line. Business-to-business (B2B) electronic commerce is also a driving force for Internet development.

The reform and restructuring of China's telecommunication sector, the country's strong human capital, technological innovation, fine-tuned business strategies, market-oriented and customer-centered business models, as well as a huge consumer base, have all contributed to the sector's continued prosperity.

Skills: The literacy rate in China has grown from 81.9% in 1995 to 86.9% in 2003. The high literacy rate is attributed to several factors. After the Cultural Revolution, the Chinese government reinstated the examination system which had been shut down during the Revolution. The Chinese leaders recognize that education is essential to the modernization of the country and its transformation into a knowledge-driven economy. In 1986, China instituted the "Law of the People's Republic of China on Compulsory Education". This made it mandatory for children to attend primary school (for 6 years) and junior secondary schools (for 3 years). High enrolment in primary and junior secondary education has also led to high enrolment in senior secondary schools.

Guided by the principle of "joint establishment, adjustment, cooperation and mergence" and after more than 8 years' efforts, the management system of higher education has been changed and the educational resources deployment has been optimized. A new two-level management system consisting of central and local governments (with the latter as the main management body) has taken shape, mobilizing the initiative of the local government in developing higher education (MOE 2005).

Education in China has thrived partly due to increased investments. The Chinese government's allocation of funds to education has grown 1% annually since 1998. In 2003, the national government budget for education was almost 350 billion yuan, approximately 3.4% of GDP (Overview of Edùucation in China). The government also encourages non-state and private entities to set up and operate educational institutions.

Initiated during the 9th five-year plan period (1996-2000), the "211 Project" aimed to strengthen higher education and revitalize China through science and education by building up 100 world class universities and key disciplines with reasonable structure and individual characteristics. In addition, the "985 Programme" has been carried out to set up world class research-oriented universities. The 10th five-year plan (2001-2005) continued with the implementation of the second round of "211 Project" and "985 Programme", to enhance China's technological and scientific capability.

In late 1980s and 1990s, competition for places in the universities intensified and university entrance examinations difficult to pass. Students typically had the mentality that only hard work would get them a place in a good university, but higher education is not free in China and tuition fees are a strain for poorer families. The government has introduced various financial incentives in the form of scholarships, work-study programs, subsidies, loans and reduction of fees. The Chinese people have always firmly believed that education is the only way of changing and improving life. Hence, the parents do not hesitate to invest in their children's education. With time, more families started to send their children overseas for a higher education.

Info-use: Television still occupies a dominant position in mass media in China and is an important part of people's lives in China.[74] As a result of the affordable cost for purchasing a television in China and the low cable subscription fees (US$1/month), the demand for televisions has steadily increased in both rural and urban areas. Large penetration increases took place during 1995-2003, with penetration growing from 77.2% to 91.1%. It is estimated that there were approximately 317 million television sets in the country in 2003. Furthermore, two-way broadband cable networks are replacing old cable infrastructure as television signals are being digitalized by the stations. The overall transition of the cable system to digital is expected to be completed by 2015.

The growth rate in residential mainlines was much faster, increasing from 9.4% in 1995 to 60.2% in 2003. It is even more remarkable to observe this growth in absolute numbers: residential mainlines grew from 29 million in 1995 to 209 million in 2003.

The CNNIC surveys[75] show that the Internet user population in China has boomed over the years. Compared with October 1997 which recorded 62,000 Internet users, there were 79.5 million Internet users in December 2003, and the number rose to 94 million users by the end of 2004, and with a surge in broadband users (42.8 million). This represents a penetration increase from almost

[74] *Television stations are owned by the government. Private investment is only allowed in "hardware" - for example, cable television network construction. The State Administration of Radio, Film and Television of China (SARFT) monitors the content.*

[75] *China Internet Network Information Center (CNNIC) has been publishing its semi-annual survey report on the Internet development in China since October 1997. Retrieved from* http://www.cnnic.net.cn

zero to 6.3 per 100 inhabitants, and an increase in absolute numbers of more than 1,000 times. Broadband has increased significantly in a three-year period from 304,000 users in 2001 to 10.5 million in 2003 (or from 0.9% of Internet users to 13.2%). Over 70% of Internet users are under the age of 30.

There has also been a phenomenal increase in the use of other ICTs. PC penetration increased from 0.2 per 100 inhabitants to 3.4 from 1995 to 2003. The number of PCs grew from 2.8 million in 1995 to 43 million in 2003. This surge can be partly attributed to China's evolution from a producer of low-grade consumer goods to the manufacturing of high-tech products. China's own brands of PCs such as "Legend" have a leading market share in the domestic market and the lower pricing of a domestic product has led to greater sales and penetration of PCs.

The amount of telephone traffic flowing in and out of China follows different trends. There is a general trend of growth in traffic going into China, indicative of an increase usage of Internet resources internationally from within China. Outgoing traffic has fluctuated at around the same level over the period.

INDIA

Madanmohan Rao

The past decade has seen the rise of India from an economic backwater to a global powerhouse in software and business process offshoring – and growth in domestic ICT diffusion and adoption has also been significant, but noticeably uneven. Digging beneath quantitative measures of India's ICT environment, this section provides a framework to understand the successes and contradictions of India's ICT performance.

The Information Society is not just about connectivity to the global information infrastructure, but about the content that is accessible, the communities that congregate online and offline, the embedded and emerging cultural attitudes, the commercial and other motives behind such activities, an attitude of cooperation and lifelong learning, and a capacity for creating and governing such information spaces. Considering that the Information Society is not just about passively using "black box" technologies, but about actively creating and shaping the underlying technical, information and service infrastructure, in addressing the state and evolution of India's Infostate the framework will touch on a set of parameters called the "8 Cs" of information societies: connectivity, content, community, commerce, culture, capacity, cooperation and capital. These parameters affect both the "instrument" aspects of ICTs (diffusion, adoption, application) and "industry" aspects of ICTs (creation of ICT industries in software and hardware services).

Networks: During the period 1995-2003 India's ***connectivity*** improved substantially. It registered an average annual growth rate of 33.7% in the provision of landline infrastructure. This was due to the introduction of economic reforms in 1991, when the emphasis shifted from centrally-planned and socially-inclined attitudes towards free markets, private enterprise and globally-orientated technology industries.

Next to South Korea, India registered the second highest growth rate of 60.3% in the provision of mobile phones, which took footage in the mid-1990s as in many other countries. The mobile penetration was significant due to lower per user cost and also lower costs for the mobile operators, resulting in near-zero waiting times for active subscriptions compared to several years of waiting

time for landline accounts. In particular, aggressive pricing and marketing by private mobile operators, like Airtel and Reliance, has resulted in 2 million new mobile subscribers per month. The privatization of government-owned operators, BSNL and MTNL, has also spurred them from cozy monopolistic positions to more active market competition. However, currently much of the mobile telephony penetration is confined to urban clusters and access to the 70% rural population is gaining footage at a much slower pace.

Skills: Many post-independence education policies in India were guided by Nehru's vision of a secular, democratic nation, where the state played a key role in socioeconomic development. Access to education was seen as key to unifying the people that were divided based on caste, religion and economic wealth. The Kothari Commission, established from 1964-1966 to develop a coherent education policy for India (Sharma 2002), proposed four main thrusts for the Indian education policy (Lall 2005): education be made compulsory and free for all children up to the age of 14; development of languages such as Hindi, Sanskrit and other regional languages (this initiative is called the 'three-language formula', under which students learn Hindi, English and the language from the region they are from); greater priority to scientific education and research; and, adult education. A key achievement of the Kothari Commission was that 90% of the rural communities were within one kilometer from schooling facilities, and that most states adopted a common education structure (Lall 2005).

In 1986, the Rajiv Gandhi's administration introduced the New Policy on Education (NPE). Privatization, secular, and science and technology education were the main cornerstones of the NPE. Private sector education in India has been growing over the years and it made up close to 2% of the GDP (Lall 2005). However, the opportunities to private education are only affordable to the wealthy and privileged. From 1998 to 2004, the BJP dominated the coalition party. The Indian education policy under this government was to "Indianize, nationalize and spiritualize" the education system (Lall 2005). These included purging all elements of the British and Moghul legacy in India from the curriculum. There was a move from a secular-based to a more 'Hindu-centric' education. Much of the time under the BJP rule was used to debate new motions to the 'saffronization' of education instead of addressing real issues pertaining to the quality of and access to education.

Despite all the programs and plans under the various administrations, India registered the lowest level of literacy rates among the selected countries. Furthermore, the 1991 census indicated that approximately half the adults were illiterate - unable to read or write (Dreze and Sen 1997). The literacy rates, though, also differ significantly based on states and gender. The northern states, which are economically poorer, have lower literacy rates than the western and southern states. Gender is also a major factor in India. For example, the female literacy rates in Bihar and Kerala are 34% and 88%, respectively. On the other hand, male literacy rates in these two states are 60% and 94%, respectively (Lall 2005).

Among the factors contributing to the low literacy rates in the country are high dropout rates, especially after Class 10. This is attributed to poor infrastructure and quality of teaching and lack of funding in schools, especially in the rural areas. These have resulted in poorly managed schools, dilapidated facilities, high absenteeism among teachers and not adequately qualified teachers.

The large literacy disparities among northern and southern states are attributed to differences in the quality of educational facilities and education programs. Richer states in the south invested heavily in science, technology and engineering-based colleges, whose number in the south exceeds

that of the northern states. For example, in Tamil Nadu there are four engineering colleges for every million people in the state, while in Bihar there is one (Lall 2005). The high number of engineering colleges, good quality infrastructure and high quality teaching staff has helped the southern states to enhance their technological capabilities. This put the southern states in a better position to attract high-technology based industries.

India human resource ***capacity*** is vast and the country is is a major producer of highly qualified IT engineers and IT-skilled business professionals, which have helped spur the global growth and success of India-based IT firms. Its tertiary educational institutes are of world class, though their output will need to significantly scale up to meet future domestic and global IT skills demand. The long-term prospects of local ICT diffusion may not remain as rosy, however, if levels if basic literacy in the country do not improve. Literacy levels in South Asia, especially India, remain embarrassingly low. Fortunately, a number of state-launched initiatives are providing better Internet access and IT educational offerings in schools and colleges, and a number of NGOs and private sector initiatives have stepped up literacy campaigns across the country.

Info-use: Indian ***cultural*** attitudes towards traditional and new media are generally friendly and pro-adoption. The Indian private sector is aggressively embracing IT, most NGOs are IT-enabled and even the traditional Indian bureaucracy is beginning to adopt ICTs. Challenges have emerged on some fronts like e-government, where a lot of political will and muscle will be needed. For instance, in areas like land records and getting power connections, some unscrupulous middlemen tend to get involved; openness and transparency will threaten them, but the government must display the political will to clean up these processes via open content publishing.

India registered a significant growth in TV uptake (especially cable TV), from 38 million households in 1995 to 64 million in 2005. This growth has been mainly due to the grass roots cottage industry of cable TV operators, which exploded in the early 1990s due to unlicensed and unregulated areas of cable TV infrastructure and network roll-out, low entry costs, high entrepreneurial spirit and “free reign”.

The penetration of Internet services in India is very slow partly due to slow growth in landline telecom infrastructure needed for the provision of dial-up, and partly due to the slower pace of regulatory reforms – infrastructure and reform are badly needed to enable a level playing field for private and state-run ISPs. In addition, high costs of PCs and Internet tariffs further dampen the growth of the Internet in the country. India’s strength lies in global IT services requiring software skills, but its Achilles’ heel is IT hardware manufacturing in comparison to power houses like China. Thus PCs are largely imported or locally assembled and relatively expensive for Indian consumers.

Low rates of Internet diffusion in India and a preference for traditional “face-to-face” negotiations have led to a slower update of online services like e-***commerce***. India still lags, however in active deployment of e-commerce infrastructure like payment gateways, secure channels, digital certification authorities, affordable overnight courier services and third party audit services. Though India’s IT Act has provided legal support for e-commerce, online vendor and consumer activity has not been significant, with a few exceptions like air and train travel.

The early years of English-oriented IT/Internet diffusion and India’s strong urban base of English speakers (a reflection of its colonial roots in the British Empire) led to the Indian Internet leaning towards English content. In contrast to Asian languages like Japanese or Korean, Indian language

speakers and IT users were not quick enough to standardise representation codes, fonts and keyboards for Indian language use. These developments solidified only around the turn of the past decade, and Indian language ***content*** on the Internet has been relatively slow to emerge as compared to English-language content from India.

On the other hand, India has been a powerhouse in generating movie and TV content, producing more films than even Hollywood. A free and largely unfettered press environment has led to an explosion in the magazine and newspaper markets. Indians are voracious consumers of media content, and this has helped support an active advertising industry. Large quantities of government and other public information are also coming online.

Given this explosion in media, an unusual contradiction in India lies in the stunted status of community radio, which has been licensed only recently. Part of this has stemmed from government concern over possible misuse of community radio which might harm the national interest or inter-religious harmony, but this concern has fortunately not been reflected in the TV boom.

Like many of its Asian brethren, Indian culture is also strongly family oriented, and family-driven habits of media consumption often dictate the success of movies and TV programmes. Strong relationships and bonds within the Indian ***community*** have also led to active usage of Internet forums like mailing lists and Web-based online communities (especially among overseas Indians), though much more potential exists for harnessing online communities across the country.

The growth of ICTs like the Internet across rural India will be driven by community-oriented models like the cybercafé or telecentre, whose penetration in India has still been largely in urban areas (much urban Internet use, especially among youth, is in cybercafés). Media forms like community radio and community TV have also been largely untapped.

As a cash-strapped developing country, India has not been able to launch major ***capital***-intensive Internet backbone or PC penetration campaigns of the scale and intensity of countries like South Korea. Thus, ICT access was possibly largely for urban areas. Only recently have private telecom and ISP players like Reliance emerged, with aggressive plans to wire up most Indian villages in the coming years. Till recently, the investment climate was not very stable or openly friendly to foreign investors beyond certain investment caps, thus stunting the role of aggressive investors in Indian telecom and Internet space. Fortunately, large pools of domestic venture capital and corporate funds have helped spur the growth of new players in Indian ICT space, which have been also aided by healthy and well-regulated stock markets for exit strategies and future revenue sources.

In sum, India's ICT growth has been significant but uneven. IT divides are likely to overlay existing socio-economic divides for lower income groups, especially in rural areas. Slow government moves in formerly closed infrastructure areas like landline telecom have led to low penetration of landlines and Internet. Opening up these sectors, especially new industries like mobile telecommunications, to the private sector has undoubtedly led to an expansion of teledensity in India, and has the potential to galvanise the entire ICT industry in a ripple-effect.

No single sector can take on the Internet economy by itself; much ***cooperation*** at the national level is needed to overcome the sectoral gaps between government, academia, private sector, civil society, and international organisations. Indian IT lobbies like NASSCOM (National Association of Software and Services Companies) have successfully campaigned for progressive IT-friendly policies at the highest levels, such as lower tariffs for IT hardware.

INDONESIA

Onno W. Purbo

Networks: Examining the competition between fixed and mobile telephony, the experience of Indonesia is similar to other populous countries like China, India and the Philippines: fixed lines were on an upward trend despite facing stiff competition from mobile phones. In particular, the number of mainlines increased from 3.3 million in 1995 to 8.5 million by 2003, registering an average annual growth rate of 11.8%.

In order to provide services in unserved areas, cellular telephony is open to the private sector, and there are a dozen operators in Indonesia. Consequently, cell phones are becoming a precious alternative for the public to get telephone access, and now they represent a much larger subscriber base than fixed lines. Mobile phone subscriptions grew at a rate almost three times that of fixed lines (30.5%), from 210,000 in 1995 to 18.8 million in 2003. It is estimated that growth has been even higher over the last couple of years and there are well over 20 million subscribers today. This increase is attributed to a combination of lower prices and several other advantages, such as: low activation cost of Rp. 15,000-25,000 (US$2-3); easy-to-get re-fill vouchers; more variety of services (SMS, MMS, caller-ID), and; wider coverage of the mobile network (which started with limited mobility under CDMA1X technology by Indonesian Telkom in December 2002, but was joined by the Mobile 8 and Star One operators later).

Factors impeding higher growth in fixed lines include: high activation cost at Rp. 300,000-500,000 (US$35-55) plus Rp. 200,000-300,000 (US$25-35) per additional telephone, especially in remote villages where no telephone poles are available; the non-availability of pre-paid services, and; the absence until recently of value-added services (SMS, called-ID etc.).

Among the key factors that hindered the development of telephony in Indonesia has been the lack of investors in this sector. Their low number, especially in the 1997-98 period, was due to the 1997 Asian financial crisis that caused the closure of many enterprises. Another key factor that influences developments is a move from a monopoly market structure to a duopoly, where Indosat and Telkom were the key providers of basic voice services.

Skills: Most of the Internet operators have duly acknowledged that people's education level is the most crucial parameter for Internet growth. Lack of adequate knowledge among Indonesian communities will pose a significant barrier to the expansion of the market. Interestingly, many ISPs, telecom providers and volunteers are willing, and are currently working hard, to help educational institutions get connected to the Internet. The most popular initiatives are the *Sekolah 2000 project* that started in 1999 by the Indonesian Internet Service Providers Association and the*"Internet Goes To School"* project that started in 2004 by Telekomunikasi Indonesia. Both projects aim to increase Internet penetration in schools, and in turn bring about an increase in the education level of the society. Out of a total of 220,000 Indonesian schools, currently only 5,000 have Internet access - mostly through self-financing schemes. The policy support for the project from the Indonesian government is limited. A simple project accounting showed that Internet connection cost only about US$2-5 per student per month due to economies of scale. However, the major stumbling block facing the implementation of the project is the mindset of teachers and headmasters who are reluctant to adopt the technology. If the school projects succeed, 38 million Indonesian students will have access to the Internet, thus increasing the overall level of skills in the country.

Provision of distance education and e-learning through the formal education system has not really gained footage in Indonesia due to inadequate regulation. Moreover, arrangements of transfer of credit have not been fully accepted by higher learning institutions. This poses a great difficulty in promoting and nurturing distance learning services. Despite these challenges, currently there are two major distance education initiatives, namely the Indonesian Open University and IBUTeledukasi. The Indonesian Open University is the formal open university run by the government. Besides that, plans are underway at the ministry of education towards setting up distance learning programs in some public universities. The IBUTeledukasi program is a newcomer, which initiated its distance learning business in 2002. This programme promotes distance education through collaboration with many institutions outside the country like the University Tun Abdul Razak (UNITAR) in Malaysia. One such course arranged with UNITAR is an IT course.

Besides organized modes and distance education, skills are also acquired through informal e-learning processes that require no certification or accreditation or permit. The adoption rate of such informal e-learning activities is very encouraging among Indonesian online communities, as the learning is mostly centered around real life elements. Transfer of knowledge occurs mainly through e-mail discussions and websites, each of which represents a virtual community providing an informal platform for the exchange of knowledge in a rapid manner. Knowledge exchanged through virtual communities is very current, practical and targeted to meet specific community interests. No such knowledge can be sufficiently obtained through the formal education system, which is very much controlled by the conventional top-down national curriculum.[76]

Info-use: The number of PCs reported in 1995 was 980,000, which grew to 2.7 million by 2003. In 1995, the number of Internet users was estimated at 50,000, but increased to exceed 8 million by the end of 2003. The latest statistics indicate that the number of Internet users is around 10 million at the time of writing. The difference in PC ownership and Internet users is due to the fact that most Indonesians have Internet access through cyber cafés, schools and neighborhood networks. One of the major reasons for the low PC ownership in Indonesia is the cost of a PC, which is beyond the reach of the average individual. The low Internet access is attributed to the weak provision of connectivity at the last mile.

In order to promote better access, after more than 12 years of struggle, many data radio installations for low cost wireless Internet access, in January 2005 the government signed an Act that no longer requires licensing and fees for deploying any WiFi (in the 2.4GHz band) infrastructure. The introduction of the new regulatory measures is expected to bring about a surge in WiFi installations. Indeed, the Indonesians are looking forward to more than 1,000 new WiFi outdoor installations, though the price could range between US$300-600 per node. The Internet industry is projecting around US$300,000-600,000 in investment, monthly. Upon reaching the installation rate number of 20,000-30,000 per month, Indonesians are actually exploring the possibility of building their own WiFi industry.

In summary, an excellent foundation is currently being built to move Indonesia towards a democratic and knowledge-based society. It is not an easy task as corruption and low levels of education are still dominant in country. It may take years to accomplish this task, but many believe that the process is in a positive direction.

[76] *More than 1,300 institutions are providing higher education degrees in Indonesia.*

MALAYSIA

Ramasamy Ramachandran, MIMOS Berhad*

Networks: Following the privatization of the telecommunications sector in the 1990s, mainlines increased at an annual average rate of growth of 3.9% over the 1995-2003 period. The number of mainlines for residential and business use increased from 3.3 million in 1995 to a peak of 4.7 million in 2001, but it had then declined to 4.4 million by 2004. More detailed analysis revealed that the decline was due solely to residential lines, while the penetration of mainlines among businesses kept increasing. In particular, the business mainlines increased from 1.3 million in 2002 to 1.5 million in 2004 (MCMC 2004), indicating that mainlines are still the preferred mode of communication in the commercial sectors.

The number of mobile phone subscribers increased dramatically, from just over 1 million in 1995 to 11.1 million in 2003, at an annual average growth rate of 30.1%. This increase, combined with the competition posed by the spread of mobile phones, accounts also for the decline in residential mainlines. Initially, mobile phones were seen as convenient and versatile tools for communication anywhere and anytime; later they became a cheaper alternative for a large segment of the population. Intense competition in the telephony market resulted in telcos slashing prices, providing flat rates for nation-wide calls and canceling access fees for post-paid services. High competition also resulted in operators introducing new services over the cellular network such as Short Message Services (SMS), Voice Mail, Calling Line Identification and Internet access with Wireless Application Protocol (WAP).

By the mid-1990's the shift towards a more open and competitive telecommunications market had paved the way for new entrants in the provision of mobile services and broke the monopoly of traditional players, especially TMB. The cellular mobile services market was able to attract new players for a number of reasons, such as: low capital-intensity investment compared with the fixed Public Switched Telephone Network (PSTN); not being subject to universal service obligations that pose financial burdens; being a good substitute for fixed lines, where a chronic shortage existed - especially in rural and remote parts of the country, and; being functionally more versatile in terms of roaming, and convenience for commercial communities and the lifestyle of urban dwellers (Ure 2000).

Skills: Malaysia has a current literacy rate of 88.9%, which is one of the highest among developing countries. The government has long recognized the importance of education to national development (MDG 2004). All development plans, commencing with the First Malaysia Plan in 1966-1970, gave significant emphasis to human resource development and education. To increase competitiveness through the human capital of the country, the funds allocated for education in the national budget have increased significantly over the years from 7.5% in 1980 to 17% in 2003. Provision of free universal primary education for children between the ages 7 to 12 years, and secondary education for the ages 13 to 17 years, are key strategies accounting for the achievement of high literacy. Over the last five years, the government has allocated large amounts of funding to upgrade the ICT infrastructure and support systems in schools. While the government provides most primary and secondary education in the country, a small number of individuals (about 10%), who can afford to pursue primary and secondary education in private schools have put private education on an upward trend.

* *Valuable contributions by Assoc. Prof. Mahendhiran Nair of Monash University Malaysia are highly appreciated and acknowledged.*

The transition from the primary level to secondary school is not subject to any public examination because the main objective of early stages of education is to provide general academic and life skills. Due to the expansion in education opportunities, the net enrolment ratio in primary schools almost doubled over the last three decades, and currently registers 98.5%, indicating near-universal coverage. The gross enrolment in secondary education also rose from 48% in 1980 to 99% in 2000. Currently, there are 7,400 primary schools in the country, and of these 937 were built over the past 30 years. During the study period alone, the number of school children enrolled in primary education increased from 2.8 million in 1995 to 3 million in 2003, including 10,000 children enrolled in special schools and classes. Being a multi-ethnic country as per its constitution, Malaysia offers instruction in Malay at national schools, and Chinese or Tamil in national-type schools. Nevertheless, Malay and English are compulsory subjects in all schools.

Enrolment in tertiary education also increased significantly in Malaysia in recent years. This has been partly due to government actions and significant growth in the intake of students, especially by privately-run institutions. The provision of tertiary education was liberalized in 1996 through a number of education Acts[77], which safeguard the quality and integrity of the provision of private educational services in the country. This led to the opening of new institutions of higher learning funded by the government, the private sector and foreign universities. In the past decade, another 8 public universities, 14 private universities and university colleges, 4 foreign university branch campuses and 690 private colleges, 18 polytechnics, 27 teacher training colleges and community colleges were opened. Currently, there are approximately 270,000 students enrolled in tertiary education, with an annual intake of 80,000.

Info-use: Like in many developed countries, TV is a popular household item for leisure and entertainment. This is evident from the last population and housing census (2000) which showed that about 85% of private households in Malaysia owned a TV - penetration was 87.8% in urban areas and 79.5% in rural areas.[78] Therefore, it is not surprising that TV penetration increased over the period analyzed, with an average annual growth rate of 2.9%. Several factors contributed to the increase in the rate of TV ownership. First, the average household income rose from RM2,020 in 1995 to RM3,011 by 2002. Second, the supply of programming in the market also increased drastically due to local TV production. Third, there was a significant influx of lower cost TV sets from China – all factors that increased the affordability of TVs to a wider segment of the population.

Between 1995 and 2001 the number of residential mainlines increased to a peak of 3.3 million lines, but their number declined afterwards. Thus, while the number of mainlines per 100 households increased from 60.2 in 1995 to 73.3 in 1998, they went on a downward trend from 1999 onwards, to 60.6 by 2003. The fall in residential mainlines is attributed to increased competition from mobile phones.

The number of PCs has increased from 610,000 in 1995 to 4.2 million in 2003. Though the number of PCs in the country and the number of PCs per 100 inhabitants has increased over the period analyzed, PC ownership has been low – the number of PCs per 100 inhabitants was 3 in 1995 and rose to 16.7 in 2003. PC ownership was low because their cost was beyond the reach of the large majority of the population. A study found that approximately 83% of rural households and 60% of urban households may face financial constraints to purchase PCs or ICT services (Jayanath and Ramachandran 2001). However, the decision to buy Internet services depends on the priority of needs - usually entertainment supersedes information and knowledge seeking. The government

[77] *These are: the Education Act, the Private Higher Educational Institutions Act, the National Council on Higher Educational Act, the National Accreditation Board Act, the Universities and University Colleges (Amendment) Act (all 1996), and the National Higher Education Fund Board Act (1997).*

[78] *The penetration of radio stood at 79%.*

introduced several initiatives to increase PC and ICT usage. This includes the abolition of the sales tax on PCs and components, and the granting of accelerated capital allowance for PCs and ICT equipment. A tax rebate of RM400 (US$105) was given for PC purchases (Ramachandran and Rathina Paandi 2003). To induce greater utilization of PCs and ICT, the government also introduced the Employment Provident Fund (EPF) scheme, under which contributors can withdraw from the savings to purchase a PC. In 1999, 245,460 applications were received, of which almost 200,000 were approved (EPU 2001). However, the EPF scheme was discontinued due to misuse – many people used the fund not for the intended PC purchases but for other uses.

The total number of Internet users and the number of Internet users per 100 inhabitants both increased significantly over the analyzed period. In 1995, the number of Internet user was estimated at 30,000, and the number of Internet users per 100 inhabitants was insignificant (0.1). By 2003, the Internet users numbered 8.7 million, while the number of Internet users per 100 inhabitants was 34.4. This dramatic increase was due to several factors. First, PC ownership had increased over the period. Second, the number of Internet hosts increased and the cost of these services had become more affordable due to intense competition among the ISPs. Third, the government intensified efforts to increase ICT awareness among the population. Fourth, the government established several ICT community centers in the rural and urban areas, catering to people who otherwise would not be able to afford these ICT services. Fifth, to increase the level of ICT literacy among students in primary and secondary schools, the Computer Infrastructure Project was launched to increase the coverage of computer-aided teaching and learning. *Smart Schools* was established with the aim of producing ICT-savvy new generation Malaysians.

The proportion of broadband users relative to Internet users was low in 2001 and 2002, but broadband users increased sizably in 2003, to exceed 110,000. This increase was due to the increased rollout of broadband using local access network (LAN) based on wireless technology. Further, ASPs can increase the number of WiFi users, using wireless hotspots without requiring additional license (EPU 2003). To accelerate the use of ADSL, service providers increased the number of ports. This resulted in lower user charges.

Like in the case of Infodensity, the progress made in Info-use was also greatly influenced by several macro factors, especially those pertaining to public policies. Realizing the importance of Internet technologies, especially their capacity to create an information and knowledge rich society, the government of Malaysia systematically formulated a number of top-down initiatives. The National Information Technology Council (NITC) was established in 1994. It functioned as the primary advisor and consultant to the government with regards to IT, in the nation's development efforts. Following this, in 1996 the NITC launched the National Information Technology Agenda (NITA). The NITA through its three-pronged approach - the development of people, info-structure and applications - provided a comprehensive framework for nurturing, promoting and fostering, as well as harnessing the development of information and knowledge activities in an efficient and effective way. NITA has been poised to play a key role in creating a 'values-based' knowledge society in Malaysia.

Key initiatives meant to facilitate Malaysia's leapfrogging to an Information Society included: the Multimedia Super Corridor (MSC), a test-bed providing an excellent infrastructure to produce state-of-art ICT and knowledge products and services; the SJ2005 programme, focusing on building a smart, knowledge-based society in a highly urbanized Subang Jaya municipality; defining the K-economy as the main strategic thrust of Malaysia's third long-term plan (the Third Outline

Perspective Plan, OPP3 2001-2010); the Mobile Internet Unit (MIU), a smart bus equipped with Internet driven PCs, initiated to provide elementary IT and computer literacy to marginalized student communities; the establishment of the Multimedia University (MMU) in the MSC area to undertake teaching and research functions exclusively on information age developments. All these have been important milestones in transforming Malaysia into a Information Society.[79]

The government of Malaysia also enacted a number of laws and regulations to facilitate the development of the digital economy. These cyber laws address issues such as the growing borderless communication; the changing organizational structures and modus operandi in businesses; the authentication and copyright affecting content development, and; safety and network security.[80]

PHILIPPINES

Emmanuel C. Lallana, Ph.D.*

Networks: The number of mainlines in the Philippines grew from 1.4 million in 1995 to 3.3 million in 2003, registering an average annual growth rate of 10.8%. By comparison, mobile phone subscriptions increased from 494,000 to 21.9 million during the same period, at a growth rate of 47.4%. Waiting lists increased from 900,000 in 1995 to 1.3 million in 1999, to decrease rapidly afterwards to 529,000 in 2003. It can be argued that had the government allowed market forces to dictate the roll-out of telephone services, the waiting lists would have been reduced much faster.

The Service Area Scheme (SAS) that was introduced by the telecoms regulator in 1994 to ensure equitable distribution of telephone services has helped the Philippines to increase the total number of telephone lines. However, by insisting that lines be rolled out in rural as well as urban areas, the country faced a situation where there was a mismatch between supply and demand. In fact, of the 10 available lines for every 100 Filipinos, only three are subscribed to. Some contend that because they were given geographically segregated areas, SAS prevented the new players from realizing economies of scale and scope, as well as from enjoying positive network externalities.

PLDT, the monopoly that was operating nationally, did not participate in the SAS. While it was given a quota of 300,000 lines to roll out, it was not given roll-out targets in rural areas. However, under its Zero Backlog program, launched in 1994, PLDT installed 1.3 million new lines within 5 years – more than double the number of lines it had rolled out as a monopoly.

The government did not regulate the deployment of cellular services. Nevertheless, the spectacular growth of mobile phones cannot be explained simply by the pent-up demand for service. Mobile service is wildly popular in the Philippines because of SMS - a method of sending text messages that are 160 characters in length or shorter over a mobile phone that was part of the original specifications for the GSM digital mobile standard. Mobile phone service was introduced in the

[79] *In addition, the Demonstrator Application Grant Scheme (DAGS) and MSC Development Grant Scheme (MGS) were established to enhance R&D in the applications of multimedia and ICT.*

[80] *Specific cyber laws are: the Digital Signature Act (1997), which facilitates e-commerce and secure on-line transactions through the use of digital signatures; the Computer Crimes Act (1997), which provides for offences relating to the misuse of computers, and defines clearly activities such as cyber fraud, unauthorized access, interception and illegal use of computers; the Communications and Multimedia Act (1980), which provides a framework for the convergence of the telecommunications, broadcasting and computing industries; the Telemedicine Act (1997), which provides a framework for licensed medical practitioners to provide tele-medicine services, and; the Data Protection Act (2002), which aims to address matters pertaining to privacy, authentication and protection of personal and company information used in formal business and social transactions.*

* *Ms. Toni Torres provided research assistance.*

Philippines in 1991 using analog (1G) technology. It was not until 1994 when a mobile phone operator shifted to GSM technology that SMS became available to Filipinos as a free service. The period from 1995 to 1999 (when mobile growth was comparable to that of fixed lines) was also the period of transition from analog cellular service to digital cellular service (1G to 2G). By 2000, all major mobile service providers had not only shifted to GSM but also started charging for SMS service. Yet, the growth of mobile phones and the number of messages sent via SMS only continued to rise. SMS's popularity is evident in its contribution to revenues of mobile providers. In 2003, the non-voice revenues of the Philippines' two leading mobile providers were between 35%-40% of their total revenues. On the other hand, the Japanese mobile providers were drawing between 20%-25% of revenues from data services, while Europe's mobile players using GSM technology derived only 15%-20% from data services.

The network growth in the Philippines occurred due to the liberalization and deregulation of the telecommunications industry. Beginning in 1993, the government initiated a number of moves to end the monopoly in telecom services and opened the sector to competition. In 1993, then-President Ramos signed an Executive Order on the "Policy to Improve the Provision of Local Exchange Carrier Service", whose primary objective was to improve the situation in "unserved" and "underserved" areas. In 1995, a new law, the Telecommunications Act of the Philippines was promulgated and came into effect. This law institutionalized the earlier efforts of the government's executive branch to open up the telecommunications sector. It also emphasized the role of private enterprises in the provision of telecommunication services and provided for the privatization of all existing government communications facilities.

In the Philippines, rather than opting for a 'big bang' open competition the government opted for 'managed' competition. It allowed a number of entrants who got assigned to specific areas in the country and were given roll-out targets. However, the new entrants were not allowed to compete with the monopoly operator nationwide. Furthermore, the SAS scheme inadvertently helped ensure the incumbent's dominance. It divided the country into 11 service areas to be served by new international gateway and cellular telephone operators. New entrants were allocated a profitable and an unprofitable service area each, to ensure both operational viability and the provision of rural telephony. However, of the 11 telecommunications companies that existed when the SAS was designed, only eight were assigned the original service areas. At the end of its program life, only four of these eight telcos were able to accomplish their SAS-required fixed line roll-outs.

Skills: The country's high level of skills is a result of the high importance given by the government and the citizenry to education. This social value is reflected in state policy. The Philippine Constitution mandates that education should have the biggest share of the national budget. By legislation, basic education is compulsory and free. Furthermore, out of the 1,600 institutions of higher education in the country, over 174 are state-funded colleges and universities.

The importance of education has historical roots; the Philippines' fight for independence was led by those who were bitter because of the lack of education opportunities under the Spanish colonial master. The American colonizer – which replaced Spain – was wise enough to recognize this and gave education priority during its rule. Under the Americans, a country-wide public education system was created, laying the foundation for the country's high literacy rates.

In the recent past, a number of issues have taken center stage in the debate on education in the Philippines such as the decline in the quality of basic education, as evidenced in the results of

standard tests; the disparity in educational achievements across social groups; the low budget allocations to education compared to other ASEAN countries; and the "mismatch" between training and actual jobs resulting in large groups of educated unemployed or under-employed population.

The affordability concern is seen in the skills indicators for primary, secondary and tertiary enrolment. While primary enrolment registered a marginal increase over the 1995-2003 period, it actually declined since 1998. Secondary enrolment growth was negative from 1995 to 1999, and tertiary enrolment has also experienced declines. Poverty seems to be the primary cause for school dropouts. While basic education is free, young Filipinos stop schooling because their parents cannot afford the extra costs related to education and/or they need to work to augment the family income.

An important policy change in the period under study is the creation of three agencies to oversee education in the country. In 1994, the Philippine legislature passed an Act that created the Commission on Higher Education (CHED) and another that created the Technical Education and Skills Development Authority (TESDA). As a result of these laws, the Department of Education's mandate is now limited to basic education which covers elementary, secondary and non-formal education, including culture and sports. CHED is responsible for higher education, while TESDA administers the post-secondary, vocational and technical skills training and development.

In 2001, the Governance of Basic Education Act was passed. This provides the overall framework for (i) school head empowerment by strengthening their leadership roles and (ii) school-based management within the context of transparency and local accountability. The law specified that the goal of basic education was *"to provide the school age population and young adults with skills, knowledge, and values to become caring, self-reliant, productive and patriotic citizens"*. These laws were enacted in the hope of continuing to improve the quality of education in the country.

Info-use: The 1980s and the early '90s were the dark years for telecommunications services in the Philippines. A 1990 government study documented the undeveloped state of telecommunications services: only 20% of the country's municipalities had access to some form of phone service, and in areas where telephone services were available, 30% of the demand was not met. Furthermore, the telecom services that were available did not usually meet reasonable quality standards. Given the high demand for telephone services, the rapid uptake of residential mainlines after the introduction of competition was rather expected. Residential mainlines jumped from 902,000 in 1995 to 2.3 million in 2003, registering an average annual growth rate of 18%. However, the incidence of the 1997 financial crisis took a heavy toll on the uptake of residential mainlines - the annual growth rate after 1997 was much lower than in previous years. The slowdown is attributed to the cheaper alternative – mobile phones.

Most Filipinos use PCs and access the Internet either through their work environment or through Internet cafés. PC purchases are primarily business-driven. Of the total number of PCs sold in the country, about 50% are bought by large corporations, 30% by SMEs (including small internet cafés), and 20% for personal or home use. The continued decrease in the cost of PCs (particularly, the so-called clones) provides a low-entry cost to computing for SMEs and households. Another driver for increased PC penetration is the recent effort to provide PCs and Internet connections to public schools in the country. Interestingly, this is not solely a government initiative. The private sector in the country has been spearheading a project called "PCs to Public Schools" since 2000. President Gloria Macapagal Arroyo has pledged that at the end of her term in 2010, all public high schools will have a PC laboratory that is connected to the Internet.

While it was the government that first connected the Philippines to the Internet, the growth of the Internet in the country has been largely market-driven. The government does not regulate the Internet and does not set the price for Internet service/access. It does not even regulate nor license ISPs. They are considered value-added service providers and under Philippine laws, they only need to register with the telecoms regulator. An issue that has emerged in the Internet space – one that will affect Internet use – is the conflict between ISPs and telcos. ISPs (and cable companies, who also provide Internet access) are complaining that telcos are driving them out of business by the way they price their DSL service. In fact, in their advertising promotions, telcos trumpet the cost advantage of their DSL bundled with Internet service over the dial-up Internet service provided by ISPs. (By 2003, telcos were giving free computers to SMEs subscribing to DSL service).

ISPs (including telcos) also use pre-paid services to increase Internet use in the country. The number of shops and stores selling Internet pre-paid cards has increased over the years. Entrepreneurial Filipinos sell Internet (and mobile) pre-paid cards from their homes. Interestingly, pre-paid Internet cards appeal not only to lower income groups; middle class families also use them as a way to regulate the time spent by their children on the Internet. Pre-paid cards are given to children like an allowance – they can only surf or e-mail up to a certain number of hours per month. However, the majority of Filipinos who access the Internet still do so from Internet cafés.

The international outgoing and incoming traffic statistics reveal an interesting facet of how the Filipinos communicate with the rest of the world. Currently, the volume of incoming traffic in the Philippines is far bigger than the outgoing traffic. In 1995, the outgoing traffic stood at 180 million minutes, peaked at nearly 250 million minutes in 1997, but by 2003 it had declined to 179 million minutes. On the other hand, incoming traffic was growing significantly during this period. In particular, it was at 560 million minutes in 1995, approached 3 billion minutes in 2000, and subsequently reached just shy of 3 billion minutes by 2003. This can be explained by the nature of the Filipino diaspora. Before 1970, many Filipinos left the country in search of better wages and a better life. By the 1980s, most Filipinos abroad were contract workers subject to a fixed period; only very few were able to stay permanently abroad. Better wages motivated even many school teachers to take up job as domestics help in Hong Kong. Since Filipinos living abroad were earning higher wages than their family members at home, the customary practice evolved over the years was that those better off pay for the communications services and that explains the higher incoming traffic compared to the outgoing traffic. Recognizing the market pattern and potential by the year 2004, many Philippine mobile service providers offer special rate cards through partnering with mobile service providers in other countries where Filipinos are living in big numbers. The special rate card provides lower per minute voice calls or text messages to subscribers of the Philippine mobile provider. One country that has adopted such a lucrative business practice is Singapore, where a large number of Filipinos are employed as maids.

SOUTH KOREA

Jong-Sung Hwang

Networks: The growth of mainlines in South Korea registered a significant growth, from just under 12 million in 1995 to almost 26 million by 2003. During the same period, mobile phone subscriptions grew from 1.6 million in 1995 to 33.6 million in 2003, recording an annual growth rate of 76% - the highest among the selected countries. A closer examination of the data showed that in 1999 cellular phone subscribers outnumbered the 20.5 million fixed lines for the first time.

The rapid growth of cellular phones in South Korea is attributed directly to a key 1991 government policy to use CDMA as the standard. Subsequently, in 1996, South Korea became the first country to introduce commercial CDMA service. The local development of this technology resulted in lower prices for services and devices, contributing to high demand. Prior to this, the TDX policy which started in the late 1970s provided a breeding ground for the mobile industry. The TDX program was developed to solve a telephone line shortage problem, which was then considered a serious concern, socially and economically, for the country's industrialization efforts. The program's goal was to develop domestic digital exchange technology and industry capacity instead of importing foreign technology. The domestic effort was targeted towards supplying cost-effective telephone lines. However, the key goal of TDX was to lay the groundwork for a domestic IT industry, a risky strategy considering South Korea's weak technical and industrial capability at the time. The success of the TDX digital exchange in 1987 ensured cheap and stable telephone line supply and strengthened the competitiveness of the country's IT industry. Moreover, the TDX program contributed substantially to the development of semiconductor industries, CDMA, the deployment of broadband and elsewhere.

The early launch of new services was another success factor of the South Korean mobile industry. The government moved very fast to enable the introduction of new services. For example, it permitted licenses for PCS in 1997 and for IMT-2000 in 2000. As a result, CDMA 2000 service started for the first time in the world. The continuous introduction of new services enabled the cellular phone market to keep creating new demand.

Skills: Skills, as measured by literacy and enrolment indicators, are very high in South Korea. The high literacy rates are due to the high value placed in education and the government's strong commitment to transform the country to a knowledge-driven society. The budget provided for the Ministry of Education (19.5% of the total) is the larger than any other government ministries (MOEK 2004). Much of the funding in education is used to upgrade the infrastructure and the quality of the educational programs.

The entrance into elementary and middle schools is high, close to 99%. The proportion of students that go on to high school is also high – close to 99.5% of middle school students pursue high school education. One of the reasons for these high student enrolments at the elementary level is that education is compulsory and free. Middle schools are free and compulsory since 1985 for agriculture and fishing communities, a practice that is slowly being extended to other communities as well.

The government considers that the competitiveness of the university education system in the country sets the tone for the competitiveness of the nation (MOEK 2004). To achieve this objective, the annual budget for tertiary education has been continuously increased throughout the study period. Increased spending was meant to continuously improve the university teaching and research infrastructure, teaching and research personnel, as well as management systems.

A significant proportion of the education budget was also allocated for connecting the schools and universities in the country to the global information network. A systematic strategic plan was introduced in 2002 called the 'Comprehensive Plan for the Information Age in Education'. The primary objective of this plan was to build the infrastructure for the education sector in the information age. About 2.7 trillion Won was invested to achieve this objective (MOEK 2004). In summary, two key factors that have contributed to the high level of skills in South Korea are the high value placed on education by

the Korean society and the strong commitment by the government in transforming the country into an information and knowledge-driven society.

Info-use: The penetration of TVs, the most popular information device, reached a saturation point around the mid-1990s in South Korea. However, the official statistics do not reflect this, perhaps because they fail to capture new types of devices such as mobile TV and DMB.

PC uptake began to rise sharply since the mid 1990s, from nearly 5 million in 1995 to almost 27 million in 2003, registering an annual growth of 50%.[81] The steady increase in PC usage among Korean households was driven by an increase in Internet subscriptions. In addition to the government's proactive approach in transforming Korea into an information-driven society, several key initiatives have led to these developments, including funding for the development of ICT infrastructure, innovation and ICT literacy. Among the specific initiatives, the following are included:

- The development of low-priced PCs suitable for basic Internet usage, is particularly targeting PC ownership among poor families.
- ICT Literacy Program for *10M People* in the late 1990s. This program was aimed at providing IT education opportunities to the disadvantaged communities identified as housewife, soldier, the old and prisoner, and;
- The promotion of information services development programs that promoted info-use via online services such as e-government, e-commerce, e-learning, etc. Apparently, the info-use initiative acts as a strong catalyst for pulling more people into Internet cyberspace activities.

Besides government initiatives, the high internet penetration rate is also driven by the private sector. There were around 16,000 commercially run "PC-bangs" (Internet cafés) in 2000. These PC-bangs are open 24 hours and offer DSL-level connectivity. The cost of Internet services at these "PC-bangs" is around US$1-2 per hour (Whinston and Choi 2002).

SRI LANKA

Nalaka Gunawardene*

Generally, Infostate levels increased in the period between 1995 and 2003, because of overall advancements in socio-economic conditions, including income levels. The population growth was 10% over this period. However, the number of households increased by 35%, indicative of rapidly changing societal structures. Sri Lanka gradually moves from the traditional extended family arrangements, where a large number of individuals stayed in the same house, to more nuclear families. This is happening in both rural and urban areas. Urbanization is taking place at a rapid rate, and income levels are increasing. Per capita GDP increased from US$755 in 1995 to over US$1,000 in 2003, at an annual rate of about 5%.[82] As a result, more and more people/ households are able to afford ICT facilities, which were once seen as luxuries.

[81] *However, a sudden surge in the number of PCs from 11.5 million in 1999 to 18.6 million in 2000 (more than 50%), was due to statistical adjustments. The figures prior to the year 2000 referred to official data from PC manufacturing companies, which discounted PCs assembled privately. The currently reported PC statistics are more reliable estimates based on a national survey.*

* *Support and advice provided by Mr. Chanuka Wattegama is gratefully acknowledged.*

[82] *This was in spite of the protracted civil war, which immersed the country in political instability during much of this period. This growth is a result of economic liberalisation policies initiated in 1977, which have been continued by successive governments.*

Networks: There has been an extensive demand for phone lines in Sri Lanka for a long time, mainly for voice. This is captured by the long waiting list maintained by Sri Lanka Telecom, the dominant fixed phone provider and former state-owned monopoly. (Other telecom service providers do not maintain such lists.) Data show that the number of potential subscribers in the waiting list was 227,000 in 1995 and peaked at 284,000 in 1997, to subside recently. However, the waiting list does not reflect unsatisfied demand accurately, as many prospective subscribers do not sign up. Moreover, the fixed phone networks cover only a portion of the country, and prospective subscribers in areas currently not covered are all included in the waiting list - where the wait can be several years.

Despite network bottlenecks, the number of mainlines increased from 206,000 in 1995 to 939,000 in 2003, at an average annual growth rate of 19%. But growth rates have been continually declining since 1998, when mobile phones begun to gain a firm footage in the country. Following the telecom reforms carried out in the 1990s, mobile networks have expanded at a much higher rate than fixed line networks. Growth in mobile phones averaged 41.3% annually over the 1995-2003 period, when subscriptions increased from 51,000 in 1995 to 1.4 million by 2003. In Sri Lanka too, an important threshold was crossed in 2002, when the number of mobile phones exceeded the number of fixed lines. In 2003, the ratio of mobile-to-fixed was about 1.5.

Mobile phones have cut across social and economic strata in Sri Lanka. Their usage ranges from basic communication between people to being a key tool for commerce and trade. Mobile phones are used everywhere, from agriculture, to retail, transportation and among SMEs who rely on mobile phones to access current and new customers or markets. The popularity of mobile phones in Sri Lanka is attributed to the following factors:

- The relative ease of obtaining a connection: Fixed phone lines are readily available only in some areas. In rural areas, prospective subscribers have to wait for as long as six months to one year. On the other hand, a mobile connection can be obtained within 24 hours.

- Lower initial cost of connection: This involves only the cost of the mobile phone and a nominal registration fee. The total comes to around US$120 at entry level. The installation cost of a fixed phone is in the range of US$200.

- Lower usage cost: Even though the fixed phone call charges remain lower than mobile call charges, mobile networks offer a variety of packages. By carefully choosing the right package and using the phone in moderation, it is possible to keep costs low - especially if usage is mostly for incoming calls.

- Lower or no monthly rentals: No monthly rentals are required in pre-paid mobiles. Even where a rental is involved for monthly billing, the rental is lower for mobile phones than for fixed ones.

Mobile network expansion in Sri Lanka would have been much higher if attempts to introduce “calling party pays” (CPP) had succeeded. At present, the mobile operators have to pay interconnection charges for call termination, which means mobile phone users have to pay for both incoming and outgoing calls. This tariff structure would have been corrected with CPP, but it has not yet happened due to pressures and protests from fixed line providers and telecom trade unions. Successive governments have backed out of CPP.

The extraordinary expansion of telecommunication networks in Sri Lanka was a direct result of the telecom reforms that started in the late 1980s but intensified around the mid-1990s for fixed lines and late 1990s for mobile phones. Specifically, the first step was taken by separating postal from telecom services in the Department of Posts and Telecommunication that had been the sole provider of telecom facilities in Sri Lanka. Simultaneously, the first two private sector competitors were introduced, but both these new players concentrated on the high bandwidth requirements of corporate clients (mainly banks and freight forwarding companies) instead of providing voice or narrowband data lines.[83] The second important institutional milestone was the Telecommunication Act of 1991, which converted the Telecommunication Department into Sri Lanka Telecom (SLT), a government-owned autonomous corporation.[84] The regulatory functions of the department were vested in a newly created office of the Director General of Telecommunications, which later became the Telecommunications Regulatory Commission of Sri Lanka. This enabled the entry of private sector players, resulting in a drastic increase in the number of telecom lines and services available. Added value or secondary service providers such as cellular, paging, trunk, data communication and leased line providers immediately entered the market, addressing the gap created by the inadequacy of basic service providers. These providers all had to invest heavily on building their own telecom infrastructure and long distance communication facilities. The initial investment by the private players exceeded US$100 million in the first round (Wijeyesooriya 1998).

Overall, telecom expansion in Sri Lanka between 1995 and 2003 did not reach the initial expectations of investors. The main reason is that socio-economic and political conditions from 1996 to 2001 were not conducive. The civil war that continued until the ceasefire in early 2002 inflicted heavy damage on the economy. The year 2001 was particularly bad: that year, Sri Lanka's foreign exchange earnings suffered due to the terrorist attacks in the U.S. on September 11, and the Tamil Tiger militants' attack on the country's only international airport in July. This led to negative GDP growth in 2001 - the first time since independence in 1948. As a result, investments dropped and hampered the growth of telecom infrastructure.

Skills: Sri Lanka has always nurtured learning and search for knowledge, recognizing the importance of developing human capital. The country has a high literacy rate (91.6% of the population), with 94% of men and 89% of women being literate. The overall school enrolment ratio, at around 90%, is also high. Both of these factors bring Sri Lanka on par with some developed countries.

In 1996-97, 20.7% of the population had had some sort of tertiary education while about 35% has completed secondary schooling and another 35% primary schooling. The percentage of the population that has never had any formal education was only 8.6% - a sharp decrease from 41.8% in 1953 (Central Bank of Sri Lanka 2002).

These achievements are a result of 'Free Education' policies adopted by all governments since independence. This gives every young person the opportunity to study at primary and secondary levels completely free of charge at government schools - a total of 13 years. Although this poses large financial burdens on the state, it has sustained high enrolments at both primary and secondary levels.

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[83] *The two private players offering terrestrial lines based on wireless local loop (WLL) technology, Suntel and Lanka Bell, hold a duopoly in providing lines based on WLL. They have contributed significantly to the growth in terrestrial lines, but this has been far less than initially expected.*

[84] *Nippon Telegraph and Telephone Company (NTT) of Japan bought 35% of the SLT shares for US$225 million in August 1997. This injection of funds and the restructuring that followed enabled SLT to make sizable investments in infrastructure. It also resulted in SLT moving from being a basic services provider to offering advanced services such as ISDN and ADSL.*

Info-use: Since it was introduced in 1979, television has been a highly popular medium for voice and picture-based entertainment and information among Sri Lankans both in urban and rural areas. Its penetration increased from 3.8% in early 1980s to 73.4% in the 2003/2004 period. Radio is much cheaper than a television set and is still the dominant household item for voice-based entertainment and information. The Consumer Finances and Socio-Economic Surveys revealed that 7.3% of the expenditure of a typical Sri Lankan family is for recreation and cultural activities. It can be safely assumed that the bulk of these expenditures are for television viewing. The survey also provides information on household ownership of selected items over time (Table 5.5). Clearly, household items such as sewing machines, refrigerators and telephones have a much smaller penetration compared to radio and TVs.

Table 5.5 **Household penetration of selected items, Sri Lanka**

	1981/82	1986/87	1996/97	2003/04
Radio	60.7	67.1	73.6	79.9
Sewing Machine	30.7	37.2	41.5	45.8
Refrigerator	2.9	8.1	16.8	31.4
Telephone / Cell phone	0.9	1.4	4.5	25.5
Bicycle	31.5	34.0	40.5	43.1
Motor Cycle & Scooter	2.4	5.3	12.0	16.1
Motorcar / Van	2.3	3.0	3.4	6.2
Television	3.8	19.2	50.6	73.4
Washing Machine	n.a.	0.8	2.9	8.0
Air conditioner	n.a.	n.a.	0.3	0.9
Personal Computer	n.a.	n.a.	0.4	4.4

Source: *Central Bank of Sri Lanka, Consumer Finances and Socio Economic Surveys*

The popularity and high penetration of TVs is due to several factors: it is the cheapest means of entertainment (compared to many other sources such as cinema and drama) and caters for everyone in the household; high literacy rates, in both urban and rural communities, enable greater appreciation of television content; the availability of local language content and locally relevant content provided by television channels, which contrasts sharply with the absence of such content online, and; the availability of electricity in 75% of the households.

In mid-2005, Sri Lanka has 11 terrestrial television channels, some of them broadcasting 24 hours a day. While a few are accessible only in the Greater Colombo area, the rest have achieved countrywide signal coverage and cater to a diverse national audience. Additionally, some cable and direct-to-home channels are available to higher income households.

Compared to television, PCs are not yet a common household item even among higher income groups. Only 4.4% households currently own a PC. This is due to a combination of affordability, cultural and lifestyle reasons. A branded, entry-level IBM compatible desktop PC (IBM, Dell, HP, Compaq and Acer are popular brands) can be purchased for between US$900-1,000. A laptop costs 1.5 to 2 times as much. The more popular, locally assembled PCs can be purchased for between US$500-750. The price difference is mainly due to the cost of licensed operating systems. In an environment where anti-piracy laws are not well enforced, the locally assembled machines are sold equipped with pirated copies of operating systems. Moreover, there is also a large second-hand PC market emerging. A used PC can be bought for as low as US$100-150, and a used laptop with a modem for US$250-400. However, not many individuals opt not to purchase second-hand machines due to maintenance concerns. Given the short lifetime of a PC (3 - 5 years, or even less in the case of second-hand PCs) their prices are still considered high for many households. By comparison, a television receiver costs less than US$200 and can be used for a much longer

period. There are also easy payment schemes for TVs, but not for PCs (brand new and second hand). Affordability and lack of easy payment schemes are key factors that hinder PC ownership in the country.

As well there are several reasons why the rate of expansion of Internet users has been below expectations. Access charges now stand at about US$1.20 per hour (higher in rural areas where users have to pay national telecommunication call charges for dial up). This means a user who averages one hour per day has to incur a cost of US$36 per month - a sizable amount for many households in Sri Lanka, with a monthly average household income of around US$170. In addition to the financial reasons, the following have been identified as the main bottlenecks preventing Internet penetration:

Lack of computer literacy: Though PCs have been extensively used in Sri Lanka for more than a decade, many still lack basic skills to perform a simple task like surfing. This has improved in recent years, but only the younger members of the population show satisfactory computer skills.

Reluctance to acquire new skills: There are many who believe that Internet is not for them, assuming it requires high intelligence and precision skills. A survey (Shrestha and Amarasinghe, 2001) showed that only 5% of the Internet users were above 55, while most belonged to the 26-35 age range (23%) followed by the 36-45 range (21%). This prevents older people from using Internet, although they know how useful it can be.

English proficiency limitations: Only about 2% of Sri Lankans have functional literacy in English. Even if Internet access is made free of cost, the remaining 98% will not be in a position to derive many benefits from access. A long-term solution would be to increase local language content, but isolated attempts by various groups and organisations have produced scattered results. Even most governmental websites are largely or entirely in English.

Technical bottlenecks: Many areas are not yet served by any of the terrestrial or WLL telecommunication networks. In some areas, though services are available, their quality is inadequate for data transmission. Most computer vendors too have their offices in Greater Colombo, so obtaining technical support in outside areas is extremely difficult. Even provincial libraries are unable to have quality Internet access due to these limitations.

Lack of any need to use Internet: The simple and routine lifestyle of many Sri Lankans does not require regular Internet use. They seem contented with news and information access from newspapers, radio and television, and see little or no reason to expand their information base. But this is changing fast. For instance, even the less educated visit cyber cafés now - not so much to surf the web, but to talk to their relatives employed overseas using Internet telephony which is cheaper.

THAILAND

Dr. Hugh Thaweesak Koanantakool and Kalaya Udomvitid, NECTEC

Networks: In terms of network infrastructure, Thailand passed the infancy stage some time ago and is now at the mid-stage of development with a high growth rate. Technological improvements have also led to an increasing move from analog to digital architecture. Moreover, the growth of international bandwidth has also been impressive. During 1999-2002, most ISPs opted for high

quality fiber links and symmetric satellite services in order to cope with their congestions in the inbound traffic. This resulted in equality between the inbound and outbound capabilities. On the other hand, the capability of the communication lines of the ISPs has been boosted up to 1,438 Mbps or more than ten times compared to the 1999 level. In addition to the ramp up of network capability by the ISPs, research and education networks, such as TEIN and ThaiREN, have been also supported by the government in order to promote a knowledge and learning society.

There were approximately 7 million fixed phone lines in 2003 but, as in other economies in the region, in the 1990s mainline penetration experienced a slower growth and was outpaced by mobile phone growth. The mobile phone market grew significantly, particularly during 2002-2003. With approximately 22 million subscribers, the penetration rate now stands at over 40 subscribers per 100 inhabitants. This phenomenon came from rising demand and new investors entering the mobile phone sector.

In the 1990s, Thailand's telecommunication sector was managed by state-owned enterprises. The private sector has taken part in providing telecom services by being granted BTO (Build-Transfer-Operate) concession contracts from the Telephone Organization of Thailand (TOT) and the Communications Authority of Thailand (CAT), which were the two main state-owned enterprises responsible for providing telecom services in the past. The entry of private companies brought some competitive elements which resulted in increased main line penetration, lower prices and a wider choice of services. The total market for mobile phones was shared by three main operators; Advance Info Service (AIS), Data Total Access Communication (TAC) and TA Orange (or True as its current name).[85] The competition among the mobile phone operators intensified in pre-paid services. Data and non-voice services are other areas where most operators saw the opportunity to generate further income in the near future.

Hutch is another newcomer in the mobile phone sector. It is a joint venture between Hutchinson Wireless Multimedia Holding Limited and CAT Telecom Public Co. Its mobile phone service is operated on CDMA 1X technology, which has high capacities to serve multimedia and entertainment functions. However, the service of Hutch now only covers the central region of Thailand, as CAT has still preserved the right to provide mobile phone service through CDMA 1X technology in other parts of Thailand.

In summary, one of the key drivers for the increased demand in telephony, especially mobile phones, is the opening of this sector to greater competition. In more recent years, the competition for pre-paid services outpaced post-paid services. The growth rate of data and non-voice service is also exceptionally high. The diversity of customer demands in Thailand have also lead to the mobile phone operators customizing their service packages to match the requirements of each target group in the country.

The current government is placing great emphasis on IT development. Therefore, many ICT related projects were initiated for small and medium enterprises in order to promote business capability. *Tambon.net*. for example, had been initiated in 2001. Initially, the project was intended to connect *tambon* (Thaiward for "sub-district") offices to the Internet so that staff can communicate speedily with the ministry. The government has since encouraged all *tambon* offices to make the service available to members of the community as well. The *tambon* network complements the "One Tambon, One Product" (OTOP) Project. In addition, the Ninth National Economic and Social

[85] *Though Orange had to compete with the other two already well-established companies, it managed to capture 8.2% of the market share within two years after the launch of its services.*

Development Plan (2002-2006) has placed high priority on the use of information technology. Some specific areas that were addressed in the Plan were IT and telecommunication infrastructure, laws and regulations, especially those that are related to Business-to-Business (B2B) and Business-to-Consumer (B2C) transactions.

To facilitate the change in a big picture, the National Information Technology Committee (NITC) and major stakeholders in the ICT sector in Thailand have collectively developed the National IT 2010 policy. Approved by the Cabinet in March 2002, IT 2010 lays down a clear strategy to build up ICT infrastructure in Thailand. The policy recommends five strategic IT flagships consisting of: e-Commerce, e-Industry, e-Government, e-Society, and e-Education.

IT 2010 policy also recognizes the need for better infrastructure. For instance, the need to provide more secure and faster Internet services to accommodate e-Commerce and e-Government transactions, the need to develop standards, guiding principles, and a framework to facilitate the interoperability of IT systems across various government agencies in order to allow one-stop e-Government services. High quality educational content also needs to be developed.

Besides the National IT 2010 Policy, necessary ICT laws have been initiated aiming to enhance the confidence in ICT society. Currently, the Electronic Transactions Act 2002 has been enacted. It covers the two primary issues: use of electronic messages in place of paper documents and validation of electronic signatures as an alternative to hand signatures under the Civil and Commercial Code.

Moreover, the Computer Crime Bill was already approved by the Cabinet and is being considered by the Council of State before re-submitting to the Cabinet by the ICT Ministry and subsequently to the parliament. The personal data protection law was drafted and is awaiting to be submitted to the Cabinet for approval. The National Information Infrastructure Bill has been approved by the Council of State and is awaiting to be re-submitted to the Cabinet by the MICT. Finally, the Electronic Funds Transfers is currently being drafted by NECTEC and the Bank of Thailand.

Skills: Thailand has had considerable success in terms of literacy. In 2003, the literacy rate was over 96% and was expected to increase to 100% by 2005. The promotion of literacy has been given high priority as part of basic education. The Thai government has set up a policy for an extensive coverage of basic education in diverse forms and methodologies to meet the demands of specific target groups in order to promote and maintain the high literacy rate.

The Satellite Distance Education Project is one of the key projects that have contributed to the high literacy rate in Thailand during the late 1990s. The project was initiated by the Ministry of Education and incorporated by the Thaicom Foundation after the launch of the first national communication satellite in 1993. The Foundation donated one satellite channel for distance education programs to the Satellite Distance Education Project. The distance education broadcasts target those who live in remote/rural places and those who work during the day. The findings show that it is has had a positive impact on non-formal education target groups, especially rural and disadvantaged school children.

Furthermore, the number of people participating in formal education has been on an upward trend over the 1995-2003 period. The highest enrolment ratio was at the primary education level, followed by the secondary and tertiary levels. The important change in enrolment, though, occurred at the secondary level; in 1995 it was less than 50%, below the average enrolment rate of all countries (which was 62%), but by 1999 it had climbed up to the average rate (66%) and then exceeded it. This increase was due to access to free basic education for 12 years, which was ensured under the National Education Act of 1999. The Act also has expanded the focus of learning to include formal, non-formal and informal education. This forms the basis of the "life-long learning" principle, and has become instrumental in building up human capacity for the country.

The National Education Act explicitly addresses the issue of ICT for education within its framework. This covers issues such as infrastructure, the curriculum and software. One of the prominent efforts in this area is the school informatization programme, *SchoolNet,* which was initiated as a pilot project in 1995, and run by the National Electronics and Computer Technology Center (NECTEC) under the Ministry of Science, Technology, and Environment. The primary objective of the *SchoolNet* initiative was to provide Internet access to schools throughout Thailand and, more importantly, provide opportunities for teachers and students to have access to the world's information and knowledge resources. At the end of the 5-year pilot, *SchoolNet* had connected approximately 5,000 schools nationwide, including all secondary schools and almost 10% of primary schools. This initiative is now part of the National Education Network (EdNet), to be managed and operated by the Ministry of Education.

Info-use: Prior to 1999 computer penetration was increasing slowly. However, since 2000, there has been a noticeable expansion in PCs attributed mainly to the general expansion of IT usage in both the private and the public sector that accompanied the country's economic recovery. At that time, many businesses started to use IT more intensively to improve effectiveness and productivity. Furthermore, the government had promoted the use of IT, both in government administration and in the delivery of public services. This, combined with growth in Internet and e-commerce usage and a growing number of home offices and entertainment businesses, led to significantly higher demand for business and home PCs.

By 2003, the computer penetration had surged remarkably and there are approximately 2.8 million PCs. As well, according to a survey of the National Statistical Office, there were approximately 6 million Internet users in Thailand in 2003, which were expected to reach 8.5 million by 2005 due to rapid growth.

The Ministry of Information and Communication Technology (MICT) has played an important role to enhance the usage of computers in Thailand by launching the "Computer ICT Program" in the first quarter of 2003. The project has provided low-cost computers including pre-install Linux and Office package from NECTEC. The computer, including a CRT monitor, was offered for sale widely at US$250. Although the project was seen by some as unfair state intervention in the market, it succeeded in raising public awareness about the benefits of IT. High demand made it possible for PCs to be offered for US$250, and makers of brand-name computers also found that it was in their interests to bring prices down. This was of great benefit to computer buyers. On the software market, the pre-loaded open source software has helped to create a demand for a less-expensive Linux system. Some users decided to switch from higher-cost proprietary software to Linux.

In terms of broadband access, there were around 12,000 users (or approximately 0.2.% of total internet users) in 2003. Over the past several years, the high cost of Internet access, especially broadband, was the biggest stumbling blocks of Thailand's IT competitiveness – and has also deterred foreign investment in the country. However, staring in late 2003 the situation has changed after the ICT Ministry introduced a policy to increase broadband penetration by changing the price structure. Through reduced prices and a flat monthly rate, the aim was to have one million broadband Internet users within a year. Currently (2005), users pay only 600-800 baht or approximately US$15-20 (including value-added tax) for monthly broadband access at 256 Kbps, and pay around US$50 for an ADSL modem. However, some telecom operators promote their services by providing free ADSL modem for their customers. In brief, the government policy and high competition among service providers have significantly enhanced broadband access in Thailand.

In closing, Thailand's Infostate has significantly transformed during 1995-2003, especially in PCs, mobile phones, the Internet, and the broadband sector, which are all moving forward. There have been some key elements to these developments. First is the increase of user demand, for mobile phones, high speed Internet and PCs for both personal and business use. Second is the encouragement of market liberalization which came from government deregulation, mainly in telecom sector. The liberalization created a competitive opportunity and eliminated barriers to entry. Hence, in the past several years, there were many Internet, broadband, and mobile phone operators both foreign and domestic entering into the market. Consequently, this has led to lower prices and higher quality of services. The last is a good facilitating environment such as ICT laws and policies, government incentives and human resources. Higher levels of Infostate imply an increase in welfare of the Thai people by expanding the opportunity to access information and/or knowledge resources nationwide and internationally.

However, along with the visibly growing Infostate, the country still has a problem with the *digital divide*. There is disparity in computer access between rural and urban areas, low-income and high-income families, among people with disabilities etc. To solve this problem, many programs have been initiated, including community Internet access in rural areas (or telecenters), a low-cost PC program and Internet in education. At the same time, websites and content should be developed that are accessible to disabled people.

In the near future, another key factor that might drive the Infostate movement in Thailand, particularly in telecommunication sector, is the WTO agreement. Under a commitment with the WTO, Thailand must open its telecommunications services market by 2006, therefore allowing foreign service operators to enter the market. Besides WTO commitment, the establishment of the National Telecommunication Commission (NTC) was already in place in 2005 and is expected to play a key role in regulating telecom operators in a level playing field. Hence, there is significant movement that might help the further evolution of Thailand's Infostate in the near future.

5.3 Information Societies in Latin America and the Caribbean

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This section analyzes the evolution of Infostates in ten countries in Latin America and the Caribbean. First, it presents an overview of the performance of the ten countries as a group, including highlights of major trends and relevant comparisons to average global movements. This is followed by a comparative analysis of the performance of individual countries, together with a summary of the major underlying reasons that explain their relative evolution. The regional overview is completed by a brief synthesis of the findings, which are derived from the detailed country analyses that follow.

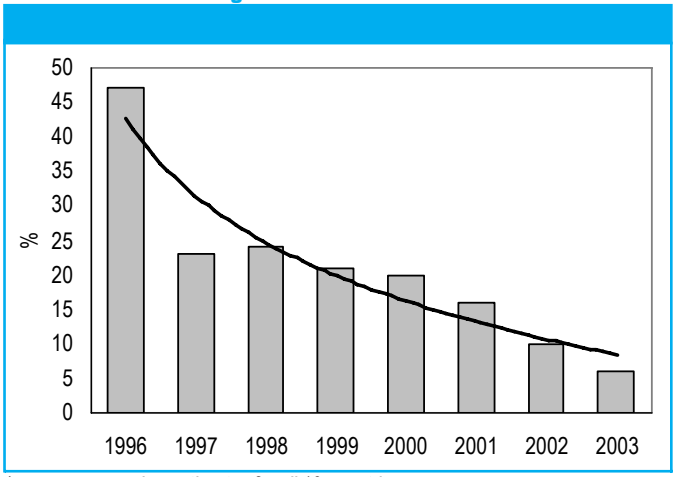
The following ten countries are included: Argentina, Brazil, Chile, Costa Rica, Cuba, Guatemala, Jamaica, Mexico, Uruguay, Venezuela.

5.3.1 Regional Overview

Dramatic changes in access, diffusion and use of ICTs have taken place in the region. In 1995, for the ten countries combined, the average number of Internet users was only 2 per 1,000 inhabitants; in less than a decade, the average increased 70 times to reach 140 per 1,000 inhabitants by 2003,. In three of the countries (Chile, Costa Rica and Jamaica) the number of Internet users was either approaching or had exceeded 25% of the population, considerably higher than the global average – and a far cry from the less than 0.5% in 1995. The expansion of mobile phones has been equally outstanding. From 1995 to 2003, the ten-country average increased from 10 subscriptions per 1,000 inhabitants to 266. In Chile and Jamaica more than half of the population uses mobile phones. As a consequence, the Internet, mobile phones and other ICTs are assuming the critical mass necessary to become integral parts of the set of networks and resources that can be pragmatically used by countries in the region for the conduct of business, the delivery of government services, including education and health, entertainment and many more activities.

There are significant similarities in the trajectories followed by the group of ten countries. Over the 1995-2003 period, all countries more than tripled their *Infostates,* and they had similar progress in *Infodensity* and *Info-use*. In general, the higher growth rates occurred in the beginning of the period (Chart 5.5), consistent with their lower *Infostates* at the time. In fact, in six countries the highest

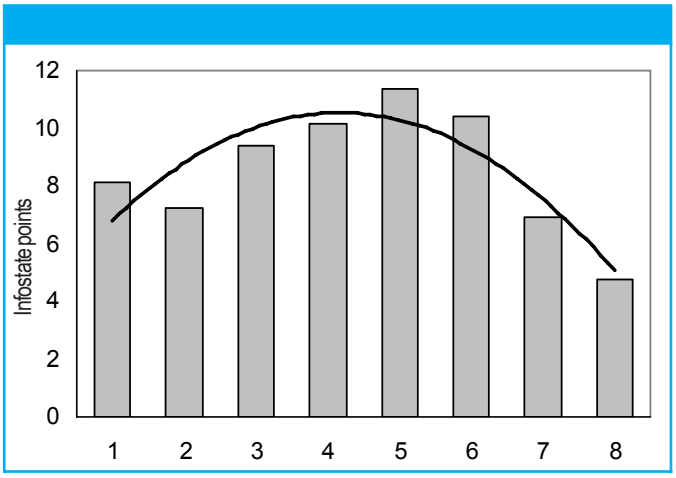
Chart 5.5 **Infostate growth***



** average annual growth rates for all 10 countries as a group*

* *Red de Indicadores de Ciencia y Tecnología Iberoamericana. The authors wish to acknowledge the valuable work of Ruben Ibañez, Felipe Vismara, Diana Suarez and Miguel Giudicatti in the preparation of the country reports.*

Chart 5.6 **Increases in Infostate***

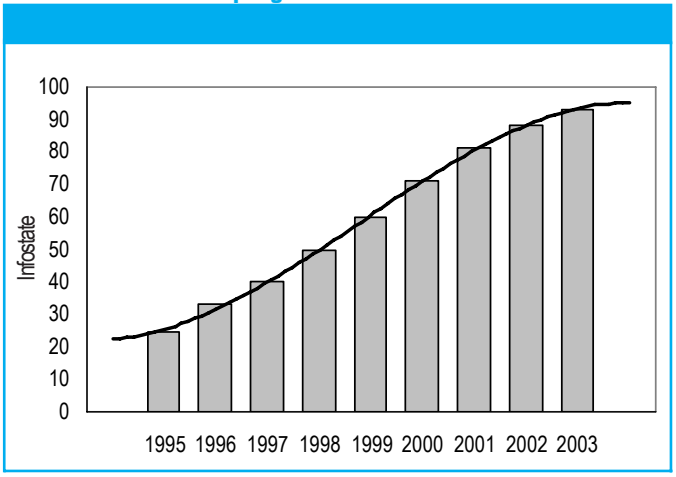


** absolute annual differences for all countries as a group*

growth was recorded in the very first year, while eight countries experienced their lowest growth in the last year of the period examined. Annual changes in absolute *Infostate* values are also revealing since, starting from a very low base, high rates of growth can be caused by very small absolute changes. The average absolute changes for the ten countries show an upward trend in the first half of the period, followed by a downward trend thereafter (Chart 5.6).

The trend revealed by the absolute *Infostate* increases over the 1995-2003 period for the set of ten countries can be stylized as an S-curve (Chart 5.7). This is characteristic of the technology diffusion process, and is even more pronounced in the *Networks* component (not shown). The S-curve shows that after a period of slight growth, a critical mass is achieved, which creates the conditions for a second stage characterized by exponential growth. This second period is relatively short but very pronounced, and it is followed by a last phase where growth is moderated. In many cases, the passage from the first to the second phase is explained by the maturing of investments, the entrance of new actors and the subsequent increase in competition and reduction in prices, commercial innovations that complement the technological innovations, the expansion of applications and services, and changes in regulations.

Chart 5.7 **Infostate progress***

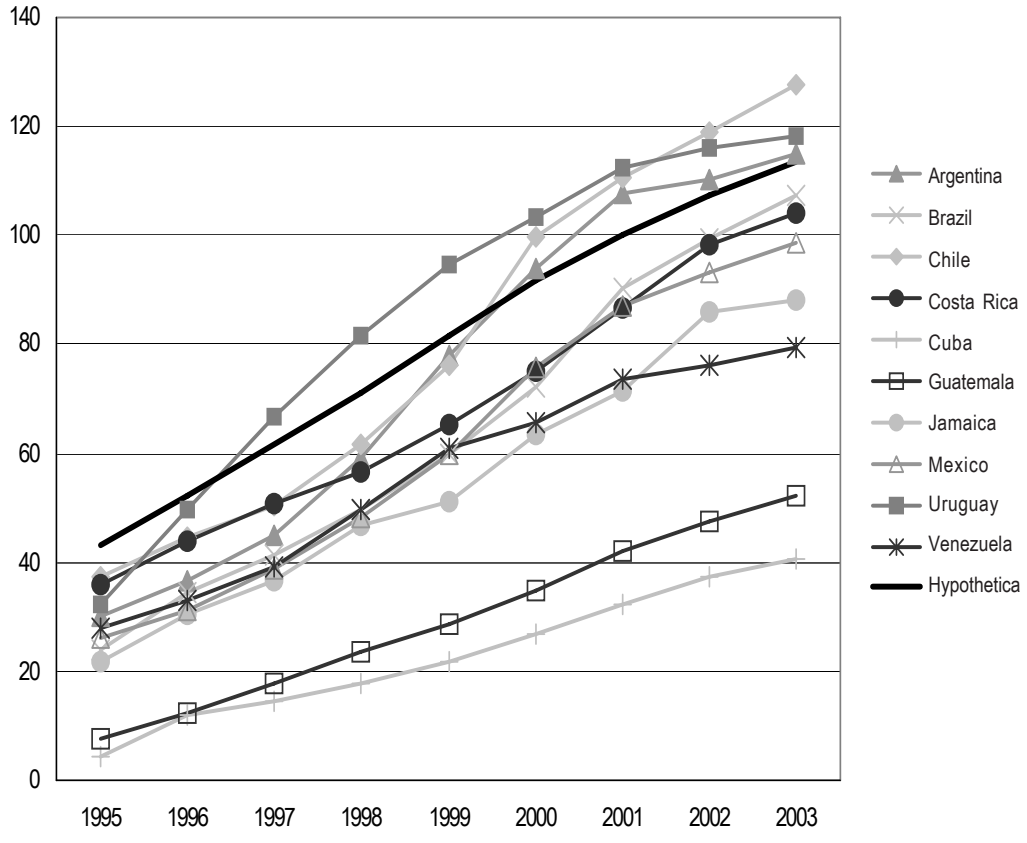


** for all countries as a group*

To the extent that the group of the ten countries examined is representative, the region made significant strides and outperformed the global average over the 1995-2003 period. The average annual *Infostate* rate of growth among the ten countries was 21%, exceeding the 13% for Hypothetica. This is primarily the result of an increase in *Info-use* which, for the ten countries as a group, increased at an annual average rate of 28%, much higher than the 15% for Hypothetica. The increase in the number of Internet users has been the key factor explaining the outstanding growth rates of *Info-use*. Nonetheless, *Infodensity* also experienced a significant and continuous improvement, growing at an annual average of 15% compared to Hypothetica's 11%. It is important to note, however, that the *Skills* component of *Infodensity* tends to grow relatively slowly in all countries, something that restraints the growth rate of *Infodensity.*[86] Consequently, for the ten countries studied, the *Network* indicator grew at a much faster pace - at an annual average rate of 32% compared with 21% for Hypothetica.

Comparative analysis: All ten countries in the region began the period below the global average – they all had a lower *Infostate* that Hypothetica in 1995. However, Chile, Uruguay and Argentina finished above Hypothetica in 2003 (Chart 5.8). All ten countries have significantly increased their *Infostates* over the 1995-2003 period. However, it becomes immediately visible that the paths they followed are subject to significant variations, which merit further investigation.

Chart 5.8 **Evolution of Infostates, selected countries in Latin America and the Caribbean**



[86] *This relates to the measurement of Skills and is explained clearly and extensively in Chapter 3.*

Chile began and ended the period as the country with the highest *Infostate*. During much of intervening period (1996-2001), though, Uruguay was on the lead. The fundamentals for Chile's leadership changed: between 1995 and 2003 it moved up from second to first in *Info-use*, but moved down from first to third in *Infodensity*. Thus, it appears that after having shaped a consistent regulatory framework and a very good infrastructure propelled by private sector initiatives, a new stage has begun in the country, where exploitation and further utilization of the existing infrastructure is the relevant factor. At this point, state programs for the diffusion of ICTs in schools and for public access appear to show good results, and their design and management are largely praised.

Uruguay's evolution is based on the successful restructuring of the state telecommunications firm - some 75% of the homes had a telephone line in 2003, the highest penetration in the region - and by the opening up of the Internet market in 2002 to more private firms as Internet service providers (although the market remains rather concentrated). The economic crisis of the last years of the analyzed period appears to have been the most influential negative factor.

Argentina's *Infostate* moved up significantly during the period, with growth rates higher than other countries in the region until 2001, but moderated between 2001 and 2003. Undoubtedly, the economic crisis, followed by the political and institutional crises that affected the country in 2001, created a climate of uncertainty which affected consumption and investment. In 2002, the devaluation of the currency led to a 300% drop at the exchange rate, which severely affected the cost of imported equipment and services. These conditions slowed the earlier growth of Argentina's *Infostate*, largely because of the impact on the growth of *Info-use* (fourth place in 2003) - since it remained in second place in *Infodensity*. The quality of Argentina's education system, and the high level of investment that followed the privatization of telecommunications in the early nineties, were two factors that mitigated the effects of the economic, political and institutional crises.

Brazil experienced an outstanding evolution over the period, becoming one of the countries with the greatest ICT development in the region. Undoubtedly, the remarkable evolution of its telecommunications infrastructure is one of the main causes of this success. Both in main telephone lines per 100 inhabitants and residential phone lines per 100 households, Brazil passed from eighth to third place among then ten countries in less than a decade. This profound transformation of its infrastructure has now been complemented by dynamic state initiatives to increase the use and reach of ICTs at every level of the society. Brazil and Chile, therefore, appear to be two of the countries where the public policies of governments are dedicated to the development and diffusion of ICTs in society.

Costa Rica shows an interesting trajectory, but in this case it is a relative fall in its *Infostate* position. Among the ten countries, it has lost ground both in *Info-use* (from 1st in 1995 to 2nd in 2003) and *Infodensity* (from 4th to 6th). This happened despite the fact that Costa Rica has the highest penetration rate for residential phones (76.9% of households), the second highest rate for mainlines (24.9 per 100 inhabitants), and the highest penetration rate for PCs which, at 22.2 per 100 inhabitants, is almost double that of the second highest country (Chile, at 13.5). The diffusion of mobile phones and the Internet among the population, however, is remarkably slow. In 2003 there were only 2.6 Internet hosts per 1,000 inhabitants, which is almost ten times smaller than in Uruguay (25.7). Only 13% of the population had a mobile phone by 2003, compared to the region's average of around 26% - and much below the leaders (Chile at 51% and Jamaica at 61%). There is wide consensus that the lack of liberalization of the Internet and the mobile phones markets stands out among the reasons for these low penetration rates in Costa Rica.[87]

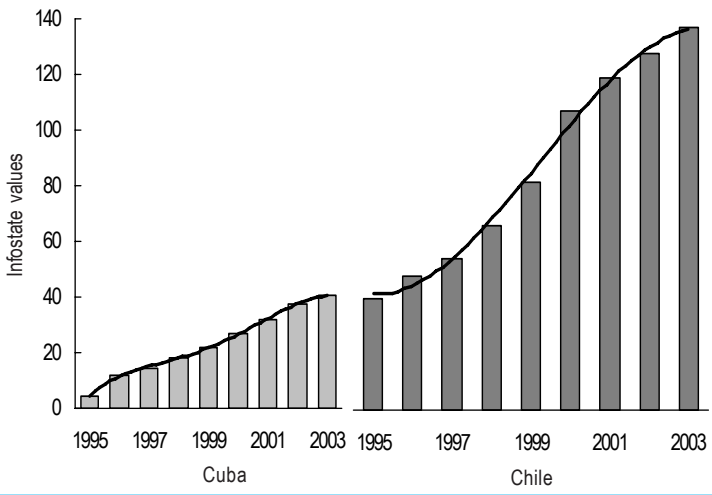
[87] *It would be necessary, however, to delve deeper into Costa Rica's situation in the future, since the small number of Internet hosts is rather contradictory to the evolution showed by the number of Internet users - with levels and rates of growth above the regional average.*

Venezuela also experienced deterioration in its relative *Infostate* by 2003. Although the country experienced growth over the period, it fell short of the regional average. Starting around 1999, in particular, all indicators show a remarkable slow-down in growth compared to the rest of the region. The main reason appears to be the political and institutional instability in the country during the last five years.

Jamaica's situation warrants close attention. Despite the fact that the penetration rates of fixed phones, PCs and Internet hosts are among the lowest in the region, Jamaica has the highest penetration of Internet users (27.9% of inhabitants) and mobile phones (60.8% of inhabitants). The abruptness of change is even more remarkable: between 1999 and 2003 the number of mobile phone users increased by a factor of ten, and almost doubled between 2000 and 2001 alone. The number of Internet users in 2002 was six times the number in 2001, following a new telecommunications law in 2000 which led to an increase in the number of Internet service providers, more competition and reduced prices. Joint actions by public and private actors (computerization and ICT training in schools, growth in ICT investment in post offices, etc.) also appear to have had a remarkable impact. (Unless a statistical mirage is at play, Jamaica could be an exemplary case of a country making the most use out of existing infrastructure).

Guatemala and Cuba maintained their *Infostate* positions at the bottom of the ten countries throughout the 1995-2003 period. Chile's *Infostate*, the region's leader, has continued to be about three times that of Cuba and 2.5 times that of Guatemala. Interestingly, Cuba and Guatemala finished the reference period with *Infostate* values similar to those of Chile at the start of the period. This raises the question of whether Cuba and Guatemala are now poised to enter a period of exponential growth and follow a development path similar to that experienced by Chile over the last ten years (Chart 5.9).

Chart 5.9 **Comparative evolution of Infostates: Cuba and Chile**



But there is also the possibility of a less optimist scenario, in which the slow *Infostate* development in Guatemala and Cuba continues. In this case, even with the lower growth experienced by some advanced countries in the region, the absolute differences between them and Cuba and Guatemala will continue to increase – as will the differences with developed countries outside Latin America. Whether an optimistic or pessimistic scenario will unfold depends largely on whether some of the

structural obstacles (mainly in infrastructure and the conditions that lead to its deployment, as well as human resources) are removed or otherwise overcome.

It is notable that in many of the countries examined in the Latin America and Caribbean region, the development of their *Infostate* potential appears to have been greatly assisted by increased competition, market liberalization following privatization and/or deregulation, and by public policies to actively promote education about, and provide public access to, the Internet. Moreover, it has also been aided by specific business practices, especially the pricing innovations of pre-paid cards and 'caller pays' in mobile phones. On the other hand, obstacles that have affected the degree to which this potential can be reached include high prices (relative to people's incomes) for services and equipment, the high investment costs associated with low population density outside the big cities and, in some cases, periods of overall economic crises and rigidities in government. More detailed findings are contained in the country analyses that follow.

5.3.2 Country Reports for Latin America and the Caribbean

ARGENTINA

Infodensity: An important development in the evolution of the telecommunications sector in Argentina began in 1990, with the privatization of the state run company ENTEL (Empresa Nacional de Telecomunicaciones). The country was divided into two areas and two operators were granted exclusive rights to provide services, one in each area. In return, these companies, which were financed by both domestic and foreign capital, had to meet an investment plan for upgrading infrastructure and improving the quality of the service.

Under private management, there was a reasonably steady growth in fixed lines and total digitization was achieved in 1998. However, the expansion of infrastructure and mainlines met an important obstacle in 1998, with the start of the economic and institutional crises - which deepened in 2001. As a consequence, the upward trend changed dramatically: for example, in 2000 one had to wait three times as long for the installation of a phone line than the previous year.

Mobile phones have experienced a dramatic rise since 1994. The changes in the commercial conditions in 1997, with the adoption of the "caller pays" principle and, later, the generalization of pre-paid cards, contributed significantly to this rapid expansion. Thus, between 1997 and 2000, the amount of mobile lines increased by more than 50% per year. Subsequently, however, the deep economic recession reduced the growth rate to 10% in the years 2001, 2002 and 2003. Currently, the macroeconomic recovery has increased the demand for this service again. Demand is additionally stimulated by the companies' commercial strategy to subsidize equipment costs, more competition among operators, and new services under GSM technologies. The growth in mobile phones was accompanied by new investments, made both by companies operating since the early nineties and by new ones that entered the market in the last few years (NEXTEL, TELMEX).

The growth of Internet hosts was substantial. The most significant increases took place in 1998 and 1999, with a plateau between 2001 and 2002 related to the general fall in economic activity.

With regards to policies and regulations, in 1996 there was a clear differentiation in pricing for Internet access, with lower prices offered.[88] In 1998 a program was launched to promote training

[88] *0610 access, with up to a 50% cutback in the cost of telephone pulses.*

and public access centres (Argentina Internet Todos), as well as a program of soft loans for the acquisition of personal computers. Although the government's initiatives were not well articulated and they have been characterized by a lack of continuity, some analysts estimate that they have had a positive impact in enabling certain household segments to access and become users of these new services.

Argentina has the highest cable TV penetration in the region, including high penetration outside the big cities (45% of the total number of subscribers). Cable penetration increased between 1995 and 1998, and then flattened out. The socioeconomic crisis made many users cancel subscriptions, dropping the service or becoming part of the large number of clandestine connections.

Argentina is characterized by its good level of training and human resources at all levels of formal education. Primary education shows the highest indicators of enrolment and attendance due to its compulsory nature. The enrolment ratio is lower at other levels, not only because they are not compulsory but also because of poverty and social exclusion. Many young people find it economically impossible to access higher levels of education, as they need to look for work and help their families. Nevertheless, the secondary and tertiary indicators show a continued rise in enrolment, even during the period of socioeconomic crisis, although some analysts estimate that there is a distortion in the measurements due to the educational reform which took place in 1998.

For tertiary training, we should highlight the proliferation of specialised training courses which took off in 1998, with a vast offer of public and private technical specialisation courses opening doors to successful jobs. Despite actions taken to spread ICTs within educational environments, however, formal education has kept away from offering training in the use of new technologies. In this sense, its contribution to the spread of the ICTs has been very low.

Info-use: The penetration of residential phone lines shows two distinct phases over the 1995-2003 period: there is progressive growth to a peak in 2000, followed by a steady reduction to 2003. The growth phase is related to the process of privatization and the modernization of the system noted earlier, while the reduction phase is related to the social and economic crises that started in 2001. During the crisis many subscribers could not afford the telephone costs and cut off service, while most of the people who had legal problems with the telephone companies (due to outstanding bills) subsequently switched from fixed lines to mobile phones.

The spread of PCs and Internet access during the period also had different stages. Between 1995 and 1998 new technologies were adopted mainly by the formal private sector, whereas use of PCs at home was limited to highly-educated, higher-income professionals in urban centres. From 1998 to 2000, there was a boom in the acquisition of new technologies, offering more alternatives for PCs and data transmission. This facilitated the spread of ICT access in homes and signalled the inclusion of middle-wage sectors. Other factors contributing to the boom in that period include lower prices, soft loans for the acquisition of PCs (offered by both the private sector, mainly retailers, and the public sector), Internet access in public places, and more free Internet connection services. Then, however, the process of expansion hit a serious obstacle when the economic crisis reached a low point during 2001 and 2002. Given the strong devaluation of the local currency, the price of computer systems tripled, and the offers of personal loans almost disappeared. The demand for all non-essential services plummeted as purchasing power fell.

Residential Internet access grew steadily over the period, despite a slight stagnation in 2001 and 2002, as many users substituted new free access, which usually includes advertising, for payable

access. Furthermore, broadband through cable modems and wireless connections have provided more alternatives and improved service through faster data transmission.

International telephone traffic has shown sustained growth in outgoing calls, reaching levels similar to incoming calls. This change is linked to the liberalization of the residential and corporate market segments, which has encouraged competition and brought about a fall in the price of international calls.

BRAZIL

Infodensity: Brazil made big strides in the 1995-2003 period. The strongest growth in fixed and mobile telephony occurred since 1998, which coincides with privatization initiatives. Fixed lines rose sharply, more than doubling from 1998 (less than 20 million) to 2003 (over 42 million). Mobile phones grew considerably faster; from less than 10% of fixed lines in 1995 they surpassed fixed lines by 2003 (more than 46 million). As for the Internet, the biggest growth occurred since the year 2000; Internet hosts almost doubled between 2000 and 2001 and continued their strong growth afterwards.

Privatization of the fixed phone system started in 1998, with Telebrás handed over to 12 different private sector companies. Duopolistic competition was introduced in all regions of the country (non-exclusive for bidders) for both mobile and fixed phones.[89] The launch of new companies increased competition, even in small cities where users had the option of a second operator. This more competitive scenario came hand in hand with strong investment by the local operators in fibre optics, submarine cables and other telecommunications equipment. Therefore, there was a sharp rise in the number of installed lines and the quality of the service, as manifested by a significant drop in faults and advances in digitization.

Mobile telecommunications showed strong growth throughout the 1995-2003 period, with the new configuration of the market structured according to the kind of services.[90] Privatization and the spread of competition were accompanied by a dramatic increase in the number of subscribers, and the quality of service improved with increasing digitization. Also, the growth of pre-paid systems enabled users to access mobile services with fewer restrictions.

For cable TV, the level of competition increased (to more than 100 operators by the year 2000) and the average monthly tariff fell (from 68 to 40 reales in 2000). Even so, the spreading of cable TV has been slow.

Internet services have grown substantially since the year 2000. In the early nineties, Internet connectivity was associated with projects in academic sectors.[91] Little by little, the use of Internet services spread from academic environments as demand by other sectors, especially the commercial sector, increased. Since 1995, the opening of the ISP market allowed more competition, accompanied by investment in infrastructure, an increase in interconnection speed and a drop in monthly subscription prices (to around US$10 per month). Following the privatization of Telebrás, infrastructure investment by the operators also facilitated the growth and development of internet networks.

[89] *Three regions for fixed, one region for national and international long distance services and eight regions for mobile services*
[90] *There are 10 areas of coverage for SMC services, using suppliers for bands A and B. For personal mobiles (bands C and E) there were 3 coverage regions, with 3 suppliers operating in the interior.*
[91] *Red BITNET, Red ANSP de FAPESP, Red Nacional de Investigación, all academic and governmental institutions.*

The enrolment rate at the primary, secondary and tertiary education levels maintained an upward trend throughout the 1995-2003 period, indicating Brazil's improvement in the formation of human resources. There was particularly strong growth at the secondary level, albeit with a small drop in the primary level in the last three years. Towards the end of the nineties, the literacy rate was around 85%, while the percentage of graduates from primary and secondary levels, with particular emphasis on the latter, had increased by one-half since 1995.

All in all, available information indicates that results achieved in the field of ICT formation are insufficient, and some efforts were made to try and change these poor results (for example, the Programme for Informatization of Schools – Proinfo).

Info-use: The pattern of growth in residential phone lines and Internet users is similar to the pattern of growth of their infrastructures. Residential lines showed a significant upward trend between 1998 and 2001, from 13 to 27 million, followed by more moderate growth from 2001 to 2003. The increase in the proportion of Brazilian homes with residential telephone lines reflects the effects of privatization and increased competition in telecommunication services, which caused a dramatic increase in the installation of fixed lines by the local operators.

The number of Internet users increased substantially throughout the 1995-2003 period, and more so between 2000 and 2003 (from 5 to 19 million). The increase was helped by initiatives of the federal and state governments and the private sector, which increased the possibilities for Internet access and use for a significant share of the population.[92]

A special emphasis can be placed on the use of home PCs, which increased five-fold, from 1.7 per 100 households in 1995 to 8.7 in 2003. The purchase of computers appears as one of the main obstacles to individuals' use of Internet services. Consequently, the national authorities launched a group of initiatives to improve the penetration of computer systems in Brazilian homes (fiscal incentives, price reductions in PC purchases, lines of soft loans, etc.).

Broadband connections also experienced substantial growth, with their number approaching one million in 2003, almost tripling from 2001. In these years, the internal Brazilian market has seen the spread of interconnection nets for the academic community (as the Red Nacional de Investigación), government, as well as the commercial sector. Speed connection is usually as fast as 2 Mbps. Additional dedicated link networks are also being developed (high-speed metropolitan nets) with minimum speeds of 2 Mbps. Investment by operators in this type of link has been very strong; yet, according to the local controlling institution (ANATEL) some 93% of Internet users access services through a dial-up connection.

The growth in international telephone traffic is clearly seen throughout the period, particularly for incoming calls which increased from 495 million minutes in 1995 to 1,200 million by 2000. The growth of outgoing traffic is basically related to the new competitive environment in the Brazilian telecommunications market, where the tariff reductions for international calls accompanied the general movement towards the reduction of tariffs in the other services.

[92] *Particularly noteworthy are the efforts developed from the start up of the Information Society Programme (1999), which is coordinated by the Ministry of Science and Technology (MCT) and implemented by a group of government representatives, the private sector, and the academic community. Initiatives were also started by NGOs to enable development of communal access and adequate ICT formation (Programa VIVA RIO, Red RITS, Information Democratization Committee CDI). Other initiatives, with both private and public participation, were aimed at generating more interconnection spaces in academic and non-academic environments (Telefónica and Estado de San Pablo, Proinfo Programme of School Informatization, etc), and increasing the use of Internet services (e-government Programme, Redegoverno.gov.br). Much of the financing of public efforts came from the FUST – Fondo para la Universalizacion de los Sercicios de Telecomunicaciones (Fund for the Universalization of Telecommunication Services), directed to the purchase and use of equipment in small communities and isolated regions, with special emphasis on the educational and health sectors.*

CHILE

Infodensity: Following the privatization of Chile's fixed telephone service in the 1980s, the 1990s saw investment in new technologies by the private companies. In the four years from 1995 to 1998, the number of mainlines increased sharply by 67%, from 1.8 to over 3 million. One factor contributing to the overall increase in lines over the period was a sharp decrease in tariffs, as regulatory changes increased the degree of competition. For example, long-distance calling were deregulated in 1994 and prices have subsequently fallen by 80%.The growth rate of mainlines then fell substantially as the number of lines increased by only 6.7% between 1999 and 2003. This is mainly attributable to a fall in the demand for fixed lines, as the use of mobile phones increased. Consequently the waiting lists for fixed phones also fell, albeit with some ups and downs, going from almost 100 thousand in 1997 to less than 14 thousand in 2003.

The number of mobile phones rose dramatically between 1995 and 2003. Growth rates in excess of 100% per year were seen in 1998 and 1999. The introduction of the PCS mobile phones in 1998 was accompanied by an increase in the number of operators, from 2 to 4, which led to significant decreases in tariffs. The introduction of the "caller pays" system in February 1999, reduced maintenance costs and had a substantial influence on growth in that year. The commercial strategy of mobile phone operators also contributed to this outstanding expansion: by offering phones to people who made very few calls, they increased the number of calls made by increasing the number of people able to receive them. In fact, the users with pre-paid cards who use the phone mainly to receive calls account for 75% of all users. Furthermore, the fact that 50% of fixed phones are blocked from making calls to mobile phones caused many companies to divide their PABX (Private Automatic Branch Exchange), so that calls to mobiles go out on a mobile line.

The spreading of Internet in Chile was initially delayed by high user costs, because the price per minute of connection was fixed at the same rate as for regular calls. Following a change in the tariff system in 1999, however, costs fell sharply and substantial growth began. At the same time, by the end of 2000, residential consumers were offered access to the Internet by cable and ADSL, and by 2001 these were used by 8.4% of all Internet users in the country. Rates of growth in the number of Internet hosts increased through 1999 to 2001, raising their number per 1,000 inhabitants from 0.6 in 1995 to 13.8 in 2003 - higher than the average in Latin America. Internet expansion was also enhanced by a very active and effective public strategy for the promotion of ICTs[93], which expanded residential use by adding content of interest to private users.

For the skills component of Infodensity, the indicators of education enrolment and literacy are typical of countries with Chile's degree of development and socio-economic characteristics. There was some growth in enrolment ratios over the period. There is a moderate gap between Chile and the best-placed countries in the region for primary education, with wider gaps for secondary and especially tertiary education. The literacy rate is high, at 96% in 2003.

Info-use: The use of ICTs grew significantly over the 1995-2003 period, with the overall Info-use index increasing from 30.1 in 1995 to 137.5 in 2003. By the end of the period, Chile had the highest Info-use index in the region, making it the most advanced country in the use of ICTs. The various components of the index explain this rapid growth, for many of the reasons previously noted.

The number of residential phone lines doubled over the period due to changes in the regulatory framework, which increased competition, considerably reduced tariffs, and spurred investment in

[93] *Programa Enlaces, Fondo de Acceso Universal, Infocentros, Electronic Government policy supported by the Ministry of Planning.*

new technologies which increased the efficiency of service suppliers. The increase in phone lines and the reduction in tariffs following deregulation, which was particularly important for long distance telephone communications, explain the sharp increase in international telephone traffic.

The big increase in the number of Internet users over the period was due to the fall in the cost per minute of connection, following the change in the tariff system in 1999, to the introduction of ADSL connections towards the end of the nineties, and to the worldwide spreading and penetration of the Internet. Also, government initiatives helped to familiarise people with the new information technologies, especially the popular education system created in 1992, Programa ENLACES, which is internationally recognised as an important contribution to ICT promotion in the educational system.

The rise of PCs in Chile, which almost doubled between 1998 and 2002, has been helped by the wide and successful application of the Programa ENLACES during the nineties, which included supplying hardware to all educational systems under a government subsidy. A series of other measures also helped, such as easy access to loans for buying computers. As a consequence, there was a dramatic increase in Internet users, from 50,000 in 1995 to around 4,000,000 in 2003. The highest rate of growth was in 1999, when the tariff change and cost reductions spurred residential penetration.

COSTA RICA

Infodensity: Significant increases in investment in the telecommunications sector, including the technological migration from copper to fibre optics, improved network digitisation.[94] The penetration of fixed telephone lines grew steadily and continuously throughout the 1995-2003 period, along with a sharp increase in mobile lines and Internet hosts. Mobile lines increased dramatically over the period, rising from less than 20 thousand in 1995 to well over half a million in 2003. Starting in 2000, more than 100,000 lines have been added each year. By contrast, the biggest increase in the number of Internet hosts occurred in 1999, when they more than doubled from 3.3 to 7.5 thousands, followed by more modest growth from 1999 to 2003, when they reached almost 11,000.

The increase in mobile phone services by local operators was partly due to technological upgrading, and partly to a slow reduction in the fixed monthly tariff. Another contributing factor was the demand from company users - SMBs and high tech companies - accompanied by the development of many services with second and third generation support.

For cable television, data for 2003 do show a high residential coverage rate for colour television (90% of homes), but a much lower rate for cable television (under 20% of homes). However, further research conducted has not shed light on what would explain the demand for this type of service.

For Internet services - dial-up and free access since 1994, and dedicated access since 1999 - the absence of competition in the market has been a negative factor, preventing a reduction of access costs which seem to be an obstacle to increased subscriptions.[95]

Costa Ricans have very high literacy rates. Indicators for primary and secondary education show particularly high levels (100% and 76% respectively). The indicators of primary and secondary

[94] *According to the ITU Statistics Yearbook (March 2003), between 1992 and 2001, investments in telecommunications increased from almost 9 billion coloners to around 77 billion.*

[95] *According to the operators, the monthly cost of dial-up access connection is $15 US plus $0.90 US per hour of telephone service. A cable modem connection ranges from around $35 US to $350 US - depending on the kind of user, residential or commercial, and the speed of connection (with an additional $40 US for installation and $65 US for cable modem costs).*

education enrolment increased throughout the period, although the increases were more significant during the early years. Indicators for the tertiary level fluctuated over the period: they increased until 1998, then there was a slump in 1999 and 2001, and they levelled off in 2002.

In 1998, to help meet the challenge of introducing ICT practices, the Ministry of Education and the Omar Dengo Fundation started the Programa de Informática Educativa (PIE) *Educational IT Programme*, whose main objective has been to improve the educational system by updating equipment, increasing access to and use of ICTs, and offer training in the new technologies. The PIE, together with other initiatives supported by public authorities and NGOs, made it possible to considerably improve Internet access for Costa Ricans.

Info-use: The indicators of home TVs and residential lines show an upward trend over the analysed period. The steady and continuous growth of fixed phone lines improved the residential coverage rate in Costa Rica, to 63% in 2003.

The biggest increase has been in personal computers, rising by around 100,000 per year since 2000. The big increase in PCs could be strongly related to initiatives developed by the national authorities. Since the mid 1980s, imports of PC systems for the domestic market have not been taxed. In addition, the *Internet Ready* program (ICE/RACSA and the National Bank) grants soft loans for buying PCs with Internet access, and also pays for ICT training, and a minimum period of Internet connection. Another element that has generated positive results is the environment Costa Rica offers for the development of high tech companies, particularly in the software industry.

The number of Internet users also increased substantially, particularly since 2001 when it increased from 384,000 to more than one million in 2003. This increase has also been clearly influenced by initiatives supported by the national government, together with the participation and sponsoring of private players and NGOs.[96] Broadband access to the Internet was first launched in 1999, but by 2003 broadband penetration was embryonic. However, ICE/RACSA investments and initiatives by the national authorities to upgrade infrastructure are expected to improve the availability of dedicated interconnection. The objective of the Red de Internet Avanzada programme (2001) was to increase national broadband coverage and achieve a significant reduction in access costs, connecting all types of users (residential, corporate and academic). This programme was complemented with actions taken by ICE/RACSA under the mantle of the Programa Frontera a Frontera, whose objective has been the nation-wide spread of broadband interconnection infrastructure. The implementation phases of this pilot programme (2002/2003) could prove successful in the near future.

International telephone traffic grew steadily between 1995 and 2003, encouraged by a slight reduction in tariffs. Although incoming traffic still exceeds outgoing traffic, the latter nevertheless increased substantially, from 53 million minutes in 1995 to 140 million in 2003.

CUBA

Infodensity: Cuba differs from the rest of the countries in the region in that the special features of the Cuban system constrain popular consumption of ICT equipment and services to low levels. Cuba comes last in many international comparisons regarding ICTs because of low current levels of use, but there is significant potential for future growth.

[96] *These entreprises sought to spread the use of ICTs by computerizing schools (Programa Informática Educativa – Educational IT Programme), by developing training in new technologies (Programa Jóvenes @ Todo Dar, by the Paniamor Fundation; Programa LINCOS, launched by the Entebe Fundation and the Costa Rican Technology Institute), and by starting up new projects for ICT infrastructure (Proyecto Comunicación sin Fronteras, Proyecto Red de Internet Avanzada, Proyecto Frontera a Frontera).*

The main *Network* components show healthy growth between 1995 and 2003. Fixed telephone lines grew at an average annual rate of 9% over the period, and the network is has been almost fully digitized. Almost half of all fixed lines in 2003 have been installed during the last 5 years. This expansion has reduced the rate of unsatisfied demand rate, with waiting lists falling from 27% of fixed lines in 1995 to less than 8% in 2003. At the same time, 80% of the mobile phones in 2003 were adopted in the last 5 years, and 95% of the Internet hosts did not even exist in 1998.

There are two main reasons for these high growth rates. First, the initial levels were very low, so small absolute increases give high percentage increases. Consequently, despite the sharp increases, Cuba remains far behind the rest of the region. Second, investment has been strong since the creation of a mixed capital company (Cuban and foreign) in 1994. In the early stages, foreign participation was exclusively Mexican capital (CITEL), but then expanded to include Italian (STET International) and Canadian (Sherrit Corporation). Moreover, there was a clear expansion of tourist activity, the pillar of the Cuban economic recovery after the fall of the socialist regime in the former Soviet Union. This created a strong demand for telecommunications services, and was such an important source of revenues that all the necessary financial resources were allocated to achieve the required levels of investment.

The literacy and education enrolment indicators are similar to those of the highly developed countries in the region. Nevertheless, the special features of the Cuban economic system account for the mismatch between the presence of highly qualified human resources and the technical infrastructure upon which expansion of ICTs can be based. Within Infodensity, therefore, there is a clear dissociation between the healthy picture for human resources indicators and the other Network indicators.

Info-use: The low levels of ICT use reflect the small penetration of ICTs to only a limited number of sectors and activities. The lack of private residential use prevents the formation of a critical mass of users needed for a massive expansion to bring Cuba closer to other countries in the region. The centralised character of the economy and the lack of competition take the dynamism out of the process of ICT diffusion in the island. There are only 4.2 PCs per 100 inhabitants, and only 1.6 Internet users per 100 inhabitants.

The telephone investments that followed the formation of a mixed capital company enabled the number of residential telephone lines per 100 households to almost double between 1999 and 2003, from 8.9 to 16.9. Over the same period, residential TV penetration remained quite stable at 67 per 100 households. The total number of all TVs (residential plus non-residential), however, would possibly show a steady increase resulting from the demand generated by construction of new hotel rooms for international tourism. In fact, the Cuban government has undertaken initiatives to create mixed companies to meet the increasing demand in this sector, which could not be met by a rise in imports because of the government's foreign currency restrictions.

Despite the low levels of all indicators, which place this country among the most underdeveloped in terms of Infostates in the whole region, there has been a noticeable upward trend in recent years. Between 2000 and 2003 the numbers of Internet and PC users more than tripled. The overall results clearly show the particular use that this country makes of these technologies and the potential that exists there - despite the lack of large investments and current levels of ICT diffusion, which are influenced by factors beyond the internal dynamics of the information and telecommunications sector.

GUATEMALA

Infodensity: Growth in telephone lines remained stable during the whole period, with an average increase of about 80,000 new lines per year. Privatization and market liberalization, which began in 1996, made the telecommunications sector more dynamic, reducing the inefficiency, low technological investment and unsatisfied demand that characterized the state-managed service.[97] Structural changes in the telecommunications sector stimulated investment in fixed and mobile telephone lines and in fibre optic networks. Complete digitization of the network was achieved by 2000, and in 2003 the waiting time for telephone installation reached its lowest point. Development of rural networks in Guatemala is affected by the country's wide rural areas, as well as its geographical peculiarities, with volcanoes and mountains increasing the investment requirements.

After the mobile phone sector was opened to competition in 1999, the number of mobile phone lines tripled between 1999 and 2001 and penetration increased from 3 subscribers per 100 inhabitants in 1999 to nearly 10 in 2001. By 2003 this number had further increased to 16.2.[98]

The number of Internet hosts in Guatemala has risen each year since 1995, with noteworthy increases in 1996, 2000 and 2003. Again, opening up the telecommunications sector to private capital has been a key element for host expansion and an increase in the number of users.

Guatemala's private education sector is bigger than the public sector. In 2003, the primary education enrolment rate was amongst the lowest of the ten countries studied, with the secondary and tertiary rates substantially below those of the other countries. Guatemala also had the lowest literacy rate. In light of these problems, education policy has been identified as a priority policy area, with the objective of increasing spending on education to 7% of GDP. Nevertheless, development is concentrated in urban centres. Important illiteracy levels persist in rural areas, linked to low public and private investment in areas furthest from urban centres. Even so, the university and technical training system that does exist is well established, and Guatemala is home to one of the most prestigious training institutions in the region - the Instituto Técnico de Capacitación y Productividad.

Info-use: Internet penetration is very low in Guatemala. Moreover, growth has been slow, although it picked up speed in recent years due to increased residential penetration. Internet use increased from 0.7 per 100 inhabitants in 2000 to 4.2 in 2003. Until 1999, access to new technologies was mainly confined to government and business. Between 2000 and 2003, following privatization, access expanded to middle-income and upper-income households.

The major factors influencing ICT expansion in Guatemala are income and the urban/rural difference. Internet access and PC expansion have been confined to urban centres. At least 40% of the Guatemalan population are low-income. Given low incomes and non-existent market penetration in rural areas, no more than 20% of the country's total population are in a position to access Internet services provided by the market.

Consequently, expansion of Internet access will largely depend upon public actions. The measures taken are oriented towards the expansion of rural telephone lines and Internet connections, together with public education about the Internet. However, government policies and initiatives by public bodies related to the Internet tend to be poor.

[97] *The first step towards market liberalization was the transfer of assets from the Empresa Guatemalteca de Telecomunicaciones to Telecomunicaciones de Guatemala, which in 1998 was sold to LUCA Corporation with Guatemalan and Honduran capital, later acquired by TELMEX.*

[98] *In 1998, the only provider of fixed telephony serrvice (together with CELCOM Corp., Milicom´s property) also provided the mobile telephone services. After the mobile phone sector was opened to competition in 1999, the main companies were CELCOM, SERCOM (of GUATEL), Telefónica Centro América Guatemala (Grupo Telefónica) and BELLSOUTH Guatemala.*

Although penetration rates for traditional technologies – TVs and fixed telephones – are substantially higher than for PCs and Internet use, they still remain low relative to other countries in the region. The number of TVs per 100 households increased from 30.9 in 1995 to 41.3 in 2003. Fixed telephone lines increased from 8.2 per hundred households in 1995 to 21.8 in 2003.

International outgoing telephone traffic has shown a consistent and steady growth since the year 2000, but there has been less growth in incoming traffic. The increase in outgoing calls is directly related to the installation of call centres as part of a strategic policy in the country. This policy is influenced by Guatemala's proximity to developed countries and bilingualism in the population (as the majority of the education institutions are bilingual). Furthermore, the impact of the expansion of the call centres on outgoing traffic has been enhanced by the fact that Guatemala has the most competitive telecommunications costs in the region.

JAMAICA

Infodensity: Despite corporate name change and mergers, Cable & Wireless (C&W) monopolized almost each and every aspect of telecommunications services. It was not until the end of the 1990s that Jamaica's government slowly moved towards greater competition, and joined the Cuarto Protocolo de la Organización Mundial del Comercio *(Fourth Protocol of the World Trade Organization)* committing to move towards market liberalization. The 2000 Telecommunications Law established a transition towards overall telecommunications market liberalization in three phases, over three years. As well, in 1998, the Technology and Trade Department issued five new VSAT operator licenses.

Even as a monopoly C&W invested strongly, making important infrastructure improvements. Complete digitization of the wireline network was achieved by 1995, earlier than other countries in the region. The number of installed fixed telephone lines increased substantially, from under 300 thousand in 1995 to exceed half a million in 2001. Subsequently, though, as the expansion of mobile phones took hold, the number of fixed lines fell to under 400 thousand by 2003. In parallel, the waiting list increased until 1999 but fell considerably after 2001, possibly due to a drop in demand accompanying the trend to substitute mobile phones for fixed lines.

Strong growth in mobile phones took place in the 1995-2003 period. While early growth in subscriptions was relatively strong, with a particularly big jump between 1998-1999, it intensified with the introduction of competition, which brought about a decrease in tariffs and an increase in demand. Until September 2001, C& W was the only mobile phone company, with a little more than 300,000 subscribers. September 2001 marks the first step in market liberalization, when licenses were granted to two more companies.[99] Between 2001 and 2002, subscriptions increased by an astounding 765,000, more than doubling. At about 1.6 million by 2003, cell phone subscriptions represent more than one mobile line for every two people.

The number of Internet hosts showed a very significant increase in 2000. Between 1995 and 1999 the number of hosts rose to almost 300, without great variations in growth, then jumped to 1,472 in 2000 and remained there through 2003.

The education indicators were considerably lower than those in developed countries, and remained at the bottom five of the ten countries examined in the region throughout the period. Enrolment in tertiary education was particularly low compared to most of the other countries.

[99] *Cellular One Caribbean and Centennial Communications Corporation; two more licenses were subsequently added.*

Info-use: Fixed telephone line services coverage by C&W has been acceptable in urban and tourist areas, but in rural areas, with lower population density and fewer economic resources, both line installation and repair services were relatively poor. Much like the pattern followed by mainlines, the number of fixed residential lines grew from about 220,000 in 1995 to almost 400,000 in 2000. By 2003, however, their number had fallen by 25%, to under 300,000.

The number of PCs rose throughout the period, with particularly strong growth rates over the first four years. The number of PCs per 100 inhabitants increased from 0.5 in 1995 to 4.3 in 1998. By 2003 the number had risen to 5.7, exceeding 150,000 units.

Internet users rose gradually until 2001, but then the figures indicate a remarkable jump by 500% between 2001 and 2002, from 100,000 to 600,000 users. By 2003, the figure had further increased to 737,500, for a penetration of 27.9 per 100 inhabitants. Clearly, in view of such a dramatic jump in time-series data, measurement errors cannot be ruled out. While this could not be ascertained at this point, there are several reasons related to diverse initiatives undertaken by the government of Jamaica, which point to an increase in the number of Internet users and coincide with the 2001-2002 period.

In January 2001, the Executive Power announced a five–year strategic plan to boost ICT use by every sector. The plan generated a 30% increase in the number of school IT Labs by the end of 2002, and enabled 60% of primary and secondary level education institutions to obtain ICT equipment. The plan also included some basic IT knowledge content in the education curriculum.

The 2000 Telecommunications Law not only set out to liberalize the market over a three-year period, but also facilitated the necessary expansion of infrastructure, training and Internet services. This liberalization of the telecommunications market resulted in 22 new licenses for Internet companies being issued in 2002. Given the highly competitive industry, network access tariffs reached levels similar to the ones in European and North American countries, something that clearly aided Internet use.

Another relevant factor explaining the increase in Internet use since 2001 is the opening of cybercafes and telecentres. The Postal Corporation of Jamaica received a US$31 million subsidy from the INTEC Fund[100] that allowed 44 post offices to be restructured and furnished with the technology needed to offer IT–based commercial services. Then, C&W agreed to install Internet community services in 60 post offices, 26 of which were already offering Internet services by the end of 2002.

MEXICO

Infodensity: The starting point for the expansion of the Mexican fixed telephone lines was the privatization initiative in 1990. The new concession included the new operators' commitment to expand the network. In the years after the privatization, there was a constant process of upgrading and expanding the telecommunications network, something that made possible the availability of greater telephone access in the most important Mexican cities. Also, the Mexican government actively promoted telephone penetration in rural areas. As part of the process of opening up the market to competition, 23 telecommunications concessions were granted to offer wireline and wireless services.

[100] *The Information Technology Project (INTEC) was created to act as the driving force for the creation of an ICT industry.*

These factors have encouraged strong growth. The number of telephone lines increased by 427,000 in 1997, compared with 25,000 the previous year. Two years later, in 1999, a million fixed lines were installed; this was followed by even larger absolute line increases until 2003. Nevertheless, although the total number of lines increased substantially and the number per 100 inhabitants increased from 8.3 in 1995 to 15.7 in 2003, penetration is still low in comparison with international values. Also, growth has concentrated in urban areas, while rural sectors still show low telephone penetration.

Efficiency improvements, accompanied by a 60% tariff reduction in 1997, increased the demand for telephone lines,[101] and the accessibility by those sectors with lower resources. The increase in demand explains the increase in the waiting lists for telephone lines, which reached a peak in 1998 but declined thereafter. All fixed lines were digital by 2001.

The number of mobile phones almost doubled each year between 1997 and 2000. This was followed by annual increases of 50% to 2001, and approximately 20% thereafter. As in other Latin American countries, growth is related to the adoption of the pre-paid system and the "caller pays" scheme. In Mexico, however, another factor explaining the huge rise in mobile telephones is the use of wireless and satellite technologies used to spread penetration in rural areas and distant urban centres. In addition, the lower costs of maintenance, operation and installation of new lines has enabled mobile telephones to spread among lower-income sectors. For instance, between 1995 and 2001, 31,228 communities with a total of 9 million inhabitants were connected by wireless technology, supported by satellite technology.

Although the number of cable television connections fell slightly between 1996 and 2002, this is misleading since Mexican paid television also includes microwave and satellite television. Taking the three paid television services together, there has been continued growth throughout the period. The fall in cable connections, therefore, is strictly related to competition from the other two types.

Residential and corporate Internet access explosion has brought about an increase in the number of host and domain entries. In 1999, growth in Internet hosts surpassed 200%, and over the whole period the number of hosts per 1,000 inhabitants increased from 0.1 in 1995 to 12.9 in 2003.

Although the enrolment rate between 1995 and 2003 fell slightly for primary education, there were increases in the rates for secondary and tertiary education. Consequently, the overall education enrolment indicator shows an upward trend over the period. The adult literacy remained fairly stable in the region of 90%.

Info-use: Between 1995 and 2003 the number of households with TVs increased by almost 50%, as did the number of residential telephone lines. Given that the number of households increased by about one-third, however, the numbers per 100 households increased from 86.5 to 95.4 for TVs, and from 35.3 to 48.1 for telephones.

The number of PCs quadrupled, and as the increase in population was just over 10%, the number of PCs per 100 inhabitants increased by a slightly smaller percentage, from 2.6 in 1995 to 9.4 in 2003.

[101] *The expansion of lines necessitated the increase in the digits of telephone numbers to 8.*

There was also a huge increase in the number of Internet users over the period, from just 94,000 in 1995 to more than 12 million by 2003: that is, from one-tenth of one percent of the population to almost 12%. Before 1998, however, the Internet developed mainly in the education sector and in big companies, so although growth rates were high the actual number of users remained relatively low. But by 2000 the number of users was more than eight times the number in 1997, and then more than doubled between 2000 and 2003.

Since 1998, the growth in Internet access was boosted by SMEs, and the deregulation of value-added services increased residential demand, and was an important contributor to the growth of the Internet. Cybercafes and Internet kiosks located in small communities and regions of the country have played a key role. In addition, the reduction in tariffs has favoured expansion of dial–up connections, along with a public Internet access promotion policy in rural areas, and initiatives for private installation of public access centres.

International incoming telephone traffic practically doubled between 1998 and 2000. Although outgoing traffic remained substantially below incoming, it nevertheless doubled between 1996 and 2003. Traffic dynamism turns out to be closely related to the recovery from the Mexican that started in 1995, and to the NAFTA (North American Free Trade Agreement). Participation in NAFTA has encouraged the setting up of companies, mainly American ones and in borderline areas, which required low cost workforce and skills. Furthermore, the greater Mexican participation in the global economy, together with the population size, made it an attractive centre for investments.

URUGUAY

Infodensity: The state–owned company ANTEL (Administración Nacional de Teléfonos del Estado), created in 1974, is responsible for fixed telephone service. Even though Uruguay did follow the region's general move to privatization in the 1990s, ANTEL has been restructured and its management improved. Investment permitted a rather fast rise in mainlines between 1995 and 1998, as well as the complete digitization of the network by 1997. The development of mainlines then slowed in the 1999-2003 period, but their number was approaching one million by 2003. The economic recession, together with Uruguay's high level of penetration - the highest in the region - may explain the path of fixed telephone service expansion. The number of telephone lines increased from 14.9 per 100 inhabitants in 1995 to 27.1 in 1999 and to 27.6 in 2003.

There was almost a 20-fold increase in mobile phone subscriptions between 1995 and 2003. The growth rates between 1995 and 1996 and between 1998 and 1999 stand out, as the number of mobile telephones doubled and more-than-doubled, respectively. Nevertheless, Uruguay shows a low penetration rate compared to other countries in the region.

Uruguayan mobile telephone growth and penetration can be explained partly by the evolution of technology and partly by the degree of competition. Mobile telephone service started in 1992 and was provided by a single company (Movicom), which operated as ANTEL´s subsidiary company. Costs were such as to allow the financing of network expansion despite the few users. This continued until 1994, when the state–owned company created ANCEL as a business unit to offer mobile services. The incorporation of ANCEL made tariffs go down, which increased the number of users. The following year, the payment system was modified to "caller pays", generating an important increase in coverage that helps explain the high growth rate between 1995 and 1996. Finally, the adoption of the pre-paid system in 1998 generated another rise in coverage, to almost 897,000 users in 1999, or 9.6 lines per 100 inhabitants.

Despite the steady growth of coverage in the following years, penetration remains lower than for fixed telephone lines, unlike the situation in many other countries. In 2003, there were 22.4 mobile lines per 100 inhabitants compared to 27.6 fixed lines. This can be partly explained by the fact that mobile telephone market is still a duopoly, in which one company contracts out to the other, so there is no actual competition. Decisions on the incorporation of new technologies are made by ANCEL´s state–owned enterprise. Furthermore, costs continue to be a determining factor in the growth of coverage, since the size of the Uruguayan market prevents the cost reductions that would result from full exploitation of economies of scale.

There was substantial growth in the number of Internet hosts between 1999 and 2000, so that between 1995 and 2003 the number per 1,000 inhabitants increased from 0.2 to 25.7 - the highest penetration rate of all the ten countries studied. Originally, ANTEL was the sole provider of Internet services, and only during the last few years were other companies allowed to enter the market. There is now a total of 79 enterprises in Internet and data transmission. Even though the sector remains relatively concentrated, with 10% of the companies having 80% of the market, the increase in competition partly explains the rise in Internet hosts between 1999 and 2000, when the number of hosts per 1,000 inhabitants more than doubled from 7.7 to 16.2.

The indicators of tertiary, secondary and primary education enrolment show steady growth over the 1995-2003 period. Moreover, the literacy level remained very high, between 97%-98% throughout the entire period. These values are among the highest in the region, reflecting the increase in Uruguay's social and economic development during the period.

Info-use: Consistent with the development of the ICT infrastructure, the Info-use indicator more than quadrupled between 1995 and 2003. Sizeable annual growth rates were registered in residential telephone lines and TV households, as well as and PCs per inhabitant - with a more rapid growth between 1995 and 1999.

Telephone lines per 100 households increased from 52.2 in 1995 to 75.2 in 2003, due to the improved performance of ANTEL - the only company providing the service - and the technological advances within the sector. The wider range of services as infrastructure developed enabled a noticeable cost reduction that was reflected in lower tariffs.

The rise in fixed telephone lines penetration was also accompanied by an increase in international telecommunications traffic, with a 60% increase in outgoing call minutes between 1995 and 2003 and an even bigger increase in incoming traffic. It is important to note that this is one of the services in which the market has been liberalized, so the increase in traffic is partly explained by an increase in competition.

Uruguay has one of the highest Internet use rates in the region. The number of users grew dramatically between 1995 and 2003, showing major growth between 1995 and 1999, and lower but constant growth between 2000 and 2003. The increase in the number of users can be explained both by ANTEL´s improvements in efficiency (at first, the only company), and by the entrance of new service providers by the year 2000.

Both the existing connection conditions and the country's socioeconomic level influenced the demand for hardware. The appearance of many IT training centres had a feedback effect on both the demand for hardware and for Internet services, especially during the late 1990s. Thus, between 1995 and 1999 when the Info–use indicator increased by a factor of 3.5, the demand for services, the range of services offered, and the economy's performance all improved. This contrasts with the

period from 2000 to 2003, when the slight (14.8%) increase in the Info-use indicator, from 96.5 in 2000 to 110.8 in 2003, can be explained by an apparent saturation in demand and a slowdown in economic development.

VENEZUELA

Infodensity: The period from 1995 to 2003 involves two distinct phases in Venezuela's fixed telephony sector. In the first, between 1995 and 2000, there was only one company, CANTV, which was privatized in 1991 but given exclusive rights until 2000. The second, resulting from market liberalization, was characterized by the incorporation of new companies and the resulting increase in competition.

During CANTV's monopolistic period, investment was not that significant and the impact on the number of users was limited. Between 1995 and 2000 the total number of mainlines remained stagnant, increasing by only 3% - with an upward trend between 1995 and 1997 and a downward one between 1997 and 2000. Investment increased after the introduction of competition following market liberalization in 2000, as did the number of fixed lines and the extent of network digitization. However, the number of fixed lines increased only by 15% between 1995 and 2003, and by the end of the period the percentage of digitized lines scarcely surpassed 80%, placing the country behind others in the region. Consequently, in spite of the constant flow of investment, the increase in competition and the Venezuelan government's explicit policy towards service universality, the fixed telephone line penetration rate has not increased sufficiently and is lower than the region's average.

Several factors explain the low evolution of telephone lines. The cost of service remained high even after the sector's liberalization. The combined effect of costs, income distribution and economic crises, especially between 2001 and 2003, did not help either. However, mobile phone lines expanded to become an important replacement for fixed lines, especially after 1998. There was also an increase in traffic through public telephones, which developed substantially.

Unlike fixed lines, mobile phones increased noticeably in the 1995-2003 period, with the number of subscriptions per 100 inhabitants rising from 1.9 in 1995 to 27.3 in 2003 (in sharp contrast to only 8.9 fixed telephone lines per 100 inhabitants). Mobile phones were first offered in Venezuela in 1988 when CANTV, still having monopoly control, introduced the first Advanced Mobile Phone Service (AMPS) network in the country and in Latin America. Three years later, a license was granted to a second enterprise, TELCEL, which marked the starting point for competition in the sector and resulted in a considerable increase in users.

Nevertheless, mobile service was concentrated in the country's main urban areas, leaving the majority of the regions without coverage. To meet the targets in the 2000 Telecommunications National Plan for universal service provision, the government divided the country into three regions and granted one more license per region.[102] But, even though this enabled broader geographic coverage, this had only a moderate impact on competition. Despite the rapid growth in mobile phones since 1998, the penetration rate continued to be low relative to other countries in the region. Among the main reasons are high tariffs, the income distribution conditions in Venezuela and the economic crisis throughout the period.

[102] *Thus three new enterprises were incorporated (Digitel, Digicel and Infonet), which would compete within the regions with the two already existing national-range companies.*

The number of Internet hosts increased significantly between 1995 and 2003, but also remained much lower than other countries in the region. Penetration went from 0.1 hosts per 1000 inhabitants in 1995 to 1.4 in 2003. Again, inadequate competition is one of the main factors explaining Venezuela's low Internet penetration. Internet service was liberalized in 1991, but despite the opening up of the market competition remained low and the service continued to be provided by already existing companies. Furthermore, the low penetration of fixed telephones and the high tariffs were two important hindrances to the development of Internet hosts. The demand for Internet services remained low, and the incentive was not strong enough to boost the development of sites.

The indicators of the evolution of enrolment in primary and secondary education show a stable increase between1995 and 2003. For tertiary education, however, the indicator remained stable between 1995 and 2000, but then decreased continually to 2003. The literacy level remained above 90% throughout the period, going from 90.9 in 1995 to 93.4 in 2003. In general, these indicators are similar to the other countries in the region, even though Venezuela had economic and political problems between 2000 and 2003, and one of the highest unemployment rates in the region. Furthermore, only 11.3% of the employed workforce are engaged in professional, technical or similar activities.

Info-use: The Info–use indicator shows an upward trend between 1995 and 2003, although growth slowed down after 2001. Between 1995 and 2001, the indicator increased at an annual average rate of around 20%, while between 2001 and 2003 the annual rate was 6%. Nonetheless, in 2003, the Info-use indicator was 3.5 times its 1995 level. There was an important increase in the number of Internet users and the number of PCs. However, when seen in the context of the total population and number of households, the use of ICTs in Venezuela is low.

There was a small increase in the absolute number of residential telephone lines over the 1995-2003 period, but not enough to keep pace with population increases. As a result, the number of fixed lines per 100 households decreased from 41.8 in 1995 to 35.4 in 2003. This is partly attributed to the deteriorating economic situation of the majority of Venezuela's population, and the cost of tariffs. Traffic through public telephones increased, however, and the effect of mobile phones on the demand for fixed phones should not be underestimated.

Despite the development in the ICT sector and the increase in the number of PCs, indicators of use are low relative to the region. Even though the number of PCs almost tripled between 1995 and 2003, in 2003 there were only 6.8 personal computers per 100 inhabitants. Similarly, despite the large proportional increase in the number of Internet users, by 2003 there were only 6 users per 100 inhabitants. The low penetration of fixed telephone lines and high costs are two major reasons for low Internet use. This, in turn, is both a cause and an effect of low PC penetration in Venezuela. According to a survey carried out by the Cámara Venezolana de Comercio Electrónico (Electronic Commerce Chamber of Venezuela), the main problems for the expansion of PC use turned out to be the lack of knowledge about how to use the technology, the lack of use itself and the lack of basic infrastructure.

In view of the situation, since 2000 the Venezuelan government has taken various measures to speed the transition towards a Knowledge Society. The 2000 Telecommunications Law, a decree during the same year declaring Internet development a national priority, and measures taken under the 2000 Telecommunications National Plan all aim to improving diffusion of ICTs. Yet the economic, political and social crises between 2000 and 2003 have created other priorities, which is probably the reason why the indicators do not seem to show the desired results.

Chapter 6

WOMEN IN THE INFORMATION SOCIETY

by Sophia Huyer, Nancy Hafkin, Heidi Ertl and Heather Dryburgh*

The economic and societal transformations of the Information Society are far from being complete, though they have been occurring for some time now. For many around the globe, ICTs touch all facets of daily life, whether economic, social, political, or cultural. Not only do ICTs facilitate information sharing and knowledge management – both key elements of the Information Society – but they also provide people, businesses and governments with the essential networks to overcome the challenges of distance and time.

As an area of policy research, the Information Society includes several general issues, such as the Digital Divide, and the linkages between ICTs and economic and social development. Prominent among specific issues is the gender digital divide. Global agreement that gender equality is essential for building a *"sustainable, just and developed society"* was re-affirmed in Beijing at the 1995 United Nations World Conference on Women. At the Geneva WSIS (2003), governments highlighted the importance of gender equality:

We are committed to ensuring that the Information Society enables women's empowerment and their full participation on the basis of equality in all spheres of society and in all decision-making processes. To this end, we should mainstream a gender equality perspective and use ICTs as a tool to that end (WSIS Declaration of Principles, para. 12).

Recognizing the pervasive influence of ICTs in the global economy and society, equal access for both women and men to ICTs is insufficient to obtain true gender equality. Instead, women need the opportunity to participate equally in, and benefit equally from: i) the design, development and application of ICTs; ii) the use of the information and knowledge generated in the Information Society, and; iii) the opportunities and resources of the Information Society.

Women are central to economic and social development, through their productive, reproductive, and community management responsibilities. They make a major contribution to the production of food, the provision of energy, water, health care, and family income in developing countries (ECOSOC 2004). As well, they make up the majority of the population in rural areas in most developing regions, which are traditionally poorer and have less access to support services and infrastructure (UNIFEM and ENU/INTECH 2000). Poverty has a severe impact on women and girls, and households headed by women are especially affected. Societies that discriminate on the basis of gender pay a high price in terms of their ability to reduce poverty and develop.

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Higher household income and education for mothers are associated with higher survival rates of children, as additional income for women has a larger positive impact on family well-being than additional income for men. Low investment in female education reduces a country's overall output, while improving women's education and skill levels increases productivity, household income, food security and reduces poverty. Thus, *"countries with smaller gaps between women and men in areas such as education, employment, and property rights not only have lower child malnutrition and mortality, they also have more transparent business and government and faster economic growth, which in turn helps to further narrow the gender gap"* (World Bank 2001).

The Millennium Development Goals (MDGs) were adopted in 2000 to provide a framework for the promotion and monitoring of poverty reduction and improvement of quality of life in developing countries. Women are widely acknowledged to be instrumental in the achievement of all of them. As a cross-cutting tool, ICTs are expected to play a catalytic role as well. Thus, it is difficult to escape the conclusion that ICTs will impact only marginally on the MDGs unless they incorporate a strong gender dimension. More specifically, the gender equality (GE) and ICT implications for the MDGs can be summarized as follows:

MDG	GE Dimensions	GE and ICT Applications
Goal 1: Eradicate extreme poverty and hunger	Female-headed households are disproportionately poor; women tend to have less access to financial, technical and labour resources; women are critical agents for poverty reduction, and produce most of the food consumed locally in food-insecure areas.	ICTs can provide information on agriculture, weather, pricing and marketing to support women's food production and income-earning enterprises. ICTs can provide information to help women care for their families and improve their well-being.
Goal 2: Achieve universal primary education	Girls and women have lower levels of school enrolment; women make up 2/3 of the world's illiterate population.	ICTs can deliver literacy and education to girls and women where they live and work; they can open up new opportunities and provide flexible learning times.
Goal 3: Promote gender equality and empower women	Women are central agents of development in their families and societies; the MDGs cannot be achieved without the full mainstreaming of women and gender equality.	ICTs are important tools to promote gender equality and women's empowerment, and to help women achieve greater success in their income generating and domestic activities.
Goal 4: Reduce child mortality **Goal 5**: Improve maternal health	Women are responsible for nutrition of their families and subsistence food production in much of the world.	ICTs can provide improved information on nutrition and agriculture; facilitate health networks and information to health professionals, and; monitor health trends.
Goal 6: Combat HIV/AIDS, malaria and other diseases	Women make up the majority of HIV-infected persons in Sub-Saharan Africa; women and girls are more vulnerable to infection for sociological, physiological, economic and cultural reasons.	ICTs can provide information on prevention and treatment; facilitate health networks and information for health professionals, and; facilitate interaction with patients in rural areas.
Goal 7: Ensure environmental sustainability	Women are important environmental managers in their communities; they own much of the world's remaining traditional and indigenous knowledge.	ICTs can provide information on the environmental situation, weather, and sustainable agricultural practices; they can disseminate women's traditional knowledge and experience to promote sustainable development.
Goal 8: Develop global partnerships	ICTs can provide a vehicle to incorporate women's perspectives and knowledge into global partnerships for development. They provide a venue for women to express their views; they also provide a way to reach women and allow them to participate where they live and work.	

Project rationale and structure

With the explosion of interest in Information Society issues, the need for reliable and comparable statistical information has become a priority for the international community. Naturally, this extends to ICTs and gender. WSIS explicitly recognized the importance of sex-disaggregated statistics and indicators, calling for the development of comparable statistical indicators that should incorporate a gender analysis. In addition, WSIS called for the development of gender-specific indicators on ICTs to assess the impacts of funded ICT projects on the lives of women and girls (WSIS Plan of Action, para. 28d).

However ICT measurements and comparative analyses in this area have been extremely scarce. The present volume quantifies Infostates, and thus the international digital divide, including detailed, policy-oriented analysis across a large number of countries and over time. However, no comparable systematic measurement on the gender aspect has been possible due to a scarcity of data – both in the scope of coverage and the degree of detail available.[103] The first part of this chapter represents an attempt to rectify this, to the extent possible at the present time. It relies on the extensive compilation of sex-disaggregated statistical data to offer a much-needed quantitative analysis of the gender digital divide. It provides a 'macro' view of its magnitude and evolution, while in parallel examining some of its key related aspects.

There is clear recognition that in order to address gender disparities in the context of the Information Society more than statistical data is needed. This provides the impetus for the second part of this chapter. The shortage of usable data notwithstanding, the gender digital divide has so many dimensions and nuances that large amounts of a different type of information are also needed, particularly touching on the context of individual circumstances across countries, social norms, histories, cultures, etcetera. Therefore, the second part of this chapter contains analysis of a qualitative nature, with in-depth information from field-work experiences, case studies, and anecdotal and contextual evidence. In so doing, it complements well the statistical analysis. Its contents are based on a comprehensive framework that defines the important elements of the main gender issues in ICT (Hafkin 2003). Taken in its totality, this chapter offers a more holistic view to the gender digital divide than has been possible until now.

Finally, the digital divide literature has dealt with two strands of research: one focussing on the international digital divide, which involves the gaps between *have* and *have-not* countries, and another concerned with divides within countries, regardless of their overall Infostates (Sciadas 2002). Within the latter, numerous and sizeable inequalities exist and have been identified. They include disparities by income, level of education, urban/rural split, ethno-cultural group, generation, disability and many more. Key among them is the issue of gender equality. The gender divide is, as all other divides are, directly linked to the overall Infostate of a nation, and its analysis should be dealt with in that context and not in isolation.

6.1 Statistical evidence and analysis of the gender digital divide

Comprehensive ICT data with a gender dimension across a large number of countries do not currently exist. There are however various pockets where some data can be found and this is where this project aims to add value. Such an exercise is labour-intensive and time consuming. It

[103] *Some promising activities are underway. One of them stems from the partnership formed by a number of UN bodies, including regional commissions, the OECD, and national statistical agencies, which aims at closing the gaps in Information Society statistics. The partnerships' objectives include an agreement on a set of core ICT indicators, a construction of a database, as well as the offering of training for capacity-building in developing countries (UNCTAD 2004).*

requires the tapping of various networks and substantial expertise to compile what is available and to sift through and apply basic quality controls. The first step in this process involves the collection of existing data from international and trans-national organizations, where data for multiple countries may have been collected. Once these sources have been exhausted, the second step is to tap into individual country holdings. A number of other difficulties exist, including the lack of a consistent time series for gender indicators (even among developed countries), the lack of common definitions and concepts, and the variety of sources (i.e. a mixture of public and private). Nevertheless, this effort represents the best that can be done today, and the collected data support the quantitative analysis that follows.

Data on access to and use of ICTs indicate that women's participation in the Information Society, particularly in the poor countries of the world, lags behind that of men, a cause for serious concern. Consistent with all that is known by now about the digital divide, it does not come as a surprise that a gender digital divide also exists. What is not known as well, though, is the order of magnitude of this divide, its evolution and its many nuances – all matters of importance for the design, implementation and evaluation of programs.

The size and the evolution of the gender divide refer largely to ICT access and penetration, which are the first and most basic requirements for their effective use. However, the issue of the gender divide is much broader. Even in countries where access is no longer much of an issue and penetration is high, inequalities in actual use can hamper women's development opportunities on both the economic and social fronts. So, although initially we begin to identify where and how big the ICT access and penetration gaps are, we can say little about women's equal and active participation in the Information Society just based on access. Access is a necessary but not sufficient condition to closing the gender digital divide. The issues of ICT literacy and skills are central to including and encouraging women to fully participate in, benefit from, and contribute to the Information Society.

6.1.1. Magnitude of the gender digital divide

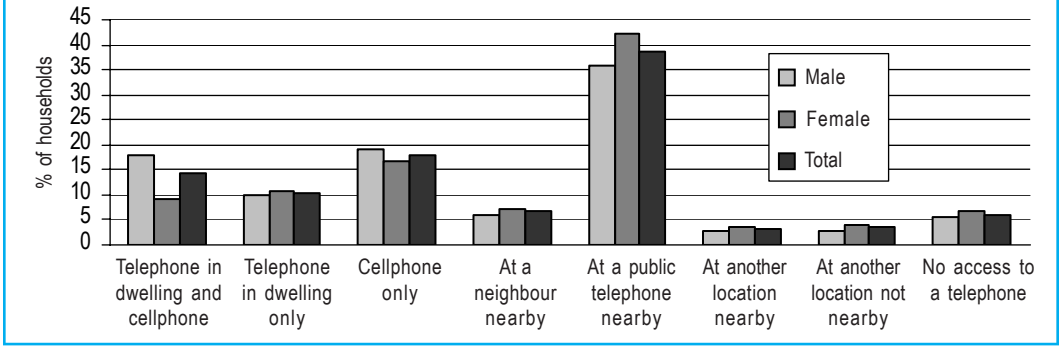
In the process of providing quantitative evidence for the magnitude, evolution and several other characteristics, the gender divide will be situated in the context of the overall digital divide, as measured by Infostates. Gender gaps must be viewed in conjunction with the overall situation of a country, and cannot be meaningfully analyzed independently. Moreover, as research in recent years has made clear, it is important that we place in perspective the entire range of ICTs, from older ones including basic telephony, radio and television, to the cell phone and the Internet. All of the above matter in the individual country context.

To get a clearer assessment of gender inequalities than has been possible to date, we draw on diverse data, where available, to piece together a detailed picture of ICT access and use by sex. While developing countries are of particular interest here, the gender divide is very much pertinent in the developed world too. This reality will be reflected in the use of statistical evidence to assess the gender divide and to gauge where we are and where we may be headed.

The case of South Africa, a leader in its continent, demonstrates well that even today in parts of the world having access to a telephone 'somewhere' is as much access as many can hope for (Chart 6.1). Public telephones were the predominant means of access for nearly 40% of household heads

in 2001. Women head of households were more likely than men to rely on such access (42% vs. 36%), as their access from home was limited. Men were twice as likely as women to have both a telephone and a cell phone in their dwelling. They were also more likely to have a cell phone as their only telephone facility.[104] A slightly higher proportion of women than men had no access to a telephone (7% of women vs. 5% of men). However, this was down substantially from the 24% of women and 15% of men with no access in 1996. South Africa has made some progress in the ease of access to telephone facilities, although a gender divide clearly persists.

Chart 6.1 **Access to telephone facilities by sex of the household head, South Africa, 2001**



Source: *Statistics South Africa, Census 2001*

Additional evidence of the harsh reality in many countries comes from Ethiopia. Within the context of a country with one of the lowest Infostates both in Africa and internationally, gender gaps are evident even among more traditional media - let alone newer ICTs. The vast majority of people have no regular exposure to media, and women more so than men. About half as many women as men listen to the radio or watch television at least once a week, a proportion that drops to less than one-third for reading newspapers.[105] A meagre 0.5% of women read a newspaper, listen to the radio and watch television at least once a week (Table 6.1). The predicament of older women is even worse.

Table 6.1 **Exposure to mass media by sex, Ethiopia, 2000**

	Reads a newspaper at least once a week	Watches television at least once a week	Listens to the radio at least once a week	All three media	No mass media
Male	6.0	7.5	23.8	2.3	72.6
Female	1.7	4.4	11.2	0.5	86.4

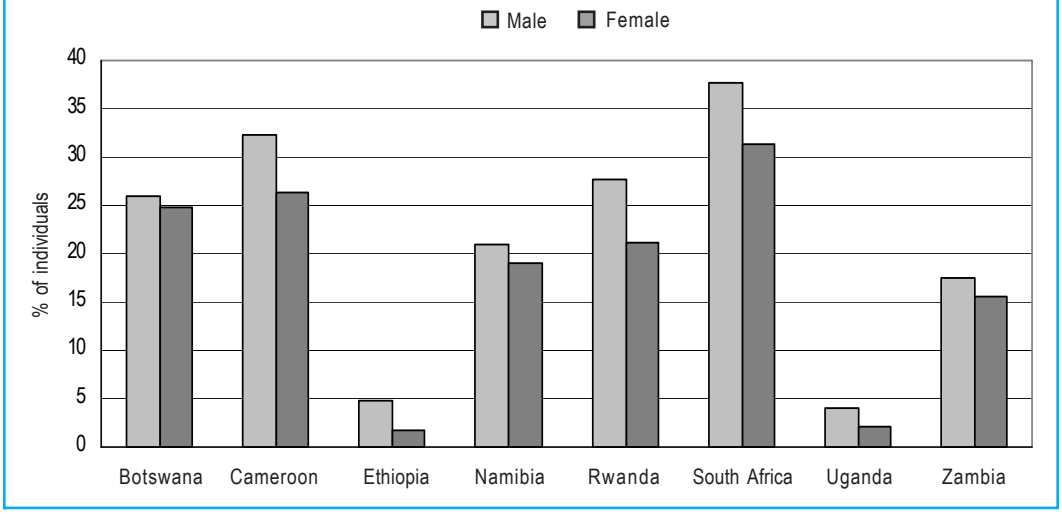
Source: *Central Statistical Authority of Ethiopia, Addis Ababa, Ethiopia Demographic and Health Survey 2000, May 2001*

Many studies have found that generally divides are larger among new ICTs with low penetration, decreasing gradually as penetration increases. Recent data on mobile phone penetration in eight African countries provide some support to this, but there are exceptions which begin to illustrate the complexities involved and the paramount importance of country-specific contexts. Chart 6.2 displays the distribution of mobile phone users by sex. The biggest gender gap is observed in Ethiopia, which has the lowest overall penetration, followed by Uganda. The gender gap is less pronounced in Zambia, Namibia and Botswana, which have a much higher overall penetration, but increases again in Rwanda, Cameroon and South Africa, which has the highest overall penetration rate (in excess of 30%).

[104] *Home access via mobile networks was proportionally higher than through fixed networks, which is more and more the case in many developing countries.*

[105] *However, it is important to analyse such data within an understanding of what are necessary means of mass communication in societies with oral traditions, which have policy implications.*

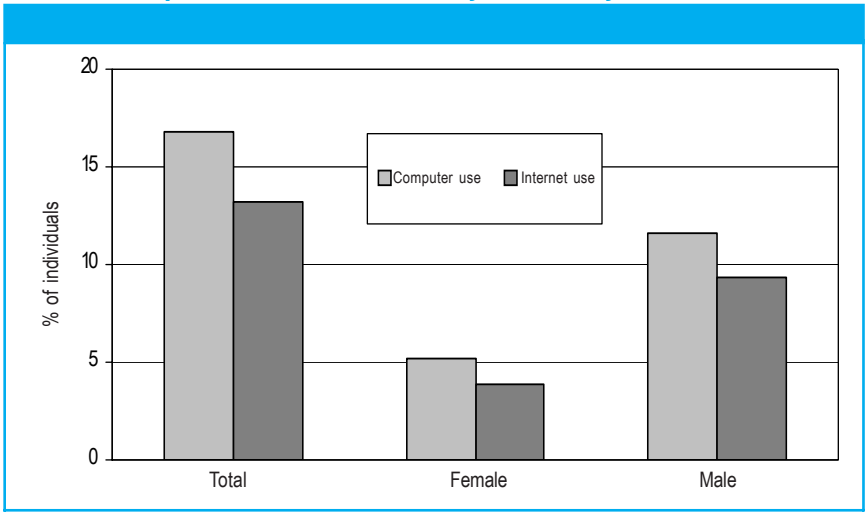
Chart 6.2 **Mobile penetration by sex, selected African countries, 2004**



Source: *Africa E-Access and Usage Index, Research ICT Africa! University of the Witwatersrand, Johannesburg, 2005*
Note: *unweighted data*

Recent data from Turkey, a country with relatively low computer and Internet use, begin to demonstrate the gender gaps that accompany the introduction of newer ICTs (Chart 6.3). Women are less likely than men to use these technologies. In many countries such gaps become dramatic, putting women at a significant disadvantage. For instance, less than 10% of the Internet users in Guinea and Djibouti are women, less than 20% in Nepal, and less than one-quarter in India. While overall penetration in these countries is low, equally large gender gaps are observed in countries with higher Internet penetration: women account for less than 20% of the Internet users in Greece and just over one-quarter in Portugal.

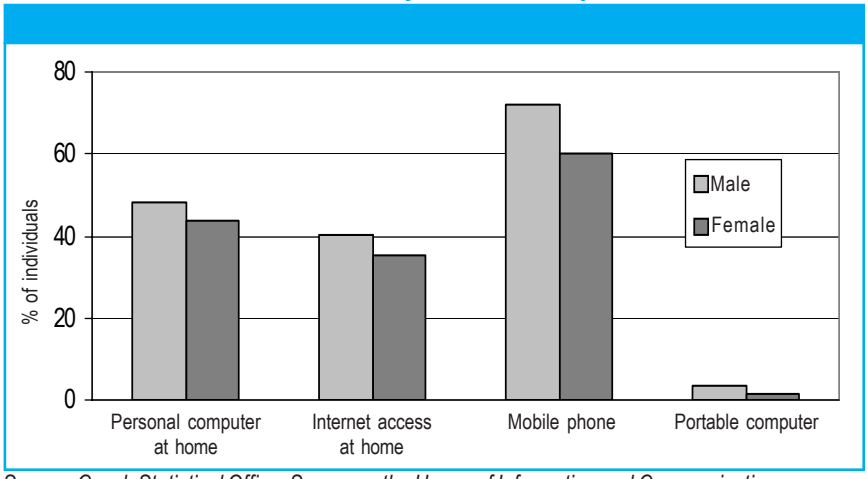
Chart 6.3 **Computer and Internet users by sex, Turkey, 2004**



Source: *State Institute of Statistics (Turkey), ICT Usage Survey on Household and Individuals 2004*
Note: *Survey reference period is April-June, 2004*

The gender divide persists as we move to countries with more developed Infostates. In China, despite substantial growth in Internet usage in recent years, women account for 40% of the Internet subscribers (compared to 60% for men). Of similar proportions is the gender gap in mobile phones in Malaysia, which reaches 22 percentage points, with men representing 61% and women 39% of mobile subscribers. In the Czech Republic, women lagged behind men in personal computers and Internet access (ICTs with medium overall penetration), but also in the use of mobile phones (where penetration is much higher - with 72% of men having access in 2003 compared to 60% of women) (Chart 6.4).

Chart 6.4 **Access to selected ICTs by sex, Czech Republic, 2003**



Source: *Czech Statistical Office, Survey on the Usage of Information and Communication Technologies in Households 2003*
Note: *Personal computer includes : desktop computer, portable computer and palmtop*

Data for Taiwan, an economy with a high Infostate, offer additional evidence of the gender divide in conjunction with the continuous evolution of technologies (Table 6.2). While gender gaps exist in all listed categories, they become progressively larger with the sophistication of ICTs. By 2004, Internet usage in Taiwan was quite high, broadband lower (but still quite high by international standards), while wireless Internet and Internet usage over mobile phones were at relatively early stages. The ratio of women Internet users to men was 93%, but this percentage dropped to 70% for mobile Internet users.

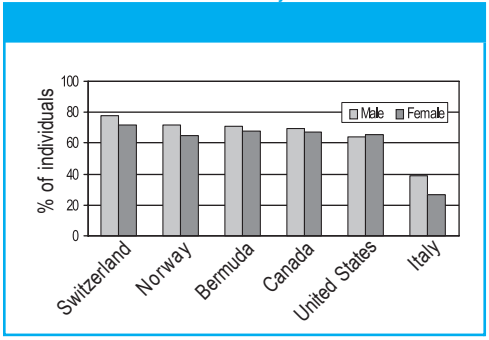
Table 6.2 **Selected ICT indicators by sex, Taiwan, 2004**

	Male	Female	female/male ratio
		%	
Internet users, age 12 and above	63.2	59.0	93.4
Broadband users, age 12 and above	52.1	45.8	87.8
Wireless Internet users	13.8	11.1	80.7
Mobile Internet users	6.7	4.7	70.3

Source: *Taiwan Network Information Center, Internet Broadband Usage in Taiwan, A Summary Report of The July Survey of 2004,* http://www.twnic.net.tw/file/broadbandsurvey0407.pdf
Note: *"Wireless Internet users" refers to access via wireless technologies and "Mobile Internet users refers" to access via mobile phones*

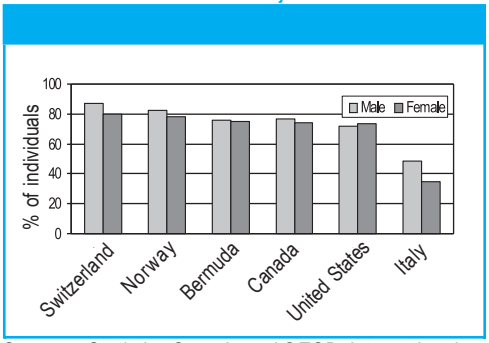
Recent results from a study of six countries (Statistics Canada and OECD 2005) are indicative of the progress women have made in some areas and countries, but also of the persistent nature of the gender divide even among developed nations. Charts 6.5 and 6.6 show that the gender gaps in computer and Internet access from home were generally small, with the exceptions of Italy and Switzerland. In fact, in the U.S. the proportions of women with access to these technologies were slightly higher than for men. Italy had the most substantial gender gap in computer and Internet access from home, with 35% of women vs. 48% of men, and 27% vs. 39%, respectively. The differences between men and women for Internet access are consistently higher than for computer access – with the exception of Italy; these findings are again generally consistent with a gender gap that increases with newer technologies.

Chart 6.5 **Home Internet access by sex, selected OECD countries, 2003**



Sources: *Statistics Canada and OECD, International Adult Literacy and Life Skills Survey 2005*

Chart 6.6 **Home computer access by sex, selected OECD countries, 2003**



Sources: *Statistics Canada and OECD, International Adult Literacy and Life Skills Survey 2005*

Similar results of moderate, yet persistent, gender gaps have come out of other countries with very high Infostates. In Australia women were not too far behind men, with 56% of women vs. 61% of men accessing the Internet in 2002. In Scandinavian countries too (Table 6.3), the gaps were generally small, but men's access was systematically higher than women's across countries and ICTs.

Compiling data on the proportion of female Internet users, together with overall Internet penetration rates, across a large number of developing and developed economies, makes it possible to take a more holistic look at the particular aspect of the gender digital divide associated with this new, powerful medium. These data are shown in Chart 6.7 by descending order of the proportion of female Internet users. They demonstrate that, with a few exceptions, the gender divide is large and widespread. They also show that generally the gender divide is more pronounced in developing economies – although there are exceptions.

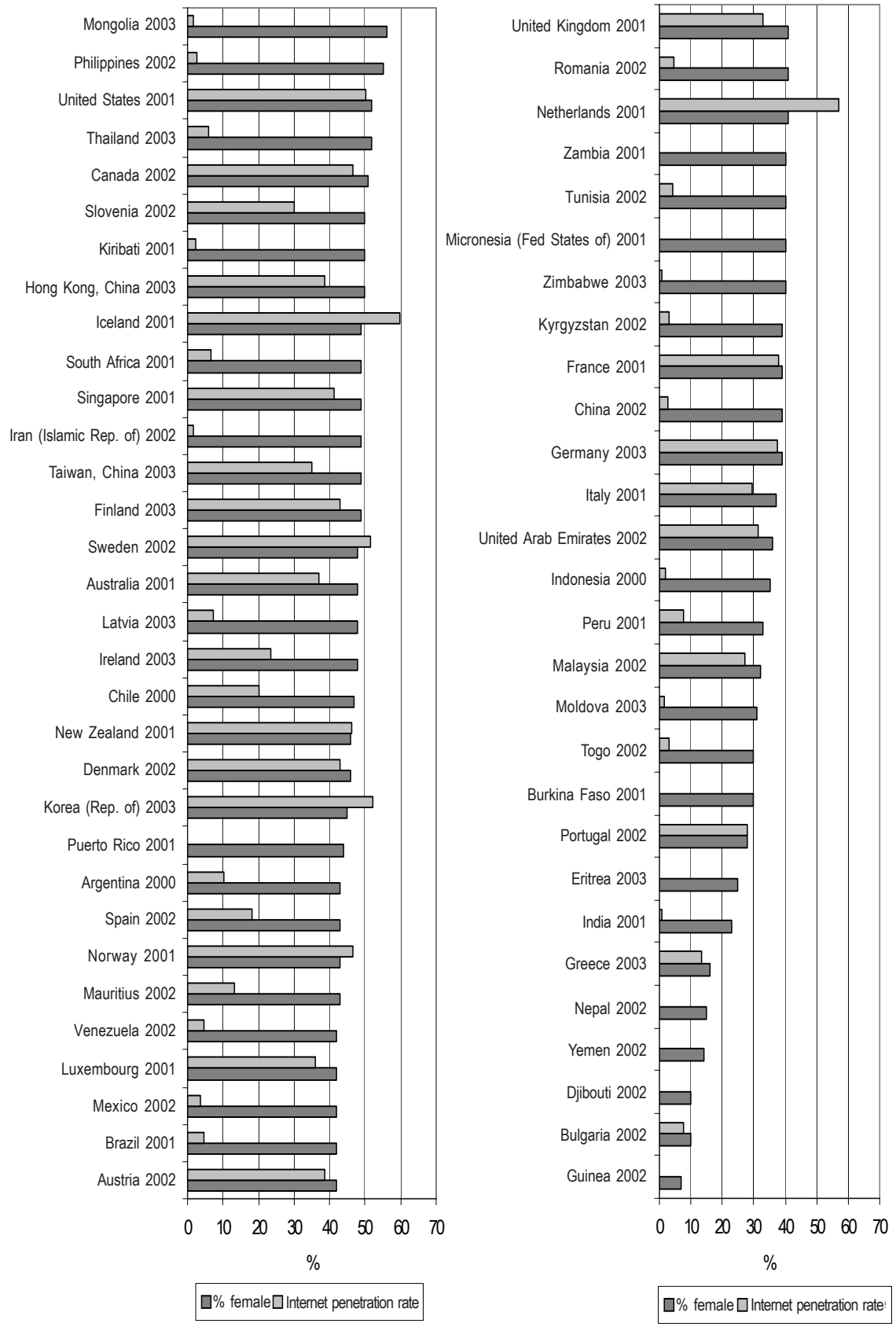
More importantly, this dataset offers the opportunity to contrast the gender digital divide with the overall digital divide, places in proper perspective earlier findings, as well as tests some hypotheses with policy relevance.These data serve as the backbone for the discussion that immediately follows.

Table 6.3 **Home access to ICTs by sex, selected Scandinavian countries, 2002**

	Computer				Mobile phone				Internet		
	Male	Female	female/male ratio		Male	Female	female/male ratio		Male	Female	female/male ratio
	%				%				%		
Denmark	80	75	93.8	Denmark	84	77	91.7	Denmark	65	58	89.2
Finland	64	62	96.9	Finland	95	92	96.8	Finland	55	51	92.7
								Iceland*	75	72	96.0
Sweden	77	74	96.1	Sweden	92	87	94.6	Sweden	69	66	95.7
Norway*	78	73	93.6	Norway*	94	91	96.8	Norway*	64	57	89.1

Source: *Statistics Norway, Nordic Information Society Statistics 2002*
** 2001 data*

Chart 6.7 **Female Internet use as a proportion of overall Internet penetration, selected economies and years**



Source: *ITU, World Telecommunication Indicators 2004 and selected national sources*

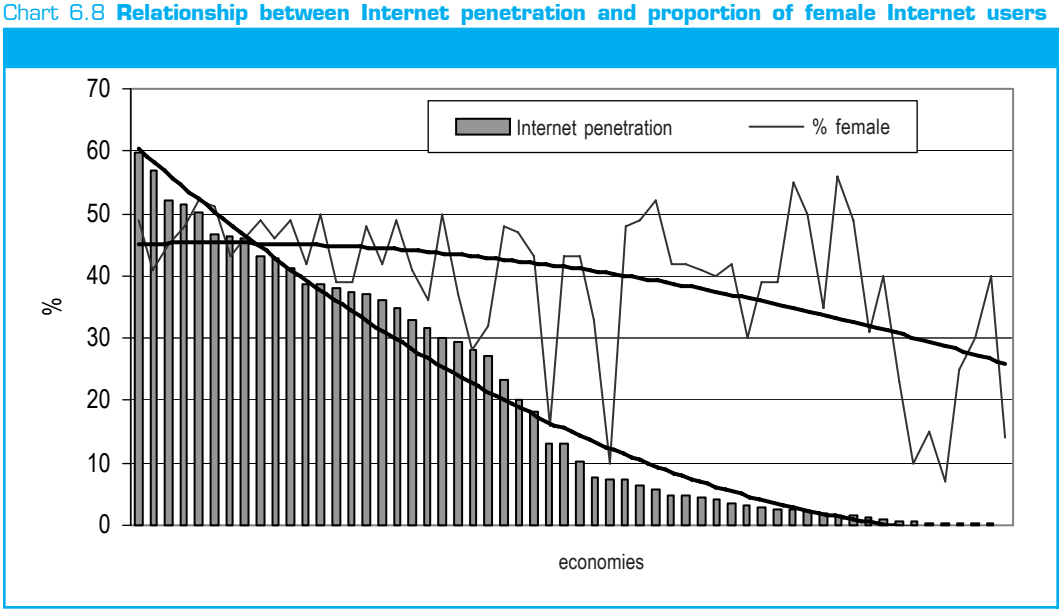
6.1.2 Relationship between the gender and the overall digital divide

Research on the digital divide, including Chapter 3 of this publication, has shown that diffusion and use of ICTs varies enormously worldwide, with generally higher penetration rates in developed than developing countries. There is also evidence that divides of all kinds, including gender, generally are larger among newer ICTs. In the case of the Internet, for example, it has been extensively documented that the stereotypical early users were young, educated, affluent males, living in urban centres. Only when Internet penetration reaches high levels does the profile of Internet users begin to resemble that of the population at large. The previous section established that the proportion of female ICT users also varies substantially by country. It is therefore worth investigating the relationship between the gender divide and the overall digital divide. In so doing, the analysis serves as a platform to cross-fertilize ongoing, broad-based research with specific research on gendered trends over the years.

If gender divides mirror the overall deployment and use of ICTs across economies, one would expect that countries with higher Infostates would have smaller gender gaps, and those with lower Infostates would have larger gender gaps. The policy implications of such a relationship, if it existed, would be significant. For instance, policies and actions undertaken to improve the diffusion and use of ICTs and help close the digital divide in general, would suffice to a large extent to close the gender divide too over time. This would run counter to voices that call for the specific targeting of the gender divide as an integral path to economic and social development.

A related question is whether the ICT evolution of developed economies and the evolution of their gender divides can be used as predictors for the future paths of developing economies. More detailed data, and of a time-series nature, would be required to take this on in subsequent research. But what follows addresses the former question with cross-sectional data, using the Internet as a case-study, both as a newer technology and because of the relative availability of data. The Internet penetration rates and the proportion of female Internet users from Chart 6.7 are re-arranged and plotted in descending order of Internet penetration in Chart 6.8 - without economy identifiers.

Chart 6.8 **Relationship between Internet penetration and proportion of female Internet users**



Source: *ITU, World Telecommunication Indicators 2004 and selected national sources*

The following observations become immediately obvious:

- Gaps in Internet penetration across countries are very large – the general issue of the digital divide
- The gender divide is clear: with a handful of exceptions, the proportion of female Internet users in the vast majority of countries is below the 50% line
- The trend line in the penetration of female Internet users is downward sloping; while this provides some support at a macro level that the gender divide moves in the same direction with the overall Internet penetration, clearly the relationship is very tenuous at best.

While the gender gap has recently vanished in a few countries with high Internet penetration, such as Canada and the U.S., this is not the case among other countries well-known for their high Infostates, such as Norway, Luxembourg, the U.K, the Netherlands, Germany and France. These countries behave differently, despite having overall penetration rates comparable to or even higher than those of the U.S. and Canada. Specifically, Norway has a penetration rate almost identical to Canada's, but women Internet users represent 43% compared to Canada's 51%. Moreover, the 40% female Internet users in the Netherlands was identical to that for Brazil, Mexico, Zimbabwe and Tunisia despite the fact that the overall penetration rate in the Netherlands approaches 60%, whereas those of Brazil and Mexico are less than 5%, and in Zimbabwe it is virtually non-existent. Italy's gender gap is not significantly smaller than Kyrgyzstan's despite the fact that the latter's Internet penetration rate is about one-tenth that of Italy's.

At the same time, we also see a number of countries with very low overall penetration that, within this context, do not seem to experience a gender divide. In the case of Mongolia, the Philippines and Thailand, female penetration exceeds male. The gender gap in Iran and South Africa is very small. On the other hand, several countries with low overall penetration rates have very high gender gaps; this is the case of Guinea (with less than 10% female), Djibouti, Yemen, Nepal and India. Still, the situation is not clear-cut between developing and developed countries either; Greece and Portugal are both fairly close to the bottom of Chart 6.7, whereas Mongolia and the Philippines are at the top.

What this statistical analysis establishes is that: a gender divide exists even in countries with high Infostates; in countries with high Infostates the gender divide tends to be generally smaller, but this is not always the case; in countries with low Infostates the gender divide can range substantially (from over 50% to less than 10% in the case of the Internet). ***The relationship between the gender divide and the overall digital divide is very tenuous and does not support the argument that the two move in tandem.*** Thus, the gender divide cannot be simplistically expected to improve as overall Infostates improve. Clearly, there are factors at play other than those associated with overall Infostate development. Even starting with these two dimensions alone - high/low Infostates and larger/smaller gender divides - distinct groups of countries can be delineated and examined in more detail in future research. This can become more complex if additional variables are brought in, such as income, regional characteristics, cultural influences, etc. As was shown in Chapter 4, for example, while there is a relationship between Infostates and per capita GDP, that too is subject to important exceptions - with high income countries having relatively low Infostates and vice versa. Moreover, the issue of individual ICTs in the context of development is very relevant too - as evidenced by headline stories on the leapfrogging to mobile networks, the greater importance of radio in many places, or the need to tailor ICTs to specific needs.

All in all, the importance of the specific country context in the gender divide is supported strongly by the preceding analysis. While it is not possible here to analyze each country individually, we use case studies and qualitative evidence to explain some of the findings. For example, evidence indicates that in countries with low Internet penetration rates, Internet usage is often confined to a very small, largely urban elite. Women tend to have fairly equal status with men in these circles, which can be quite global and cosmopolitan. Mongolia is one of the Asian countries with higher female tertiary level enrolment rates for women than men. That may influence the high percentage of women using the Internet. In the Philippines, the operative language is English, so content is accessible and women are very active in both politics and economic life. Iran has a high rate of female tertiary education and a well-connected (electronically and by other means) upper class. Thailand also has many women in tertiary level education and strong policies encouraging women in science and technology. Such qualitative issues will be dealt with more fully later in this chapter.

6.1.3 Location of use

An additional dimension of the gender divide is from where women access and use ICTs. Data from a number of EU countries and Turkey (Table 6.4) support some interesting observations. In this group of countries, the home was the prominent location of Internet access for both men and women. Access from work was not far behind, and indeed it was higher than home access in Latvia, Lithuania and Turkey. Access from school was considerably smaller among countries with high rates from home and work, whereas access from Internet cafés was very low.

Table 6.4 **Access to Internet from various locations by sex, selected countries, 2004***

	HOME			WORK			SCHOOL			INTERNET CAFÉ		
	female	male	female/ male ratio	female	male	female/ male ratio	female	male	female/ male ratio	female	male	female/ male ratio
	%			%			%			%		
Denmark	65	71	91.5	53	54	98.1	14	10	140.0	-	-	-
Sweden	68	71	95.8	34	40	85.0	12	11	109.1	-	-	-
Luxembourg	50	68	73.5	18	35	51.4	6	8	75.0	1	3	33.3
Iceland	64	66	97.0	39	44	88.6	14	11	127.3	-	-	-
Germany	48	57	84.2	15	21	71.4	8	9	88.9	2	3	66.7
United Kingdom	47	55	85.5	26	33	78.8	11	10	110.0	3	7	42.9
Finland	46	52	88.5	37	37	100.0	18	14	128.6	3	4	75.0
Austria	33	42	78.6	19	29	65.5	6	5	120.0	0	1	0.0
Estonia	31	33	93.9	20	21	95.2	14	10	140.0	5	5	100.0
Slovenia	24	28	85.7	20	20	100.0	8	8	100.0	-	-	-
Cyprus	18	27	66.7	13	15	86.7	5	6	83.3	1	5	20.0
Italy	17	26	65.4	11	18	61.1	4	4	100.0	-		-
Ireland	21	24	87.5	14	15	93.3	5	5	100.0	1	1	100.0
Portugal	14	20	70.0	13	16	81.3	8	7	114.3	-	-	-
Hungary	12	17	70.6	9	11	81.8	7	7	100.0	2	3	66.7
Poland	14	16	87.5	9	9	100.0	8	8	100.0	5	6	83.3
Greece	9	15	60.0	7	11	63.6	4	4	100.0	2	2	100.0
Latvia	9	13	69.2	18	16	112.5	7	6	116.7	4	6	66.7
Lithuania	10	12	83.3	13	12	108.3	12	11	109.1	-	-	-
Turkey	3	5	60.0	3	8	37.5	1	1	100.0	2	9	22.2

Source: *Eurostat, NewCronos Database 2004*

** Refers to access in the last 3 months*

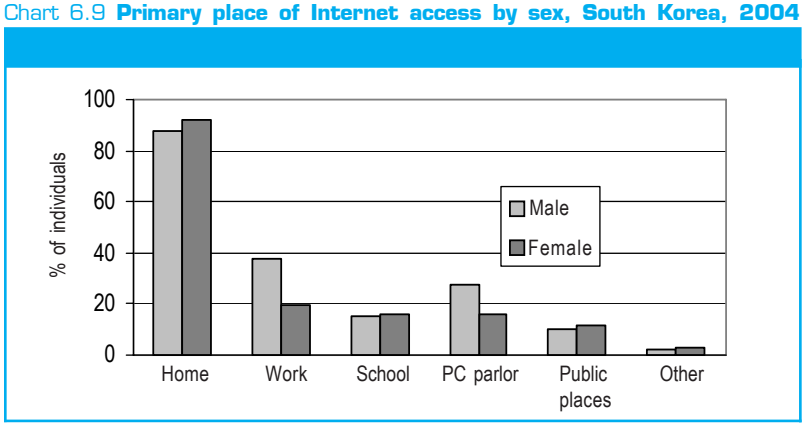
The gender divide was prominent for both home and work locations, but findings were subject to variations. Among countries with high Internet penetration, Luxembourg had the largest gender gap from home, coupled with an even larger gap from work - with women's rate at just over half of men's. This may be partially explained by the relatively low rate of female labour force participation - just 59.3% in 2001. Among other countries with severe gaps in home access (Turkey, Greece, Italy, Cyprus, Latvia, Portugal, Hungary),

only Turkey and Italy had a bigger gap from work. The gender gap improves slightly in Greece, more in Portugal and Hungary (where the female/male ratio improves by more than 10 points), and much more in Cyprus (where the female/male ratio improves by more than 20 points). The gap is reversed in Latvia and Lithuania, while Poland and Finland have gender parity.

A larger or equal proportion of females than males accessed the Internet from school in all countries, except for Cyprus, Germany and especially Luxembourg, which shows another big gap. Use rates were generally very small from Internet cafés in this particular group of countries, but with the exception of Ireland, Greece and Estonia, gender gaps appear to be very large. Relative to other locations, for example, Cyprus and Turkey have relatively high use rates among men. This is likely due to social and cultural practices with respect to women in public places. (These factors will be addressed in section 6.2).

A slightly different picture emerges from South Korea (Chart 6.9). Internet access is very high from home, where women's rate exceeds men's. Women are also ahead in schools and public places, locations with much lower usage.[106] Women lag behind men only with respect to the work and PC parlour locations.[107] This concurs with the relatively low proportion of women who are economically active in the country.

Chart 6.9 **Primary place of Internet access by sex, South Korea, 2004**



Source: *Ministry of Information and Communication, National Internet Development Agency of Korea (NIDA), Survey on the Computer and Internet Usage 2004*

This example points again to peculiarities from country to country, which relate not only to the available access options, but to labour force participation, government policies, socio-cultural norms and numerous other factors. Typically, the availability of access in locations other than the home have been perceived as equalizing forces for several aspects of the digital divide at large. While this is true in developed countries as well, in many developing countries alternative locations, especially public places, offer the main (if not the only) means of access. Generally, women have problems in access from such locations too – the more detailed discussion of which is deferred again to section 6.2.

6.1.4 Patterns of use

Documenting the extent to which women access and use ICTs is only a first step to understanding the gender digital divide. To take the analysis a step further, we ask whether women use new technologies differently than men. In so doing, we examine statistical evidence related to

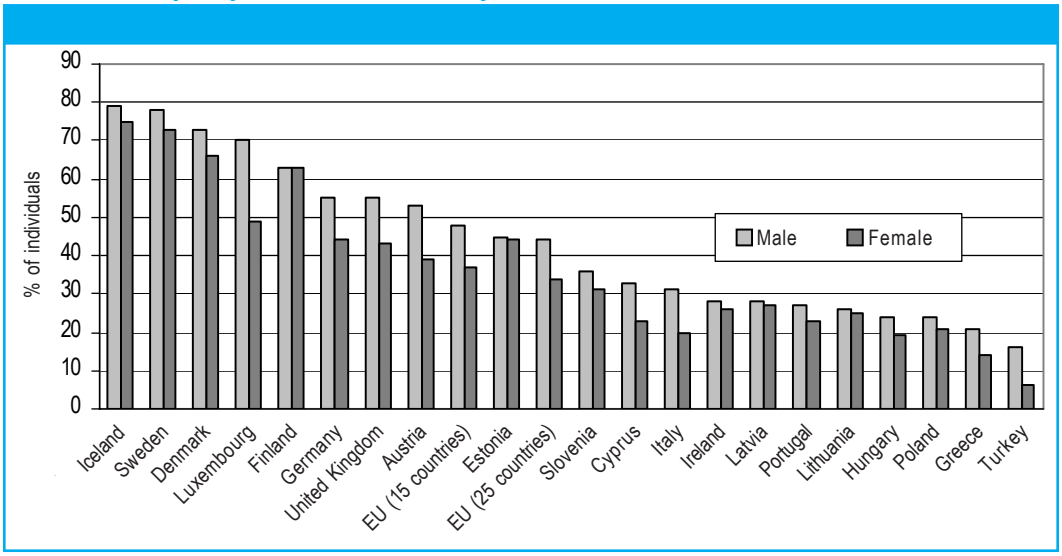
[106] *The South Korean government, through a special education program geared specifically to women, offered ICT training to a million housewives, unemployed women, and elementary school students between 2001 and 2003. The government then mounted a second program to train two million women (Lee 2003).*

[107] *PC parlours are a combination of Internet cafés and gaming centres. They are popular meeting places for socialization.*

the frequency, intensity and diversity of use, as well as the types and reasons of such use. Obviously, women do not behave as a monolithic group, and factors such as class, socioeconomic status, education and age will also affect use. Additionally, use depends on the various roles and multiple responsibilities women take on in their daily lives. For instance, shoppers may well be looking for bargains, while mothers may want to screen and monitor sites visited by their kids. Information at this level of detail is drawn from a large number of sources, and it is not possible to present a comprehensive statistical portrait. Nevertheless, the available data unveil some potentially important issues worthy of understanding in the context of the gender digital divide.

In addition to the gaps in access to and use of ICTs, gender gaps appear to extend to the frequency of use. Women fall short of men in accessing the Internet at least once a week in a large number of European countries (Chart 6.10). These gaps are not unlike those found in overall Internet access. Luxembourg, where less than half of the women accessed the Internet at least weekly, registers the largest gap, followed by Austria, the U.K., Germany and Italy. By contrast, such gaps are very small in the Baltic countries (Estonia, Latvia and Lithuania), while there is no difference between men and women in Finland.

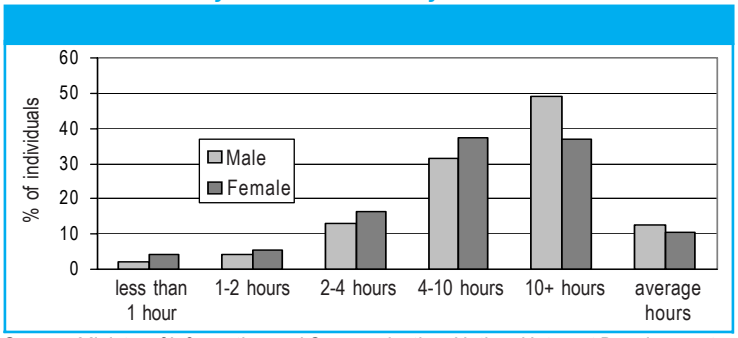
Chart 6.10 **Frequency of Internet access by sex, selected countries, 2004***



Source: *Eurostat, NewCronos Database 2004*
** accessing at least once a week*

On average, men also seem to spend more time accessing the Internet than women (Chart 6.11). Data from South Korea indicate that about 37% of women spent more than 10 hours per week, compared to 50% of men. In marked contrast, the proportions of women spending lesser amounts of time exceeds that of men in all other categories.

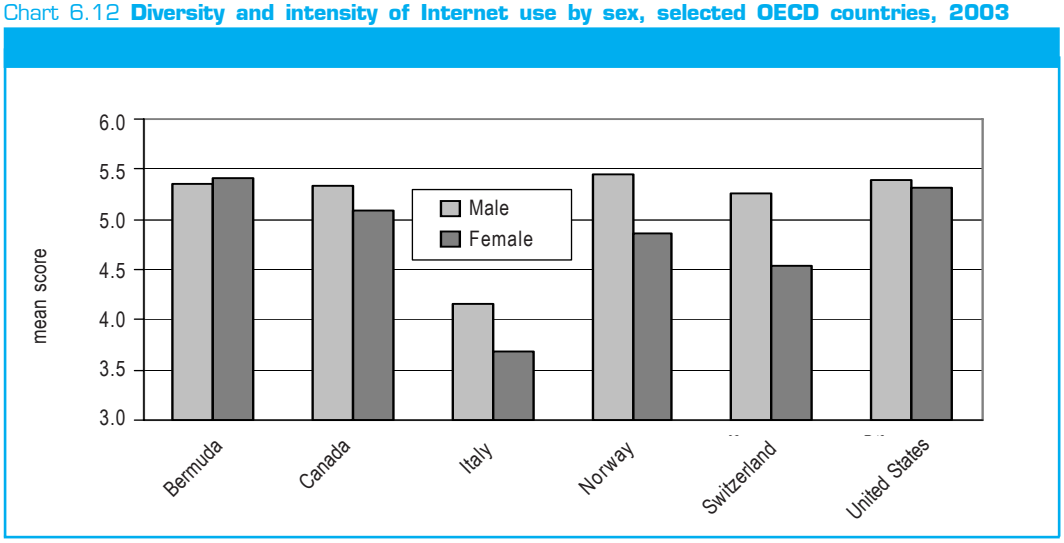
Chart 6.11 **Intensity of Internet use by sex, South Korea, 2004***



Source: *Ministry of Information and Communication, National Internet Development Agency of Korea (NIDA), Survey on the Computer and Internet Usage 2004*
** Average weekly use time*

More detailed data were used to construct a measure for *diversity and intensity of Internet use*[108] among six countries (Chart 6.12). The gender gap is again evident, with women in most countries scoring lower than men, with the exception of Bermuda. Clearly, the extent of these gaps differs by country. Italy, Norway and Switzerland recorded the biggest gender gaps, whereas the difference was very small in the U.S.

Chart 6.12 **Diversity and intensity of Internet use by sex, selected OECD countries, 2003**



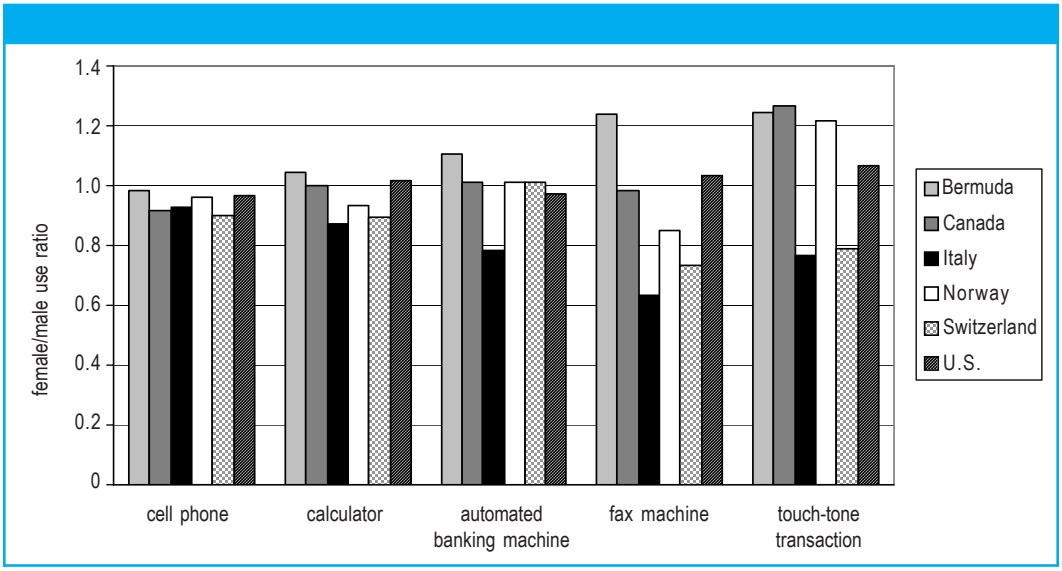
Source: *Statistics Canada and OECD, International Adult Literacy and Life Skills Survey 2005*

Similar findings with respect to the gender gap emerge from data on a measure of the *use of computers for task-oriented purposes*. However, women ranked close to, or higher than, men in scores for a measure of *perceived usefulness and attitudes towards computers*. Perceived usefulness, of course, is not independent of overall use and familiarity. The more people use ICTs, the more useful they tend to consider them – even indispensable; non-users have less appreciation for their benefits.

Data from the same source also provide evidence for sizeable gaps among men and women in the use of various technologies and related activities across countries. The female/male use ratios for each were computed and plotted for all countries in Chart 6.13 (a ratio of less than one indicates lower usage by women). These results show variations by ICT or activity, but the differences between the countries studied are even greater. For instance, in Italy women's use of all ICTs was significantly lower than men's – with the gap being proportionately smaller in the use of cell phones (where women's use was lower in all countries). The situation was similar in Switzerland, with the exception of automated banking, where women's use was comparable to men's. With the exception of cell phones, though, Bermuda once again had a higher proportion of women than men using each type of ICT. Higher female/male ratios were also the case in the U.S. for the use of touch-tone transactions, fax machines and calculators, albeit proportionately lower than in Bermuda.

[108] *This index is based on a variety of uses, including e-mail, chat groups, shopping, banking, music downloads, searches for various types of information, playing games and general browsing. The index on the use of computers for task-oriented purposes is based on writing or editing text, using spreadsheets for accounts or statistical analysis, creating graphics, designs, pictures or presentations, programming or writing computer code, keeping a schedule or calendar and using a CD-ROM or DVD. The index of perceived usefulness and attitude toward computers is based on respondents' self-assessment as to whether computers have made it possible/helped to: get more done in less time, obtain useful information more easily, learn new skills other than computer skills, communicate with people, and reach career goals. (For more details see Statistics Canada and OECD 2005).*

Chart 6.13 **Use of selected ICTs, selected OECD countries, 2003**



Sources: *Statistics Canada and OECD, International Adult Literacy and Life Skills Survey 2005*

Additional data regarding detailed types of Internet use were compiled from independent national sources (Table 6.5). Gender gaps differ even across such a small sample of countries. Men tend to use the Internet more than women for most types of activities, such as searching for information, accessing news sites and playing games – although this appears to be less the case in South Korea than in the other countries. Women were much more likely than men to use the Internet to search for or use health and medical information or services. This is the case in Canada (with high Internet usage), Malta (with medium Internet usage) and the Czech Republic (low Internet usage).

Table 6.5 **Access to Internet from various locations by sex, selected countries, 2004***

	Canada (2000)			Korea (2004)			Malta (2002)			Czech Republic (2003)		
	female	male	female/ male ratio	female	male	female/ male ratio	female	male	female/ male ratio	female	male	female/ male ratio
	%			%			%			%		
Search for information on goods and services	70	79	88.6	72	75	96.0	54	76	71.1	54	55	98.2
Access online news sites	48	62	77.4	13	19	68.4	45	54	83.3	29	34	85.3
Search for/use health and medical information/services	52	41	126.8	-	-	-	38	25	152.0	12	5	240.0
Access information on gov't programs or services	37	44	84.1	-	-	-	32	44	72.7	11	13	84.6
Play games(1)	33	38	86.8	48	59	81.4	44	48	91.7	23	37	62.2
Use online chat services(2)	28	32	87.5	17	14	121.4	37	34	108.8	18	28	64.3
Purchase goods or services	19	28	67.9	22	9	244.4	11	17	64.7	8	12	66.7
Electronic banking	19	26	73.1	8	8	100.0	6	13	46.2	10	14	71.4
E-mail	-	-	-	88	85	103.5	89	92	96.7	81	82	98.8
Learning	-	-	-	16	11	145.5	51	52	98.1	3	3	100.0

Sources: *(Canada) Statistics Canada, General Social Survey, cycle 14 2000;*
(South Korea) Ministry of Information and Communication, National Internet Development Agency of Korea, Survey on the Computer and Internet Usage, September 2004; (Malta) National Statistics Office, Survey on ICT Usage in Households in Malta 2002; (Czech Republic) Czech Statistical Office, Survey on the Usage of ICT in Households 2003

Notes: *(1) Malta and Czech Republic included music with playing games.*
(2) Czech Republic includes videoconferencing and ICQ.

Another important observation from this sample of countries is that e-mail use was large and fairly gender-equitable. The evidence on gender differences in e-commerce activities is mixed. In Canada, Malta and the Czech Republic more men than women purchased goods and services online. However, the situation was reversed in South Korea, where women out-numbered men by a substantial margin. Online shopping, with or without online payment, depends on people's overall usage and history of usage, which confers a degree of familiarity and increased comfort with the new medium. Even then, early purchases tend to be associated with small-ticket items. In the Czech Republic, the gender gap should be placed in the perspective that in 2003 only about 4.5 percent of the population aged 15 and over had ever purchased something over the Internet. Among Internet users only, men out-shopped women (15.8% vs. 10%). Regardless of sex, books, magazines or textbooks were purchased more often, followed by purchases of electronic equipment among men, whereas clothing and sports goods came second for women. When it comes to paying for goods purchased online, men and women in the Czech Republic use similar methods, with over half paying cash on delivery. Women were somewhat less likely to pay with a bank transfer (22% vs. 29% of men).

Reasons for using the Internet can also vary between women and men depending on various social, economic and demographic characteristics. For example, in the U.S. 29% of women with children said they used the Internet to play games online, and 40% used it to do research for school and homework-related projects (Jupiter Media Metrix 2002). In addition, 44% of women with children indicated that their Internet usage caused them to spend less time watching television. By comparison, women without children are even heavier users of the Internet and also tend to use it differently. They are more likely to make travel arrangements, conduct research for work and read the news online.

Despite the lack of comprehensive data on types of Internet use, some important issues for the gender digital divide have been raised through selective use of available data. In general, men tend to use ICTs more frequently, spend more time, and engage in more diverse uses than women. To understand why this is the case, it will be important to understand the extent to which women use ICTs less because of gendered social and cultural expectations (see section 6.2). It will also be important to factor in the different involvement of men and women in the conceptualization, design and implementation of ICT applications.

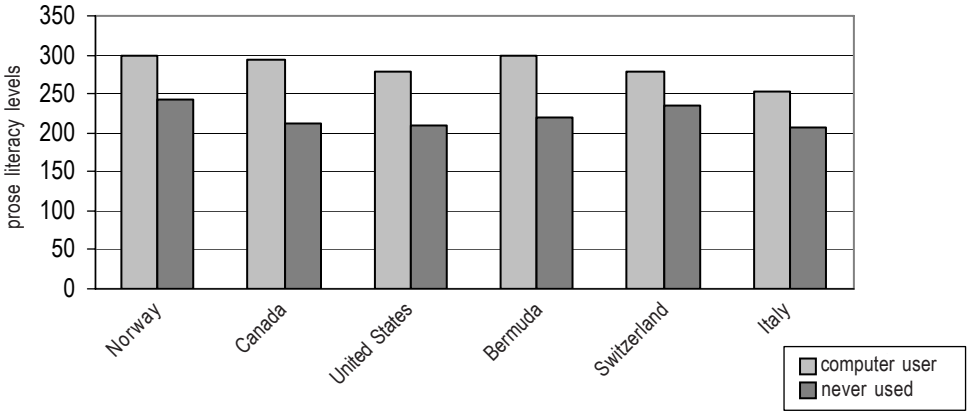
6.1.5 ICT literacy, education and skills

A significant question related to the gender digital divide is whether women have the education and training required to use ICTs effectively. How do they compare to men in this regard? One measure of this is the extent to which women have access to ICT education; at a more fundamental level, gender differences in literacy rates provide a sense of how truly "accessible" some ICTs are, particularly the Internet. Of the many possible programs and initiatives to bring about gender digital equality, clearly education and training rank very high as a priority. Here, we bring together information on literacy and education to put the gender digital divide into a clearer perspective.

Chart 6.14 sets the stage by showing the relationship between higher prose literacy[109] and computer use. Consistent with general research findings concerning the use of ICTs, women computer users consistently had higher prose levels than women who had never used a computer. Thus, use increases with literacy.

[109] *Prose literacy is defined as the knowledge and skills needed to understand and use information from texts such as editorials, news stories, poems, and fiction (Statistics Canada and OECD 2005).*

Chart 6.14 **Computer use by female prose literacy levels, selected OECD countries, 2003**



Source: *Statistics Canada and OECD, International Adult Literacy and Life Skills Survey 2005*

More detailed evidence on the influence of education is shown in Table 6.6. Clearly, the proportions of computer and Internet users in Turkey increase significantly among groups of people with progressively higher levels of education, regardless of sex. Low rates of usage among people with only primary school education increase noticeably among those with secondary and high school education and become significant among university graduates. Moreover, the gender divide tends to narrow at higher levels of education. Even within this context, however, the gender gap remains intact, with women having lower rates of usage at each and every level of education. This indicates that while education exerts a powerful influence on ICT usage, other factors are at work too, including those associated with the transition from school to the workplace.

Table 6.6 **Computer and Internet use by sex and level of education, Turkey, 2004**

	Total number of individuals .000	Computer use Total	Computer use Female	Computer use Male	Internet use Total	Internet use Female	Internet use Male
		%			%		
Literate without a diploma	7,188	0.9	0.3	0.7	0.7	0.2	0.5
Primary school	21,135	2.2	0.4	1.8	1.3	0.2	1.1
Secondary school and vocational school at secondary school level	6,156	24.1	6.0	18.1	17.6	3.6	14.0
High school	8,992	37.8	11.7	26.2	29.8	8.3	21.6
University/Master/Doctorate	3,567	69.7	26.2	43.5	60.1	22.6	37.4

Source: *State Institute of Statistics (Turkey), ICT Usage Survey on Household and Individuals 2004*
Note: *Survey reference period is April-June, 2004*

Patterns of ICT use associated with tertiary education differ significantly from those associated with literacy without a diploma and low levels of education. Women's literacy rates are lower than men's in the majority of countries, but the countries with the largest gaps in literacy do not necessarily have the largest gender gap in tertiary education enrolments. For example, in Libya, where the percentage of literate women is 20 points below men, almost twice as many of the students enrolled in tertiary education are women. In Botswana, where a higher percentage of women than men are literate, women's enrolment in tertiary education is 80% of men's. Botswana is quite rich by sub-Saharan African standards, so the country's wealth may well account for the absence of a gender gap in literacy.

Since literacy rates reflect the total population – usually predominantly rural, poor, and more heavily female in most developing countries – they can be quite low, while at the same time the female representation in tertiary education can be high. However, the tertiary education "pool" is a very small pool in most countries. Those who do reach that level are usually from heavily urban and generally far wealthier regions than the population as a whole. It is often a question of class differences; so that the majority of the population with few resources dominate the low literacy rates, but for those who can afford higher education there tends to be little resistance to the idea of tertiary education for girls. Different factors come into play in determining who proceeds to tertiary education – among them class, race or ethnic group, employment opportunities, marriage, government policy and cultural attributes.

While it is not possible in this report to examine the specific relationship between the gender digital divide and literacy and education in every country, some examples are offered to illustrate cases where specific elements of the gender gap can be explained.

- South Africa: The country's Internet penetration rate was quite low in 2001, at less than 10%, yet of those using it almost half were women, up from 17% in 1997. Women's literacy rate was about 4 percentage points lower than men's, but their proportion of enrolment in tertiary education was higher than men's.

- Bulgaria: Again, the Internet penetration rate was low, at less than 10%, but here the percentage of female users was also low, at only about 10% of Internet users. Nevertheless, literacy rates for men and women are close to equal, and women's enrolment in tertiary education is slightly higher than men's. In this case, education does not adequately explain the gender digital divide. A recent study found that female economic participation rates have been falling over the last decade, and that state-run programs to facilitate women in acquiring qualifications and re-integrating into the labour market rarely include training related to technology.

- Mongolia: This is another country with a very low Internet penetration rate, at 2%. Nevertheless, it had the highest proportion of female Internet users among the countries for which data were obtained. Literacy rates for men and women are about equal and women's enrolment in tertiary education is much higher than men's (1.5 times). As discussed earlier, in this case the few Internet users found are among the educated elite, where gender gaps tend to be smaller.

- Yemen: The low Internet penetration rate and the small proportion of women Internet users (14%) can be attributed to a number of social and economic factors, including the high illiteracy rate among adult women (75% compared with 32.5% of men). In fact, illiteracy is one of the primary obstacles for not using the Internet among 27% of the non-users (Noman 2002). Moreover, most Internet use in Yemen is either at the desks of professional and administrative employees in relatively large offices, where few women are found, or in cybercafés, where cultural constraints make it very difficult for women to frequent.

While literacy and education are surely important for many types of ICT use, they belong to a very long list of determinants, including a host of general and country- or technology-specific factors. Education and training specifically related to ICTs provides an interesting linkage to ICT use. As shown in Table 6.7, more than one-quarter of individuals in the Czech Republic had some ICT training at some point, while about 10% did so in 2003. Women exceeded men, consistent with their higher use. Nearly two-thirds of women who had ever used a PC reported having taken training related to computer use, while this was the case for just over half the men. Formal ICT training is a very important, but not the only, way to obtain digital literacy necessary to function in an Information Society. Digital literacy, in turn, is a broad and evolving concept and belongs to the continuum that includes basic literacy.

Table 6.7 **Computer training by sex, Czech Republic, 2003**

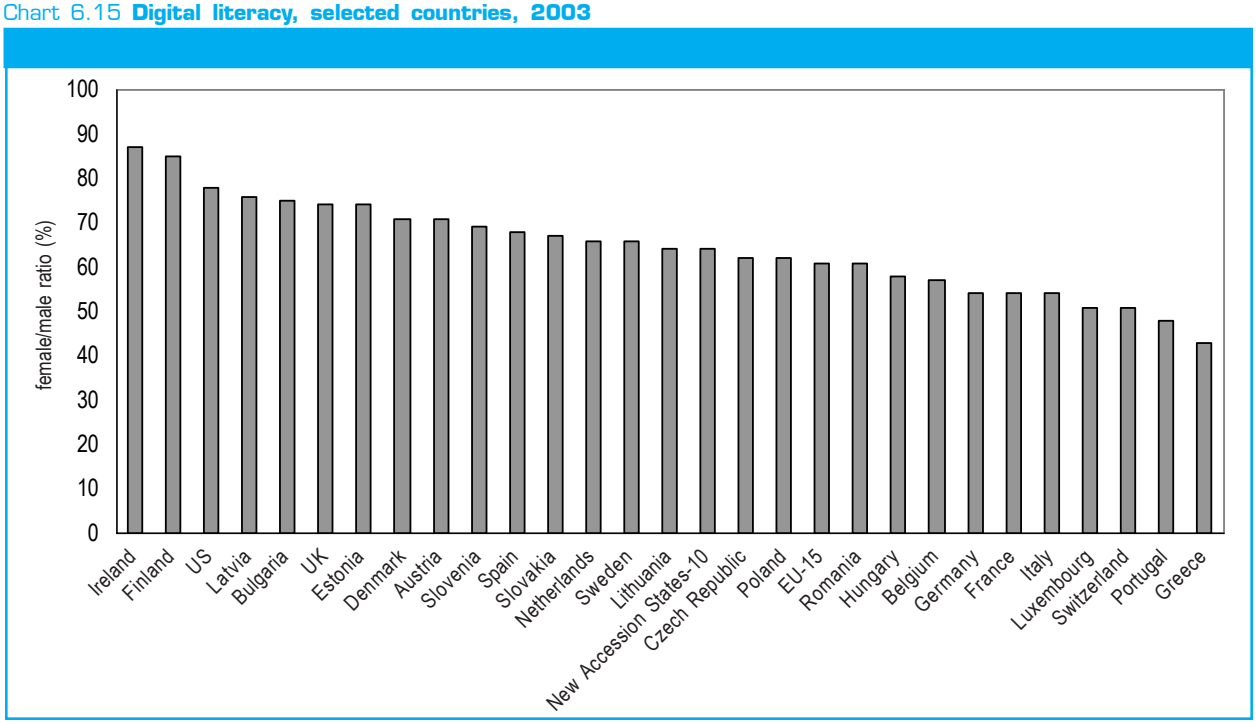
	Individuals 15+	Individuals who have ever taken any training course related to computer use			Individuals who have taken any training course related to computer use in 2003		
	.000	.000	%*	%**	.000	%*	%**
Total 15+	**8,659**	**2,358**	**27.2**	**59.1**	**852**	**9.8**	**21.3**
Males	4,178	1,077	25.8	53.2	402	9.6	19.9
Females	4,480	1,282	28.6	65.1	449	10.0	22.8

Source: *Czech Statistical Office, Survey on the Usage of ICT in Households 2003*
** % of individuals aged 15+*
*** % of individuals who have ever used a personal computer*

Digital Literacy

Looking beyond formal education, in a group of EU and other countries, most with a fairly high Internet penetration, women score lower than men on a digital literacy score. This score combines four types of skills: communicating with others by e-mail or other online methods; obtaining or downloading and installing software on a computer; questioning the source of information on the Internet; and, searching for required information using search engines. Women in Ireland rank closest to men in digital literacy, but still fall short by 13 percentage points (Chart 6.15). These digital literacy scores range from 0 to 3, with Ireland falling in the mid range of country scores with a value of 1 for men and 0.9 for women. The highest levels of digital literacy for men and women are in Denmark and the U.S. at 1.7 for men and 1.2 and 1.3 for women, respectively.

Chart 6.15 **Digital literacy, selected countries, 2003**



Source: *SIBIS Pocket Book 2002/03, GPS 2002 survey and GPS-NAS 2003 survey,* http://www.sibis-eu.org

Gender Digital Divide in Francophone West Africa: A Harsh Reality

Pioneering fieldwork in measuring the gender digital divide was recently completed in six countries: Benin, Burkina Faso, Cameroon, Mali, Mauritania, and Senegal. The Gender and ICT Network (Régentic), sponsored by the Canadian International Development Research Centre (IDRC), undertook the project based on a survey of use of computers, the Internet and cell phones.

The methodology: A sample survey of approximately 6,750 individuals and 380 institutions was carried out during the fourth quarter of 2004. The individuals' sample was stratified to be representative of the population distribution by sex, age and place of residence. It covered only those areas that were served by ICTs, and was 63% urban, 18% semi-urban and 19% rural. Because of the emphasis on use, individuals with more education were overrepresented: 52% were at secondary level and 29% had reached higher levels. The survey collected data on 18 variables grouped under four main indicator headings – connectivity, skills, content and decision-making (for details see Régentic 2005: *http://www.famafrique.org/regentic/indifrect/fracturenumeriquedegenre.pdf*).

Key findings: The existence of an overall gender digital divide, as captured by a composite indicator (0.64), is demonstrated by the finding that women have 36% fewer ICT– related opportunities and benefits than men in the countries surveyed. However, the summary index masks some big disparities, both across indicators and countries.

2004	All	Benin	Burkina Faso	Cameroon	Mali	Mauritania	Senegal
Connectivity	0.88	0.84	0.89	0.94	0.94	0.88	0.81
Skills	0.70	0.65	0.67	0.97	0.64	0.63	0.73
Content	0.62	0.62	0.61	0.62	0.69	0.61	0.64
Decision-making	0.34	0.22	0.54	0.33	0.48	0.22	0.52
Gender digital divide	**0.64**	**0.58**	**0.70**	**0.71**	**0.69**	**0.59**	**0.67**

- Generally, the gender gap in connectivity is smaller than in skills and content. The largest gap was in decision-making, where women's chances to participate were one-third of men's. The major connectivity obstacles for women were related to place of access (safety and security issues), time constraints and technophobia.
- Women tend to use the Internet and cell phones more for personal and social use, and men for professional or work-related reasons.
- The gender gaps in connectivity and skills were lowest among young women educated at least to secondary school level, who were more likely to undergo training in computer use and work in a computer-related field. Nevertheless they were mainly working at entry level jobs and trained at elementary levels for secretarial or data-entry tasks, not in creating content or developing systems. Although young and educated women have become the majority of those using ICTs at work, the men win the positions that lead to advancement.
- Men frequently felt threatened by women's use of cell phones and the Internet; the new freedoms afforded to women were perceived as destabilizing to relationships. In many cases men monitored the cell phone and Internet use of their partners.
- Very little local content relevant to gender issues was available, but most women did not notice this gap, revealing the need for more critical thinking and awareness about relevant content.
- Very few people were aware of any connection between gender and ICTs, and the notion of gender equity in access to and use of ICTs was not commonly understood or accepted.

Recommendations include:

- To help close the gender digital divide, ICT policy needs to move beyond access, where the gender gap is not large, into skills, content and decision-making.
- Young women must be encouraged to undertake ICT training beyond elementary levels.
- Before gender-equitable ICT policy can be elaborated, tools to monitor and evaluate the differential impacts of ICTs on men and women need to be developed.
- Universal access strategies are necessary for adult women living in poor areas to obtain access to ICTs.

6.1.6 Men and women digitally divided at the workplace

The diffusion and use of ICTs in every part of the economy have important implications for labour markets around the world, vis-à-vis knowledge-sharing, innovation, productivity and competitiveness. The gender gap captured by statistics on home access and use of ICTs is not a reliable predictor of gender discrepancies elsewhere. For instance, while in the U.S. women were slightly ahead of men in using the Internet at home, they lagged behind men in Internet use at work, with a 60-40 split in favour of men (Nielsen//NetRatings 2002). To begin to shed light on such gaps, it is important to look at labour force participation, employment status and occupation – at a minimum. Undoubtedly, the gender gap in the use of ICTs at the workplace is directly impacted by the presence of women in the labour market. Furthermore, within the workplace, the roles of men and women are different. In the U.S. nearly half of all men who used the Internet in the workplace are employed in professional, executive or managerial roles, compared to one-third of females.

The participation of men in the labour force exceeds that of women in every region of the world. The largest differentials are observed in the Middle East and North Africa, followed by South Asia and Latin America and the Caribbean. Many factors contribute to this phenomenon. For instance, the fact that in many sub-Saharan African countries the presence of women in the labour force is considerably higher than elsewhere may have much to do with the fact that many women are frequently the sole wage earners and heads of their households.

Rwanda has one of the highest female labour force participation rates, at 92.1%. The contribution of women is central to overcoming the country's challenges. In the 1994 genocide and civil war, 800,000 people were killed, essentially crippling the country's human resource capacity. There are few educated people to fill government jobs. Moreover, 42% of Rwandan women are widows, and at least 35% of households are headed by women. Nearly half of the total population is under 14 years old, and 60% is under 20 years old. This shift in demographics and the country's social structure has imposed a heavy burden on women and girls to support and care for their families and siblings. In turn, this means that time and funds for school and training are nearly impossible. Nevertheless, in the process of reconstruction, which encompasses Information Society initiatives, the active participation of women is paramount.

By contrast, the participation of women in the labour force is lower in Latin America – at least based on official figures. It ranges from only 25% of women in Belize to 73% in Uruguay (ILO 2004). The under-representation of women in the labour force is also particularly large in parts of Asia. Pakistan, for example has only 14% of women in the economically active population, compared to 70% of men.

Numerous factors influence labour force participation, including education and the degree of urbanization. Table 6.8 illustrates the situation in India.

Table 6.8 **Labour force participation rates by sex, level of education and area, India, 1999-2000**

	Literate below secondary	Secondary & higher secondary	Graduates & above
	%		
Male			
urban	82.0	68.2	85.4
rural	86.4	74.7	89.8
Female			
urban	17.9	12.7	30.2
rural	36.6	19.5	41.0
female/male ratio (%)			
urban	21.8	18.6	35.4
rural	42.4	26.1	45.7

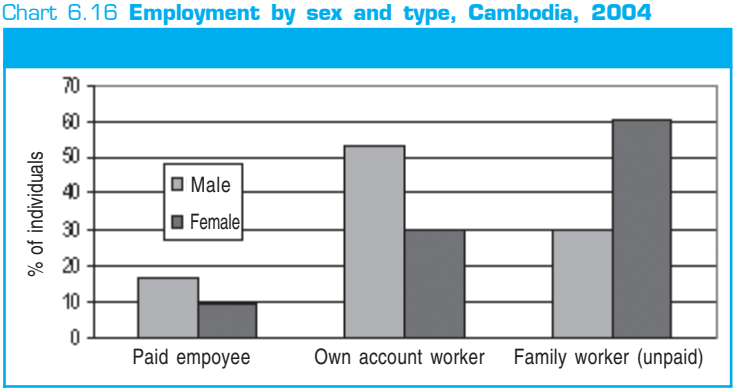
Source: *Central Statistical Organization of India, Ministry of Statistics and Programme Implementation, Selected Socio-economic Statistics: India 2002*

Note: *The labour force participation rates are for persons aged 15 years and above.*

Differences between men and women are enormous, regardless of education or urban vs. rural living. Even when the gaps are relatively lower (graduates and below secondary education in rural areas, where farming and other agricultural activities provide the majority of jobs), women's participation is less than half that of men. However, the participation of women graduates is larger both in rural and urban areas.

In addition to labour force participation in general, the sector of engagement matters. In Cambodia, for instance, where there is practically no difference between the participation rates of women and men in the labour force, a substantial proportion of men compared to women are either paid employees or self-employed, while the proportion of women in unpaid family employment is twice that of men (Chart 6.16). Women are always more likely than men to be family workers.

Chart 6.16 **Employment by sex and type, Cambodia, 2004**



Source: *National Institute of Statistics (NIS) of Cambodia, Inter-Censal Population Survey 2004*

In Turkey, even within the regular employee category, men outnumber women in the usage of computers and the Internet by very large margins (Table 6.9). The gaps become even more pronounced among self-employed workers, where women's usage is miniscule. Even among students, who account for the bulk of usage of these technologies, the gender gaps are huge. For example, men's computer usage was double that of women's.

Table 6.9 **Use of computers and the Internet by sex and labour force status, Turkey, 2004**

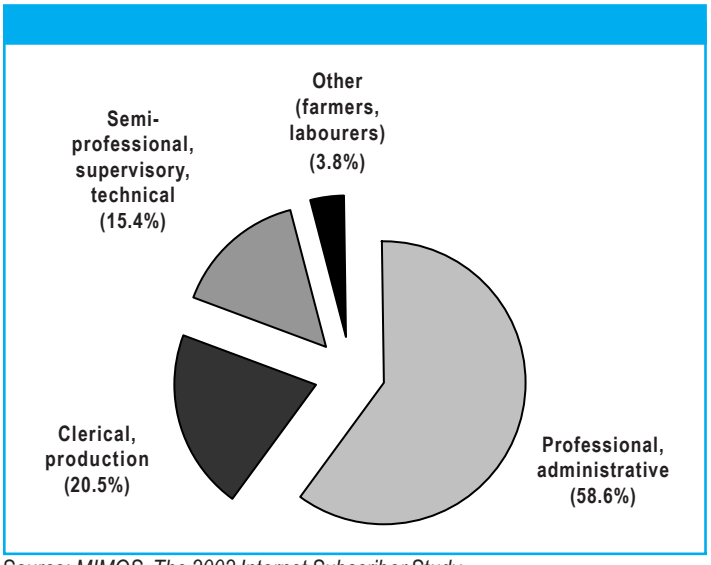
Labour force status	Computer use			Internet use		
	Total	Female	Male	Total	Female	Male
	%					
Regular employee	33.6	9.4	24.3	26.6	7.5	19.1
Self employed	11.2	0.9	10.2	8.5	0.9	7.7
Unpaid family worker	6.6	1.5	5.2	5.1	0.9	4.2
Housewife	2.6	2.6	-	1.2	1.2	-
Unemployed	22.5	6.9	15.6	20.7	5.9	14.8
Retired	4.3	2.0	2.3	2.7	1.3	1.4
Student	64.4	21.7	42.7	53.5	17.0	36.5
Other	3.3	-	3.3	2.7	-	2.7

Source: *State Institute of Statistics (Turkey), ICT Usage Survey on Household and Individuals 2004*
Note: *Survey reference period is April-June, 2004*

Type of occupation is another key factor, which has been found to be among the determinants that account for differences in ICT use. Not surprisingly, it also accounts for the lower use of ICTs by women. Women account for a lower proportion of professional, executive or managerial jobs, and

they are more likely to be occupied as service, sales or craft workers. In South Africa, for example, although women make up just over half of the total population and 41% of the employed population, they occupy only 15% of executive manager positions and a fraction of director positions. Chart 6.17 presents data from Malaysia to illustrate that women employed in professional jobs are more likely to use ICTs. In 2002, almost 60% of JARINGS's women Internet subscribers[110] were employed in professional and administrative occupations (MIMOS 2003).

Chart 6.17 **Female Internet subscribers by occupation, Malaysia, 2002**



Source: *MIMOS, The 2002 Internet Subscriber Study*
Note: *Data refer to JARING Internet subscribers only*

ICT employment

Further evidence of the difficulties encountered by women stems from their employment in industries of the ICT sector, both in developed and developing countries In Australia, women accounted for only 16% of ICT workers in 2003-04 (ABS 2005). In India, with its booming software sector for example, the participation of women in IT jobs was an estimated 21% of total IT workers in 2003 (650 thousand). However, this is higher than the 15% in 2001 (Ilavarasan 2004). In Japan, the proportion of men employed in the ICT sector was three time higher than that of women in 2002. The gaps were larger among the self-employed, whereas women have a much higher representation than men in family work (Chart 6.18).

Chart 6.18 **ICT sector employment by sex and type, Japan, 2002**

Source: *Statistics Bureau of Japan, Ministry of Internal Affairs & Communications, IT Statistics for Japan 2003*

[110] *The 2002 Internet Subscriber Study in Malaysia was conducted by MIMOS Berhard. JARING was Malaysia's first ISP, and in 2002 it had a total of half a million subscribers (covering about 2 million users).*

Further examination reveals that the majority of ICT occupations for family or home workers are clerical or administrative in nature. In Japan most women are engaged in text and data entry, while the proportions of men in occupations related to engineering or systems design and programming are easily twice or three times those of women (Table 6.10).

Table 6.10 **Home workers by sex and type of business, Japan, 2001**

Type of business	Male	Female
	%	
Text entry	6.4	30.4
Engineering, Drafting, Design	38.2	15.6
Writer, Translation	14.5	11.0
Data entry	0.9	14.8
Systems design, Programming	20.9	6.5
Desk Top Publishing (editing), Computer typesetting	6.4	6.8
Website creation	3.6	3.0
Audio-typing	1.8	1.9
Research, Consulting	0.0	2.7
Computing, Information search service	0.9	1.1
Business document preparation, Document organization	0.0	0.4
Other	5.5	5.3

Source: *Statistics Bureau of Japan, Ministry of Internal Affairs & Communications, IT Statistics for Japan 2003*

An attempt by the International Telecommunication Union (ITU) to collect data on employment in the telecommunications industry (full-time staff)[111] revealed that, on average, among the reporting countries the proportion of women employees was short of one-third of total employment. To underscore once again the importance of the particular context of each individual country, significant variations were found. Women's employment ranged from a high of 65% in Panama to a low of 6.5% in Iran. An ITU report offered some pertinent perspective: *"In general, members of the Commonwealth of Independent States (CIS) tended to have the highest levels of female telecommunications staff while Gulf States tended to have the lowest. The CIS nations tend to have high levels of female literacy and education. At the same time, they have fairly old telephone networks which may require more operator intervention. Telephone operators tend to be women. In the case of Gulf States, traditional cultures have usually resulted in few women working"* (Minges 2003, p. 2). As is the common thread in the many facets of the gender digital divide, a plethora of factors are at work.

6.1.7 Comparisons of the gender divide with other digital divides

The gender digital divide is one of several manifestations of unequal ICT opportunities between groups of people, whether within or across countries. There are, however, other socio-demographic and economic characteristics of interest that introduce additional dimensions to the digital divide. Income, age, education, employment type, geographical location, family type, race, ethnicity and disabilities are all examples of characteristics that can produce sizeable inequalities among and within the populations groups. While each variable has been found to exert its own independent influence on the digital divide, they are often interrelated. For example, higher education may well lead to professional occupations associated with higher income and increased use of ICTs. Part of the gender digital divide may largely be due to the fact that ICTs are less available, less reliable and more expensive in rural areas, where people are less educated and poorer, and where women make up the majority of the population. This section will add perspective to the gender divide by placing it in the broader context of other ICT-related divides.

[111] *About one-third of the countries reported. While this was the case for many developing countries, many developed countries were also unable to provide such figures.*

As discussed earlier, the gender divide is lower among more educated women. It is also well-known that income is one of the most important determinants of ICT adoption and use. A study from South Korea also demonstrates how various aspects of the gender digital divide improve with income. Indexes measuring ICT awareness, access, utilization and skills necessary for effective use were all lower at lower levels of income (Table 6.11).

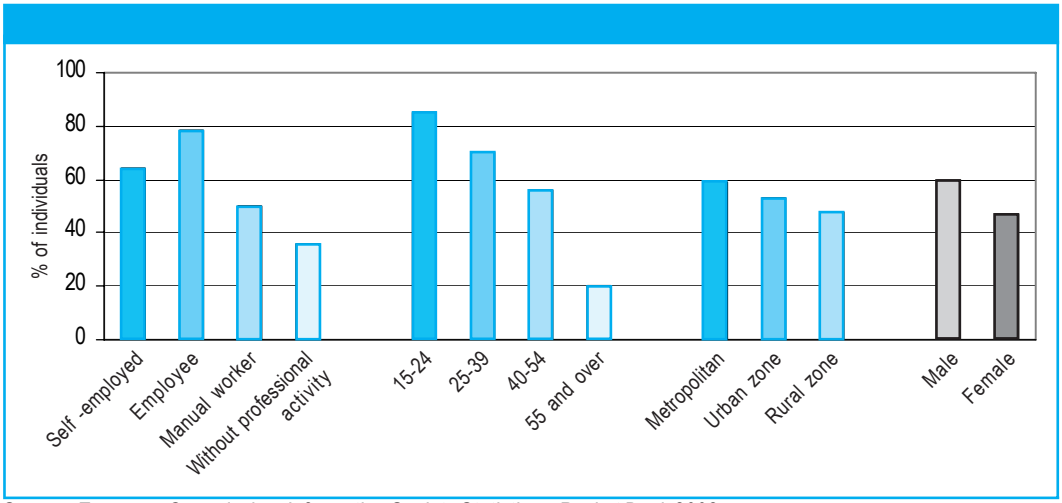
Table 6.11 **Female digital divide by income, South Korea, 2004**

Income (million Wons)	Awareness	Access	Utilization	Skill	Effect	Inequality
	indexes					
> 4	100.0	100.0	100.0	100.0	100.0	100.0
3-4	96.6	79.3	76.5	96.0	104.5	90.4
2-3	93.4	63.5	56.0	93.6	98.8	80.7
1-2	91.5	58.8	60.8	88.7	91.7	77.9
< 1	86.8	42.3	45.7	87.0	79.9	67.7

Source: *Republic of South Korea, 2004*

Data in Chart 6.19 show clearly that along with sex, labour force status, age, and urban/rural locations give rise to divides. With respect to home Internet access, in the EU age proves more dividing than other variables, with big differences between the youngest and oldest groups. This is closely followed by labour force status, with paid employees much more likely to have Internet access from home than those without a professional activity or involved in manual work. The gender divide associated with labour force status was more pronounced than the difference between rural areas and metropolitan centres.

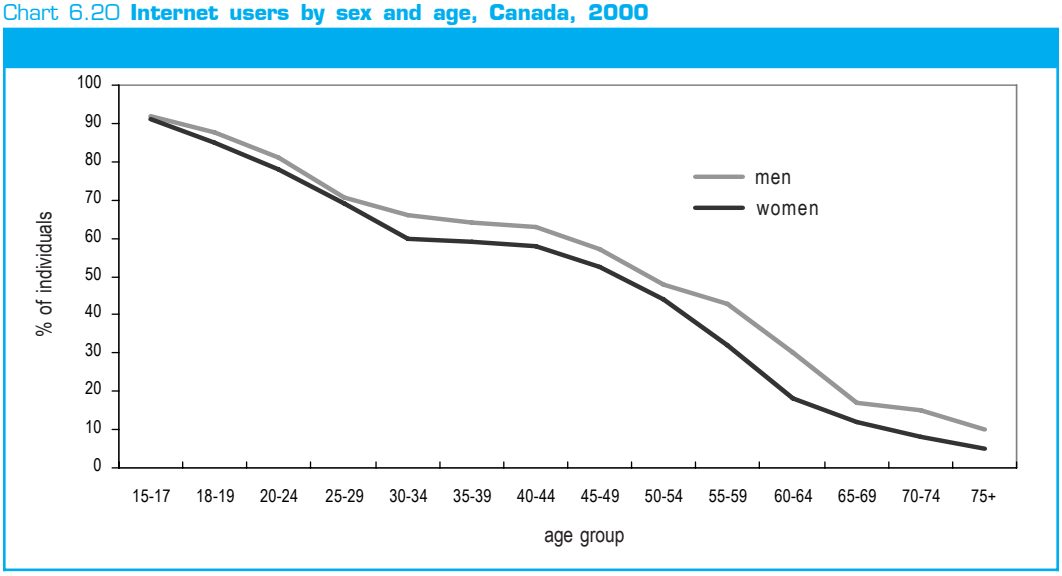
Chart 6.19 **Internet access from home, EU, 2002**



Source: *European Commission, Information Society Statistics – Pocket Book 2003*

Additional evidence that, within the gender divide, age is a very influential dividing factor is contained in Chart 6.20. While even in Canada there was a gender divide in 2000, the generational gap was proportionately bigger than the gender gap. The main observation is that while 9 in 10 persons between the ages of 15 and 17 were online, this was the case for about 13% of individuals aged 60 and over. In general, the proportion of Internet users declines steeply with age. While a gender gap does not exist in younger ages, it becomes visible within older age groups (Silver 2001).

Chart 6.20 **Internet users by sex and age, Canada, 2000**



Source: *Statistics Canada, General Social Survey, cycle 14, 2000*

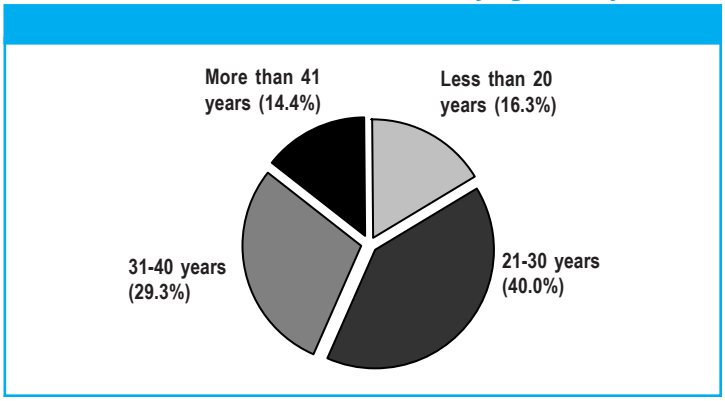
Corroborating results can be seen from Malaysia where a gender gap was present even among the youth. In 2002, the overall male-to-female ratio among JARING Internet subscribers was more than 2, but it ranged from a low of 1.7 for those under 20 years of age to more than 3 for those over 41 years of age (Table 6.12). Clearly, the gender divide widens with age. At the same time, examined in conjunction with the distribution of female JARING subscribers, we see that while females aged 31-40 years were subject to a proportionately larger gender divide compared to younger age groups, they made up the second biggest subscriber group (Chart 6.21).

Table 6.12 **Internet subscribers by sex and age, Malaysia, 2002**

Age (years)	Male %	Female %	male/female ratio
< 20	62.3	37.7	1.7
21-30	66.7	33.3	2.0
31-40	69.7	30.3	2.3
> 41	75.4	24.6	3.1
Total	**68.7**	**30.8**	**2.2**

Source: *MIMOS Berhad of Malaysia, The 2002 Internet Subscriber Study*
Note: *Data refer to JARING Internet dial-up subscribers only*

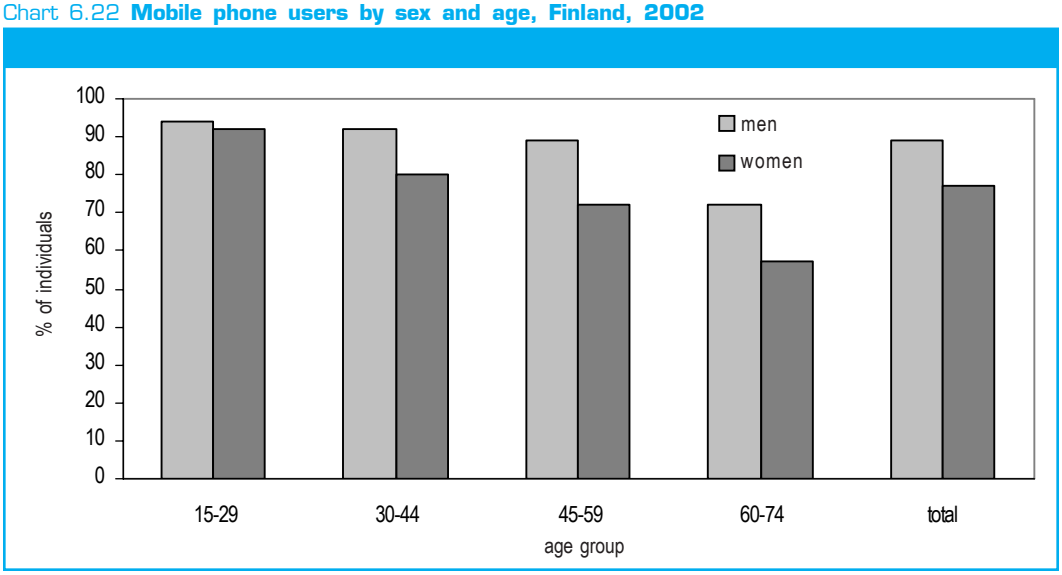
Chart 6.21 **Female Internet subscribers by age, Malaysia, 2002**



Source: *MIMOS Berhad of Malaysia, The 2002 Internet Subscriber Study*
Note: *Data refer to JARING Internet subscribers only*

Even in the use of mobile phones in Finland, the gaps by age are more pronounced than those associated with sex (Chart 6.22). Thus, while evidence presented in this work outlines a substantial and multi-dimensional gender digital divide, and while the issue is unquestionably an impediment to economic and social development, work in this area would benefit by placing it in the proper context of related dividing factors which intersect with sex. Age, in particular, is a *de facto* critical dimension of the gender digital divide.

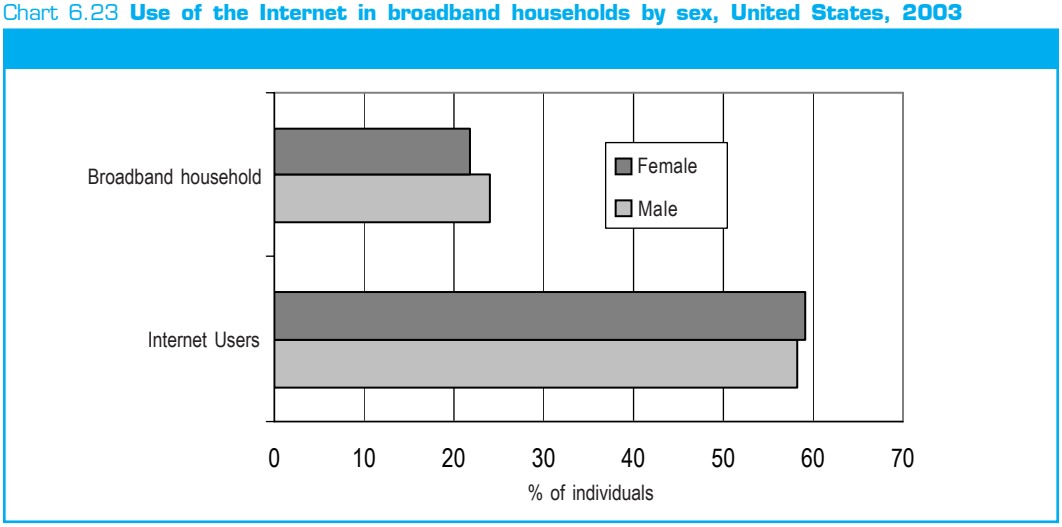
Chart 6.22 **Mobile phone users by sex and age, Finland, 2002**



Source: *Statistics Norway, Nordic Information Society Statistics 2002*

Finally, we must also be cognizant of the continuous evolution of the very technologies that gave rise to the digital divide in the first place. ICTs and their applications do not stand still, feeding an ever-evolving digital divide. By implication, the gender divide too becomes a moving target. As one example, the issue of women falling behind in the use of the Internet and more basic ICTs in the U.S. a few short years ago has already been replaced by concerns that women seem to be at a disadvantage with regards to broadband use[112] (Chart 6.23).

Chart 6.23 **Use of the Internet in broadband households by sex, United States, 2003**



Source: *U.S. Department of Commerce, National Telecommunications and Information Administration, A Nation Online: Entering the Broadband Age, September 2004*
Note: *3 years of age and older, October 2003*

[112] *As discussed in Chapters 2 and 3, broadband is generally not available in most countries.*

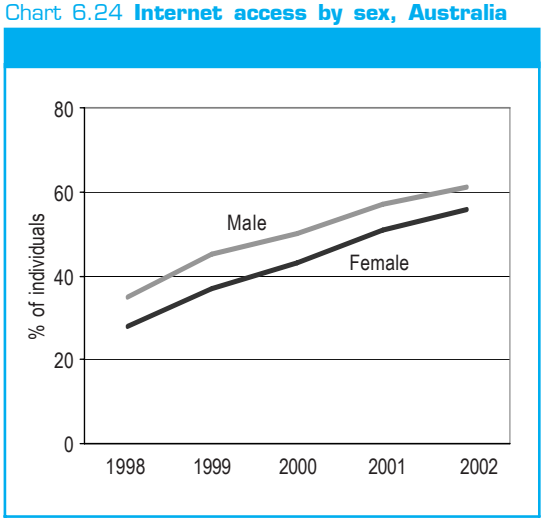
6.1.8 The evolving gender digital divide

As ICT diffusion expands, the various digital divides generally become smaller – to varying degrees and speeds, depending on the country and the specific divide in question. While a comprehensive analysis of the type performed in Chapter 3 for overall Infostates is not possible due to data limitations, there is enough, albeit scattered, evidence that the gender divide too is narrowing somewhat. Of course, as has been discussed earlier in this chapter, this refers to the access to and use of ICTs, which are only 'entrance' issues to the gender digital divide.

In many developed countries the gender gap is closing but, with a few exceptions, not disappearing. Recent U.S. data (2004) show that in October 2003 the Internet penetration rate of women (59.2%) exceeded that of men (58.2%). The gap had closed at least two years prior to that (September 2001), when penetration rates among women and men were both 55%. In Canada, where approximately 18% of individuals used the Internet in 1994, women lagged behind men by 8 percentage points (14% vs. 22%, respectively); by 2000, when Internet usage had jumped to 53%, the gap was smaller (6 percentage points or 50% of women, 56% of men) (Dryburgh 2001). By 2002 the gap had reversed.

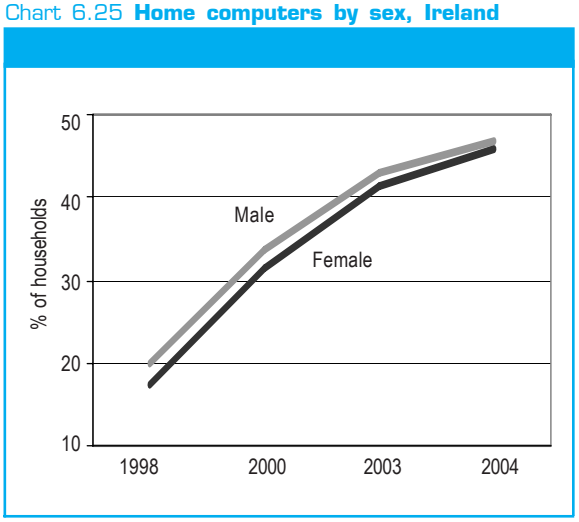
According to the OECD (2004), a narrowing of the Internet gender gap is generally the case. There were some mixed signals, though, among the countries examined; in Sweden the gap appears stable in recent years even as Internet use continues to expand. These findings are corroborated by further data from the EU. In Australia the gender gap in Internet access also declined over the 1998-2002 reference period, but it did not disappear (Chart 6.24). By 2002, 61% of men and 56% of women accessed the Internet, compared with 35% and 28% in 1998, respectively.

Chart 6.24 **Internet access by sex, Australia**



Source: *Australian Bureau of Statistics, Household Use of Information Technology, 2003*

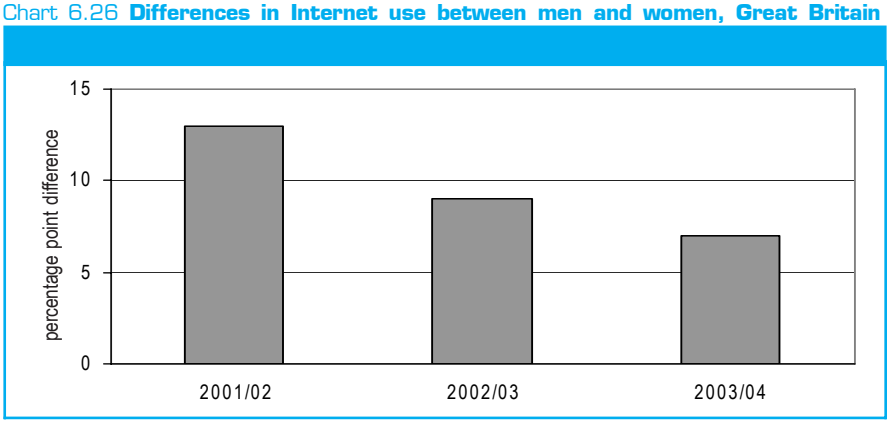
Chart 6.25 **Home computers by sex, Ireland**



Source: *Central Statistics Office Ireland, Information Society Statistics 2004*

The same direction in the gap between men and women was also experienced in Ireland. In 1998, when household computer penetration was still modest, a small difference existed, with 20% of men and 17% of women having access. By 2004, when penetration had more than doubled, the gender gap was nearly gone, with usage among men and women at 47% and 46%, respectively (Chart 6.25). The same pattern holds true for Internet use in the UK; in general, the gender digital divide is lessening (Chart 6.26).

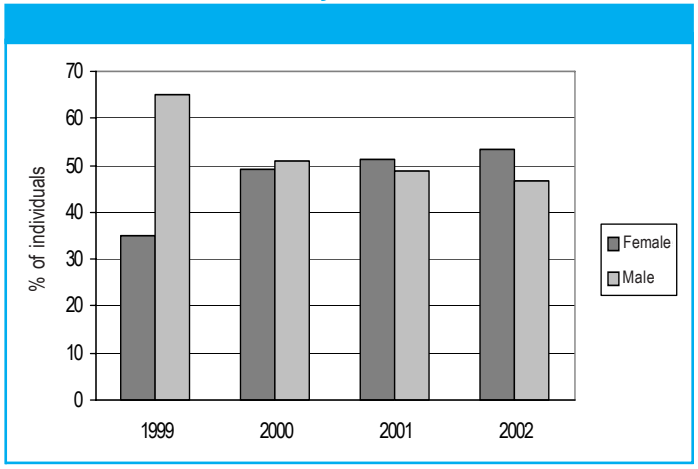
Chart 6.26 **Differences in Internet use between men and women, Great Britain**



Source: *Office for National Statistics, National Omnibus Survey, National Statistics, http://www.statistics.gov.uk,*
Crown copyright material is reproduced with the permission of the Controller of HMSO
Note: *Based on adults who have used the Internet in the 3 months prior to the interview.*

Similar findings in the direction of the gender divide emerge in countries with lower Infostates. In Thailand, the proportion of women Internet users grew substantially over the 1999-2002 period. While just over one-third of all Internet users were women in 1999, the gender gap almost disappeared by 2000. Starting in 2001, the proportion of women Internet users exceeded that of men, and this became more evident in 2002 (Chart 6.27).

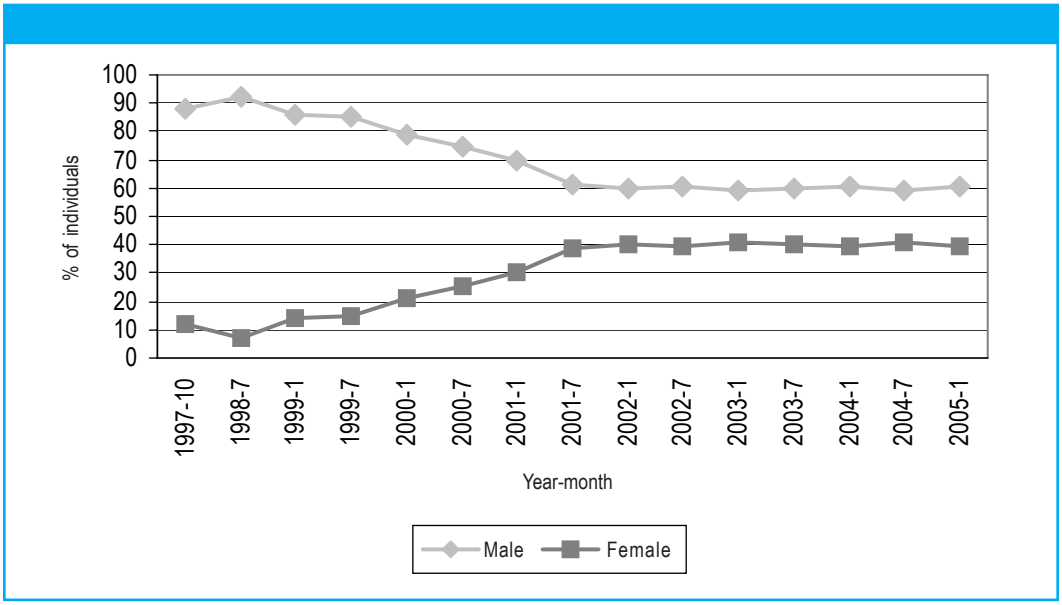
Chart 6.27 **Internet users by sex, Thailand**



Source: *National Electronics and Computer Technology Center (NECTEC), Thailand ICT Indicators, Moving Towards the Information Society, Series I, October 2003*

By the beginning of 2004, the estimated number of Internet users in China was 79.5 million, an increase of 11.5 million or 16.9% over a 6-month period, and 34.5% over a 12-month period. The number of Internet users skyrocketed from the estimated 620,000 Internet users in October 1997. The gender divide was large in the late '90s, but closed gradually until women accounted for about 40% of Internet users early in 2002. However, since then, and despite the continuous booming of the Internet, the gender gap persists and the 20 percentage points separating women from men remain stable (Chart 6.28).

Chart 6.28 **Internet use by sex, China**



Source: *China Internet Network Information Center (CNNIC), China's Internet Development and Usage Report 2004*

A somewhat smaller, but rather persistent gender gap is also observed in South Korea, which has much higher Internet penetration. By June of 2004, male Internet users approached three-quarters of the population, and female users exceeded 60%. Between 2001 and 2004, the ratio of female/male Internet users increased from 76% to 83%, but its evolution remains modest in recent years (Table 6.13).

Table 6.13 **Internet use by sex, South Korea**

	Male	Female	female/male ratio
	%		
2001	58.7	44.6	76.0
2002	63.5	52.4	82.5
2003	70.7	57.5	81.3
2004	74.4	62.0	83.3

Source: *Ministry of Information and Communication, National Internet Development Agency of South Korea, Survey on the Computer and Internet Usage, September 2004*

Rapid closing of the gender gap took place in Mauritius over a two-year period, from 2000 to 2002. The proportion of female computer users increased substantially, and the proportion of female Internet users even more. In both cases, female users accounted for three-quarters of men in 2002 (Table 6.14).

Table 6.14 **Computer and Internet use by sex, Mauritius**

	Computer users		Internet users	
%	2000	2002	2000	2002
Male	69	57	72	57
Female	31	43	28	43
ratio (female/male)	**38**	**14**	**44**	**14**

Source: *National Computer Board, Mauritius, ICT Penetration within the Mauritian Society, February 2003*

While there can be some cautious optimism regarding the evolution of the gender digital divide for access, there appear to have been few gains and some troubling trends in women's experience of IT-related education and employment. In addition, the data show clearly that the relationship between literacy, education and access to and use of ICTs has to be viewed within the context of socioeconomic status as well as sex. We now turn to a qualitative approach to examine these complexities more closely.

6.2 The many dimensions of the gender digital divide

This section examines several aspects of the gender digital divide with three objectives in mind: first, to put in perspective the quantitative trends presented in the previous section, by probing deeper into the issues and factors behind the numbers; second, to provide policy makers, development agencies, educators and other stakeholders with a better understanding of the situation so that they may begin to take remedial action, including developing and implementing guidelines and strategies to lessen the gender divide and; third, to set the stage for the development of additional non-quantitative indicators to systematically measure the participation of women and girls in the Information Society.

The contents of this section are based on a comprehensive framework that defines important elements of gender issues in ICTs (Hafkin 2003a). It is also an attempt to answer the following questions:

- How do socio-cultural customs, infrastructural and access barriers restrict women from accessing and using ICTs?
- Do women have the education, training and skills required to function in the Information Society?
- How severe are gender disparities in ICT employment? Why do they occur?
- Are there gendered differences in access to and control over financial resources which affect participation in the Information Society?
- What are appropriate media and content for women and girls? Are they available? Do women and men have different communications patterns?
- What are the gendered patterns of risk to privacy and security brought about by the new ICTs?
- What is the extent of women's representation and participation in ICT policy and governance?
- What is the impact of ICTs on women and girls? Can ICTs contribute to gender equality and women's empowerment?

6.2.1 Social and cultural barriers to ICT infrastructure and access

Access to ICTs is inextricably linked to the availability of the necessary infrastructure, which is in turn linked to location. In much of Asia, Sub-Saharan Africa, and parts of the Caribbean, women make up the majority of the population in rural areas, as men migrate to the cities for work (UNIFEM 2000). In virtually all developing countries, telecommunications infrastructure, as well as electricity, is weaker and less available in rural and poor urban areas. In Africa in particular, reliable Internet connectivity is frequently available only within capital and major secondary cities, while the majority of women live outside these regions. The urban bias in the diffusion of ICTs, coupled with

DEFINITIONS

Active participation in the Information Society includes more than just access, whether to the Internet or other ICTs. Active and equal participation in the Information Society for women and men involves equality in ICT access, knowledge and use, regardless of ethno-cultural group, sex and class.

Equality in ICT access, knowledge and use: as measured by technology fluency; mastery of analytical skills, computer technology, information and communications concepts; ability to imagine innovative uses for technologies across a range of problems and subjects; and ability to find and use information and knowledge to improve one's life and expand one's choices (Huyer and Mitter 2003).

Gender equality (GE): equal status between men and women, so that women and men have equal conditions for realizing their full human rights and potential to contribute to national, political, economic, social and cultural development, and to benefit from the results. It involves the equal valuing by society of the similarities and differences between women and men, and the varying roles that they play (CIDA 1999).

The term *sex* refers to the biological differences between men and women, while *gender* refers to the socially-constructed roles and relations between men and women which shape their lives, experiences, divisions of labour, and access to resources.

the fact that most poor women in developing countries live in rural areas, make the placement of infrastructure a gender issue. Thus, simply by being the majority of the population in rural areas, women have fewer opportunities than men to access new technologies (Hafkin and Hambly 2002). Linked to location, but also to religious and socio-cultural attitudes, the mobility of women (both in the sense of access to transport and ability to leave the home) is also more limited than that of men.

For women, gendered roles and religious and socio-cultural customs can limit both their access to and use of ICTs, especially the Internet. Their multiple roles limit the time they have available to access and use ICTs. Three large North American surveys concluded that *"women's domestic responsibilities, particularly raising children, limit the use they make of the Internet"* (Kennedy, Wellman, Klement 2003). This is compounded in many developing countries where home access to ICTs is rare and women must travel to public access venues. In a series of interviews with telecentre managers throughout Africa, all said that domestic responsibilities, socio-cultural constraints and economic hurdles were key impediments to women's access (Johnson 2003). Women themselves frequently pointed to lack of time as a primary barrier to using telecentres. In addition, it is sometimes the case that public access centres are not open at times when women can visit them, or they may be open only in the evening when it is more difficult for women to visit them due to safety concerns (Hafkin and Taggart 2001).

A major cultural variable that affects women's ability to frequent information centres or cybercafés is the norm governing men's and women's interaction in public places. Information centres or cybercafés are often located in places that women may not be comfortable frequenting or that are culturally inappropriate for them to visit. This is the case not only in cultures such as that of Pakistan or Saudi Arabia that practice strict segregation of the sexes in public places, but elsewhere as well. Moreover, women who do use telecentres throughout Africa are frequently uncomfortable receiving one-on-one technical assistance from a man. Having to interact closely with men may put off many women from visiting the telecentres (Rathgeber 2002b). The amount of pornography on the Internet is also a major deterrent to female users, particularly for those who are dependent on public

WOMENS' CONSTRAINTS IN ACCESSING AND USING ICTs

Lack of time and infrastructure

- A series of national reports on the use of ICT for distance learning pointed out that electricity is not available in rural areas in many African countries, as well as Vanuatu and Belize. In Malawi, for example, 84% of the population lives in rural areas with no electricity, while 8% of homes in Kenya and 10% of the population in Tanzania have access to electricity (Green and Trevor-Deutsch 2002).
- *Regional Reach* provides rural populations in Kenya with information in local languages through community screening of videotapes focusing on current social problems. Female viewership is just 16% during the week, as a result of household chores and responsibilities (Green and Trevor-Deutsch 2002).
- Interviews with women in Asia who had taken distance education courses found that household responsibilities were a major factor to be taken into account when undertaking distance courses (Kanwar and Taplin 2001). These time constraints also mean that women are often unable to invest in developing the skills necessary to effectively use ICTs (Johnson 2003).

Social norms

- In Seelampur and Sitakund, India, where there are community ICT training centres, Muslim women are restricted in travel or use of public spaces and girls from the community are not allowed to travel unaccompanied outside the confines of the city centre (Slater and Tacchi 2004a). In another case, the nearest telecentre was too far for rural women farmers in South Africa to reach (Kiplang'at 2004).
- Kenyan women said they would encounter problems if computers are located in meeting places regarded as men's preserves, even in such seemingly innocuous locations as rural shopping centres, libraries and community centres. In Pakistan, if computers are located in study centres, there must be separate areas for girls and women (Green and Trevor-Deutsch 2002).
- In India and elsewhere, the Internet café manager is typically a young male who frequently surfs pornographic content, helping his friends to do the same; the café serves as their hangout (Gurumurthy 2004).

Education and employment

- An ICT survey of 1,800 people in Ghana, Botswana and Uganda (McKemey et al. 2003) found that the most important indicator of any kind of communication use was not related to sex but to the level of education. The higher the education, the higher the rate of use.
- A report of gendered patterns of ICT for distance learning in Malaysia suggested that *"women may be handicapped by their lower employment status."* In many regions, home or office access to and use of the Internet is less likely for women, as more men occupy the academic, management or technical positions that provide free access (Green and Trevor-Deutsch 2002). Similar trends exist in Europe; a European Union report found that the Internet requires literacy and that its content is geared towards the better educated. Thus, *"higher Internet use seems to remain clearly and consistently related to higher educational and occupational status"* (CEC 2005).

Cultural constraints

- In Peru, a project to contribute to rural development by increasing the productive capacity of small farmers found that joint-sex meetings and training courses constrained women's participation. Women reported that their greatest difficulty was not the level or the specialization of the training courses, but men's attitudes towards their participation. Already shy and apprehensive, they were mocked by the men when they used computers. The project team realized that the project was better served by implementing separate training for men and women (Hafkin 2002b).
- In Burundi, when national news comes on the radio, women report that their husbands take it to the pub. When he returns, they have to listen to the programs of interest to him. Even if he is away, the women can't use the radio because the husbands are afraid they may break it and drain the batteries (Beardon *et al.* 2004).
- In Bangladesh, 71% of men and 44% of women had access to a radio (Beardon *et al.* 2004); *"Men own all the technology"* reports from Kenya and Zambia said (Green and Trevor-Deutsch 2002).

access. The tendency of young men in Internet public access points to view pornography deters many young women from frequenting such places.

Class and education levels can keep women away from public ICT access. Girls make up two-thirds of children in the developing world without access to basic education. Particularly in India, the poorest often fear that ICTs and ICT centres are not for people like them for reasons of caste, illiteracy and gender power relations. They often assume that these centres are only for educated people. In Darjeeling, for instance, illiterate people frequently asked if the centres were only open to the literate (Slater and Tacchi 2004a).

The confluence of culture and computers can also constrain women from accessing and using ICTs when the traditional cultures view female use of computers negatively or if the use of computers by women is seen to be a burden to current (and potential) families. This is the situation for young Muslim women in Seelampur, India who were rejected as candidates for arranged marriages on the grounds that because they are computer-literate they will not adjust in the marital family. Instances have also come to light about greater dowry demands for computer literate daughters (Maindiratta and Maindiratta 2004).

Gendered patterns of technology use: Many gender differences emerge in the use of ICTs, as was discussed in the preceding quantitative section. Generally women's use is lower than men's. There are, however, many nuances, such as the type of ICT and the type of usage, as well as differences between developed and developing countries, regions, cultures and more.

African men use telecentres more often than women. Studies of ICT facilities usage in Kenya, Uganda, Senegal and Mali have shown that women represent a small percentage of ICT users (Thioune and Séne 2001; DOT-COM Alliance 2005). In Uganda women represented 29% of telecentre users, 35% in Mozambique, 23% in Mali and 20% in Accra (Johnson 2003).The one exception where women constituted the majority of telecentre users was in Gasaleka, near the Botswana border in one of South Africa's poorest provinces. Established by the *Universal Service Agency* in 1998 and with a specific gender emphasis, women represent 60% of the users there. The centre is run by a woman, and women are particularly attracted by the training opportunities (Benjamin 2001). Even in the few instances where women's rate of use is higher than men's, there is more than meets the eye. For instance, there are discrepancies between ICT use and ownership (see Insert below). Some accommodations have been made in various parts of the world to ensure gender equity in public access and use of ICTs, including adaptation of schedules to better suit women's needs and availability of women support staff and trainers (Hafkin and Taggart 2001).

With respect to the type of ICTs, in a number of telecentres in Africa it was found that women did not use computer-based facilities to the same extent as men, but rather concentrated on telephone, fax and copiers (Rathgeber 2002b). In a study of the type of media preferred in rural India, both men and women ranked radio as the preferred medium, while the Internet ranked eleventh (after such choices as oral communications, telephones, letters, and dance/drama) – although if the education variable is added, the differences tend to diminish (Beardon *et al.* 2004). At the same time, women in developing countries are less likely to own radios and to have access to them at times of their choosing, even when there are radios in the household.

Many sources attest to the feeling of discomfort with computers that poor women in developing countries experience. In Senegal, Uganda and Kenya women expressed attitudes that computers

WOMEN AND CELL PHONES

Recent studies from Tanzania and South Africa show a very high percentage of women among both owners and users of mobile phones. In South Africa, significantly more women than men are both owners and users of mobile phones (in a sample that had broad representation by age, income, education levels and sex). Women made up 57% of the respondents who owned a mobile phone and 60% of the users (but not owners). In Tanzania, a poorer country where the ownership of communications media is generally in male hands, the percentage of women mobile phone owners is lower than in South Africa but still very high (48.4 %), while women respondents predominated among the users but not owners (52.7%) (Samuel, Shah and Hadingham 2005).

Country	Category	% Male	% Female
South Africa	Owners	39.1	56.8
	Users	40.0	60.0
Tanzania	Owners	50.5	48.4
	Users	47.3	52.7

A study of the use of ICTs by women entrepreneurs in four southern African countries found that women were losing out in expanding their business networks by relying on cell phones, rather than the Internet that could broaden their contacts. By using telephones (fixed and mobile) in communicating with customers and suppliers, they limited their contacts to formal family networks, which limited their potential for growth (UNIFEM 2003).

were not for them (Thioune 2003, Thioune and Séne 2001). In Asia and Africa the attitude is widely held that technology is a man's domain. In Malaysia, numerous women affirmed this phenomenon, saying that they preferred their husbands or sons to find the information they need from the Internet. Women in Tonga also reported that the tendency there to direct women into non-technical professions means that women feel fear and embarrassment when dealing with ICTs (Green and Trevor-Deutsch 2002). This is also the case in so-called developed countries.

Women attending ICT training in Nigeria at the Fantsuam Foundation *"will only use ICT facilities if they meet immediate needs for them and their families"* (Comfort *et al.* 2003). For example, women may use ICTs to transmit urgent messages to distant family members, to collect remittances from family members overseas, to obtain health information on vaccinations and preventative measures for epidemics, to search for job opportunities in the cities, to check dates for student national exams, market prices of grains and availability of fertilizers at affordable prices, to check weather forecasts, and make wedding and funeral announcements (Comfort *et al.* 2003).

Among women users of the Internet at telecentres in Senegal, there were large variations in the use of applications between rural and urban women. In urban areas, women users preferred Internet navigation over e-mail and word processing, while in rural areas 'surfing' was not the preference of any of the women, probably due to the language and education variables (urban women users were likely to be better educated, younger and French speaking) (Thioune 2003).

The question has been raised as to whether socio-cultural norms may induce both technophobia and a disinterest in technology by women. In terms of social attitudes about technology, women themselves sometimes subscribe to the attitude that technology is something for men, with respect to both use and utility. This opinion is not exclusive to developing countries. Lower levels of women

ICTs FOR DEVELOPMENT

Designed for women…

- In order to combat gender-biased attitudes towards technology, a number of changes have taken place with respect to public access points for women. In Ghana and South Africa, telecentres run by NGOs allocated special times for women to provide more comfortable access to technology (Fontaine and Foote 1999). South Africa has also been in the lead in making gender-specific changes in the design and implementation of telecentres to make them more accessible and attractive to women, especially through its *Universal Service Agency* (Johnson 2003). In Nigeria, the *Bayanloco Community Learning Centre* introduced women-only weeks and times and discounted telecentre services for women (APC 2003). The telecentre in Timbuktu, Mali (where the centre coordinator is a woman) tried to attract more women users by putting photos of women on the front page of outreach and marketing material. In Lesotho, telecentre managers are frequently women, and content has been developed to preserve their cultural heritage (Johnson 2003).

- In Mozambique, all-women training sessions (*Skills for Women)* were instituted at two telecentres in an effort to attract more women users. Once the training program was launched, there were no dropouts, and women became regular users and trained others (Gaster 2003). In Seelampur, India, where the mobility of women is highly restricted, the ICT centre was set up in the women's section in the *madrasa* house of prayer and learning. A special entrance was set up for women, making it more comfortable for girls and women to come and go (Maindiratta and Maindiratta 2004).

- As a result of a gender assessment of *WorldLinks* projects in Africa, special actions were introduced to encourage women and girls to participate in the program. These included awareness sessions on gender and development and relieving girls from some domestic chores (Green and Trevor-Deutsch 2002).

- The development of curricula for women has also increased ICT access for women. Among the most extensive training modules developed is the AMARC Internet Training Module for women (AMARC 2001). Others include: Arab Women Connect (*http://www.arabwomenconnect.org*) and Women's Electronic Network Training (WENT), jointly managed by the Association for Progressive Communications-Women's Networking Support Programme (APCWNSP), and the Asian-Pacific Women's Information Network Centre (APWINC) on behalf of the Asia Women's Resource Exchange (AWORC) (*http://www.aworc.org*).

…and changing culture

- In Medak, India women members of the *Self Employed Women's Association* (SEWA) trained in videography have entered caste households – hitherto a restricted zone – as professionals documenting cultural practices. Such interventions can bring changes in self-perception and community perception of poor *dalit* women's worth (Gurumurthy and Sarkar 2003).

- The Women Farmers Advanced Network (WOFAN) observed that women depended on men for the interpretation of the Koran on reproductive rights because most of them were illiterate. They have now learned to read the Koran, as well interpret it, and have produced radio broadcasts presenting women's rights in health, livelihood, governance's capacity building and functional literacy (Zulu 2005b).

- Young women using an ICT Learning Centre in Seelampur who were unhappy with the decision to close down the Centre for Ramadan approached the authorities to request that the centre remained open, but close at an earlier time. *"Only a few months ago such a dialogue between the Maulana and the girls would have been unthinkable"* (Sharma and Maindiratta 2005).

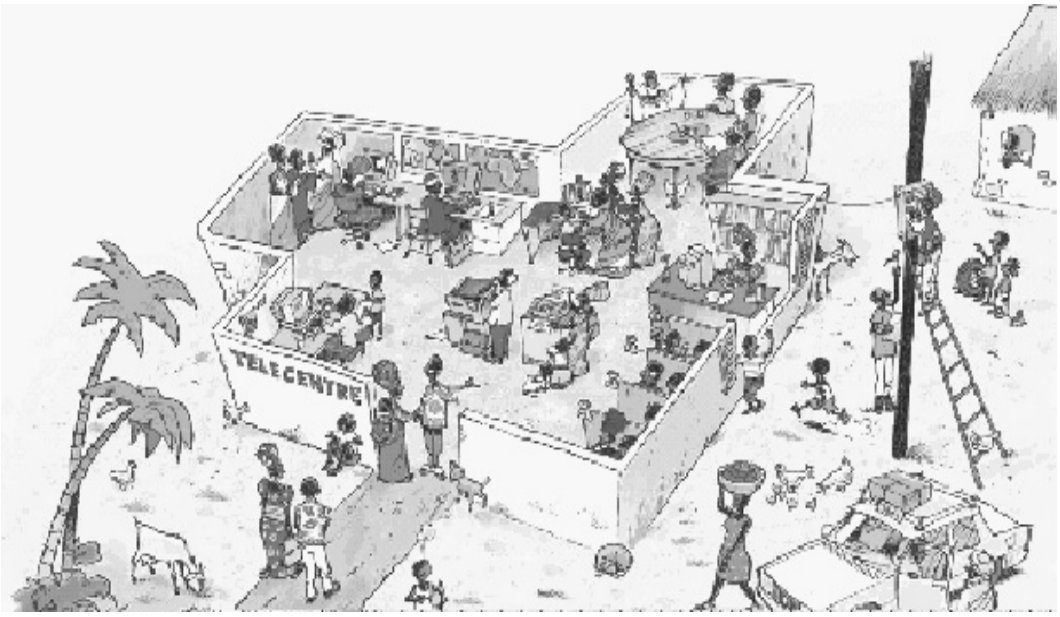
- Girls in the *WorldLinks* project managed to escape cultural constraints in Mauritania when they used the Internet to gain information on subjects considered taboo for girls, such as reproductive health (Gadio 2001).

in ICT education and the ICT workforce are attributed in part to the lack of interest of girls and women in a profession that is considered "geeky" and boring (Royal 2005). Proponents of gender-biased social constructions of technology argue that personal computers are made in socially constructed and cultural ways without women in mind. Their position is that until computers are designed by women and for women, women will not be able to fully appropriate the technology in a way that they can use it for their empowerment (Daly 2003).

Using ICTs to change culture: Another interesting question related to the social and cultural constraints facing women is whether they can use ICTs to change culture. Women's NGOs have been among the leading users of ICTs worldwide in the campaign for women's rights, many of which involve cultural issues, such as female genital mutilation. Advocacy for women's rights through ICTs has been well documented (see especially Harcourt 1999, Friedman 2004, and Asian Women's Resource Exchange 2001).

In addition, a number of examples exist whereby women have used ICTs to confront cultural taboos and challenge cultural prescriptions at the local and personal level. They no longer need to limit themselves to the controlled information and social spaces given by their society and families. *"We get our freedom from the Internet since in our society girls have limited freedom of movement. We are not allowed to go wherever we want. The Internet . . . takes us out to other people, places and other realities. No one controls where we go with Internet. It is for us a way of escaping from our closed society. It is vital to us; it gives us liberty"* (Gadio 2001).

One of the most interesting efforts to make the use of ICTs easier, safer and more equitable in developing countries involved the International Development Research Centre's (IDRC) model telecentre that incorporates features conducive to women's participation. Rather than through narrative, the model was presented in a drawing that is reproduced below.



Several features of this telecentre stand out as particularly important for women. The centre is not seen as a technology place, but rather as a community place, integrated into the community's daily needs and activities. The physical setting seems to be easily accessible to women. Childcare is not an issue, as children and groups of all ages are welcome (Fontaine 2002).

6.2.2 Education and skills

Women and girls are poorly placed to benefit from the Information Society because they have less access to scientific and technical education specifically, and to education in general. They have less access to skills training and development, which will enable them to gain employment in the ICT sector of ICT occupations and, when they do, they generally work in lower level positions, with less pay. Paradoxically, the new technologies also offer many opportunities for women and girls to gain the education and technical skills required to participate equally in the Information Economy.

Taken together, global education rates for girls at the primary level and literacy levels for women remain lower than those for boys and men. In fact, two out of three of the 110 million children in the world who do not attend school are girls – and there are 42 million fewer girls than boys in primary school. Women also make up two-thirds of the world's 875 million illiterate adults. Factors affecting the lower enrolment of girls include an increased investment in boys' education at the expense of girls, who are kept at home to help with domestic chores (Akintola 2004), as well as early marriage and motherhood – in Nepal, for example, 40% of girls are married before age 15 (UNESCO 2003).

It is expected that as more children graduate from primary school, attendance at secondary levels will increase. This is borne out to a certain extent by existing figures which show that enrolment of girls at the secondary level has increased in all developing regions since 1990, although discrepancies continue to exist in some countries, especially those with very low female enrolments in primary grades (UNESCO 2003). At the tertiary level, women have seen increasing levels of enrolment, reaching 46.8% globally. However, there are wide regional variations in participation: for example, in OECD member countries and Central and Eastern Europe, gross enrolment rates are at 45%, while in the great majority of developing countries, the percentage is less than 30% (UNESCO 2003).

The representation of women and girls in science and technology-related courses is less positive. Girls at the secondary level tend not to enrol in scientific and technical subjects. Analysis of tertiary-level enrolments in science, engineering and technology subjects provides further evidence of a gender gap. While the participation of women in biological and life sciences has increased and continues to do so in many regions, female representation in sciences such as physics and engineering is persistently low around the world (National Science Foundation 2003; European Commission 2003). The numbers for computer sciences are especially concerning. In the U.S. and Canada, for example, female participation in the ICT sector has been declining.

Barriers to female participation in science and technology education fall roughly into three categories: socio-cultural barriers; qualification barriers; and institutional barriers.

Socio-cultural barriers: These can be many and diverse:

- ***Lack of family commitment***, as parents tend to be less inclined to invest in their daughters' education. The cost of education is a major barrier when women do not have independent control of their resources.

- ***Attitudes*** about what is considered appropriate for girls and women can also affect parents' encouragement, or lack thereof, for girls' choices of subject or discipline. The perceived economic climate may also affect parents' choices, while teacher's attitudes towards girls in the classroom can often echo or affirm these socio-cultural messages (Margolis and Fisher 2001). In many cultures male partners tend to be unsupportive of women's higher education, particularly in nontraditional spheres that are considered to be unsuitable for women.

- Girls and women often experience ***discomfort or disinterest in scientific and technological subjects.*** For example, a narrowly focused technology curriculum, while appealing to boys, can alienate girls, who tend to be more interested in understanding how the technology fits into a larger social, historical, environmental or work context.

- ***Social class*** is also a factor in women's access to higher and technical education. Women in higher social classes are more likely to have family support for continuing their education, as well as access to the necessary resources (Gajjala 2002, Evans 1995).

SOCIO-CULTURAL BARRIERS TO FEMALE EDUCATION

- In a study in Mali almost one-third of households surveyed said that the reason they differentiated between girls and boys in education decisions was because boys were more intelligent (UNESCO 2003).

- In Togo, a lack of employment for women added to the low numbers of jobs for those with advanced education discourages investments in female education (UNESCO 2003). Some reasons given by women and men in Nigeria for the low participation of women in ICT were that ICT and related careers were unsuitable for the female personality, too strenuous for women, and limited their chances for marriage (Ajayi and Ahbor 1996).

- A Commonwealth of Learning study of women distance learning students found that many had to overcome initial resistance from husbands and parents (Kanwar and Taplin 2001). A study of the ICT sector in India revealed that women were expected to make sacrifices in their careers for their families and their husbands, while men were not (Gajjala 2002).

Socio-cultural barriers specific to ICTs include the perceived masculine nature of the technology and the dominance of male interests, approaches and understanding of technology. This can lead to a perception that technology is more "suited" to the male than the female. Many studies show that girls are alienated early on by the intensely masculine nature of technology, including masculine language and images. They reject computer games as violent, redundant, and tedious; they also

reject the non-social, technical obsession they see in their fellow male students (AAUW 2000). As a result, girls are less comfortable with computers. Perceptions of "geeks" not only deter women, but skew perceptions of which behaviours characterize successful computer scientists.

Qualification barriers: Aside from the situation that participation rates for women in tertiary level Science and Technology are low, those women who do reach tertiary level and higher in S&T experience a range of additional barriers:

- ***Lack of formal math and science education or experience in computer programming*** skills are often perceived as a barrier for continuing education in S&T and ICT, both by admissions departments and by students and teachers themselves. Evidence suggests that lack of previous training in these subjects is less of a barrier than expected.

- Women often take ***breaks in their professional careers*** for personal and family reasons (including child bearing). It can also be difficult for them to move up in the educational system after breaks, or to return to school to upgrade their skills.

Institutional barriers: These include the lack of female teachers and role models, and the assumptions of teachers mentioned above; inflexible admission, selection, and entry requirements which do not take into account women's varying educational backgrounds, approaches, and abilities; work conditions which do not take into account women's life responsibilities; and heavy attendance requirements for practical skills and laboratory work which are more difficult for women to meet in view of their family responsibilities. Women also do not participate as fully in workplace networks (Huyer 2003, 2004).

Strategies to encourage women's participation in scientific and technical education: There is a substantial body of research on strategies and approaches to increasing the participation and success rate of women and girls in scientific and technical education, including changes in curricula to reflect a gender-neutral, or gender-inclusive, image of scientists and the practice of science; science education that emphasizes hands-on activities and application to everyday life, society and the environment; female role models and mentors, and; conscious efforts by teachers to ensure that girls and boys are treated as equals in the classroom (Huyer 2004). In developed countries some general strategies have proven to be effective in encouraging the continued participation of girls and women in education, such as scholarships based on merit, culturally appropriate facilities, female teachers, alternative schools with flexible schedules, and vocational training. Further strategies would include bridging programs that allow re-entry for women already qualified in technical subjects, conversion programs that provide older women and school drop-outs access to technical education, and community-based programs built around issues of direct relevance to the lives of women.[113] The use of ICT to promote access for women and girls to education at all levels is a promising area.

Use of ICTs in formal education: Emerging evidence indicates that the use of ICTs in the educational environment can both increase women's access to education and help them feel more comfortable with technology-related courses. For example, ICTs can be used for distance

[113] *Steps taken at the Carnegie Mellon School of Computer Science increased its entrance rate for women from 7% to 40%, and the retention rate for young women increased to equal that of young men. The admissions policy was altered to give equal preference to both highly and less-experienced students. The quality of teaching was improved by putting better, more experienced, and more senior teachers into the earlier courses. A unit on diversity with emphasis on gender equality was integrated into the training of teaching assistants. In addition, several courses were initiated which placed technology in a real-world context. At the same time peer tutoring and promotion of networking among women staff and students were implemented (Margolis and Fisher 2001).*

and in-class education, for both children and adults. Radios, video and audio cassettes are used both to augment and, in some cases, substitute for a teacher (Perraton and Creed 2001). In general, girls benefit equally with boys in this setting. The introduction of computers in classrooms, while potentially equally beneficial, carries with it the range of gendered perceptions around and approaches to technology. Little research has been done on the gendered patterns of use and effect of computers in classrooms in developing countries, but existing data indicate that girls and boys will not benefit equally from computer use, nor have equal access to classroom computers, unless specific steps to ensure equal participation by girls are taken.

Distance education through ICTs provides real opportunities for women and girls to overcome many educational obstacles. The flexibility of access and study times and the potential to reach women in rural areas make this a very positive educational approach. It is often difficult for women to travel to attend school for reasons of time, cost of transportation, safety, and perceptions of the appropriateness of traveling on their own.

While distance learning can take place through a variety of technologies – radio, video, TV, etc. – e-learning is generally understood as computer- and Internet-mediated learning. Studies indicate that women benefit from and take advantage of distance and e-learning. In general, female students worked more cooperatively as a group and needed less time and assistance in learning computer skills and completing education-related tasks over the Internet.

Various surveys of open and distance learning (ODL) are emerging on the situation in certain countries in Sub-Saharan Africa, Asia, the Caribbean and the South Pacific. The Commonwealth of Learning found that although there is an assumption that women are relatively well-represented in ODL, they are not equitably represented in all countries, and there is significant variation in their representation in ODL between and within regions (Green and Trevor-Deutsch 2002). There appears to be more parity in enrolments in Asia, with the exception of India. In the Caribbean, the situation is very different: *"At all levels and in all countries the participation rate of females in education outstrips that of men, and where data is available, this includes the use of ICT"* (Green and Trevor-Deutsch 2002).

Non-formal education and skills: Given women's low literacy levels and the lesser likelihood that they will have the skills to use ICTs effectively, non-formal education in ICTs is a vital means for them to acquire such skills. Many programs have emerged around the world which use non-formal methods to bring ICT skills to women, whether to use the technologies effectively or to use the technologies for other purposes, such as to become literate, to gain employment, to generate income, or to improve skills and communication. Non-formal literacy instruction for women in several countries has profited from the use of ICTs. ICT tools can be used in non-formal education settings to link computer skills training with a wide variety of livelihoods for women.

ICTs AND GENDER IN FORMAL EDUCATION

- A study found that computers introduced into classrooms in North America were dominated by boys who spent more time using them during lessons and during free time (Volman and van Eck 2002). Similarly, a study on the use of computers in schools in Africa found that boys dominated the use of computers, and that a high student-to-computer ratio and first-come-first-served computer policies put girls at a disadvantage. In Uganda, where computers were set up in a separate lab, girls used computers less than boys because it was considered unsuitable for them to run. The boys arrived first at the computers and were unwilling to limit their time to allow the girls to use them (Gadio 2001).

- Another study found that socio-cultural factors affecting girls' ICT access included their domestic chores and early curfews at boarding schools, as well as lack of confidence in using computers. When girls had access to computers, they tended to use them more for academic research and communication with friends and family, increasing their reasoning and communication skills. They also used the Internet to obtain information on issues such as reproduction and sexuality, information not available from their families or communities. Boys tended to use the computers for sports and music and received little academic benefit. When girls did have equal access to computers, their self-confidence improved. One participant in Senegal said: *"We are no longer dependent on boys. We feel capable of solving our problems with great autonomy"* (Gadio 2001).

- Interviews with women in Asia demonstrated that women use distance education to increase income-generation, find a career that would enable them to support their families and send their children to the university, improve performance in their current work, increase self-confidence, and learn new skills. Most had to overcome strong opposition from family members, which often dissipated when the benefits to the family as a whole became evident (Kanwar and Taplin 2001).

- In Kenya, men greatly outnumber women in the ODL programs for which data were available. Men tended to be represented in agricultural extension programs, programs for health field workers, cooperative extension officers and teachers. Women were present more in adult literacy and traditional birth attendants' health programs.

- At the University of Zambia, females made up 17% of distance learners between 1994 and 1998, and 17% of students at the Africa Virtual University campus at Kenyatta University. Women make up about one-third of the student population in Zimbabwe's Open University, 23% of students in the Faculty of Science of the African Virtual University and, in 2000, 36% of students at Uganda Polytechnic.

- In Malaysia, the Institute for Distance Education at Universiti Putra Malaysia had a female enrolment of 46%, while at Pakistan's Allama Iqbal Open University (AIOU) 43% of students are women. At the Indira Gandhi National Open University (IGNOU), 28.4% of students were women in 1998.

- The South Pacific appears to experience gender parity in ODL programming: at the University of the South Pacific, the largest ODL provider in region, 48% of students were women in 2000. Data varied on campuses in various countries: in Solomon Islands, the female participation was 25.5%, in Vanuatu it was 35%, and in Tuvalu and Kiribati 60%.

- In Jamaica and St. Kitts and Nevis, more women than men used computer-based literacy programs, a trend that follows educational trends in the region in general. In the Caribbean, more boys than girls drop out of school, for a variety of socio-cultural reasons including lack of male role models, lack of male teachers, and violence. (Huyer 2004).

- Among developed countries, the percentage of women in ODL programming also varies, although women are in the majority in several countries. In North America, for instance, female participation in distance courses ranges from 61%-78% (Thompson 1998, Commonwealth of Learning 1999, Kanwar and Taplin 2001, Green and Trevor-Deutsch 2002). Female participation is lower in Europe.

ICTs AND GENDER IN NON-FORMAL EDUCATION

- The largest non-formal ICT skills education program worldwide geared specifically to women was that of the South Korean government, which trained a million housewives, unemployed women, and elementary school students between 2001 and 2003. The government is now mounting a second program to train two million women. The program also encompassed e-business classes for women beginning in 2003 (Lee 2003).

- In Estonia, more than 73,000 women who had never used the Internet were trained in computer skills, comprising 71% of those trained in a free-of-charge, low-cost program financed by four companies (Look@World Foundation 2003).

- In ICT-assisted literacy classes in Zambia and India, a majority of the students were women, most from socio-economically disadvantaged communities with no or very limited previous exposure to ICTs. In India, the women were eager to learn to use computers because they associated them with income-earning opportunities. They continued to use computers beyond the courses. In Zambia, this economic motivation was not present, and almost none of the women have continued to use computers outside of the course (Farrell 2004).

- In the Caribbean, Networked Intelligence for Development organized a workshop in collaboration with the Jamaica Organic Agriculture Movement (JOAM) for women engaged in organic farming. The workshop taught them how to use the Internet in order to access and exchange information about organic farming methods, to promote their business, and to market their products. These examples indicate that the impact of literacy and computer use was greater for learners who could link literacy and computer use with their livelihood activities (Tandon 2004).

- In Afghanistan, the United Nations Development Program (UNDP), in conjunction with the Women's Affairs Ministry, has opened computer training centres targeting women in order to teach basic accounting and word processing skills to government and NGO employees (Abirafeh 2003).

- In Malaysia, *Mothers4Mothers* (*http://www.mom4mom.com*) trains women to use ICTs to build communication communities and networking opportunities for homemakers, home workers and teleworkers, including advice on becoming "homepreneurs" (Green 2004).

- A challenging situation has been targetted in India, where low literacy rates, traditional gender roles, lack of marketable skills, and lower educational levels make it difficult for women to find employment, (especially skilled or technical jobs). *Datamation Consultants Pvt. Ltd*, a 3000-employee software development firm, set up a train-and-hire program whereby partner NGOs offer free or low-cost six-to-eight month ICT training courses conducted in local languages to marginalized groups of women. Upon completion, successful women candidates are awarded full-time jobs at the firm. Datamation's organizational philosophy is to *"empower the weakest of the weak using ICT"*, especially women and the disabled (Datamation 2005).

- In northern India, Rural Litigation and Entitlement Kendra (RLEK) trains tribal nomads in using wireless communication. In a highly patriarchal setting, the project chose to train an equal number of men and women after a gender analysis showed that women were often the only residents of the tented camps. *"Men folks are moving all the time and therefore there is need to train women also because they are left behind in the houses and in case of emergency they will need the wireless"* (Nainwal 2003).

- In Thailand, the *Computer and Internet Learning Centre* at Nangrong based at a house owned by one of the local village women, serves as a learning centre where the community learns about technology and applies it to their daily lives. It is also a source of information. Emphasis is on management skills for community leaders, accounting skills and how to manage income and expenses to help increase income and reduce debt from unnecessary expenses. The female project leader became a role model to encourage other women to participate (NECTEC 2003b).

6.2.3 Employment and occupation

The rate of girls' and women's education in science and technology has been improving over the last decade. However, evidence of the last 10-15 years indicates that despite these improvements, the increased numbers of girls and women at lower levels of the system do not necessarily translate into increased numbers in higher levels of research and private sector employment. Worldwide, it appears that women scientists do not transfer their scientific qualifications into scientific occupations to the same degree as men. Data and research in both the academic institutions and industry indicate that the representation of women consistently decreases as one moves up in the system. Women's rate of temporary and shorter-term work is greater than that of men's, and women are paid significantly less than men[114] (Glover and Fielding 1999, European Union 2003, Glover 2001). These trends are reflected and in certain cases are exacerbated in the IT sector.

For those women who do enter the scientific and technical professions, two kinds of segregation exist: horizontal and vertical.

- **Horizontal segregation** constitutes segregation by discipline or sector. Existing data show that most women scientists work in the biological and health sciences, with low representation in the "hard" science disciplines such as physics and engineering. This is true in most countries. Another kind of horizontal segregation concerns the marginalisation of women into less desirable scientific disciplines or sectors. There is evidence that women enter scientific fields in greater numbers when men do not choose to enter these fields, i.e. for reasons of prestige or remuneration. More research is needed on how this pattern might relate to the low participation of women in the ICT sector.

- **Vertical segregation** relates to the issues of retention and advancement. Data from the U.K. (supported by data from the U.S.) show that women with high-level scientific qualifications tend to leave the labour market in their late '20s and early '30s, during their prime child-bearing years.[115] As a result, women's scientific careers tend to be less stable and characterized by shorter-term and temporary work rather than continuously-held positions. A U.S. study found that women's rate of exit from science is higher than that of other professions, and twice that of men. In many OECD countries, women scientists and engineers working in the industrial sector are under-represented and more likely to leave technical occupations, as well as the labour force, than women working in other sectors (Glover 2001, Preston 1994, European Union 2003).

Men are also more likely to be found in senior and management positions. The main activity for men with scientific qualifications is management, while for women it tends to be teaching and non-professional activities not requiring a university degree, i.e. technicians. In ICT industries, in particular, the numbers of women are low and even lower in senior management positions (Salkever

[114] *This trend is illustrated by a study of women faculty in the School of Science at the Massachusetts Institute of Technology (MIT) in 1994. It found that of the 209 tenured faculty members in the School, 15 were women – 8% (compared to 194 men). This figure of 8% had not changed in the previous 10 and possibly 20 years, despite major increases in enrolments of women in undergraduate science courses, indicating that attrition of women through the system was ongoing and unchanging (MIT 1999).*

[115] *Forty-four percent of men in scientific professions are employed for at least 10 years at a stretch, while only 13% of women are employed for the same period, and three-quarters of male employment periods last at least five years compared to one-third for females.*

2004)[116]. Women in the South African ICT industries overwhelmingly felt (85%) that there continues to be a gender bias in the field, while 59% felt that sexism is an area of concern in their workplace. Nearly half (49%) have been asked to perform tasks not required from male colleagues at the same level (van der Werwe and Stander 2002). In Australia, a survey of successful strategies of women in ICT professions also focussed on organizational factors as most significant in women's adaptation to the workplace: "*Women think that their difficulties rest more on the adaptation to a male organizational culture than women's technological aptitudes"* (Pringle *et al.* 2000).

The lower level of retention of women in science careers and the resulting lower number of women in senior positions can be partially attributed to the lower age of women in science, but a wider range of factors also apply to produce this glass ceiling. These include work-life balance, child-bearing and –rearing, gendered patterns and approaches to productivity, and attitudes towards the performance of women in the S&T academic or industry workplace.

Work-life balance: In the U.S., professional women work roughly 15 hours/week more at home than their husbands and sleep 20 minutes less per night. Those with children sleep 40 minutes less per night than their husbands (Schiebinger 1999). Men are more likely to spend extra time on the job, and more likely to work on weekends than women (Rathgeber 2002a). Campion and Shrum found that women scientists in East Africa who participated in their study were perceived as the primary caregivers at home (2004). In China, women working in IT, although earning higher than average salaries, experience role conflicts, as they average only 2 hours a day in personal/ family time while other working women average 5 hours (Survey of Chinese Women in Information Technology 2004). In general, it is well recognized that it is more onerous for women to reconcile work and home life.

The ICT sector is characterized by an intense "workaholic" culture, which frequently involves late nights, working weekends, and ad hoc meetings. Women often have to choose between having children and a family life or career advancement (Salkever 2004). Since women remain primarily responsible for children and family, it is more difficult for them to work extended hours in evenings or weekends or take business trips (Hill 2005). A study in the U.S. found that women in technology love the creative freedom, opportunities for growth and relative lack of barriers to advancement in the field. Nevertheless, many consider that the hours and level of commitment required in many ICT jobs do not promote a healthy balance between work and personal life (Melymuka 2004).

Returning to the workforce after leaving for child-rearing poses another set of difficulties. Many women attempting to return to the private sector find that their skills need updating, especially if they have been away for more than 1-2 years. Additionally, if unemployment rates are high, candidates with no break in employment experience are generally considered more desirable than those who have been out of the workforce (Salkever 2004).

Work Culture: A work culture that is unfriendly and more demanding of women may also be a factor which restricts their success in the technology workplace. As well as dealing with a "workaholic" culture, women in the ICT sector may have to contend with perceptions of "who" is a computer scientist. The quality of the work of those who do not fit the "geek" stereotype can as a result go unrecognised and it is more difficult for them to be taken seriously in the field (Margolis and Fisher 2001). Other factors to consider in the work culture include:

[116] *In fact, in the U.S., the percentage of women in the ICT workforce overall is decreasing. In 1996, women made up 41% of IT workers, but by 2002 that figure had dropped to 35%, and according to some the rate of decrease is continuing (Hill 2005, Melymuka 2004).*

- **Age:** women tend to be younger than their male colleagues, since women's entry into science, engineering and technology fields is a relatively recent phenomenon. This is true in developed as well as developing countries.
- **Position:** even after controlling for factors affecting promotion, including experience, women are less likely to be in senior ranks. They receive less credit for experience than men do – either due to family responsibilities, workforce interruptions, or gender bias.
- **Performance:** women's contributions tend not to be as readily recognized as those of men (National Science Foundation 2003, Rathgeber 2002a, van der Merwe and Stander 2002, Ilavarasan 2004, Vendramin et al. 2003, Huyer 2004).

Non-professional employment in the ICT sector: The rise of ICT-related employment, created partly as a result of trade in services such as data processing, call centre work and cybercafés, can be seen in some respects as an opportunity for women – similar to that experienced in the rise in women's manufacturing work in the export sector. It may represent new and better-paying employment opportunities for women in developing countries, although women tend to be overrepresented in lower-paid, lower-skilled and lower-level positions (in both developed and developing countries) (Mitter 2003, Barry 2005).

Telework and flexi-time: The term "telework" usually implies home-based work or telecommuting. In certain situations it can enhance the participation of women in e-commerce and employment, as it allows certain flexibility both in timing and location of work. There has been a wealth of empirical research by scholars on the potential of telework to allow women to combine the demands of domestic duties with those of a career. In developed countries telework can be a boon, allowing women to combine child-care duties with their professional lives, or allowing them to live outside of urban centres.

Research in this area so far has taken place predominantly in developed countries. One exception concerns two research projects in India and Malaysia, by Mitter (2000, 2002) in collaboration with local research teams, to explore the potential and spread of teleworking in developing countries. The incidence of home-based telework in Asia is extremely low, even in centres of commercial activity such as Mumbai and Kuala Lumpur (1% and 0.35 % respectively). In institution-based teleworking it is easier to monitor and supervise employees, while for the workers themselves home-based teleworking involves skills in self-management and time management.

Concerns about teleworking in developing countries include the risk that home-based work will deprive women of the status and security they have as working women and of dignity at work, as well as pose feelings of isolation and additional costs for technical equipment and support. Some concerns are relevant to both developed and developing countries, such as difficulty balancing home and work environments, and the use of home workers as a way for businesses to avoid labour laws, paying benefits or social insurance (Angelina 2004, Mitter 2003).

ICTs and women's entrepreneurship: In North America, many women in the ICT sector choose to set up their own businesses, providing them with more flexibility and independence. ICTs can also provide a base for women's enterprises in developing countries. However, access to credit and other resources are a problem for women everywhere. While women led 28% of all U.S. businesses in 2002, employing more than 10 million workers and generating $1.5 trillion in sales, female entrepreneurs historically have received a disproportionately low share of available venture capital, as little as 4%-9% ("New Report" 2004).

However, ICTs have a role to play in supporting women's small-scale enterprises, and evidence exists that when women do have equitable and affordable access to ICTs, they use them effectively to support income-generation. ICTs can act as a basis for enterprises such as call centres and cyber kiosks[117], but they can also support other income-generating activities through improved communications, business management and training.

ICTs AND WOMEN'S ENTREPRENEURSHIP

- The Inter-City Marketing Network for women micro-entrepreneurs was initiated by FOOD in India in April 2001 when it was noticed that there was often a production surplus in some areas, and a shortage in others. In addition, many women from low-income families made food and household products at home, but were not always effective at marketing these items, so that the products were often sold at relatively low prices to middlemen. The network aims to link women micro-entrepreneurs from different urban areas to exchange goods and to enable them to develop new markets for their products. The groups trade over 100 basic products including soap, cooking oil, washing powder, rice, pickles, spices and candles. Communication is maintained through mobile phones, which are used for receiving and placing orders for goods with other groups in the network and for comparing prices across the region. Each group is responsible for choosing its own mobile network providers, tariffs etc. In the space of one year this project has grown to link 300 women's groups across Tamil Nadu (Batchelor and Sugden 2003).

- Hipknit is an e-commerce project initiated by the Society for Health Environment and Women's Development (SHEWD) that markets online a wide range of custom-designed wool clothing hand-knitted in Nepal. Participants learn profitable handicraft skills as well as business skills, and part of the profits are reinvested in other community projects in health, environmental awareness, and education (CIDA 2004).

- At the Datamation ICT Centre in Seelampur, India, women use Paint Brush and other creative tools such as Adobe Illustrator, Photoshop and Corel to design and visualise their tailoring, embroidery, paintings and other traditional craft and designs. For example, young women bring embroidery designs and patterns to the centre and computerize them using scanners and digital cameras (CIDA 2004).

- SEWA-India, is a member-based organization of poor women working in the informal sector. Two-thirds of the members live in rural areas and are home-based workers, vendors, manual labourers, service providers, and producers. SEWA's ICT unit has been exploring the use of ICTs as a tool to increase the efficiency of rural micro-level enterprise activities to secure poor women's livelihood. It provides its members with access to information, trains them with communication tools and customized software, provides technical training on repairing tools, generates job opportunities and even provides child and health care (Patel 2003).

6.2.4 Financial barriers and universal access

It has been well documented that many women cannot afford to pay at the same levels as men for access to information. Female earnings in general are less than those of males, while many women earn no cash income at all. In developed and developing countries alike, much of women's work is unpaid. In developing countries, women tend to lack access to other economic resources as well, such as land and labour force. Moreover, not only do women have less disposable

[117] *IDRC has found that women make excellent managers of telecentres and cyber kiosks, and several examples exist of women-run cyber-kiosks.*

income than men in general, they have more family responsibilities and are more likely than men to spend their earnings on food, clothes and other basic needs (UNFPA 1999).

To exacerbate this situation, the costs of communication in developing countries, notably on the African continent, are daunting. In many African countries, the price of a dial-up connection generally runs at about US$25-$40 per month, roughly the same as a (much faster) connection in North America. However, as a percentage of annual per capita income, the difference is dramatic. Even at the low figure of US$25/month, such a connection amounts to 300% of annual per capita income in LDCs such as Ethiopia, whereas in the U.S. it represents less than 1%. In other words, the cost of an Internet connection can be 300 times higher in parts of Africa than in the U.S. As women have less access to cash in such countries, they are particularly heavily hit by those prices. They are also affected by policy decisions that make illegal communications applications that would lower prices. For example, the prohibition of low-cost telephone using Voice over Internet Protocol (VoIP) in many countries affects women's access to long-distance communications.

High costs pertain not only to connectivity but to ICT equipment. In addition, as was discussed in Chapter 5, taxes are levied that make prices so high relative to people's incomes that they have been the subject of protests in some countries.[118] Women's perception of usefulness of ICTs is similar to that of men, as discussed in section 6.1, and this extends to their willingness to pay. One study found no discernible differences between men and women in their willingness to pay for phone use in Ghana, Botswana and Uganda (Scott, McKemey and Batchelor 2004). However, affordability is a major issue.

ICTs NOT AFFORDABLE TO WOMEN

- In a survey of access to ICTs by South African rural women farmers, Kiplang'at (2004) found that 37.8% of women were unable to use ICT for economic reasons: the cost of ICT equipment and access were the major barriers to their use.
- A Commonwealth of Learning study in Zambia reported that *"women are generally not engaged in their own economic activities and very few women have money. In many cases, their husbands bar them from making money. Since they need consent from their husbands to obtain a loan, they may have no access to lending institutions"* (Green and Trevor-Deutsch 2002).
- Even though Uganda has exempted computers from taxation, the types of ICTs that are most useful to women, such as radios, are not exempt. A community radio station, 101.7 MAMA FM, set up by the Uganda Media Women's Association (UMWA) to reach poor women, was subject to taxes exceeding its total budget (see *http://www.wougnet.org*).

Gender dimensions of universal access policies: Although the standard mechanism for reaching underserved populations in developed countries has been through universal service, the challenge of doing so in poor countries has led to universal access policies (providing access to the community rather than the individual, at affordable prices). New technologies have made these solutions more promising, and many developing countries are investing in such policies. Expansion of public telephones and ICT access points (e.g. in post offices) are examples of these solutions. They are particularly promising for poor women in underserved areas (Jorge 2002b).

[118] *In March 2005, women were prominent in a protest of mobile phone users over the costs of cell phones in Bangladesh. Users demonstrated in the capital Dhaka to demand that operating companies reduce their call charges. The protesters say the charges they face are more expensive than those of other operators in other countries of the South Asia region (BBC 2005).*

The shift from universal service to universal access underlines that one solution for augmenting women's access, especially in the rural areas of developing countries, may be that of shared community access. Community access strategies can address two of the greatest obstacles that women face with respect to ICTs – the lack of access and the cost of access. Any solution, particularly in rural areas or areas with no infrastructure at all (traditionally believed to be unattractive for private investment due to high costs and low demand potential), will need to be stimulated by regional and national policies that promote and facilitate the development and deployment of ICT in these areas (Jorge 2002b, Marcelle 2000, AIS-GWG 1999).

Telecentres have become the fashionable solution, but even these projects do not guarantee affordability. Most telecentres are implemented as business ventures, charging for services based on their costs, which, among other things, reflect high communications tariffs, expensive equipment, and salaries. While sustainability, and even increasing profitability, are possible in many areas, the main challenge lies in the ability of advocates to influence the process and policy makers to establish policies that will improve access for underserved groups and lead to project success. Initiatives such as discounted tariffs for telecentre and community access points and/or special subsidies to fund projects until demand is large enough to ensure sustainability are potential options (Hafkin and Jorge 2003).

Universal access policies can also include Telecommunications Development Funds (TDF), which are established and administered by telecommunications regulators to finance the expansion of ICTs in underserved and rural areas. TDFs are among the most interesting and potentially effective mechanisms to make ICT more affordable for women through financing of projects in telecentres, phone shops, public telephones and libraries. TDFs have been successfully developed and implemented in many Latin American countries (e.g. Peru and Chile), and several countries in Africa and Asia are currently working towards developing their own (e.g. Zambia, Uganda, Nigeria, Sri Lanka). It has been suggested that gender advocates get involved in TDF discussions, placing emphasis on gender-focussed issues – such as the proportion of funding allocated to women, women owners and managers, and assuring the participation of women in ICT training (Jorge 2002b).[119]

Several additional pro-poor ICT policies have been suggested that would potentially ease the financial burden of ICTs on women, particularly those in female-headed households in developing countries. They include: pro-competition provisions for ICT infrastructure, including the last mile; pro-poor license obligations for service providers and operators; creating space for local initiatives and policies; enabling community radio, and the application of cost-effective and locally adaptable tools such as Free and Open Source Software (FOSS) (Gerster and Zimmermann 2005). However, the institution of these policy provisions would not be sufficient by themselves without incorporating an awareness of gender equity issues in each of them. Many instances exist of countries which have included such policy provisions without a concomitant positive effect on gender equity (Jorge 2005).

Open-source software: Women's advocacy organizations, particularly those in support of the use of ICTs for advocacy of women's rights, are actively supporting FOSS as a tool useful to women.

[119] *In South Africa a number of telecentres have been established with particular attention to the needs of women users, with funds from the national TDF. The Fund has a policy that at least 50% of telecentre managers and owners should be women or women's organizations (Jorge 2000).*

The attraction of FOSS[120] is that it makes affordable software possible. The Civil Society Working Group (CSWG), of which the NGO Gender Strategies Group was a member, made FOSS part of its WSIS platform: *"We need to encourage local, low-cost and open source solutions and South-South exchanges that prevent the growth of monopolies in the ICT sector"* (CSWG 2003).

6.2.5 Media and content

In addition to the lack of electricity and ICT infrastructure, low levels of literacy, lack of computer skills, lack of knowledge of the languages that predominate on the Internet, little free time, little discretionary cash income and numerous other socio-cultural impediments, the lack of appropriate and useful content is an important barrier for women's equal access to and use of ICTs. To reach women with the information and knowledge they need, ICT systems should incorporate a mix of technologies which are appropriate to the local infrastructure, socio-economic situation, and levels of education and literacy. Initiatives to develop locally-relevant content, which is useful to varying groups in the community and available in local languages, are in short supply but necessary in order for ICTs to live up to their potential.

For these reasons, radio remains a critically important ICT. Gerster and Zimmermann (2005) make the point that the choice of appropriate media should be determined by level of country development: *"In an area with low income, significant illiteracy and lack of knowledge of major international languages, community radio – particularly community radio linked to Internet – makes more sense for women than Internet over computers. This is particularly so in Africa, which, while it lags behind Asia in number of phone lines and Internet users, has a high number of radios. Average for the region is 238/1000, while it is only 145 for Asia; and half the countries in Africa have more than 200 radios per 1000 users"*.

Community radio has become a significant medium throughout the world. Radio has high popularity with women in rural Africa, where 93.4% of women listen in. Even among those who do not own a set, 69.2% listen (Makunike-Sibanda 2001). The possibilities for using radio in ways that reach women, particularly poor women in developing countries, range from simple community radio, to community radio using rural-friendly power sources, to two-way communication combining radio and new ICTs (which also provides training for women users and supports associations of women communicators). The combination of community radio linked to the Internet is one example of using "blended media" to increase women's access to ICTs (a combination of two or more media, e.g. Internet and radio, video and Internet radio). This approach has been used in several projects aimed at women in rural areas of developing countries.

Culturally and linguistically-appropriate content: According to the Association for Progressive Communication (APC), content of interest to women either is not local, relevant or available in indigenous languages (APC 2005b). The dominance of English language content on the Internet, often from countries of the North, is a major concern raised by women and women's organizations. Ninety percent of Internet content is in 12 major languages.

A study on the use of ICTs by indigenous women in Bolivia found that more information should be made available in the Aymara language in order for women to benefit (Rodriguez 2001). Another study found that women do not use computers in telecentres because they don't find the content

[120] *Globally the organization that supports FOSS for women is* LinuxChix*, "a community for women who like Linux". In addition to the U.S., there are chapters in Africa, Australia, Canada, throughout Europe and Brazil. In 2004, the first LinuxChix chapter in Africa came into existence. The aim of the African chapter is to help build critical mass of Linux skills among African women and to advocate for the use of FOSS for the many community development challenges being faced by Africans, especially African women (LinuxChix 2004).*

WOMEN AND RADIO

- In Suva, Fiji, Femtalk 89.2, a women's community radio initiative of femLINKpacific (Media Initiatives for Women), uses a mobile 'suitcase' radio to broadcast to women and their communities in semi-urban and rural Fiji (FemLINKpacific 2005).

- A rural radio project focusing on development information in West Africa that has been successful in incorporating gender issues is the Benin MicroFinance and Marketing Project (PROMIC). FM radio is used to broadcast price and market information in local languages to women farmers, 90% of whom are illiterate and the main earners of family income (Tounessi 2000, *http://www.ifad.org/ngo/doc/#benin*).

- In Zimbabwe, some 52 women's radio listening clubs are active in the Development Through Radio (DTR) project, which is aimed at giving rural women access to radio through participation in the production of programs based on their development needs and priorities. The DTR project involves two-way communication and not simply broadcasts. In the project, the women record their views and questions on development issues in Bemba; tapes are then sent to a producer in Lusaka who records responses from relevant officials and edits the discussion and the responses into weekly broadcasts (Mufune 2001). In another DTR project for women farmers in northern Nigeria, women received a badly needed electric power transformer from government authorities as a result of a request sent by radio (Garba 2004).

- DTR's use of radio-Internet convergence has spread to Sierra Leone, where the target audience is women war victims. The women's listening clubs define and develop their own agenda and radio programs. The programs are digitized, archived and incorporate the use of video with radio (Development Gateway 2003).

- Women's community radio is supported by the Women's International Network of AMARC-WIN, an assembly of women communicators working to ensure women's right to communicate through and within the community radio movement. It is particularly active in francophone Africa (*http://win.amarc.org*).

- In Bankilare, an area of nomads 240 km west of the capital of Niamey, Niger, solar-powered WorldSpace satellite receivers and Baygen Freeplay windup/solar powered FM radios deliver program content from the WorldSpace Afristar satellite. The Africa Learning Channel and the Francophonie Channel are re-broadcast on FM community radio stations. Women represent a significant proportion of the local content committee, which determines what programs will be broadcast, and represent a large proportion of the users (Benamrane 2000, Hijab 2001).

- In the Deccan Development Society in South India, socially disadvantaged women use radio and video to document, archive and disseminate traditional farming practices, and reach policy makers (Pavrala 2000).

they need (Rathgeber 2002b). Researchers also found that rural women in South Africa didn't use telecentres, although they were actively seeking agricultural information, because they couldn't or didn't find relevant content (Kiplang'at 2004).

Several sources have underlined the importance for women of locally produced and relevant content, to call attention to their own knowledge and knowledge production, to develop Internet spaces that they feel comfortable with and which are useful to them, to distribute knowledge to others, and to develop a cyber-culture and knowledge system that is not dominated by a small number of large corporate entities (NGO Gender Strategies Working Group 2003).

Women's advocacy groups have called attention to barriers that language and literacy issues pose to women's access to ICTs, as well as the recognition that lack of multicultural content alienates many users and limits the usefulness of these new technologies for women. They identified this as a critical issue for gender equity at WSIS: *"Language barriers to information access require the development of applications like multilingual tools and databases, interfaces for non-Latin alphabets, graphic interfaces for illiterate women and automatic translation software. Likewise, the principle and value of adequate multi-cultural content in digital media calls for the production of local content by women for women to build their own knowledge, and encourage racial diversity in the representation of women"* (NGO Gender Strategies Working Group 2003).

A key question to ask in this regard is what kind of content women want. User needs' studies provide some evidence of that from developing countries. For example, in Uganda, women expressed the need for content relating to credit, agriculture, health (particularly HIV, ante-natal and reproductive health), education opportunities for girls, cooking, women's rights and dowry, children, and property rights. Girls wanted information on educational opportunities, as well as reproductive health and HIV/AIDS, women's rights, and job opportunities (Beardon et al. 2004).

Information available in inappropriate form is also a major problem. A recent study by the International Institute for Communication and Development found that despite the proliferation of agricultural information systems directed at the improvement of African agriculture, there is little information in such systems that would be accessible or of use to African women farmers because it is scattered, too abstract, or in a format directed at researchers rather than grassroots users such as small farmers. Coverage of local issues is also low so that these systems are more relevant to the North than the South (Besemer, Addison and Ferguson 2003).

In the last five years or so, awareness of the dearth of content for women in developing countries has led to a substantial number of projects and initiatives to correct this situation (see Insert next page).

6.2.6 Privacy and security

Undoubtedly, besides their benefits, ICTs bring new security threats and opportunities for greatly increased invasion of privacy. New video and computer-based technologies have increased the capability for: undetected surveillance, such as spy software which allows remote tracking of keystrokes made on a computer; eavesdropping on wireless transmissions via mobile phones; e-mail tampering, such as intercepting or redirecting e-mail; hidden GPS tracking devices and many more.

The new technologies pose the threat of abuse of the privacy of both men and women. However, harassment, pornography and other illegal activities, including the use of the Internet to facilitate trafficking of women and girls, are serious concerns. Examples of these issues are discussed next.

Harassment or cyber stalking: Cyber stalking is an outgrowth of traditional forms of stalking, in that it incorporates persistent behaviours that instil apprehension and fear (Ogilvie 2002). Some even argue that cyber stalking is more prevalent than other forms of stalking, since the Internet in effect promotes this behaviour through lower costs (free e-mail and chat room access), and the ability to contact a large number of potential victims almost immediately, with no geographical limitations. There are three main forms of cyberstalking:

CONTENT MADE FOR WOMEN

- Village Knowledge Centres in Pondicherry, India, run by the Swaminathan Foundation, are information shops run by women volunteers to give information on markets, healthcare and agriculture-related information, and to teach computer skills (Balaji et al. 2004).

- Women's Information Resource Electronic Service (WIRES) targets women entrepreneurs in small-scale business in Uganda addressing their need for information repackaged in simple, ready-to-use formats, in local languages. Through WIRES, women can access ICTs for information on markets, prices, credit and trade services (*http://www.ceewauwires.org*).

- Through video production and using the Internet the *Nutzij* project, run by a collective of young Mayan women in Guatemala, helps women develop skills to preserve their community's cultural heritage on video, and market the content to the world via the Internet (NUTZIJ 1998).

- The aim of the Online Learning Centre for Women (OLC) in Seoul, South Korea, is to develop content for women ICT trainers utilizing the workspaces of the OLC system. This initiative is the first step towards developing gender-sensitive ICT content and enhancing the development of women and ICT communities in the region (OLC 2002).

- Khwezi FM in KwaZulu-Natal is a community radio station which promotes content directed particularly at women who make up 60% of the staff and most of the listeners. Among its programs, Mothers Desk deals with issues on children's health, HIV/AIDS, and outreach programs (Promoting community radio content in Africa 2002).

- The CD-ROM 'Rural Women earning money' produced by the International Women's Tribune Centre in English and Luanda for illiterate or newly literate women farmers in the Nakaseke region of rural Uganda uses local language and incorporates a strong visual component to reach women with limited literacy (IWTC 2001).

- The Farmwise project in the Zomba district, Malawi, uses a database, an online input calculator, and e-mail to help women farmers improve their agricultural production (Nyirenda 2004).

- Feminist International Radio Endeavor (FIRE) (*http://www.fire.or.cr* and *http://www.radiofeminista.net/indexeng.htm*), based in Costa Rica, is women's Internet radio that supports community media with content on women's rights.

- A pilot project using ICT in literacy was set up by the Commonwealth of Learning in Kabwe, Zambia. Literacy training materials were interwoven with women's topics such as health, nutrition and childcare, so that the number of women learners far outnumbers that of men, a rarity in Africa where there are far more men in distance education than women (Green and Trevor-Deutsch 2002).

- ***E-mail stalking*** consists of the use of e-mail in a way that is threatening, obscene, or incites hatred. It can also take the form of spamming (sending viruses or high volumes of electronic junk mail). For example, a North American university student harassed five female students, sending over 100 messages which included death threats, graphic sexual descriptions and references to their daily activities (Grabosky 2000 and Ogilvie 2002). Anonymizers and anonymous re-mailers, which hide the e-mailer's identity, provide protection for stalkers together with incentives to begin or continue the stalking.

- ***Internet stalking*** is more public, in that web sites and chat rooms are used to threaten and slander targets, as well as to publish intended actions against the target. A particularly gruesome example in the U.S. involved a young man who was looking for a woman who he believed had humiliated him in high school. He maintained a web site for nearly two years, describing the young woman, providing updates on her, and outlining his plans to kill her. He obtained her social security number, licence-plate number and place of employment via Internet people finder services. Eventually, he drove to the woman's place of work and shot her as she got into her car (Romei 1999).

- ***Computer stalking*** is conducted through security holes in operating systems, which are used to assume control over the computer of the target through a direct computer-to-computer connection over the Internet. The perpetrator can track the web sites visited by the target, track key strokes, and even view the computer desktop (Ogilvie 2002).

According to a group entitled *Working to Halt Online Abuse* (WHO@, *http://www.haltabuse.org*), which collects self-reported data on online harassment, cumulative statistics for the period 2000-2004 indicate that women made up 78% of the targets overall, while men represented only 20%.

Pornography: Research on the effects of the Internet on pornography indicates that:

- ***It has increased the reach and number of pornographic images exponentially.*** New ICTs have contributed to the massive increase of the porn industry, which is estimated at US $46 billion per year (not including the $11 billion escort services industry). Text, images, and audio and video files can be sent from anywhere to everywhere quickly and at a relatively low cost. In the U.S. alone, the industry has been estimated at $12 billion. Of this, child pornography generates $3 billion (Internet Filter Review 2005).

- ***It allows more interactivity between customer and client.*** Live transmission of video images allows live online strip and sex shows. This can be interactive, as the buyers are able to direct the women's actions or "order" the service or person they prefer. On the other hand, the availability of web cams and cheap video equipment allows women sex workers to manage their own businesses and avoid exposure to violence, incarceration or sexually-transmitted diseases (Lynn 2005).

- ***It allows new forms of interaction among customers*** who can network and exchange information more easily and, if desired, anonymously. Chat rooms, newsgroups, and e-mail are used to share information about where to buy sex services, post pornographic pictures and videos, and broadcast live sex shows. Some sites and newsgroups provide sex travel advice and reviews.

- ***It provides new types of products,*** such as sex tours, live strip/sex shows, a range of styles and subjects of pornographic images and movies (even computer-generated images), mail order bride services, and recruitment of unsuspecting women for these purposes (see the section on trafficking below).

- ***The anonymity and ability to cross national borders provided by the Internet allows the industry to violate sexual exploitation and violence laws.*** Servers located in countries with fewer restrictions have a global reach and can serve countries with more restrictive legal environments.

- ***The Internet has increased extreme pornographic material***, including increased child pornography and violence. The proliferation of pornography on the Internet has increased the demand for "new" materials, leading to the growing presence of more violent, rougher and degrading images (Amis 2001).

While the enormous increase in the distribution of pornography as a result of the Internet is well-known and documented, a newer area of concern is the distribution and use of images of women without their consent, taken either with or without their knowledge. These pictures are used in videogames and distributed on the web or cell phones. The spread of cell phone cameras is increasing this activity.

Trafficking of women and children: ICTs also contribute to an increase in sex trafficking in various ways:

- They facilitate connections between suppliers and clients, including direct propositions through chat rooms to people living, working and studying abroad. Perpetrators can disguise their identities to make connections with targets, a common strategy with pedophiles.
- They provide increased advertising opportunities to live and work abroad. Targets are promised help with travel, living and visa arrangements, while related financial transactions are faster and easier through electronic tranfers.
- They aid in the recruitment of those targeted for trafficking. For instance, they "identify" particular women to be sent to clients, who view the pictures on a website before a particular woman or girl is brought over.
- Other approaches include mail order brides and prostitution tours. Mail order agencies now prefer to use the Internet as their primary market location over more traditional media, as they can easily update the information and target their prime market: men from Western countries.

Measures taken to address and combat these abuses of ICTs include advocacy and networking, as well as national legislation restricting trafficking and sexual violence (see Insert below). Such approaches, however, can encounter opposition when legislation passed to restrict cyber crime and criminal activities online is perceived to threaten human rights.

MEASURES AGAINST ILLICIT ACTIVITIES

- National anti-trafficking and anti-slavery laws are currently in place in France, a frequent destination for women trafficked for prostitution and domestic servitude.
- The U.K., as a primary destination for women trafficked from Eastern Europe, as well as from Southeast Asia and West Africa, supports cooperation between policy and prosecutors nationally and internationally. The Nationality, Immigration and Asylum Act includes punishment for trafficking.
- The Council of Europe's Convention on Cybercrime attempts to set international standards for policing of electronic networks. Although it does not deal with trafficking, one of its areas of focus is child pornography and exploitation.
- The government of Brazil asks hotels to discourage child prostitution on their premises.
- The governments of the Gambia and the Netherlands have set up a police unit to track Dutch pedophiles in the Gambia.
- The government of Thailand works with NGOs to develop and implement anti-trafficking strategies (Chawki and Wahab 2005).

On the other hand, ICTs can also help women bypass traffickers by providing direct information on employment abroad, such as visa requirements, access to legitimate job announcements, and by allowing them to make direct contact with potential employers. They can be used as tools to find people who have disappeared, allowing rapid exchange of information among groups. Website and e-mail lists provide resources, information and support for targets of security abuses, and also monitor and expose activities of perpetrators and stalkers. While many developing countries are grappling with the basic access and ICT infrastructure issues, many countries in the North are now defining the basic rights framework for Internet use and governance.

6.2.7 ICT policy and governance

ICT policy is not gender neutral: Given gender-based constraints and differential access to resources and attitudes about appropriate gender roles and behaviours, ICT policy will not be gender neutral, but will in fact exacerbate existing gendered socio-economic inequalities in a society – unless both gender and social implications are taken into account. Doing this does not require a large investment of resources, but rather a shifting of perspective. A long-term perspective on communications regulation which takes into account the larger societal goals of connectivity, education, information, consumer protection and resolving market failures will be more conducive to achieving the goals of ICT policy and regulation, and to incorporating social considerations, including women's needs and concerns (Huyer and Sikoska 2003).

At the international level, the Geneva WSIS Declaration and Plan of Action (2003) contain several references to women and gender equality, including the commitment to ensure that the information *"enables women's empowerment and their full participation on the basis of equality in all spheres of society and in all decision-making processes"* and to *"mainstream a gender equality perspective and use ICT as a tool to that end"* (para. 12 of the Declaration). The Plan of Action contains references to women and gender concerns in its paragraphs on ICTs for education and training, fostering entrepreneurship, promoting health, employment and telework, media, and ICT indicators.

Frameworks and strategic plans on national ICT policies are generally devoid of women-focussed issues or pay lip-service to women's concerns. The strategic framework for ICT development in India, Malaysia, and the Philippines is silent on gender issues and considerations (although India has some programs to encourage women to use ICT in different sectors) (Ramilo and Villaneuva 2001). Analysis of the current projects and policies on ICTs and digital inclusion in Brazil shows that in none of them is gender equality addressed as a main issue (Selaimen 2005). The ICT Policy for China addresses women and ICT as part of the overall development of women. The ICT policy in Tanzania mentions *gender*, *women* and *equitable* five times in total, mostly in relation to discussions on the notion of *human capital* for a well-educated and learning society, but every ministry is required to have a women's desk (Etta 2004). Among ICT policies in African countries available for review, those of Botswana, Malawi and Madagascar contain no references to women or gender equality.

There is some positive movement, though. A plan adopted in 2002 by the Ministers of Communications of the Pacific Island Forum states that *"Everyone will have equal opportunity access to ICT without barriers and with special regard to women, the disadvantaged, the disabled, under represented minorities, and those in rural and remote communities*" (cited in Green and Trevor-Deutsch 2002). Indonesia has mainstreamed ICTs in its overall development plan for women, but only the Republic of Korea has a plan and a budget for this, and has pursued it vigorously. Preliminary work has been done to date in assessing the degree of gender equity analysis in national ICT policies in developing countries. Recent studies have looked at the treatment of gender issues in ICT policies and their follow-up in some African countries; the results are mixed at best (see Insert).

WOMEN IN AFRICAN NATIONAL ICT POLICIES

- In Mozambique, when its ICT policy was approved in December 2000, there was much hope that this would become a best practice on gender equity. It contained an entire chapter on gender and youth, covering a wide variety of policy areas from decision-making to training, e-commerce, applications and content development. However, the strategy for implementation, adopted in July 2002, has proved disappointing. It contains no references to women using or producing ICTs. The only reference to women, along with children, is as victims of pornography, abuse, and violence on the Internet. Significantly, no women's organizations were mentioned as participating in the national Consultative Forum (Mozambique 2002, Hafkin 2002a).
- In Senegal, telecom policy formulation has focused almost exclusively on the performance of the operator and the structure of the sector. The Telecommunications Regulation Agency is directed by a Regulatory Board with 30 employees, of which only three are women (Mottin-Sylla 2002). Women's NGOs and other stakeholders concerned about gender issues are active in Senegal, but have not been able to influence the development of the national ICT policy.
- South Africa's 1999 Telecommunications Act established the Universal Service Agency and provided the policy and legislative frameworks to redress the gender imbalance, among other issues. During the consultative process leading up to the Act, the White Paper on communications (1996) stated that *"besides referring to those who were disadvantaged by the apartheid system in the past, the term 'disadvantaged" also applies to those South Africans who have been historically disadvantaged through discrimination on the grounds of gender and/or disability"*. It also stressed the need to ensure gender equality in issues such as licensing, procurement and training. Additionally, the national research and development strategy includes a chapter on human capacity building in S&T, generally, with many references to the importance of gender equality. However, implementation has fallen short on gender impact. A major reason for the shortfall is that current policy does not address issues of affordability, because technical features of the network are presumed to be gender-neutral with respect to costs, and because insufficient attention has been given to seeking innovative ways of addressing women's information needs. Gender has not been mainstreamed into the activities of regulators and operators. A relatively small percentage of women will benefit from the policy through their inclusion in the ownership and control of new companies, or from increased employment or promotion opportunities in the telecommunications sector (Gillwald 1999).
- Uganda's National Information and Communication Technology Policy Framework (2002) includes references to the need for a policy to stimulate industrial growth, commerce, infrastructure and linkage of rural and urban communities *"as well as uplifting of disadvantaged groups, while taking care of gender balance"* and making available communications at affordable costs *"which match the ability of their users to pay, so as to reduce gender and spatial disparities in information access."* In addition it states that one of its policy objectives is to ensure gender mainstreaming in ICTs for development and associated strategies (Uganda 2002).
- In Zambia, the first draft of the National Information and Communication Policy (November 2003), lists several references to gender and youth. Its guiding principles include mainstreaming youth and gender into the policy formulation, review, and implementation.
- In Ghana, the ICT for Accelerated Development Policy (2003) includes several references to women and gender equality, with an overall goal *"to accelerate the development of women and eliminate gender inequalities in education, employment, decision making through the deployment and exploitation of ICT by building capacities and providing opportunities for girls and women"*. Bridging the gender inequality gap in social, economic and political development is listed as a strategic focus, while objectives and priorities include: increasing women's access to ICTs by ensuring gender balance in training; promoting women's rights to expression and communication through ICT; and the development of a reporting mechanism to monitor progress.
- The ICT Policy and Strategy in Benin includes the objective of making Benin an information literate society made up of men and women capable of being active in and benefiting from the information society. Actions include increasing women's capacities to use ICTs, promoting ICTs among women's organizations, and using ICTs to develop an information system which promotes women and women's concerns.

6.2.8 The impact of ICTs on gender equality

Obviously, impacts can be both positive and negative. Some argue that while ICTs can be important tools for promoting gender equity and empowering women, they have also been appropriated by those seeking to profit from the exploitation of women. Daly (2003) notes that relatively few applications of the technology will be planned to achieve gender goals, but indirectly ICTs may have profound effects on gender roles, gender equity, and the empowerment of women. What seems relatively clear, however, is that gender issues have to receive frontline attention if ICTs are to promote women's equality.

In any event, there are plenty of examples that indicate the potential for ICTs to promote increased self-esteem, social status and increased confidence in women. The number and frequency of such accounts and their clear gendered nature indicate that ICTs enable women to overcome isolation and move towards increased opportunities. However, there is little rigorous analysis of the role of ICTs in women's empowerment to date. Similar findings of the effects on technology use by women in developing countries have been more credibly documented in the case of agricultural technologies. When introduced in a participatory manner that recognizes the situations, interests, concerns and access to resources of women, agricultural technology can contribute to women's empowerment in dealing with traders and their husbands, increase their freedom of movement, freedom from physical violence, and political knowledge and awareness specifically related to the adoption of the technology itself *(*Meinzen-Dick et al 2003). There is a need for more systematic and rigorous work on measuring ICT impacts on women, at various levels and contexts. The issues of self-esteem, social status and women's empowerment are elaborated below.

Self-esteem: In six case studies of multi-donor ICT projects, women participants emerged from each project with enhanced self-esteem (Hafkin 2002b). In a self-evaluation of users at the Sitakund ICT centre, in India, none of the men mentioned any increase in self-confidence, while every women user identified this as an outcome. One of the users of the centre attested: *"But among these changes the most significant change in me has been that I previously used to feel some kind of fear to get out of the house alone, and I used to feel diffidence after coming to the centre. But now there is not a bit of that previous fear in me"* (Slater and Tacchi 2004b).

An evaluation of the WorldLinks program in Africa showed that while 70% of boys saw no impact on their self-esteem from the program, 95% of the girls said that they gained confidence and self-esteem from it (Gadio 2001). Women in ICT projects in Afghanistan reiterated the benefits of a reduced sense of isolation and increase in self-esteem and empowerment (World Bank 2005). In Bolivia, indigenous Aymara women using ICT found that the use of computers *"strengthens considerably the self-esteem"* and sense of self-worth of women (Rodriguez 2001).

Social status: Association with technology also seems to convey increased social status to women in their communities. Poor Bangladeshi women experienced an enhancement of their social status by virtue of their privileged access to a means of communications in the Grameen Village Pay Phones program (Aminuzzaman 2002). In Seelampur, India, women who had learned computer skills were seen as worldly, as sources of information and as having mastered a sophisticated technical device. They gained a position in decision-making in their family that they did not have before (Slater and Tacchi 2004a). At Nabanna, another ICT centre in India, women reported that they had gained respect in their local communities as a result of their ICT skills. Not only were they able to use a computer but also they were recognized as valuable sources of information (Ghose and Ghosh Ray 2004). Local women reporters on rural radio programs also reported higher social status as a result of their association with the medium (Joshi 2005).

ICT IMPACTS ON WOMEN

- The classic case cited is that of the Grameen Bank Village Pay Phones, where women operators were netting about US$700 per year, more than twice the annual per capita income in Bangladesh (Richardson, Ramirez and Haq 2000). Another example of direct links between women, ICTs and income generation is that of e-Seva (e-services) of West Godavari District, Andhra Pradesh, India where 80 web-enabled rural information kiosks have been established at mandal (subdistrict) level, run and managed by women from self-help groups. The centres are becoming self-sustaining and the women operators are earning between 6,000 and 15,000 rupees per month (GKP 2003).

- In the Farmwise project in Malawi, improved access to information resulted in increased productivity of women farmers. The project leaders claim that, as a result of the database information project, the women's productivity more than doubled to the point of producing about 10–15 bags of maize each (Nyirenda 2004).

- After accessing and using information made available to them in the Manage project of the National Institute of Agricultural Extension Management in Hyderabad, Andra Pradesh, women began to put pressure on bureaucrats to serve them properly and in a timely fashion (*http://www.sustainableicts.org*).

- The pilot phase of the Women Information and Communications Technology (WICT) project aimed to use modern ICTs to empower poor urban women in Nairobi by enabling them to communicate to policy makers. The women acquired a video camera and negotiated to supply one of the leading broadcasting stations in the country with TV news items and video clips. Material covering several incidences of unrest in the settlement were provided to the media, and subsequently used as news items. This has raised their profile in the community and their own self-esteem.

- Online communities in Saudi Arabia have enabled men and women to communicate in new ways. While they remain physically segregated when communicating with each other online, their interaction allows them to overcome culturally-imposed separation of the sexes to a certain extent (Al-Saggaf and Williamson 2004) - raising interesting questions about the potential for new modes of communication between men and women in such societies. Interestingly, positive results of this online communication included greater open-mindedness for both women and men, who became more aware of the personal characteristics of individuals within their society and less inhibited about the opposite sex. Online communication in Saudi Arabia *"is disrupting long-established traditions, enabling the mixing of members of both sexes, and making people aware of different ways of living"* (Al-Saggaf 2004)."

- At a computer education centre in India, young women were given the opportunity to physically and socially enter into a mixed public space, to move freely around their community, to express themselves to men and other authority figures, to voice criticism, suggestions, to gossip and have fun, and express themselves through cultural forms such as singing, public debates (held at the centre), using pictures and words (on the computer). Each of these steps in the Sitakund culture is a direct challenge to traditional roles and norms (Slater and Tacchi 2004a).

- In Iran, blogs have provided an opportunity for women to talk about taboo subjects in their society, such as the role of women, sexuality and other social issues (Hermida 2002).

According to a project leader in the M.S. Swaminathan Research Foundation's Village Knowledge Centre in Pondicherry *"The women in the Pondicherry knowledge centre villages have acquired some status and standing in the community. Men - farmers, landless laborers, traders - come and ask them for information and they provide the answers. They have set up self-help groups and micro-enterprises. They have taken part in discussions held at our Foundation and answered questions posed by many overseas delegates. Only a few years ago they would not have ventured out of their village unaccompanied by their husbands or in-laws"* (UNITes 2003).

Empowerment: Examples that ICTs are boosting women's ability to take action, locally and globally continue to accumulate. Women volunteers and women users of the centres now see themselves connected to the world outside of their village. *"They are no longer the ordinary village women whose horizon does not extend beyond their village. They are on their way to becoming global citizens"* (UNITes 2003). In Latin America the Internet has become a powerful tool for NGO activism in gender equity. The 'new utility' expands the efficacy and reach of advocacy petitions and action campaigns (Friedman 2004). A concrete aspect of the impact of ICTs on women is the creation of a global civil society, led by the women's movement. *"It is arguably the women's movement which has been at the forefront of this development, first with the evolution of a formidably organised, coherent and effective caucus around the Beijing and Cairo conferences, and more recently with a series of initiatives carving out international spaces on the internet and using this to take forward a global movement"* (Panos Institute 2001).

Conclusions

Ironically, the digital divide affects those who stand to benefit the most from the new opportunities afforded by ICTs. This is certainly true in the case of women, as has been examined in the preceding sections, with serious implications for the roles they are called to play in overall development efforts. While some progress has been made in recent years - at least in raising the issue - much remains to be done in order to understand better *why* gender gaps exist and *why* they matter, as well as to initiate actions as to *how* best to close the gender digital gaps and *how* this links to more general disadvantages facing women. To this end, proper quantification and analysis become critical. Such efforts, however, continue to be hindered by a dearth of adequate and reliable statistical information; much like the digital divide, a statistical divide exists where the need is greatest – in developing nations. While efforts are underway to address the situation, it may be years before satisfactory progress is achieved. In the meantime, the best alternative is to compile all that exists, despite its incompleteness and heterogeneity, and combine it with contextual knowledge as a means to deepen our understanding, support much-needed policies, and monitor progress. This is where this project aspires to contribute.

The first part of this report represents a first attempt to compile and integrate available data from both international and national sources. We are cognizant of the fact that we have only begun to address a few of the key questions – what is the magnitude of the gender digital divide, where is it found, what may affect it, how does it compare to other divides, and how it is evolving over time. We are also aware that the statistical evidence is still scant; but at least we are beginning to substantiate claims that were until now left to rhetoric, and to outline an approach to guide future research.

Mindful of these limitations, the quantitative analysis is complemented and enhanced with qualitative information. This comes in the form of field experiences, case studies, anecdotal and contextual evidence related to women in the Information Society. This type of information further illuminates some of the key issues in this area. It sheds light on some of the social factors related to women's access to and use of ICTs, including the cultural environments in which they live, the promise of ICTs for more education and skills, the financial and affordability impediments facing women, gender-appropriate media and content, gender-specific issues of privacy and security, and the shortage of women involved in ICT policy and governance. In fact, such real-life experiences may be the only way to begin to assess the outcomes and impacts of ICTs in the working and social lives of women, particularly in the developing regions of Africa, Latin America and Asia.

This research should greatly facilitate our understanding not only of the underlying causes of the gender digital divide, but also contribute to the design of pragmatic actions that need to be taken. Women's issues are right at the heart of the Information Society, and more generally absolutely indispensable to the achievement of development, growth and equity.

Chapter 7

FREE AND OPEN SOURCE SOFTWARE

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Introduction

This article uses exclusively the term free and open source software and its acronym FOSS. "Free software" and "open source software" are designated terms of the two major advocacy groups: the Free Software Foundation (FSF) and the Open Source Initiative (OSI). Using either of these terms is best avoided as it has the indirect effect of (dis)favouring one institution's activities and rationale over the other. That could be an unwise and non-neutral choice for policy makers and public entities given that both the FSF and OSI pursue the same objective – a greater use of FOSS.

FOSS is frequently brought up in discussions about how to improve access by using more affordable technology. Thus, it has been one of the issues debated in the context of the digital divide internationally, with implications for developing nations. It is also a common item in news reports about intellectual property theft and litigation. Headlines claiming that an institution saved significant sums of money by using FOSS or that lawyers rebutted allegations of code pilfering by FOSS programmers, are not uncommon. Many of the pro-FOSS voices are fuelled with resent against proprietary software giants. Many anti-FOSS lobbyists hide behind "freedom of choice" slogans. In the FOSS debate, science and technology mix well with emotions and aspirations, greed and glory, needed solutions and wishful thinking.

Advocates claim that FOSS provides empowerment, an environment for the development of local industry and skills, and technological sovereignty and independence. In short, strong medicine for the digital divide, whereby tales of user unfriendliness are but the proverbial and unavoidable bitter flavour. Teaching users and programmers the spirit of sharing may become part of a policy prerogative for digital inclusion as ethical dimensions become increasingly important for exercising development policy with a social conscience.

Software matters

Many, if not most, people take software for granted, as it is usually pre-loaded on purchased hardware or "found" at the work place. Let us remind that software is a business worth in excess of US$300 billion and it is an immensely important component for Information Society development. At a personal level, it is the interface between humans and computers

* *The views expressed in this article are those of the author and do not necessarily reflect those of the UNCTAD secretariat.*

that speak the binary language of ones and zeros; software enables the management, control and exchange of data and knowledge at a technical level (UNCTAD 2003).

Each and every program we use and the data it accesses come with implied or explicit contracts of rights, restrictions and compensation. Therefore, software governs our digital access at an economic, social and political level as well. Clicking, for example, the "I accept" button during a software installation or an access request is non-trivial, even though it is functionally simple. If software is characterized not only by technology or function but also by the social, economic and legal conventions it carries, then public policy on software procurement goes beyond being a technical concern and becomes a governance issue.

FOSS Definitions

There are two complementary ways of defining FOSS. First, it can be defined by the type of rights it gives to users, which are uniquely different from those given by proprietary programs, and; second, by how it realizes these rights, that is, by making its source code available to all users. FOSS can also be described in terms of what it is not. It is not necessarily "free of charge", even though many FOSS programs are available only for the cost of a CD or the cost of the Internet connection used to download them. "Free" in FOSS is understood in the sense of free speech, not in the sense of "gratis". FOSS is also not freeware or software in the public domain. Freeware is not distributed with its corresponding source code, while public domain programs are free of copyright - contrary to FOSS which proposes and enforces FOSS licenses. Finally, FOSS is definitely not "non-commercial"; indeed, many large companies are successfully developing, deploying or using FOSS for profit.

Thus, FOSS is software that gives its users unique freedoms and rights. According to the FSF, FOSS must give its users four basic freedoms. The freedom to:

(1) run a program for any purpose;
(2) study how a program works and adapt it to one's own needs;
(3) redistribute copies of a program to help other users, and;
(4) improve the program and release those improvements to the public, so that the whole community benefits.

The OSI provides a three-point criterion called the Open Source Definition:

(1) Source code must be distributed with the software or otherwise made available for no more than the cost of distribution;
(2) Anyone may redistribute the software for free, without owing royalties or licensing fees to the author;
(3) Anyone may modify the software or derive other software from it, and then distribute the modified software under the same terms.

The common elements in both definitions are that they define FOSS as the practice of distributing the software:

- together with its "source code"; and
- under free and open licences.

Open source code

Software is written using a programming language and the resulting text, called the source code, determines what a program can do. FOSS is software that has made its source code open to the public. But to be actually used on a computer, the source code has to be translated into object or binary code: one or several files containing a set of ones and zeros that a computer can run. Proprietary software is distributed only in binary files, while the source code is a closely guarded secret and considered valuable intellectual property. FOSS distributes both the binary file to run, and the source code to inspect, modify and compile into binary code.

Producers and distributors of proprietary software use the unavailability of the source code to prevent competitors, students or curious hobbyists from taking advantage of their investment in intellectual property. The lack of source code, however, does not stop people involved in software piracy from copying the binary files and selling them on contraband CDs or posting them on peer-to-peer networks. What source code secrecy prevents is other users and programmers from understanding how the software works, improving the program by replacing original code with a better code, reusing parts of the code in their own programs, finding and correcting bugs and security problems, and developing new software that is capable of working well with existing programs.

FOSS licences

FOSS programs are distributed with specific licences that permit and motivate users to inspect, modify and redistribute a program under the same or similar conditions. FOSS licences are designed to prevent or discourage the transformation of FOSS into proprietary software. The worst reward for a FOSS programmer's work would be to have another developer hijack and redistribute the software with a proprietary licence. FOSS is not set against copyrights or copyright regulation as such, but only against proprietary licences whose objective is to restrict user rights. To provide an alternative to traditional and restrictive copyright conditions, the FSF developed, as far back as 1983, a standard "free copyright" text, the so-called "GNU General Public License" or "GPL".[121]

The GPL, often called "copyleft", is formulated to prevent the closing of the source code of a computer program and stopping it entering a proprietary development environment. It requires users to use, simply and without exception, only the GPL should they choose to redistribute the software, either intact or modified, or as a part of another software. Once software is distributed under the GPL, it and any derivative stay under the GPL practically forever. This is why the GPL has sometimes been described as a viral licence. The substance of the GPL is essentially the maintenance of the four freedoms outlined above.

In a different approach, the Open Source Initiative does not have a prescribed licence text. Rather, it requires entities distributing open source software to satisfy the Open Source Definition (OSD) in its copyright statement. There are more than 20 approved Open Source Licenses, including the GNU GPL licence, but also licences from IT heavyweights such as IBM, Nokia and Intel. Recently, there have been efforts to reduce the plethora of licences as their numbers hamper cooperation among programmers sharing or reusing code because they can increase uncertainty over whether the licences will "cooperate" in the new or derived program.

[121] *The FSF has also developed the more permissive GNU Lesser General Public Licence for software and the GNU Free Document Licence for documents.*

The economics of FOSS

While giving users more rights and freedoms may be a worthwhile initiative, real-world considerations require that FOSS makes basic economic sense. The fact remains that a large amount of FOSS programs are developed and used, while a substantial number of applications have become world-class standards, such as the Apache web server, the GNU/Linux and FreeBSD operating systems or, more recently, the Firefox browser.

In theory, programmers should not invest time and expertise in developing programs that anyone could use as a free rider. In a tragedy of the commons scenario, no one would make substantial contributions and FOSS would stop being produced. In practice, though, there is little evidence of such a process and this raises several questions. Why do for-profit corporations or talented programmers choose to allocate substantial portions of their time, intellect and resources to FOSS development?

The answer becomes more apparent when revenue streams are considered. For any software business there are two choices: one is to sell proprietary user licences and services, such as systems integration, administration and customization; the other is to use FOSS and commercialize only the service component. The financial implications for the client of using FOSS will vary greatly from market to market and it is nearly impossible to generalize cost implications, particularly where proprietary solutions "compete" with heavy discounts or through piracy.[122] The situation in some markets may favour FOSS, as local services and expertise, where these exist, may be less costly, compared to proprietary software licences that should have the same global prices. Recognizing the possibilities of FOSS as a tool for generating revenues, rather than as a product to be sold, allows IT companies to share solutions and improvements reached while performing contracted work for clients. Underlining this approach is the notion that software is often made to order and is often too specific to be commercialized and sold pre-packaged in significant volumes.

Moving from a business perspective to mapping the motivations of individual developers, several studies (Ghosh 1998, Holmström 1999, Lerner and Tirole 2001) attempt explanations using conventional economic theory. An open-source programmer's code can be associated with the author and be well recognized, providing a certain level of ego gratification. Career incentives may also figure prominently in motivating programmers to contribute. Programmers may also make voluntary contributions as a reaction to abundance rather than scarcity - the abundance being that of knowledge and information, as well as of network bandwidth and computing power. Other explanations suggest that FOSS comes about when users do not want to pay or charge for goods and services that thrive on the Internet - millions of people on the Internet publish on matters that interest them and contribute to communities, including those involved in FOSS.

FOSS and human resources development

FOSS is sometimes described as a global IT apprentice shop. Students and professionals alike have much to gain from working in an environment where information is shared, and advances become part of a common knowledge base. Becoming a better programmer or having a more competitive IT service sector can be worthwhile goals from either a personal or a national e-policy

[122] *Microsoft's Bill Gates, quoted in the* ***Fortune*** *magazine on July 20, 1998, explained the tolerance of piracy in China as follows: "As long as they're going to steal it we want them to steal ours. They'll get sort of addicted, and then we'll somehow figure out how to collect sometime in the next decade".*

standpoint. From a development perspective, locking in knowledge behind restrictive proprietary licences may make commercial sense in some business models but it may not be a universally optimal strategy for human resources or technology development.

FOSS, intellectual property and innovation

As countries move towards a stricter implementation of strong intellectual property (IP) regulation, efforts by international proprietary software producers to decrease piracy improve the fundamental conditions for increased adoption of free and open-source software as well. FOSS is not anti-IP nor is it an alternative to respecting IP. Just like proprietary software, FOSS comes with user licences and relies on IP regulation for protection and legal remedy. Without IP regulation, FOSS enters the public domain and loses its value, thus rendering development and commercial exploitation difficult. Proprietary software producers argue that promoting the GPL means locking out software from proprietary commercial development. However, proprietary licensing allows only the owner to commercialize the intellectual property at stake; thus, the formal outcome is not that different from that of the GPL (Lessig 2002). Contrary to common understanding, the proprietary model may encourage excessive copyrighting and patent hoarding, with the final outcome being reduced investment in research and development activities as funds are redirected towards defensive patent acquisition (Bessen and Hunt 2004).

FOSS and government policy

An increasing number of developing country governments are taking a positive and active policy stance towards FOSS. This is not surprising given the touted benefits. Brazil, China, Malaysia and South Africa have all invested in FOSS policy, production or both.[123] Countries with enormously diverse levels of digital and economic development are discovering their own resourcefulness and are questioning the established proprietary paths. Theoretical advantages aside, governments need to be able to take decisions and turn policy into practice. However, this task does not scale easily. Criteria change with assigned responsibilities and levels of governance.

Individual consumers and firms choose software on the basis of cost, security, functionality and device compatibility. However, governments are publicly funded and are mandated to perform in the public interest. Use and procurement objectives may therefore be different or broader, and FOSS is often suggested as a potentially good match for government use. But this can easily deceive: procurement and use are not effected “in principle”, but in order to satisfy a certain need. Thus, public interest requires the efficient use of public funds for well-specified needs.

Judgements about needs and efficiency can be vastly different from a public perspective as compared with an individual one. Governments may choose to use technologies that have important positive externalities, which should be included in the efficiency calculation and the criteria of merit. Examples of such externalities would be simplified software localization, effects on overall human capacities and skills, mobilizing local IT services companies or producing software for public use under a permissive licence. All these are formally more achievable with FOSS because of the available source code and its anti-restrictive licences.

[123] *A list of updated country policy examples are maintained on the UNCTAD website:* http://r0.unctad.org/ecommerce/ecommerce_en/freeopen_en.htm.

Cost can definitely be a policy issue for developing countries, or indeed any country and administration. It is difficult to argue against FOSS when a proprietary desktop bundle costs the equivalent of effective $30,000 in Africa, $10,000 in Asia and $4,500 in Latin America, in comparison to $1,000 in the EU or $560 in the USA (Ghosh 2003), while a FOSS license costs nothing. In reality, total costs would also include services such as systems design and maintenance. However, this may be less of an issue for developing countries as local labour costs would also be lower. Cost can be an unbalancing factor in the near term if a country chooses FOSS but it does not have the skill base to use it - but this would almost equally apply to proprietary solutions too. Given the near-term cost ambiguities, and recognizing its potential for capacity-building, FOSS strategies may need to be of a medium- to long-term and developmental nature.

Governments may also choose not to lock public data into proprietary data formats, and may prefer not to store, manage and process such data with secret-code software but with FOSS, using open file formats. The combination of proprietary formats and vendor failure may be an undesirable risk if data permanence is a fundamental requirement, in particular if it relates to tax data, vote counts, civil information or health records. FOSS programs and their corresponding file formats bare-all and allow unrestricted and neutral inspection. A related issue is that citizens should not be forced to purchase or use a particular vendor's technology in order to gain access to government data or, indeed, to their own data.

Policy implementation can assume different forms, from awareness building and education to guidelines for procurement or investment, all the way to legislation prescribing FOSS use whenever possible in public entities. One question frequently asked in FOSS policy discussions is: should governments legislate positively the use of FOSS in public institutions? Unfortunately, there is no clear answer. Suffice it to say that if the social, economic and development logic is valid, strong legislation may add little. Legislation often helps in restricting activities that have no economic or social upside, such as not using safety belts in vehicles. The activity of not-using-FOSS may or may not fall into this category, and this is an important policy decision for governments.

Conclusions

Governments should consider having a policy on FOSS as part of their overall e-strategy. There are many good reasons to favour FOSS, but these should be evaluated on the basis of the realities of local digital readiness and an assessment of connectivity, human resources capacities and potential for the development of a software services sector. From an Information Society and development perspective, FOSS has a number of positive characteristics, in particular for the medium- to long-term. The task for policy makers is to determine whether and how these can be brought into play to improve digital inclusion.

Chapter 8

METHODOLOGY, DATA SOURCES AND DEFINITIONS

8.1 Methodological issues

The data: The work starts with the raw data. All data used in the empirical application of the model come from well-known sources, have history and continuity, they are well-tested over time, and their pros and cons are well-known. The strictest standard, that of the lowest common denominator, was applied: every series must be available for every country and for each year. Therefore, estimation of missing cells was kept to a minimum.

Nevertheless, in such a large statistical operation, where data for up to 192 countries, 21 indicators and 9 years of observations are used, it is not surprising that missing cells existed. Their estimation relied overwhelmingly on a series' trend and each country's own information - rather than donor imputation or generic techniques. Typically, the average of two years was used to fill in missing values in intermediate years or the applicable rates of growth. The fact that we deal with series that generally grow over time is tremendously conducive to this type of estimation. In total, the proportion of cells estimated represents about 4% of the total, and the quality of the fits is estimated to be in the 95%-99% confidence interval. Only about 1% of the values were imputed from donor information, selected on the basis of geographical proximity rather than through the application of generic rules. While this adds to the complexity of the calculations, it also adds to the specificity of the estimates – although obviously the quality of these fits cannot be assessed.

All in all, considering the approach to use well-known and well-tested indicators, in conjunction with the quality of the raw data, the relatively small proportion of estimated values, and the high fit of the estimates that can be assessed, the data used are deemed to be of the best quality possible.

Discussion of indicators: The conceptual framework calls for the measurement of the notions of infodensity and info-use, their sub-components and their aggregation to countries' overall Infostates. As is always the case, adaptations must be made in moving from the conceptual purity of the concepts to an empirically applied modeling exercise. Any model fit will inevitably be an approximation of the framework.

The empirical application is based on an indicators model. As explained earlier, the key to such an approach is the appropriateness of the indicators used and not their quantity. Selecting suitable but not multiple indicators for individual components of the model also avoids the problem of high

autocorrelation among indicators, something that our particular application is free of. In practice, sometimes, the choice of a suitable indicator between model components becomes blurred and the same indicator could be potentially used in either component. Judgment must be exercised, based on a combination of subject-matter knowledge and data availability. Thus, the end result of the empirical application represents a combination of statistical work and subject matter knowledge.

Having a complete set of data for all countries, all variables and all the years for which each variable is available the next step was to convert the raw data to indicators for purposes of comparability across countries and eventual aggregation. While in most cases individual indicators derived from the raw data were constructed, where appropriate, indicators were combined to form composite indicators that would come closer to the concepts that the model calls for.

Moreover, some indicator series are subject to an extreme range. A thorough statistical analysis was performed for each and every indicator, complete with its statistical moments. Although the model does not admit to any maximum values, since Infostates are unbounded upwards, this type of individual series analysis was used to apply a smoothing procedure. This was of the minimal intervention type and took care of some 'outlier' values, which distort the data more than anything else. At the same time, it is believed that this procedure takes care of some data anomalies, such as the problem with the allocation of too many Internet hosts in the United States. This procedure is based on the mean, the standard deviation (variance) and their ratio (the co-efficient of variation), and was applied in a systematic way on the basis of set rules, across individual series and years.

The measurement of Infodensity calls for the measurement of ICT capital and ICT skills. No adequate statistical information exists to measure either of these components at a detailed level. In the case of ICT capital, there are enough good indicators, though, that allow the measurement of networks. Thus, ICT capital will be restricted to networks. This is useful as it is indicative of a country's infrastructure readiness and potential.

Networks: The following indicators were used to measure networks: main telephone lines, waiting lines, digital mainlines, cell phone subscriptions, cable connections, Internet hosts, secure servers, International bandwidth.

For our purposes, we need to measure the extent of the wireline telecommunications network, which is traditionally measured by the indicator of main telephone lines (per some population measure). The reason for the widespread use of this indicator for many years is an implicit assumption that over time the demand and the supply match. In other words, if the demand is not there, it is unlikely that the network will continue to expand, as this would be uneconomical. While this assumption works reasonably well in the context of developed countries, it cannot be said to reflect reality equally well in developing countries where there is still a substantial amount of unsatisfied demand, as demonstrated by the data. In recognition of that it is really the extent of the network that we wish to measure, the following two adjustments are introduced: first, the number of waiting lines is used to adjust the main telephone lines in order to reflect better the actual extent of the network (considering that the level of demand in countries with waiting lists clearly exceeds supply, either in terms of actual geographical/population coverage or in the capacity of the switches), and; second, the degree of the network's digitization is used as an additional adjustment for the extent of the network, in so far as its capacity to deliver value-added services is concerned. (The former may be perceived as a 'quantity' adjustment and the latter as a 'quality' one).

It is for the same reason, the parallel movement of demand and supply over time, that cell phone subscribers are used as an indicator of the extent of the mobile telecommunications network. Ideally, the indicator should exclude lines used purely by households. Lines used for business and government purposes, however, cannot be isolated in the data.

Cable connectivity is another network indicator, but it poses a peculiarity. Many countries have no cable networks at all, and using the indicator indiscriminately would violate the desirable property of technological neutrality. This is so because the principal service offered by cable networks has been signals of television channels, something that is accomplished elsewhere via satellites and dishes or even antennas. Thus, the use of this indicator would unduly bias the comparisons against those countries devoid of cable networks. On the other hand, cable today is not used only for the transmission and reception of television signals, but serves increasingly as a channel for the provision of Internet services (considered broadband) and telephone services. In that sense, it is undoubtedly an extra valuable piece of the overall converging infrastructure. Thus, the availability and extent of cable networks in countries that have them should be reflected in the measurements, albeit countries that do not have them should not be 'penalized' as if they did not have, say, a wireline telecommunications network - given the multiplicity of services offered via cable, coupled with the fact that there are alternatives for what is still the main service. In this case, a monotonic transformation was applied.

So far, the extent of the Internet is commonly measured by Internet hosts, an indicator for which several caveats have been identified. From 2001 onwards we also have data for secure servers and international bandwidth. From a subject matter point of view, the significance of each of these is very different. However, they both improve on the Internet hosts indicator. Secure servers denote the sophistication of a country's Internet infrastructure. However, in many ways, they are not yet a widespread phenomenon. Even in highly developed countries, their number is very small proportionally to Internet hosts and placing this indicator on equal footing with hosts would not be sensical as it could seriously distort reality. In many island states, the mere existence of one or two of these servers, for whatever reasons they are located there, would represent an enormous proportion if expressed in terms of their small population bases. This would not indicate anything of particular importance but would rather confuse things. Therefore, a good treatment for secure servers is to incorporate them as an adjustment in the Internet hosts indicator. This way, they are used to differentiate between countries infrastructures to some extent, while keeping their importance in perspective, without unduly biasing the results in a meaningless way.

International bandwidth is emerging as a significant indicator and heralded as much superior to Internet hosts (IDRC 2002). While it is true that bandwidth matters enormously, and is related to issue of prices, the structure and architecture of the Internet infrastructure internationally, with its physical backbones, nodes, interconnections and the like can give rise to biases of a different nature that Internet hosts. For instance, cities such as Brussels and Geneva have the 'big pipes', something not unrelated to the presence of big international and transnational organizations there. While this does not change the fact that these big pipes are indeed there and form part of the countries' infrastructure, reflecting them to their full extent today would result in figures of such massive overcapacity that would border the meaningless. A simple test, the ratio of a top-bandwidth country per capita over that of a bandwidth-starving one, will produce dubious figures extremely difficult to comprehend, digest and make sense of. Again, a monotonic transformation is performed to put the differences in conceivable scale, while still maintaining the ranking of countries intact. A final note here concerns the applicability of a country's bandwidth not only to the Internet but to all networks, as it is used to carry all traffic.

Skills: There is increasing interest in work to measure ICT skills but at this point it is still at very early stages, particularly with regards to data across a large number of countries needed for international comparisons. Therefore, skills are approximated with generic education indicators, which progressively become more advanced. The following indicators are used: literacy rate and gross enrolment ratios in primary, secondary and teartiary education.

While little differentiation is offered by literacy rates and gross enrolment in primary education, especially among developed countries, the use of such indicators is consistent with theories and frameworks that view ICT skills embedded in a continuum, which starts with basic skills that become increasingly more complex and specific (ETS 2002). More differentiation is offered as we move to enrolment in secondary and tertiary education indicators, which denote the acquisition of more advanced skills and, in that sense, offer a better proxy for ICT skills. For this reason they are weighed more in the calculations. Although this treatment is the best we can do at this point for an application of this scale, this should most definitely be an area where serious improvements must be sought by the international community.

Uptake and intensity of use: The model calls for separate measures of ICT uptake and ICT intensity of use. It was deemed, however, that not enough information exists that would capture the intensity of use in a way that could be deemed satisfactory. Therefore, while uptake is measured on its own and identified as such, the available intensity of use indicators are aggregated with those of uptake to arrive at a measure of Info-use.

Uptake is measured by the following indicators: television equipped households, residential phone lines, PCs and Internet users.

The proportion of television-equipped households over 100 households serves as an indicator of the capacity to receive information through this medium, still vitally important in many countries. Obviously, it does not offer any differentiation among developed countries, where penetration rates have achieved saturation for some time.

Residential phone lines are a good indicator of uptake among households, and is used as a proxy for the better indicator, namely the proportion of households with a telephone. Unfortunately, the latter exists only in countries that have regular household surveys. One limitation of the residential lines is that there are many households with more than one phone line. This phenomenon differs by country and the numbers involved are not known for possible adjustments to be made. Therefore, in several instances, involving mostly developed countries, the indicator exceeds 100 and it is capped there.

PCs is one of those indicators that could fit equally well in measures of ICT capital rather than uptake. Given that it is not possible to differentiate between availability in business, governments and households, in combination with the focus on networks and the need for such an indicator in uptake, it is used here and provides a good idea of overall ICT uptake.

Internet users is a very good indicator for our purposes.

The following intensity of use indicators completed the measurement of Info-use: broadband users and international outgoing and incoming telephone traffic.

Data on broadband users were available from 2001 onwards and are quite relevant since broadband is associated with intensity of use. Here again, though, we encounter a situation similar to that of cable: many countries have no broadband users at all and this would bias the comparisons if they were treated on equal footing. (Implicitly, the argument is that more differentiates Internet users from non-users than narrowband Internet users from broadband users). Moreover, some controversy continues to exist as to what exactly constitutes broadband, something that could impose additional biases. The indicator used here represents DSL and cable connections. To mitigate these problems, a monotonic transformation was applied.

Incoming and outgoing telephone traffic were combined and used as an indicator of intensity of use. National traffic, if added, would offer an even better view, but such statistics are not measured in a consistent way across countries and therefore are not conducive as indicators. In dealing with traffic statistics one must be cognizant that, on a planetary scale, one country's outgoing traffic is the rest of the world's incoming traffic and vice versa. Moreover, such data are also subject to several anomalies, such as the capturing of traffic routed through countries intermediate between those where the calls were originated and terminated. Even though this requires usage of a country's infrastructure, is does not represent usage by its inhabitants. The way international traffic takes place is a function of many things, and results in certain anomalies. For this reason, this series too was subject to a monotonic transformation.

Reference year and country: The model calls for a reference (base) period and a reference country. These provide the benchmarks to quantify and monitor the evolution of the Digital Divide across countries and over time, while admitting all along to the reality that Infostates and their components can continue to expand from year to year everywhere. The year 2001 was chosen as the base, because this is the year for which additional indicators exist and therefore it can produce the best measurements.

Rather than picking a specific country as the base, Hypothetica, was created. This country represents the average among all countries used in each component of the model. In effect, Hypothetica has as values the average of each indicator among all countries examined and provides an initial delineation among countries, serving as a useful analytical tool for benchmarking.

Another benchmark country was created with its own analytical usefulness: Planetia represents the planet. Rather than be the hypothetical country of the average values of all countries, it contains the aggregate values of the whole planet if it was viewed as one country. Planetia is based on the sum total of all countries available for each component. In 2001, these countries account for: 99% of the population of the planet in networks, 98% in skills and infodensity, and 95% in info-use and the overall infostate. (In skills, the available indicators used are expressed in percentages and no cumulative totals can be constructed, therefore, Planetia and Hypothetica concide). While Planetia could be a good alternative reference country, Hypothetica was preferred in the analysis as our world still evolves around comparisons among countries more than planetary averages (effectively, of the weighted type - the weights being populations). However, Planetia was kept throughout the calculations, the presentation of the results, and the analysis.

Technical specifications and indexes: Starting from the raw data indicators were constructed with the appropriate denominators. Then the smoothing adjustment for outlier values was applied. This was based on the specific nature and characteristic behaviour of each and every series and

practically it establishes only maximum permissible values. The indicators used are such that admissible minimum values are at zero. Specifically, the following rule was applied:

for CV<1.5, max = $\bar{x} + 4std$

for 1.5<CV<3, max = $\bar{x} + 3std$

for CV>3, max = $\bar{x} + 2std$

with CV being the series' coefficient of variation, $\bar{x}$ its mean and *std* its standard deviation. This resulted in only a few, but useful, maximum values and not in all series. As explained earlier, it does not pose an upward boundary to measurements over time.

While many indicators are used as they are, some others are combined to form composite indicators. These indicators (and the associated indexes) were arrived at as follows:

For the fixed telecommunications network,

$$I^{fixed} = \frac{\text{mainlines} \times 100}{\left(1 + \frac{\text{waiting lists}}{\text{mainlines}}\right) + \left(2 - \frac{\text{digital lines}}{\text{mainlines}}\right) \times \text{population}}$$

For the Internet,

$$I^{Internet} = \frac{1 + \left(\frac{\text{secure servers}}{\text{Internet hosts}}\right) \times 100}{\text{population}}$$

The gross enrolment indicator,

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

The traffic indicator,

$$I^{traffic} = (\text{int'l outgoing} + \text{int'l incoming})/2$$

Some indicators were subject to the monotonic transformations discussed earlier. These were of the linear type, with a scalar. Again, rather than arbitrarily selected, the scalars were arrived at through a simple and systematically applied rule based on statistical analysis of each individual series. Specifically,

for CV<1.5, scalar = 4 $\bar{x}$

for 1.5<CV<3, scalar = 3 $\bar{x}$

for CV>3, scalar = 2 $\bar{x}$

Having moved from the raw data to a complete set of indicators, each indicator was converted to an index regardless of its original unit of measurement. During this conversion, a reference country (Hypothetica) and a reference year (2001) were specified, since our objective is to compare both across countries and within countries over time. (The exact choices do not distort the rankings). This is done at the level of each and every indicator, country and year.

Thus, for the reference country (c) we get:

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

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

Using the notation j for all other countries we have:

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

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

Once every indicator has been expressed in index form, we proceed to aggregate across each component. Indexes are obtained as:

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

with Π denoting product and n the number of each component's individual indexes. In 2001, for networks n=5 (fixed, mobile, cable, Internet and bandwidth), for skills n=2 (literacy and gross enrolment) and for uptake n=4 (television, residential lines, PCs, Internet users).

We continue likewise for the subsequent level of aggregation. Networks and skills are combined into the Infodensity index as:

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

with k=2. While no index is computed for intensity of use, info-use is arrived at as:

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

where z=6, that is all the four uptake indexes plus broadband users and traffic.

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

$$\textbf{Infostate} = \sqrt[2]{\textbf{(infodensity x info-use)}}$$

Clearly, once indicators have been constructed as previously explained, what follows is an unweighted average, indifferent to each individual good or service, as we have no knowledge basis to do otherwise. The choice of a geometric rather than an arithmetic mean represents a valued judgment that favours symmetrical rather than lopsided development across indicators of interest.

In order to take care of the situation whereby indicators available for 2001 are not available for prior years, the computations for the reference year 2001 were carried out twice: once with all variables and another with only the variables present for the 1995-2000 period. This yielded the link factors both for Infodensity and Info-use, which were then applied to all previous years. (Link factors are only relevant for networks and intensity of use). Considering the transformations that were necessary, the end figures do not really represent percentage changes. (In the absence of such transfromations, an index point would correspond to one percentage point).

It is clear from this methodology that the reference country has a value of 100 for the base year throughout the exercise – for each and every indicator, each component and the overall Infostate. The indexes for all other countries assume their corresponding values. However, the reference country's score is not static; it is moving over time. So, consistent with the terms of reference, two-fold comparisons can be made: cross-country at any given point in time, and within each country over time. In a sense, for specific indicators, aggregate components of interest or the overall Infostate index, the values of different countries will effectively reflect each other's timeline. For instance, if a country had 20% Internet penetration in 1999 while another country achieved that in 2001, it can be said to be two years behind.

Sensitivity analysis: In statistical work of such scale numerous decisions come into play and various alternatives open up. From creating composite indicators, to applying smoothing techniques, to the alternative ways of performing monotonic transformations (scalars, logarithms, square roots etc.), to grouping variables for aggregation, to using geometric or arithmetic means, a huge number of permutations is possible. As is well-known, each different choice, such as method of aggregation, affects the end figures. To ascertain the robustness of the conclusions of the overall results – rather than the actual figures – a vast number of tests was carried out, effectively exceeding 2,000 permutations and therefore an equal set of estimates. While the precise figures change, especially among the top countries, the conclusions stand. They were found to be extremely robust to different methodologies – with the exception of the top tier of countries.

Among these countries that top the infostate list no definitive conclusions can be reached. At least half the countries there can come up on top of one another depending on the specific application. Therefore, comparisons based on the ranking of these countries cannot be supported by the results. This would require much more detailed information than is available and would represent a totally different exercise. That the same groups of countries comes up on top, though, and that their difference from countries at the bottom is huge, comes out loud and clear and is in no way affected by the exact choice of technique or method of aggregation. This is consistent with the terms of reference to place the emphasis on developing countries.

8.2 Data Sources and Definitions

Demography and economy: These data come from national statistical offices as well as the following sources: International Monetary Fund. Various years. International Financial Statistics. Washington, D.C. World Bank. Various years. World Development Indicators. Washington, D.C. United Nations. Various years. Monthly Bulletin of Statistics. Various years. Population and Vital Statistics Report. New York. Various years. Comtrade database. Geneva.

Telecommunications: Data on this subject are obtained from ITU annual questionnaires as well as reports from national statistical offices, telecommunication ministries, regulators, and operators. A full list is available from the address shown in the Introduction. Selected data were also obtained from the following sources: Asociación Hispanoamericana de Centros de Investigación y Empresas de Telecomunicaciones. Various years. Anuario. Madrid. Regional Commonwealth in the Field of Communications. Various years. Statistical Report. Moscow.

Broadcasting: These data come from national statistical offices and broadcasting agencies. In addition, the following publications were consulted: European Audiovisual Observatory. Various years. Statistical Yearbook. Strasbourg. National Cable Television Association. Various years. Facts at a Glance: International Cable. Washington, D.C. United Nations Educational, Scientific and Cultural Organization. Various years. Statistical Yearbook. Paris.

Information technology: Data on Personal Computers are estimated based on stock and shipment data from many national and international sources. Data for Internet hosts are from: Internet Software Consortium. Various years. Internet Domain Survey. Available from *http://www.isc.org*. RIPE (Réseaux IP Européens). Various years. European Hostcount. Available from *http://www.ripe.net*.

ITU definitions

Some indicators in this category are useful for deriving ratios in order to make comparisons across countries. They are generally obtained from international organizations (see Sources) or national statistical offices. Readers are advised to consult the publications of the international organizations shown in Sources for precise definitions of the demographic and macro-economic data.

Population: The data for population are mid-year estimates. They typically refer to the de facto population within the present boundaries.

Households: The data for households refer to the number of housing units consisting of persons who live together or a person living alone. Estimates are based on growth rates between censuses.

Gross domestic product (GDP): The data for Gross Domestic Product (GDP) are current price data in national currency. GDP is the sum of final expenditures on goods and services in the domestic economy.

Telephone Network: The indicators in this category refer to the fixed telephone network.

Main telephone lines in operation: The number of telephone lines connecting the subscriber's terminal equipment to the public switched network and which have a dedicated port in the telephone exchange equipment. This term is synonymous with the term main station or Direct Exchange Line (DEL) which are commonly used in telecommunication documents. It may not be the same as an access line or a subscriber. The definition of access line used by some countries varies. In some cases, it refers to the total installed capacity (rather than lines in service). In other cases it refers to all network access points including mobile cellular subscribers. Telephone subscribers would not generally include public telephones which are included in main lines.

Main telephone lines per 100 inhabitants: Calculated by dividing the number of main lines by the population and multiplying by 100.

% digital main lines: Refers to the per cent of main lines connected to digital exchanges. This percentage is obtained by dividing the number of main lines connected to digital telephone exchanges by the total number of main lines. This indicator does not measure the percentage of exchanges which are digital, the percentage of inter-exchange lines which are digital or the percentage of digital network termination points. A note should indicate if the digital main lines included in the definition represents the total capacity.

% residential main lines: Refers to the per cent of main lines in residences. This percentage is obtained by dividing the number of main lines serving households (i.e., lines which are not used for business, government or other professional purposes or as public telephone stations) by the total number of main lines.

Waiting list for main lines: Unmet applications for connection to the Public Switched Telephone Network (PSTN) which have had to be held over owing to a lack of technical facilities (equipment, lines, etc.). This indicator refers to registered applications and thus may not be indicative of the total unmet demand.

Cellular mobile telephone subscribers: Refers to users of portable telephones subscribing to an automatic public mobile telephone service which provides access to the Public Switched Telephone Network (PSTN) using cellular technology. This can include analogue and digital cellular systems (including micro-cellular systems such as DCS-1800, Personal Handyphone System (PHS) and others) but should not include non-cellular systems. Subscribers to fixed wireless (e.g., Wireless Local Loop (WLL)), public mobile data services, or radio paging services are not included.

Digital cellular subscribers: The number of mobile cellular subscribers who use a digital cellular service (e.g., GSM, CDMA, D-AMPS, PCS, PHS).

Cellular subscribers per 100 inhabitants: Calculated by dividing the number of cellular mobile subscribers by the population and multiplying by 100.

Traffic: The indicators in this category refer to the volume of traffic carried over the Public Switched Telephone Network. There is wide variation in the way telephone traffic is reported. Specifically there is no standard convention among countries for measuring the unit in which telephone traffic is recorded. Calls refer to the actual number of completed calls. Minutes refer to the number of minutes of use. Pulses refer to charging units used by the country to measure telephone traffic.

Note that telephone traffic measured in1pulses is often not comparable across time for the same country and is not comparable across countries. This is because the length of the charging unit varies within countries (depending on the type of traffic or the time of day) and across countries. Furthermore, the length of the charging unit can be changed. The following factors also affect the measurement of telephone traffic: mobile traffic (for some countries this is included); whether total attempted or completed calls are used; whether calls to directory and other services are included and whether both automatic and manually placed calls are included.

International incoming telephone traffic: Effective (completed) traffic originating outside the country with a destination inside the country.

International outgoing telephone traffic: This covers the effective (completed) traffic originating in a given country to destinations outside that country. Many countries have now shifted to reporting international traffic volumes based on point of billing. This means that the data refers to traffic billed in the country.

Television receivers: Refers to the estimated number of television sets in use.

Television equipped households: Refers to the number of television households that have television receivers. This is not the same as the number of television receivers since households can have more than one receiver and other entities besides households may have receivers (e.g., businesses). In some countries, the number of licenses (i.e., system where television sets must be registered) us used as a proxy for television households. Since households may not register, the number of licenses may underestimate the number of television households.

Cable TV subscribers: The number of cable television subscribers. Refers to households which subscribe to a multichannel television service delivered by a fixed line connection. However some countries report subscribers to pay television using wireless technology (e.g., Microwave Multi-point Distribution systems (MMDS)). Other countries include the number of households that are cabled to community antenna systems even though the antennas are simply rebroadcasting free-to-air channels because of poor reception.

Personal computers: The number of personal computers (i.e., designed to be operated by a single user at a time) in use in the country. Primarily ITU estimates based on a number of national and international sources.

Internet hosts: The number of computers that are directly connected to the worldwide Internet network. This statistic is based on the country code in the host address and thus may not correspond with the actual physical location.

Estimated Internet users: The number of Internet users.

UNESCO and World Bank Definitions

Illiteracy rate, adult total (% of people ages 15 and above): Adult illiteracy rate is the percentage of people ages 15 and above who cannot, with understanding, read and write a short, simple statement on their everyday life.

School enrolment, primary (% gross): Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Primary education provides children with basic reading, writing, and mathematics skills along with an elementary understanding of such subjects as history, geography, natural science, social science, art, and music.

School enrolment, secondary (% gross): Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more specialized teachers.

School enrolment, tertiary (% gross): Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level.

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STATISTICAL ANNEX

Table A3.1 **Evolution of Networks**

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Denmark	106.7	144.6	180.0	230.6	262.7	292.7	322.7	386.7	420.0
Netherlands	70.9	94.4	119.8	167.0	228.7	294.8	329.7	357.7	399.2
Sweden	121.0	164.6	201.3	226.2	266.2	289.7	317.6	363.3	379.2
Norway	109.0	150.2	189.6	225.2	278.1	318.8	333.1	367.8	378.6
Switzerland	98.4	129.5	161.2	196.8	235.7	291.0	323.2	359.3	369.6
Finland	96.8	134.0	163.1	190.7	230.4	257.7	300.6	347.6	369.2
Taiwan, China	35.9	42.8	73.9	115.0	170.6	222.3	260.5	292.4	350.4
Luxembourg	73.8	99.6	119.7	170.8	211.6	253.3	290.8	320.4	338.2
United States	101.5	134.7	161.3	185.1	216.6	249.0	279.1	300.5	322.9
Hong Kong, China	62.7	95.2	114.5	131.8	159.6	206.3	237.3	262.1	315.3
Austria	66.5	87.5	112.0	153.6	201.2	228.5	237.7	271.4	305.3
Iceland	73.9	101.2	124.5	151.6	189.6	216.0	256.1	280.1	300.2
Canada	109.6	137.7	159.6	181.9	214.8	240.9	262.5	285.0	294.0
United Kingdom	84.0	104.0	122.0	154.6	190.5	223.8	235.1	272.1	289.4
Belgium	53.1	78.1	107.7	150.0	188.4	232.7	253.3	281.6	284.6
Singapore	63.3	74.1	106.3	118.4	164.9	198.6	207.2	255.7	277.4
Germany	69.3	90.0	118.1	144.5	171.9	222.2	242.1	257.8	264.7
Ireland	53.2	75.7	102.9	131.3	158.1	202.0	214.8	250.1	263.7
Australia	71.3	105.0	124.2	136.1	155.9	195.3	226.5	243.9	254.4
Bermuda	89.8	114.4	138.6	154.2	162.0	170.6	189.6	233.3	251.2
Liechtenstein	66.3	96.1	147.1	160.5	201.0	220.3	228.6	242.0	244.4
Israel	66.1	96.8	125.5	144.2	157.2	175.7	187.6	189.3	240.2
France	48.7	64.7	90.0	117.1	155.1	181.9	198.6	210.9	239.9
Japan	51.6	83.9	104.9	121.8	143.8	173.0	199.2	217.1	236.3
New Zealand	75.4	95.4	105.5	121.1	166.1	180.3	206.4	211.6	217.2
Andorra	22.0	51.5	73.2	83.9	99.5	124.9	161.1	177.6	212.6
Czech Republic	19.3	35.0	53.6	75.2	101.5	137.2	170.3	195.8	210.3
Korea (Rep.)	33.2	46.7	65.9	86.7	123.5	139.6	160.3	183.2	204.0
Hungary	27.9	42.7	62.9	78.1	95.7	121.1	141.9	155.3	198.8
Slovenia	30.7	44.0	62.5	78.8	116.6	145.4	158.0	174.5	197.2
Guernsey	13.0	23.0	32.8	41.2	126.7	141.9	175.4	188.8	196.5
Malta	23.1	38.7	48.8	64.3	99.8	136.6	168.3	184.0	196.2
Virgin Islands (U.S.)	14.3	33.0	75.6	91.6	105.7	140.3	165.4	187.0	189.4
Estonia	26.5	41.4	62.2	86.0	108.7	135.9	150.4	174.5	182.3
Jersey	12.9	22.5	36.0	48.0	124.5	147.7	164.7	176.5	180.0
Faroe Islands	45.2	48.9	70.3	92.6	109.1	147.0	159.1	169.4	177.9
Portugal	30.7	45.2	68.3	92.2	114.2	135.9	150.7	162.8	177.0
Gibraltar	33.8	50.0	71.9	91.6	112.3	128.2	150.2	165.5	175.1
Spain	30.7	51.1	66.5	83.4	105.9	127.2	140.9	156.1	174.8
Italy	41.7	57.0	77.9	100.6	115.8	131.4	141.5	158.1	174.3
Aruba	10.9	33.0	39.0	43.3	73.3	87.4	128.1	135.0	169.0
Slovak Republic	12.8	21.6	44.1	63.8	78.1	96.2	136.2	150.7	168.8
Cayman Islands	46.7	65.9	77.8	88.3	105.5	112.7	127.2	151.5	165.8
Qatar	7.1	17.4	33.9	50.7	61.4	79.2	106.6	133.9	161.3
Greenland	34.8	52.8	65.4	112.4	136.1	143.9	146.6	155.6	156.8
Cyprus	33.5	53.5	69.4	86.4	98.1	114.2	131.0	142.2	151.9
Greece	25.0	36.4	48.3	71.1	96.0	119.0	136.4	142.6	147.6
Brunei Darussalam	33.4	41.2	47.0	65.4	73.5	108.1	123.7	132.6	136.9
Latvia	14.4	25.5	35.5	53.8	67.0	82.3	104.7	120.6	135.2
Poland	10.1	16.7	28.4	41.8	57.7	82.3	103.0	121.4	135.1
Lithuania	8.7	17.3	30.2	44.4	52.8	64.9	93.9	118.6	128.5
Uruguay	13.7	23.4	43.0	53.9	75.4	97.9	111.5	119.1	125.2
United Arab Emirates	20.2	33.3	37.6	71.6	84.7	107.9	113.4	122.8	124.8
PLANETIA	**24.5**	**32.3**	**42.6**	**52.6**	**67.7**	**84.5**	**98.2**	**107.0**	**120.4**
HYPOTHETICA	**26.1**	**35.6**	**45.6**	**56.6**	**71.4**	**86.5**	**100.0**	**110.4**	**120.3**
French Polynesia	5.4	15.2	29.3	37.8	58.4	75.9	87.9	107.4	119.7
Chile	19.3	26.0	30.1	43.8	57.7	75.4	95.2	104.1	116.7
New Caledonia	4.5	12.3	21.1	28.6	36.4	43.9	105.3	113.3	116.4
Argentina	14.3	21.2	32.1	50.0	69.2	88.2	101.4	103.2	113.4
Croatia	16.2	23.7	33.4	39.6	51.1	74.9	95.5	110.7	113.2
Brazil	8.9	15.4	20.5	27.9	43.3	61.4	79.8	88.7	102.0
Bulgaria	8.5	12.4	19.3	25.2	39.5	53.3	68.9	81.6	99.8
Bahamas	32.1	33.9	37.1	40.4	48.5	58.5	70.6	87.0	93.3
Mexico	10.3	13.8	17.3	27.1	47.1	60.6	77.9	84.6	91.3
Trinidad & Tobago	8.2	11.5	21.7	29.5	41.1	64.4	73.6	80.6	87.6
Bahrain	25.4	31.8	38.1	48.7	63.1	69.6	77.4	82.6	86.4

Table A3.1 **Evolution of Networks** *(cont'd)*

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Turkey	11.1	17.4	25.6	34.3	48.3	60.0	63.6	70.7	86.3
Seychelles	3.5	7.8	9.7	19.5	26.7	31.1	79.3	81.5	84.3
Macao, China	31.1	35.1	38.7	46.2	52.0	55.6	61.7	69.2	83.3
Guam	37.4	40.6	47.3	56.2	64.3	69.8	75.2	80.1	83.0
Guadeloupe	1.3	2.1	18.5	28.8	48.1	59.9	72.5	77.5	82.1
Tonga	3.3	5.7	18.4	24.9	30.8	35.3	40.8	72.8	80.9
Malaysia	20.9	36.5	42.5	49.0	55.9	64.1	70.4	75.2	80.1
Martinique	1.4	7.1	15.8	29.2	58.1	65.2	75.0	76.9	80.0
Mauritius	3.3	13.6	19.6	28.1	35.1	58.3	66.6	71.1	78.2
Dominican Rep.	5.7	12.9	16.8	20.4	26.9	32.8	59.9	66.4	76.6
Romania	4.3	8.0	18.0	28.8	40.7	50.4	56.6	64.2	72.5
South Africa	20.0	28.0	35.5	44.3	52.4	58.7	65.2	68.8	72.0
Belize	5.5	11.0	24.4	26.6	31.6	39.5	47.4	64.2	71.7
Barbados	9.4	18.6	20.8	27.2	34.8	42.5	53.3	63.3	71.6
Kuwait	32.4	42.2	44.5	46.5	49.8	55.5	63.4	67.1	69.0
Samoa	1.3	1.3	3.9	5.3	8.0	34.7	43.2	44.4	66.2
Puerto Rico	18.8	19.7	27.0	40.0	49.8	53.4	56.6	62.9	65.3
French Guiana	2.2	4.9	7.0	30.5	44.1	53.2	61.5	62.7	64.8
Russia	6.4	10.7	17.1	20.3	26.2	35.0	45.1	56.1	64.4
Lebanon	11.5	20.9	30.1	38.9	46.8	54.6	60.9	61.9	64.2
Yugoslavia (Serbia & Montenegro)	0.2	8.6	16.1	24.2	33.6	45.1	50.7	57.8	63.5
Costa Rica	14.5	20.4	24.8	28.8	38.2	44.3	51.0	58.0	63.2
TFYR Macedonia	1.4	5.4	13.5	21.4	26.2	35.4	49.0	56.8	61.7
Panama	1.4	10.9	15.4	25.1	33.4	42.0	46.4	51.6	60.5
Jamaica	12.3	15.5	17.6	19.9	24.3	44.3	50.5	57.8	59.5
Colombia	8.9	15.4	20.8	26.4	34.6	37.8	43.8	51.4	59.4
Thailand	10.8	15.6	19.6	21.8	26.2	31.8	41.4	51.8	56.8
Moldova	0.5	1.7	5.5	11.6	14.8	25.7	30.9	36.1	56.4
Venezuela	10.4	14.0	19.2	26.6	35.6	41.4	47.5	48.6	52.2
Ukraine	3.7	6.1	8.8	11.7	15.4	23.2	35.3	41.7	50.4
Saudi Arabia	1.8	3.5	4.1	8.9	21.1	29.2	37.8	45.3	49.3
Maldives	1.2	3.5	11.3	14.6	20.5	27.5	36.9	45.4	48.9
Guatemala	2.5	5.1	7.8	10.2	16.7	28.7	32.5	38.4	47.6
Grenada	8.6	9.4	10.9	15.7	17.3	21.1	31.8	33.1	46.8
Paraguay	1.4	6.5	9.9	18.5	21.9	26.1	33.5	39.0	45.5
Botswana	1.0	1.0	11.7	14.8	25.3	33.0	38.9	43.1	45.3
El Salvador	3.0	5.5	7.1	14.1	22.9	30.5	35.0	38.2	44.3
Peru	5.8	10.4	14.7	18.1	23.8	26.0	28.9	32.7	44.0
Namibia	3.6	9.6	14.4	23.2	26.4	34.4	37.0	39.8	43.5
Belarus	2.3	4.8	6.8	8.7	11.7	15.8	24.6	33.5	43.1
Jordan	3.3	5.8	9.0	12.8	18.4	28.1	37.2	41.4	42.1
Saint Lucia	8.4	15.4	18.8	20.6	22.7	24.5	25.6	37.3	42.1
Fiji	7.3	9.2	11.0	15.4	22.9	32.0	37.5	39.8	41.8
Kazakhstan	2.6	4.6	5.3	7.2	11.7	18.2	27.0	34.1	39.7
St. Vincent & the Grenadines	5.4	5.9	11.9	15.1	19.0	22.7	31.7	35.6	39.4
Georgia	1.4	3.8	8.8	12.9	17.1	22.8	27.3	33.1	38.3
Bolivia	3.0	7.4	11.0	14.0	18.6	22.6	24.3	26.4	38.3
China	2.8	5.2	7.5	9.4	16.4	21.6	26.7	33.9	38.2
Reunion	5.8	7.3	8.6	14.3	18.8	26.1	30.8	34.0	37.5
Philippines	4.8	7.4	8.7	11.9	15.5	21.9	29.3	32.4	37.2
Suriname	3.6	4.1	4.8	5.2	10.4	15.0	29.4	33.1	36.8
Ecuador	7.3	8.1	11.7	15.9	19.4	22.8	27.3	32.1	36.8
Guyana	1.9	5.2	5.9	6.2	8.3	18.7	25.2	28.6	34.4
Oman	2.5	2.8	20.8	24.2	25.1	26.6	31.1	33.1	34.3
Swaziland	0.5	1.8	2.1	11.3	16.0	21.5	25.8	27.7	31.9
Nicaragua	3.8	6.0	7.0	8.5	11.3	15.0	19.0	22.5	31.5
Northern Marianas Islands	13.7	14.6	24.2	25.1	26.4	30.2	30.5	31.0	31.0
Cape Verde	0.9	0.9	1.2	3.5	12.4	18.6	22.9	26.4	29.0
Albania	0.5	2.6	3.8	4.9	6.6	9.5	21.5	26.0	28.7
Armenia	1.4	3.2	8.1	11.0	14.0	17.5	19.4	24.5	27.5
Gabon	2.6	2.8	4.6	5.6	6.8	14.3	17.5	19.6	26.4
Azerbaijan	2.1	3.3	7.6	9.3	16.1	18.1	22.3	24.5	25.6

Table A3.1 **Evolution of Networks** *(cont'd)*

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Morocco	3.4	4.6	7.0	8.4	11.8	18.7	21.5	22.7	25.0
Gambia	1.6	1.9	3.9	3.9	4.4	4.9	14.6	22.7	24.5
Indonesia	3.1	5.9	7.0	8.3	11.0	13.5	18.0	21.6	24.1
Mongolia	0.3	1.9	2.6	4.5	7.9	14.9	17.7	20.0	23.2
Iran	2.2	3.3	5.3	7.0	8.9	12.2	16.8	18.6	22.7
Kyrgyzstan	0.3	0.3	1.0	3.9	9.0	13.1	17.8	20.8	22.5
Djibouti	0.7	1.9	2.2	2.2	4.0	4.2	12.5	19.4	22.2
Honduras	0.2	2.1	4.2	6.0	8.0	9.8	13.3	18.1	22.2
Tunisia	2.3	2.9	3.5	6.1	7.4	10.1	15.0	16.8	22.0
Bhutan	0.7	0.7	0.9	2.1	4.2	4.9	5.5	5.7	21.9
Egypt	1.9	2.4	4.8	5.6	9.3	13.0	17.1	19.5	21.3
Sri Lanka	1.3	4.0	5.3	7.4	10.7	14.4	16.5	17.7	19.9
Côte d'Ivoire	0.1	2.5	3.5	4.7	6.9	10.2	16.4	18.2	18.3
Zimbabwe	0.4	0.5	3.4	5.4	11.1	14.1	15.2	16.6	18.1
Kiribati	2.3	2.3	2.3	2.9	9.4	12.4	13.3	15.7	16.4
India	0.9	1.9	3.1	4.2	5.7	7.9	11.7	13.6	16.3
Marshall Islands	8.3	10.0	10.9	11.2	11.4	11.4	12.9	14.7	15.4
Kenya	0.7	1.5	2.0	2.5	4.5	7.0	10.9	13.3	15.3
Senegal	0.6	1.6	3.0	4.8	7.4	12.4	13.5	14.4	15.0
Algeria	1.1	1.7	2.2	2.6	4.8	6.5	7.6	10.5	14.3
Mauritania	0.3	0.3	0.3	0.5	3.8	5.2	9.6	12.5	14.2
Syria	0.2	0.2	0.3	0.4	2.1	4.0	7.9	11.7	14.0
Pakistan	0.8	2.2	3.4	4.9	5.9	6.7	9.5	10.9	13.9
Solomon Islands	3.6	4.4	5.6	5.8	11.5	12.9	13.0	13.2	13.2
Sudan	0.0	0.2	0.9	1.5	2.4	4.0	6.6	8.7	13.0
Turkmenistan	0.3	0.3	1.8	5.9	8.5	10.8	11.6	12.2	12.7
Lesotho	0.4	1.1	2.7	3.9	5.3	6.2	7.9	10.3	12.7
Lao P.D.R.	0.7	0.9	1.0	1.1	1.3	1.9	6.5	8.4	12.5
Togo	0.2	0.3	2.2	3.8	4.9	6.9	8.8	10.4	12.0
Benin	0.6	1.3	1.6	1.9	2.1	6.3	9.1	10.6	11.9
Libya	0.3	0.3	1.9	3.4	3.7	7.0	9.5	10.7	11.7
Zambia	1.6	2.3	2.6	3.5	5.4	8.1	9.0	9.9	11.5
Uzbekistan	1.7	2.9	3.8	4.6	5.3	5.8	7.2	7.7	11.2
Cuba	0.7	1.7	2.2	2.7	3.6	5.7	7.0	9.2	10.6
Tanzania	0.3	0.4	1.1	2.0	2.6	5.2	7.2	8.3	10.5
Mozambique	0.1	0.3	1.3	2.0	2.3	4.2	6.7	8.7	10.5
Viet Nam	0.4	0.9	1.6	2.2	3.5	4.9	7.4	8.6	9.7
Cameroon	0.4	0.5	0.6	0.7	2.2	4.9	7.4	8.4	9.5
Tajikistan	0.3	0.5	1.3	2.2	3.0	4.1	4.5	6.9	9.2
Rwanda	0.1	0.2	0.2	1.6	2.9	4.5	7.1	8.1	8.9
Ghana	0.8	2.3	3.0	3.7	4.5	5.9	6.3	7.6	8.8
Uganda	0.6	0.9	1.0	2.2	2.9	3.5	4.6	7.3	8.6
Yemen	0.8	1.0	1.6	2.1	2.7	3.3	4.8	6.6	8.3
Congo	0.3	1.0	1.2	1.4	1.9	4.4	8.2	8.7	8.2
Cambodia	0.5	0.6	2.0	2.4	3.4	5.0	6.1	7.0	7.9
Papua New Guinea	0.3	1.0	3.2	4.3	5.8	6.6	6.9	7.4	7.7
Burkina Faso	0.1	0.3	1.2	2.0	2.5	4.4	5.9	6.4	7.6
Sierra Leone	0.2	0.2	0.2	0.3	2.6	4.1	5.6	6.8	7.4
Madagascar	0.3	0.9	1.3	1.9	3.8	5.2	6.4	6.6	7.4
Bangladesh	0.1	0.2	1.1	2.0	3.1	4.0	5.1	6.2	7.2
Guinea	0.5	0.6	0.9	1.3	4.5	5.3	5.7	6.3	7.1
Mali	0.1	0.5	0.6	0.7	1.3	2.6	4.1	4.8	7.0
Haiti	0.2	0.3	1.6	2.0	2.6	3.4	4.0	5.0	6.4
Nigeria	0.3	0.4	0.8	1.4	1.7	1.9	3.7	5.3	6.4
Nepal	0.2	0.3	0.3	0.4	2.4	4.0	4.7	5.0	6.1
Malawi	0.4	0.6	0.7	0.8	1.2	2.6	3.2	4.2	5.2
Angola	0.6	0.8	1.1	1.4	1.8	1.9	2.7	3.3	3.7
Burundi	0.6	0.6	0.6	0.6	0.6	1.3	1.7	2.3	3.7
Niger	0.2	0.2	0.5	1.1	1.3	2.1	2.1	3.1	3.3
Central African Rep.	0.4	1.5	1.6	1.6	2.1	2.2	2.5	2.5	3.1
Chad	0.1	0.2	0.2	0.2	0.3	1.3	2.0	2.4	2.7
Myanmar	0.3	0.4	0.5	0.5	0.8	1.1	1.7	2.3	2.6
Ethiopia	0.1	0.1	0.2	0.2	0.9	1.3	1.6	1.9	2.4
Congo D.R.	0.2	0.2	0.3	0.4	0.6	0.7	1.4	1.9	2.3
Liberia	0.3	0.2	0.3	0.3	0.3	1.3	1.8	1.9	2.0
Eritrea	0.3	0.3	0.3	0.3	0.5	1.4	1.4	1.7	1.8

Table A3.2 **Evolution of Infodensity**

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Denmark	120.4	141.1	158.5	179.2	193.0	204.7	215.8	236.2	246.1
Sweden	129.8	152.9	170.7	184.6	203.1	211.6	221.9	237.3	242.4
Netherlands	100.8	116.2	130.1	153.4	178.9	204.0	216.7	225.7	238.5
Finland	118.0	139.5	154.8	167.4	186.9	198.5	215.2	231.4	238.4
Norway	123.0	145.3	164.5	180.0	200.4	215.0	219.8	231.0	234.3
Switzerland	110.2	126.7	141.4	156.1	173.8	193.6	204.8	215.9	219.0
United States	121.3	139.7	152.7	163.6	175.1	186.0	197.4	204.8	212.3
United Kingdom	109.6	122.2	132.4	148.3	170.2	184.4	189.0	203.3	209.7
Belgium	88.5	107.6	126.6	149.4	166.5	186.0	195.8	206.4	207.5
Austria	93.7	107.7	121.8	141.6	163.9	175.6	179.5	191.8	203.4
Canada	125.1	140.3	151.2	161.6	171.8	181.7	190.3	198.3	201.4
Iceland	96.6	113.2	126.7	140.6	157.7	169.4	185.2	193.7	200.5
Australia	103.1	126.9	138.7	145.7	155.9	172.9	187.0	193.3	197.5
Luxembourg	88.2	103.5	114.1	137.2	153.0	167.7	180.3	189.3	194.5
Ireland	83.8	100.3	117.5	132.3	145.9	165.8	171.2	184.8	189.7
Germany	95.3	109.0	125.2	138.0	150.0	170.6	177.9	183.6	186.1
Hong Kong, China	82.3	100.8	110.9	119.3	131.4	149.5	160.5	168.8	185.2
France	81.5	94.1	111.0	126.7	145.5	157.7	164.8	169.9	181.2
Singapore	82.6	90.6	109.7	117.2	138.4	152.1	155.4	172.8	180.1
Israel	89.0	108.2	123.7	133.8	141.9	150.9	156.7	157.5	177.5
New Zealand	102.4	115.5	121.6	130.9	153.7	160.6	172.3	175.1	177.4
Japan	81.4	104.1	116.7	126.3	136.8	150.7	162.3	169.4	176.7
Korea (Rep.)	65.5	78.3	94.4	109.6	131.1	139.6	150.7	162.1	171.1
Slovenia	61.0	73.3	88.1	100.8	124.7	140.0	148.3	155.8	165.7
Czech Republic	47.7	64.7	79.4	92.9	108.6	128.0	144.2	154.6	160.2
Estonia	56.4	72.6	89.7	106.5	121.7	137.1	145.2	156.4	159.8
Hungary	57.4	71.6	87.2	97.2	108.9	123.7	134.6	140.8	159.3
Spain	64.5	83.9	96.0	107.0	120.1	132.5	140.1	147.5	156.2
Portugal	62.2	76.2	94.0	109.8	122.2	134.4	142.5	148.2	154.7
Italy	72.4	85.0	100.2	114.4	122.1	130.3	136.0	143.9	151.1
Malta	50.6	65.6	74.0	86.8	105.6	123.8	138.7	145.2	150.1
Slovak Republic	38.3	50.3	72.0	86.5	95.6	106.9	127.9	134.6	142.4
Greece	55.4	67.4	78.3	95.8	111.8	125.1	135.3	138.4	140.8
Latvia	40.3	54.3	65.1	81.2	93.1	104.7	119.7	128.4	136.0
Poland	35.2	45.7	60.0	73.4	86.6	104.5	118.1	128.3	135.3
Cyprus	59.5	75.6	86.4	98.1	106.4	114.8	123.1	128.3	132.7
Lithuania	31.7	45.0	60.1	73.5	82.7	93.1	113.4	127.4	132.6
Qatar	26.8	42.0	58.6	71.9	81.4	92.6	106.7	119.8	131.7
Uruguay	40.0	52.4	71.4	80.5	96.6	110.3	118.6	123.3	126.4
Argentina	40.8	50.2	62.1	78.4	94.4	107.4	116.5	118.7	124.4
Brunei Darussalam	57.7	64.4	68.3	81.0	87.6	107.5	115.2	119.5	121.4
Chile	45.9	53.5	58.4	70.9	82.1	94.9	107.1	112.0	118.7
Croatia	42.5	51.8	61.6	67.4	78.1	94.6	107.3	115.9	117.3
Bulgaria	31.1	38.4	48.2	56.3	70.6	81.9	93.0	101.3	112.0
Brazil	28.2	37.7	44.4	53.2	68.4	84.7	97.3	103.1	110.7
PLANETIA	**47.4**	**54.9**	**63.4**	**70.9**	**81.2**	**91.3**	**99.1**	**103.9**	**110.4**
HYPOTHETICA	**49.0**	**57.7**	**65.5**	**73.5**	**83.4**	**92.4**	**100.0**	**105.5**	**110.3**
United Arab Emirates	42.8	54.8	58.5	81.1	88.2	99.5	102.3	106.6	107.6
Macao, China	57.6	61.5	64.8	71.3	75.9	78.9	87.3	95.9	105.4
Bahamas	59.3	62.2	65.0	67.8	74.4	81.8	89.9	99.8	103.4
Mexico	31.9	37.2	41.9	52.9	70.0	80.1	91.3	95.2	99.0
Bahrain	53.1	59.4	64.7	73.1	83.1	87.5	92.2	95.5	97.8
Barbados	33.5	47.4	50.3	58.1	66.4	73.7	83.1	90.7	96.5
Russia	28.4	36.7	46.6	50.6	58.0	67.8	77.9	88.7	95.1
Turkey	32.1	40.7	49.8	57.5	68.7	77.2	80.5	85.7	94.9
Trinidad & Tobago	28.8	34.2	47.0	55.4	65.5	81.9	88.1	90.5	94.4
Romania	21.6	29.5	44.9	57.0	67.8	75.5	80.8	86.1	91.5
Malaysia	43.5	58.1	63.0	68.1	75.4	81.2	85.7	88.5	91.5
Dominican Rep.	22.3	34.1	39.4	44.1	51.5	57.5	78.0	83.3	89.6
Mauritius	17.1	34.9	42.3	51.0	57.5	74.8	81.2	84.3	88.6
Yugoslavia (Serbia & Montenegro)	4.3	29.0	39.6	50.7	62.8	74.0	77.7	83.0	87.0

Table A3.2 **Evolution of Infodensity** *(cont'd)*

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
South Africa	46.8	55.8	63.0	70.1	74.6	78.8	82.3	84.7	86.7
Lebanon	35.1	47.4	57.1	65.0	72.2	78.1	83.2	84.6	86.3
Kuwait	53.1	61.6	63.7	65.7	69.2	74.1	80.2	83.3	84.6
Belize	22.0	31.6	47.0	49.7	55.0	62.0	68.1	79.4	83.9
Panama	12.1	34.3	41.1	52.7	60.9	68.3	71.9	76.2	82.6
Samoa	10.8	11.3	19.3	22.8	28.4	59.3	66.2	67.5	82.4
Costa Rica	38.7	46.1	50.8	54.9	61.2	66.2	72.3	78.8	82.3
Thailand	32.1	38.9	44.1	47.3	53.4	59.8	69.8	78.4	82.1
Ukraine	21.5	27.5	33.0	38.1	43.8	54.4	67.8	74.6	82.0
Colombia	29.6	39.2	46.1	52.6	60.7	63.7	68.7	73.9	79.5
Moldova	7.4	13.7	25.0	36.2	40.6	53.4	58.3	63.3	79.1
Jamaica	33.7	37.9	40.4	43.7	49.4	67.4	72.4	77.8	79.0
Belarus	16.8	24.6	29.4	33.0	38.8	45.4	57.3	67.2	76.2
Venezuela	31.2	36.2	42.9	51.5	60.9	66.2	70.6	71.1	73.8
Peru	25.0	33.7	40.1	44.9	51.9	54.3	57.2	60.9	70.8
Kazakhstan	17.7	23.4	25.2	29.4	36.8	46.2	57.2	65.0	70.1
Jordan	16.9	22.6	28.5	35.7	44.8	56.0	64.7	68.6	69.3
Paraguay	11.2	24.2	30.0	41.4	45.6	50.8	58.3	63.6	68.7
Saudi Arabia	12.1	17.0	18.6	27.7	43.1	51.4	58.6	64.2	67.2
Georgia	12.7	21.2	32.5	39.5	44.4	51.5	56.4	62.5	67.2
Bolivia	16.3	26.0	31.9	37.1	44.8	50.2	52.7	55.5	66.9
Fiji	27.7	31.3	34.3	40.4	48.9	58.1	63.2	65.2	66.9
Philippines	23.4	29.1	31.6	37.0	42.2	50.2	58.3	61.6	66.1
Botswana	8.9	9.2	31.8	36.1	47.1	54.2	59.1	62.4	64.1
El Salvador	15.3	21.0	24.0	34.6	45.5	52.7	56.7	59.4	64.1
Namibia	18.3	30.0	36.6	46.5	48.5	55.3	57.7	60.0	62.9
Guyana	13.8	23.1	24.8	25.8	30.2	46.1	53.6	57.2	62.6
China	16.0	22.0	26.7	29.5	39.4	45.7	51.3	57.9	61.5
Ecuador	26.8	28.3	34.4	39.6	44.0	47.9	52.5	57.2	61.3
Guatemala	12.7	18.3	22.6	25.9	34.0	45.3	48.5	53.0	59.1
Armenia	12.2	18.4	29.6	34.4	39.6	44.9	47.2	53.3	56.4
Oman	13.7	14.7	40.2	43.8	45.7	47.6	51.8	53.9	55.0
Albania	6.3	14.6	17.9	21.1	25.7	30.9	46.7	51.6	54.3
Kyrgyzstan	5.7	5.5	10.4	20.4	32.4	39.6	46.8	50.8	52.8
Mongolia	5.8	13.8	16.0	21.2	29.1	40.7	45.2	48.4	52.2
Swaziland	6.4	12.5	13.5	31.2	36.4	42.0	45.9	47.4	51.0
Nicaragua	17.1	21.6	23.4	25.8	30.0	34.7	39.1	42.9	50.9
Indonesia	16.6	23.2	25.4	27.7	32.0	35.6	41.5	45.8	48.4
Iran	14.1	17.3	22.3	25.9	29.4	34.4	40.6	42.6	47.3
Gabon	14.1	15.0	19.2	21.3	23.6	34.4	38.2	40.7	47.2
Tunisia	13.8	15.8	17.5	23.4	26.2	30.8	38.1	40.7	46.7
Sri Lanka	11.2	20.0	23.0	27.1	32.5	37.9	40.8	42.5	45.1
Egypt	12.3	13.9	19.7	21.5	28.7	34.2	39.5	42.4	44.4
Honduras	3.9	12.5	18.0	21.5	25.1	27.8	32.6	38.0	42.1
Morocco	14.0	16.4	20.5	22.6	26.7	34.2	37.3	38.7	40.8
Zimbabwe	5.8	6.5	17.3	21.8	30.7	34.0	35.3	37.2	38.9
Libya	5.8	5.9	14.2	19.2	20.5	29.2	33.9	36.8	38.6
Algeria	9.5	11.7	13.5	14.9	20.2	23.6	25.8	30.7	36.0
Cuba	8.6	13.4	15.3	16.6	20.0	25.3	28.3	32.8	35.2
Syria	3.7	3.8	5.1	5.7	13.3	18.4	25.9	31.6	34.8
Gambia	7.9	8.8	12.8	13.0	14.1	15.1	26.4	33.2	34.8
India	7.7	11.4	14.7	16.9	20.1	23.8	29.1	31.4	34.5
Kenya	6.8	9.8	11.5	13.0	17.8	22.4	28.3	31.7	34.0
Djibouti	5.2	8.7	9.5	9.6	13.0	13.2	23.7	30.0	32.2
Lesotho	5.2	9.1	14.2	17.2	20.1	21.8	25.2	28.9	32.1
Tajikistan	5.9	7.8	12.0	15.7	18.0	21.0	22.2	27.6	31.9
Côte d'Ivoire	2.6	11.0	13.2	15.5	18.7	22.9	29.4	31.4	31.6
Viet Nam	6.0	9.0	12.3	14.3	18.4	22.1	27.0	29.3	31.1
Lao P.D.R.	6.7	7.8	8.2	8.6	9.6	11.4	21.6	24.9	30.5
Togo	3.6	4.5	11.6	15.5	18.3	21.8	24.7	27.0	29.1
Sudan	1.5	3.2	6.7	8.7	11.3	14.7	19.5	22.5	27.6
Zambia	10.1	12.2	13.1	15.0	18.7	23.0	24.2	25.5	27.5

Table A3.2 **Evolution of Infodensity** *(cont'd)*

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Cameroon	5.3	5.5	6.1	6.8	12.0	18.1	23.1	24.9	26.6
Pakistan	6.0	10.1	12.4	15.1	16.7	17.8	21.4	23.0	26.2
Mauritania	3.3	3.3	3.5	4.9	13.2	15.5	21.2	24.3	26.0
Senegal	4.6	7.9	10.7	13.8	17.3	22.7	23.9	25.1	25.8
Ghana	7.0	11.9	13.5	15.4	17.2	19.8	20.7	22.9	24.9
Benin	4.6	7.1	8.0	9.0	9.6	16.9	21.1	23.2	24.8
Congo	5.3	9.3	10.2	10.5	12.2	17.8	24.5	25.0	24.5
Uganda	5.3	6.6	7.3	11.9	13.5	15.3	17.6	22.2	24.3
Rwanda	2.7	2.9	3.6	9.6	13.2	16.9	21.2	22.7	24.0
Cambodia	5.7	6.6	11.5	12.7	14.2	17.5	19.8	22.1	23.4
Tanzania	3.5	4.6	7.1	9.7	11.0	15.8	18.6	20.4	23.1
Yemen	6.3	7.1	9.1	10.5	12.5	14.0	17.2	20.3	23.0
Mozambique	1.9	3.0	6.8	8.9	9.8	13.5	17.5	20.5	22.6
Madagascar	4.3	7.3	8.6	10.4	14.9	17.6	19.7	20.0	21.4
Papua New Guinea	3.7	7.3	13.0	15.3	17.9	19.3	19.9	20.7	21.1
Nigeria	4.1	5.0	6.8	9.4	10.3	11.0	15.5	18.8	20.7
Bangladesh	2.3	2.6	7.0	10.0	13.1	15.1	17.2	19.1	20.6
Haiti	3.3	4.2	9.6	10.7	12.2	14.0	15.3	17.2	19.7
Nepal	3.1	3.8	4.4	4.7	11.6	15.1	16.7	17.7	19.7
Malawi	4.6	6.2	6.7	7.1	8.6	12.8	14.3	16.4	18.2
Guinea	3.9	4.3	5.5	7.0	12.9	14.4	15.1	16.3	17.3
Mali	1.7	3.3	3.9	4.2	6.2	8.8	11.1	12.2	14.9
Myanmar	5.2	6.0	6.4	6.3	7.8	9.5	11.7	13.7	14.7
Burkina Faso	1.6	2.8	5.2	6.8	7.7	10.5	12.3	12.9	14.4
Angola	4.9	5.7	6.8	7.5	8.4	8.8	10.5	11.6	12.5
Liberia	3.0	2.9	3.0	3.7	4.4	9.2	10.7	11.1	11.5
Central African Rep.	3.8	7.4	7.7	7.8	9.2	9.5	10.3	10.2	11.5
Chad	2.0	2.3	2.6	2.8	3.2	7.3	9.2	10.0	10.8
Congo D.R.	3.3	3.3	3.9	4.4	5.3	5.9	8.2	9.6	10.5
Ethiopia	1.3	1.3	2.3	2.3	5.7	6.9	8.0	9.0	9.9
Eritrea	3.4	3.4	3.6	4.0	4.9	8.5	8.4	9.6	9.7
Niger	1.5	1.9	2.8	4.2	4.7	6.0	6.2	7.8	8.1

Table A3.3 **Evolution of Info-use**

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Switzerland	100.9	112.7	134.5	158.1	188.8	219.1	223.5	262.0	286.9
Singapore	92.2	131.9	162.1	183.3	203.0	226.8	236.0	262.8	282.7
Hong Kong, China	104.5	121.3	156.3	173.3	204.8	232.0	251.5	267.2	280.5
Canada	109.3	129.4	164.1	195.9	224.2	243.2	247.4	260.3	274.1
Denmark	99.9	115.4	143.2	174.8	197.2	221.0	223.5	246.2	264.0
Sweden	100.0	122.5	155.8	182.2	204.0	219.9	224.7	243.4	260.1
Iceland	105.7	129.4	153.4	173.8	195.4	210.1	215.6	238.0	256.3
Korea (Rep.)	56.9	72.2	90.4	110.1	163.4	212.0	230.0	240.0	254.2
United States	112.9	134.3	158.4	179.5	199.6	217.0	224.8	239.9	253.2
Netherlands	101.1	116.5	134.8	158.3	193.1	205.7	206.3	230.4	246.6
Luxembourg	82.3	117.1	131.0	150.8	169.2	190.7	209.7	227.6	246.3
Norway	104.9	128.3	151.9	171.0	191.5	205.6	206.9	226.0	244.8
Taiwan, China	59.8	75.5	102.7	125.6	165.5	179.9	201.1	225.1	243.1
Belgium	70.9	95.8	111.8	127.9	148.1	182.2	191.5	214.3	228.7
Japan	59.3	82.3	104.7	126.4	148.9	166.3	184.7	207.2	223.9
Bermuda	114.1	136.7	161.9	183.3	205.3	215.9	214.0	219.4	223.0
Australia	80.7	85.7	113.3	150.1	167.5	181.9	190.3	207.4	222.5
United Kingdom	69.4	87.4	105.2	128.0	149.4	164.1	177.7	206.1	220.2
Germany	71.1	84.1	106.5	123.2	152.5	176.4	192.6	206.6	219.2
Finland	104.9	125.5	149.6	167.0	176.7	189.8	189.9	204.8	218.8
Austria	75.2	106.3	122.2	143.8	163.0	189.1	191.1	203.2	218.1
Macao, China	43.0	56.1	77.7	108.3	119.3	138.0	177.1	192.2	213.3
Israel	53.5	69.3	87.1	111.5	123.7	145.2	161.8	183.7	212.0
New Zealand	87.8	102.7	124.3	142.6	164.3	182.4	189.2	199.7	208.0
France	65.1	75.0	89.2	104.4	118.8	138.5	168.4	187.9	207.1
Ireland	60.2	76.2	94.2	118.4	135.4	163.0	178.9	190.9	206.1
Malta	36.1	58.3	86.4	103.8	114.2	136.0	174.0	192.0	203.0
Barbados	17.6	48.1	58.4	76.2	80.9	96.0	130.5	160.9	201.8
Estonia	54.8	63.1	77.8	97.5	111.1	137.5	144.4	161.1	193.2
Cyprus	39.4	49.3	88.4	111.9	130.8	146.7	164.4	180.0	192.9
Italy	41.7	50.7	65.4	81.5	114.0	136.1	152.7	170.5	189.6
Gibraltar	54.9	64.4	77.2	92.4	108.0	153.2	170.9	180.8	187.3
Slovenia	60.1	79.4	97.7	108.8	119.3	126.7	157.3	178.5	184.2
Spain	37.9	55.8	70.6	83.1	96.6	120.3	146.1	168.1	180.8
Portugal	50.9	63.8	74.7	91.7	106.1	124.9	142.9	159.4	170.0
Bahrain	36.5	49.1	62.0	77.4	94.7	101.8	141.4	154.6	165.7
Qatar	31.7	49.3	75.7	82.2	88.2	95.7	118.6	134.1	157.1
United Arab Emirates	25.3	38.5	69.7	88.0	109.9	130.9	142.7	147.8	149.6
Croatia	28.6	37.3	48.7	61.5	70.8	89.7	118.8	132.0	144.5
Czech Republic	46.1	53.8	63.9	71.3	83.7	94.1	115.1	131.5	139.8
Chile	30.1	37.5	43.8	53.4	70.4	104.7	114.5	126.5	137.5
Hungary	38.7	43.7	56.0	68.5	78.8	85.1	112.4	123.7	135.9
Latvia	20.4	32.5	49.0	61.4	71.0	88.9	99.1	114.9	135.7
St. Vincent & the Grenadines	29.3	42.3	52.2	64.0	71.9	79.0	100.0	124.8	135.7
Malaysia	21.5	35.0	48.4	69.1	86.4	102.8	119.4	127.6	134.5
Kuwait	32.3	48.7	63.7	74.1	86.4	95.2	108.3	114.8	133.2
Costa Rica	33.3	41.9	50.4	58.7	69.6	85.2	104.3	122.5	132.2
Slovak Republic	33.7	40.8	54.2	63.5	79.6	96.5	110.7	117.5	129.0
Poland	33.6	41.1	49.1	62.3	71.2	77.8	97.5	119.0	128.4
Seychelles	37.7	45.8	55.6	67.2	85.5	92.4	110.0	117.9	126.6
Lithuania	14.7	28.7	41.8	56.1	63.4	79.1	93.4	111.5	123.7
Lebanon	18.8	24.9	47.1	61.0	76.1	87.4	105.8	115.8	122.9
Mauritius	18.0	26.0	37.4	58.6	71.0	83.9	101.2	111.4	119.2
HYPOTHETICA	**38.3**	**47.3**	**58.2**	**68.8**	**80.0**	**91.0**	**100.0**	**108.8**	**116.6**
PLANETIA	**39.6**	**48.2**	**56.4**	**65.5**	**75.3**	**85.3**	**97.0**	**107.6**	**116.4**
Greece	37.3	44.4	50.9	60.9	77.6	87.7	103.3	111.4	114.5
Romania	17.1	23.5	29.0	45.6	51.7	63.3	74.8	101.7	112.5
Uruguay	26.1	47.3	62.5	82.9	92.6	96.5	106.4	109.2	110.8
Bulgaria	17.5	28.4	34.7	41.0	49.0	67.6	88.6	94.0	110.1
Brunei Darussalam	44.2	59.9	68.0	74.6	79.9	85.5	104.0	106.8	108.1
Argentina	22.3	26.5	32.7	44.5	64.5	82.1	99.6	102.5	106.2

Table A3.3 **Evolution of Info-use** *(cont'd)*

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Trinidad & Tobago	22.3	30.3	43.7	56.6	71.5	80.2	95.1	100.7	105.7
Brazil	20.5	31.4	38.4	46.2	52.6	61.6	83.7	95.9	104.0
Saudi Arabia	12.5	16.4	20.2	25.3	39.7	58.9	83.7	98.0	104.0
Jamaica	14.0	24.2	33.1	50.4	53.2	59.5	70.8	95.2	98.1
Mexico	21.1	26.3	36.0	43.8	51.0	71.6	83.3	91.3	98.0
Iran	9.2	13.8	19.1	24.3	35.0	45.1	62.6	79.9	92.1
El Salvador	15.5	21.4	29.2	35.0	44.5	51.8	70.9	83.9	91.0
Turkey	17.5	22.7	29.9	35.3	50.8	56.0	80.7	84.8	91.0
Belize	15.0	35.4	42.7	51.3	64.0	73.1	79.6	83.5	89.8
China	5.7	8.1	11.7	19.7	30.7	41.2	54.3	71.7	87.7
Colombia	22.8	28.9	35.1	42.8	48.2	52.2	69.4	77.8	86.3
Venezuela	24.9	30.4	35.5	48.1	61.0	65.0	76.6	81.6	85.8
Russia	21.6	27.1	33.1	39.4	41.9	56.3	71.5	79.6	85.6
Maldives	6.5	19.6	23.0	28.8	36.8	47.1	64.3	75.8	83.3
Jordan	11.4	13.9	27.9	37.8	46.3	52.8	70.6	76.7	83.0
Yugoslavia (Serbia & Montenegro)	15.5	22.0	28.2	31.2	34.0	53.1	73.2	76.3	80.3
Oman	4.3	21.2	27.3	35.4	47.4	57.1	69.8	75.8	79.0
Thailand	18.3	24.3	32.9	36.2	45.9	55.8	62.5	69.1	75.1
Peru	13.4	23.6	28.3	39.7	46.9	54.5	64.8	69.7	75.0
Cape Verde	5.5	8.7	13.9	22.1	39.2	46.7	64.5	70.5	74.9
Suriname	23.0	28.6	42.6	48.6	50.4	54.3	69.0	72.9	73.7
Fiji	11.1	19.1	26.7	35.3	39.8	46.0	55.2	69.9	72.4
Tunisia	8.9	11.8	13.4	19.4	38.6	49.2	61.6	66.7	72.0
Ecuador	13.9	17.7	19.9	21.3	35.0	41.7	55.1	66.1	70.1
Moldova	5.1	6.2	10.9	21.5	27.9	39.3	49.1	59.3	68.3
Panama	15.9	23.7	30.8	38.2	44.4	55.3	68.8	68.5	68.1
South Africa	32.2	36.5	44.9	55.3	61.5	66.9	64.7	65.6	66.8
Guyana	11.0	14.3	17.3	20.7	41.8	48.3	61.1	63.4	66.4
Egypt	11.1	14.3	16.8	20.5	25.8	32.0	44.1	54.6	61.9
Armenia	8.1	10.7	12.7	14.9	26.5	30.2	45.1	51.1	61.9
Georgia	10.4	14.5	16.6	19.9	29.0	31.9	46.6	52.2	60.0
Namibia	6.3	7.9	14.5	23.9	26.3	43.3	50.0	53.0	58.8
Mongolia	6.1	7.8	13.2	15.1	22.0	29.6	35.3	39.8	57.5
Ukraine	14.3	18.3	23.0	26.5	29.3	34.7	49.6	54.4	57.4
Philippines	11.6	14.4	18.7	32.6	35.6	41.5	44.2	52.2	55.5
Syria	2.4	2.6	13.4	16.8	20.8	23.8	37.5	49.2	52.6
Kyrgyzstan	2.1	3.4	5.5	9.0	14.6	27.5	47.8	47.7	51.8
Bolivia	11.0	14.4	17.9	23.1	29.5	35.5	42.0	46.5	49.6
Paraguay	7.1	11.2	17.5	21.3	26.4	32.1	40.4	45.1	48.0
Samoa	9.9	14.0	17.0	20.5	22.3	27.2	40.9	43.6	47.4
Morocco	6.1	7.0	10.4	18.6	21.8	31.6	38.4	42.8	47.2
Cuba	2.3	10.9	13.8	19.3	23.8	28.7	36.4	42.7	46.8
Nicaragua	13.3	18.5	24.7	28.1	32.0	39.6	40.9	43.8	46.3
Guatemala	4.6	8.4	13.7	21.7	24.4	26.8	36.5	42.7	45.8
Zimbabwe	5.3	8.5	10.9	14.3	18.6	24.8	26.4	42.3	45.2
Botswana	9.7	13.1	17.2	22.0	29.1	33.5	41.9	43.2	44.6
Viet Nam	1.2	2.6	6.6	9.6	17.9	22.3	31.8	36.4	44.1
Algeria	4.8	5.4	8.6	10.7	19.7	25.3	34.1	40.7	43.7
Togo	1.7	5.3	11.8	13.8	19.4	33.8	34.2	40.3	41.8
Honduras	5.8	7.6	13.7	20.1	25.0	29.7	34.8	39.2	41.7
Gabon	4.4	4.5	13.0	18.7	21.2	32.0	34.1	36.6	41.2
Indonesia	9.8	13.0	18.9	20.5	24.3	30.1	34.9	36.5	41.0
Albania	4.5	7.1	9.5	11.6	13.6	16.0	28.0	32.3	39.7
Senegal	3.6	7.8	10.4	14.4	21.3	23.7	31.5	32.9	37.4
Kiribati	6.0	11.9	15.3	18.4	23.3	28.2	32.7	34.5	37.2
Gambia	3.2	6.0	7.3	11.2	19.2	22.7	29.2	31.3	33.1
India	6.5	8.0	9.6	12.3	15.5	20.0	25.4	30.5	33.0
Sri Lanka	4.2	9.7	13.5	16.4	17.8	21.8	25.5	29.9	31.6
Sudan	1.1	1.3	4.2	6.2	8.6	14.1	17.1	21.3	30.7
Djibouti	10.1	12.3	16.1	17.1	17.9	21.2	24.0	27.5	30.2
Côte d'Ivoire	1.6	5.2	8.3	11.9	14.9	18.3	23.5	25.6	29.9

Table A3.3 **Evolution of Info-use** *(cont'd)*

	1995	1996	1997	1998	1999	2000	2001	2002	2003
					indices				
Yemen	1.5	2.8	6.7	8.0	10.5	12.0	14.8	25.5	28.6
Pakistan	2.3	5.3	9.6	11.3	12.1	16.8	21.1	25.8	27.6
Papua New Guinea	2.0	3.8	10.5	13.6	24.7	30.6	21.3	23.0	23.9
Solomon Islands	6.8	13.8	16.6	17.9	19.9	20.7	20.6	22.3	23.0
Mauritania	3.3	3.3	6.0	10.9	15.2	18.1	16.5	18.4	19.8
Kenya	1.9	4.8	7.7	9.3	12.2	16.3	15.7	18.2	19.4
Ghana	2.2	4.6	7.2	8.2	11.8	13.4	13.5	18.1	19.2
Nigeria	6.7	8.1	9.8	11.1	12.7	14.2	12.9	16.4	18.6
Zambia	7.2	7.5	7.7	10.5	16.0	17.6	14.9	17.1	18.1
Benin	1.4	2.7	5.7	7.4	10.7	12.3	13.2	15.4	17.9
Lao P.D.R.	1.3	1.4	4.5	6.6	9.7	13.1	14.1	15.7	16.8
Cameroon	3.5	4.4	5.4	6.5	11.9	14.8	14.3	15.9	16.8
Nepal	1.6	2.6	4.0	5.4	7.9	9.3	14.9	15.9	16.8
Bangladesh	0.3	0.8	1.8	3.9	7.3	9.9	10.6	12.3	15.0
Eritrea	1.7	1.8	4.3	4.6	6.4	10.2	10.1	11.6	14.6
Tanzania	2.0	3.0	4.6	4.8	8.8	10.9	10.4	11.7	14.6
Guinea	2.5	3.6	4.5	5.5	9.8	11.2	10.0	12.0	12.4
Cambodia	1.4	3.4	4.7	6.3	7.9	9.4	9.0	11.4	12.3
Angola	1.0	1.9	3.3	4.7	7.0	8.5	9.1	11.1	12.0
Mozambique	1.3	2.3	4.3	5.3	7.2	9.2	9.6	10.8	11.1
Madagascar	2.2	3.3	5.0	7.5	10.3	11.1	8.9	10.6	11.1
Burkina Faso	0.9	1.9	4.4	6.0	6.7	7.5	8.7	9.3	11.0
Mali	1.1	2.7	4.4	5.7	8.0	10.4	8.8	9.3	9.8
Uganda	2.2	3.0	4.2	7.2	9.0	10.4	7.7	8.5	9.2
Malawi	1.0	1.4	2.1	3.1	4.9	5.7	6.5	7.4	8.1
Myanmar	0.4	0.5	0.6	0.7	2.2	4.9	6.0	7.5	7.7
Ethiopia	0.4	1.4	2.0	2.7	3.2	3.8	5.1	6.3	7.4
Central African Rep.	1.1	2.6	3.5	4.6	5.6	6.3	5.9	6.5	6.8
Chad	1.0	1.1	1.7	3.0	4.2	5.7	4.3	5.5	5.9

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