Can the digital divide be contained?

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Rapid technological change typically occurs in an uneven fashion. Certainly, there is no doubt about the unprecedented speed of progress in the use of the new information and communication technologies (ICTs) — but patterns of diffusion are less clear and change fast. Given the pervasive impact of ICTs on society, there is grave concern about whether the rapid and uneven spread of ICTs will further widen the "digital divide" that has already emerged between industrialized and developing countries. For, since the conditions enabling the spread of ICTs vary — or are simply unmet — in many parts of the developing world, differing speeds of diffusion will inevitably mean a widening digital divide. Then, if ICT use proves to be associated with economic gains, that widening digital divide can only reinforce and deepen the existing socio-economic divide between industrialized and developing countries. Concern over the uneven diffusion of ICTs is therefore well placed and is at the heart of this article.

This article is based on several findings of the ILO's *World Employment Report 2001: Life at work in the information economy*. It begins by summarizing the extent of the digital divide between industrialized and developing countries. There follows an analysis of the economic effects of ICT use, for example, as a result of the commercial applications of the Internet, or the productivity gains of the application of ICTs to business processes. The policy fundamentals underlying the successful entry into the information economy of certain developing countries are then discussed. Finally, an outline is provided of initiatives at international level to put ICTs at the service of development.

Measuring the digital divide

The term "digital divide" is used to describe situations in which there is a marked gap in access to or use of ICT devices measured by, for example, the number of phone lines per inhabitant, or the number of Internet users, or

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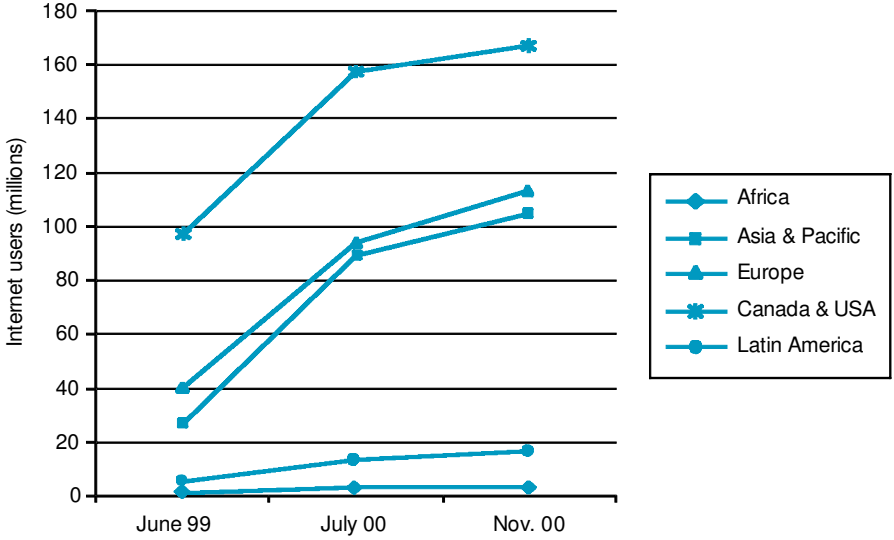
Figure 1. Estimated number of Internet users, by region, June 1999 – November 2000



Source: Data downloaded periodically over 2000 and 2001 from Nua Ltd. Web site www.nua.survey/how_, many_online_/index.html,
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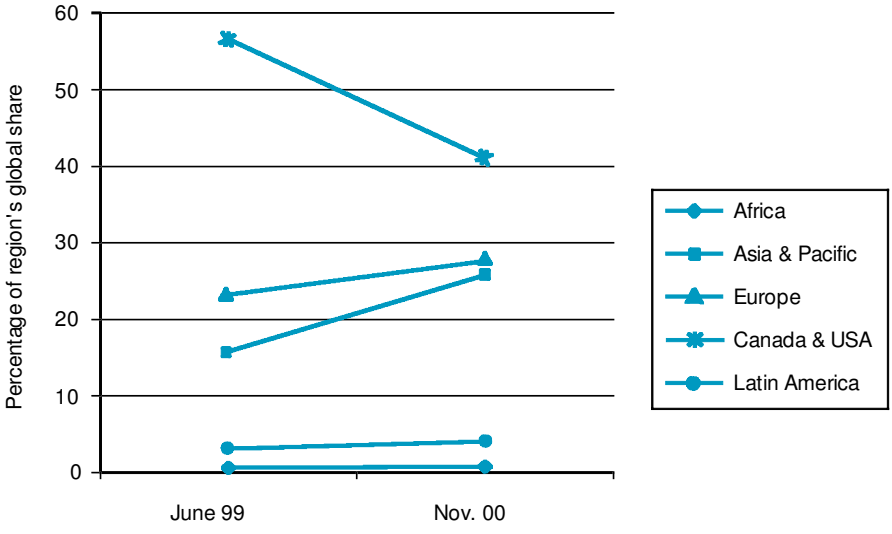
of mobile telephones in the population. A distinction is commonly made between a digital divide within a country and one between countries. An example of the former is the divide that usually exists between young and old, male and female, the more and the less educated, the more and the less wealthy, and urban and rural locations. In general, the digital divide refers to that between industrialized and developing countries — although comparisons of ICT use at different spots on the world map are now almost as significant as inter-country comparisons. For example, regarding Internet usage, Kuala Lumpur may soon be closer to convergence with Sydney or Milan than with rural Malaysia. However, this article focuses on the international digital divide, i.e. the divide between countries.

By almost every indicator, the disparities between industrialized and developing countries in the availability of ICT products, access to the Internet, and the inputs critical to further technological change and innovation are already wide — and growing wider. The extent of this gulf is starkly conveyed by the fact that half the world population has yet to make its first telephone call, or that the density of telephone lines in Tokyo exceeds that of the entire continent of Africa.

Figures 1 and 2 show estimates of the growth of Internet use on a regional basis, between June 1999 and November 2000. Latin America and

Figure 2. Change in regional shares of global Internet use, June 1999 – November 2000



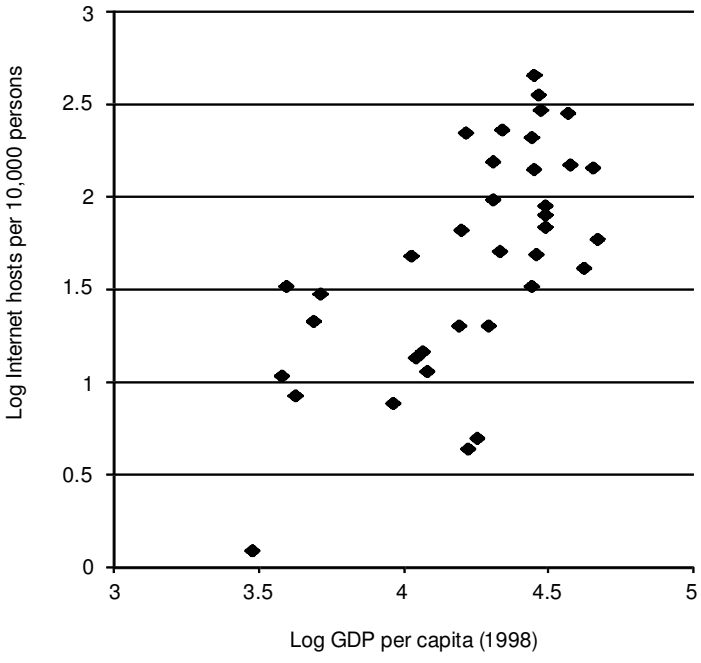
Source: Data downloaded periodically over 2000 and 2001 from Nua Ltd. Web site www.nua.survey/how_many_online_/index.html

Africa trail far behind North America,[1] Europe, and Asia and the Pacific. Figure 2 shows that, in fact, the North American share of global Internet users declined in relative terms over the period, although the number of users in the region grew in absolute terms (see figure 1). The decline in the North American share is the result of the very rapid increase in the European and Asian shares.

Figure 3 illustrates a collective measure of ICT use — Internet hosts per 10,000 persons — in relation to per capita national income, for 36 countries. Not surprisingly, the two are closely related. The interesting point, however, is the correlation's imperfection. It implies that despite their very different per capita incomes some countries show a similar degree of spread and use of the Internet. Conversely, countries displaying largely similar per capita incomes appear to be on opposite sides of the digital divide. In short, national income, though clearly important, is by no means the only explanation for the digital divide. Evidence shows that, in addition to income, the extent of political and civil liberties, the level of education, and the extent and affordability of the telecommunications infrastructure are important predictors of Internet use (Rodríguez and Wilson, 2000; see also Robison and Crenshaw, 2000).

[1] Excluding Mexico.

Figure 3. Internet use and per capita national income

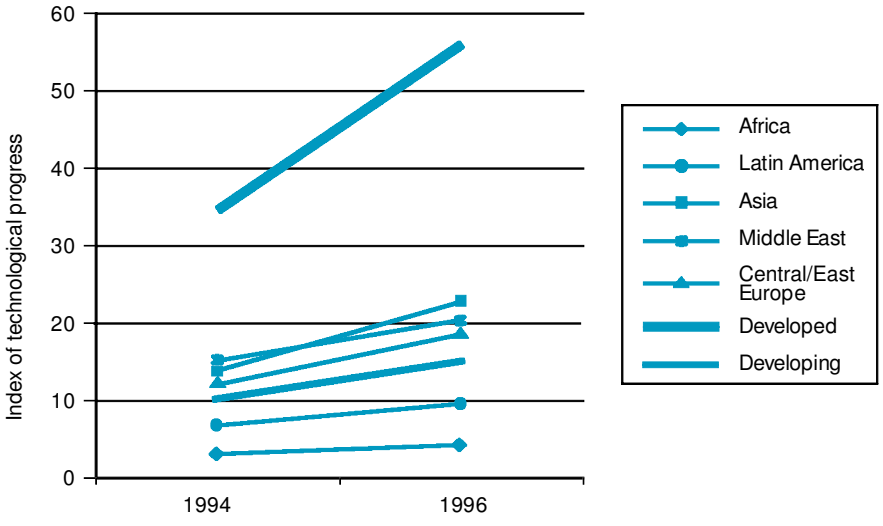


Sources: Income data for 36 countries from UNDP, 2000, pp. 178-179; Internet hosts data from Rodríguez , and Wilson, 2000, table 1-3.

The digital divide between regions is illustrated in figure 4. That developing (non-OECD) countries as a whole have trailed behind the industrialized countries in the spread of ICTs is an indication of the widening of the divide. Only the countries in the Asia and Pacific region (mostly China, the Republic of Korea, Malaysia, and Singapore) have been able to keep pace with industrialized countries, at least for the period covered in the figure (1994-96).

Two further observations may be made on figure 4. First, while several of the countries in east Asia appear to be keeping pace with the world leaders in ICTs, the pace is a constant one, i.e. they are not catching up with them. Second, the analysis represented in the figure is based on data now five years old. While it is true that the digital divide is still widening, its contours are most likely to have changed, given that five years is an exceptionally long time in terms both of the speed of technological change and of diffusion of technologies such as the Internet and mobile telephony. Some countries will certainly have fallen further behind; others may have narrowed the gap. By February 2000, the number of Internet users in the Republic of Korea, for example, had reached an estimated 12 million (Kenny and Utz, 2000, p. 20).

Figure 4. Technological progress by region in 1994 and 1996



Note: The index of technological progress comprises measures of ICT use, including the number of personal, computers, Internet hosts, fax machines, mobile phones and televisions.

Source: Rodríguez and Wilson, 2000, table 2.1.

Another feature of the divide is arguably more worrisome than the uneven spread of ICT devices or other technology "outputs", namely, the disparities in "technological inputs"[2] existing between industrialized and developing countries. These disparities are indeed significant, and they correlate quite closely with the spread of ICT devices. The disparities are of concern, as national differences in these inputs are precisely those likely to remain fairly stable over time: the number of mobile telephones could increase quickly, for example, but the number of scientists substantially less so.

Pessimism over the possibility of narrowing the divide stems from the fact that, though the need for considerable financial resources is a serious constraint in its own right, far more obstacles will need to be overcome to narrow the divide. Yet, as implied above, some of these needs (e.g. a well-educated workforce, available ICT software and hardware skills) are difficult to meet since they are time-dependent. In this regard, the majority of European Union (EU) countries trail significantly behind the United States in measures of ICT use. But EU countries may prove to have a comparative

[2] Technological inputs are defined as the number of scientists and technicians per 1 million persons and the number of telephone mainlines per 10,000 persons. See Rodríguez and Wilson (2000), tables 1-1 and 1-2.

advantage here because of their above-average levels of attainment in basic and secondary education. In both instances, however, it will be necessary to create the opportunities to harness this skill base locally: evidence shows that persons with unused skills are increasingly mobile, and capable of being absorbed into the global labour market through international labour migration (Glanz, 2001).

Finally, technology transfer is one aspect of the divide which has distinct policy implications. The ubiquity of information is a defining feature of the digital era yet, ironically, technological development in the post-Cold War era has been increasingly dominated by the private sector, rather than by public sector expenditure on research and development. Thus, on the one hand, access to information for application to economic and social ends has never been easier. On the other, the core knowledge permitting technological advance is in the hands — or rather the heads — of major private enterprises. The implication (to which this article will return) is that though a national strategy on ICTs is essential for countries, national strategies alone are unlikely to solve the problem of the digital divide in the absence of other measures to assist the transfer of technology. As Sachs has observed: "[T]oday's world is divided not by ideology but by technology ... A small part of the globe, accounting for some 15 per cent of the earth's population, provides nearly all of the world's technology innovations. A second part, involving perhaps half of the world's population, is able to adapt these technologies in production and consumption. The remaining part, covering around a third of the world's population, is technologically disconnected, neither innovating at home nor adopting foreign technologies" (Sachs, 2000, p. 99).

Economic effects of ICT use

The true significance of the digital divide does not reside in the uneven distribution of inputs and outputs — scientists or mobile telephones, for example — but in the fact that both may be increasingly important for economic growth. The outputs give rise to greater flows of information and, as argued below, these in turn may result in higher economic growth. Consensus reigns on the fact that investment in human capital has become a more significant source of wealth creation than investment in land or physical capital. If the digital divide is represented by uneven access to ICT inputs and outputs, then a widening digital divide could lead directly to a widening economic divide between industrialized and developing countries. At this early stage in the communications revolution, the evidence on this point is far from conclusive.

Certainly, it appears that the technology "bubble" has now burst. The volatility of technology equity markets since 2000, reflected in the boom-to-bust cycle of the first generation of "dotcoms", is a dramatic reminder of how little is known about the effect of ICTs on economic and employment growth. Beyond such short-term vicissitudes, however, the real test of the new tech-

Table 1. Savings by industry from Internet-based business-to-business sales

Industry	Estimated potential savings in total costs (percentages)
Aerospace machinings	11
Chemicals	10
Coal	2
Communications/bandwidth	5-15
Computing	11-20
Electronic components	29-39
Food ingredients	3-5
Forest products	15-25
Freight transport	15-20
Health care	5
Life science	12-19
Machinings (metals)	22
Media and advertising	10-15
Maintenance, repair and operations	10
Oil and gas	5-15
Paper	10
Steel	11

Source: Brookes and Wahhaj, 2000.

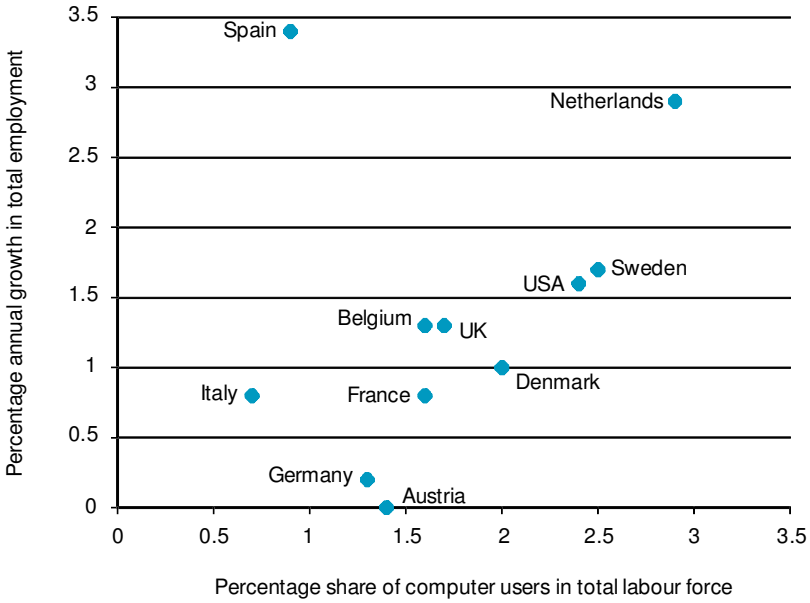
nologies' implications for economic and employment growth will be their effect on the "old" economy. Here the early evidence, however limited, appears to suggest that ICTs are consistent with economic growth and job creation.

In theory, ICTs ought to lead to positive economic outcomes by making markets more transparent through greater access to information, and more efficient through the resulting decline in transaction costs. Some empirical studies, reviewed in a paper by Smith, Bailey and Brynjolfsson (2000), do find that prices are lower in electronic markets relative to those in conventional markets. These studies concentrate on business-to-consumer markets, but their findings are supported by estimates of potential savings for business-to-business commercial transactions (the overwhelming share of online commercial transactions), shown in table 1.

The labour market may also be affected through improvements in job search efficiency. Online job search may speed up the matching process and be a factor in lower unemployment. As Krueger has observed for the United States:

> There has been a striking decline in short-term unemployment in the United States in the 1990s with a lower proportion of the labor force flowing through unemployment by 1997 than in any time in the past forty years. Suggestive evidence indicates improvements in labor market matching and greater labor market competition from the growth

Figure 5. Growth in employment, 1995-99 and share of computer users in total labour force of United States and selected EU countries, 1999



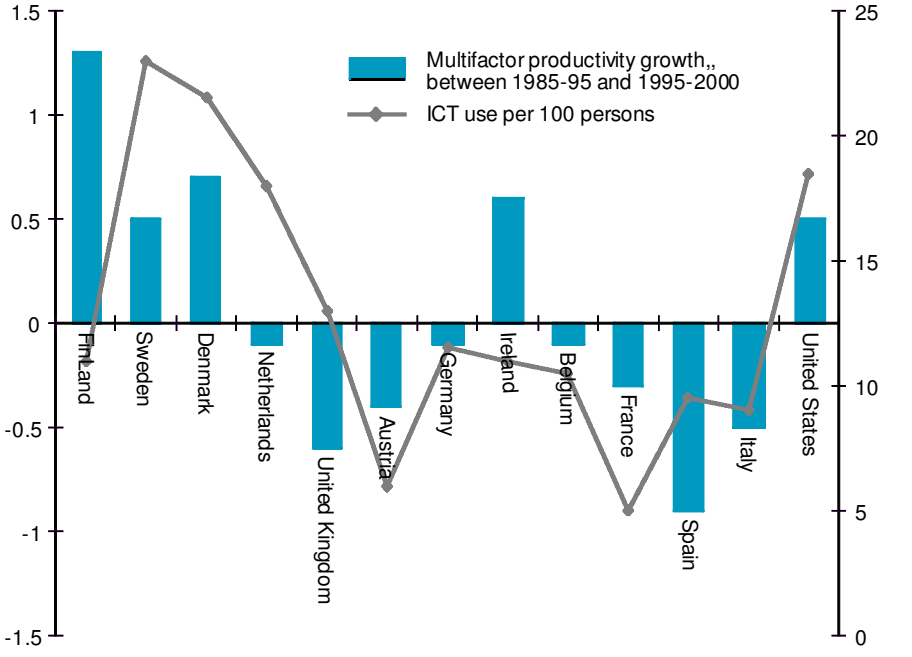
Source: Constructed from OECD, 2001, charts 4 and 5.

of labor market intermediaries may be playing a role in reducing labor market bottlenecks and potentially lowering the natural rate of unemployment. Increased software compatibility across work sites that allows new employees to quickly integrate into many computer-oriented jobs may be having a similar effect (Krueger, 2000, p. 8).

Evidence shows that durable productivity gains have been greatest in enterprises in which ICT use has been greatest (Bresnahan, Brynjolfsson and Hitt, 1999). At the aggregate level, the growth in multi-factor productivity in the late 1990s (compared with a decade earlier) was greatest in countries in which ICTs were most widespread. And these were countries where employment growth was greatest. ICTs lie behind the automation of routine jobs in manufacturing, but are also associated with the growth of the service sector, including "intangible" markets — markets in which the product itself is digital — such as software development.

Data on productivity, employment, and ICT use are presented in figures 5, 6, and 7. Those in figure 5 appear to suggest a relationship between OECD estimates of the share of computer users in the labour force and the growth of employment. If one takes the share of computer users as a (rather imperfect) proxy of ICT diffusion, it is encouraging to note its apparent positive correlation with employment growth.

Figure 6. Productivity growth between 1985-95 and 1995-2000 and ICT use in Jan. 2000, in selected industrialized countries



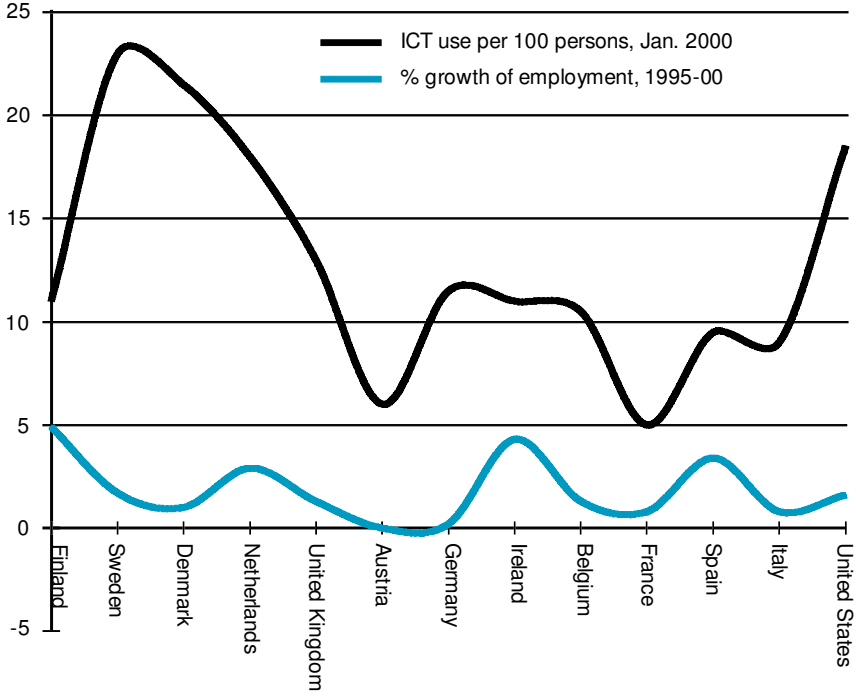
Source: Constructed from OECD, 2001, charts 1 and 2.

Figure 6 suggests that ICT use (OECD estimates of ICT users per 100 persons) and improvements in multifactor productivity tend to be associated. And the lines traced in figure 7 show that in most of the countries examined ICT use and employment gains also appear to move together. Naturally, such correlations cannot be claimed to be conclusive as they merely illustrate an apparent relationship and say nothing about causal relations. However prima facie evidence to date is at least consistent with the view that, far from heralding the end of work, the new technologies could be associated with both economic growth and job creation.

The effects of the Internet may well be related to favourable employment creation outcomes, but it is important to note that the communications revolution involves more than just Internet use. A strong correlation between the spread of telecommunications and economic growth has already been observed, and more recent studies have sought to determine the causal relation between the two.[3] For example, though it stands to reason that wealthier

[3] For a review of the econometric evidence, see: Analysys Group (2000), Annex A "Literature review and bibliography".

Figure 7. Employment growth (percentage), 1995-2000 and ICT use per 100 persons in Jan. 2000, in selected industrialized countries



Source: Constructed from OECD, 2001, charts 2 and 4.

countries can afford better telecommunications infrastructures, is it true that better telecommunications lead to greater economic growth?

Some evidence suggests a two-way causality, namely, that wealthy countries can afford better telecommunications, and that better telecommunications are also a determinant of economic opportunity. A World Bank study maintains that as much as one half of the difference between Africa's manufacturing exports as a share of GDP and the much higher east Asian share may be caused by the former's poor telecommunications (World Bank, 2000). Evidence for Botswana and Zimbabwe shows that areas without access to telephones have substantially less entrepreneurial activity (ibid., p. 20). A similar study states that: "areas with high levels of resources and skilled labor but with lower levels of telephony have fewer 'productive enterprises'" (Robison and Crenshaw, 2000, p. 5). This suggests that it is quite plausible that countries with poor telecommunications are *poorer in turn* as a result: a good telecom infrastructure is not only the outcome of economic growth, but is an input to growth as well.

Information is vital for development — indeed, it is possible that the marginal gains from access to information are even greater in developing than in industrialized countries. For example, the Internet broadens access to learning materials for wealthy students in industrialized countries, who can thereby supplement their own local access to knowledge. Consider the "leverage" that such access could provide to poor students in developing countries, where school systems are under-funded, teachers few or poorly trained, and libraries poorly equipped.

Possibly, then, the digital divide could further entrench the economic divide between rich countries and poor countries with minimal connectivity, resulting in diverging domestic growth rates and, even, in the marginalization of the latter from the world trading system. But if the marginal gains accruing to developing countries from participation in the communications revolution are greater than for industrialized countries, this could allow "leapfrogging" to occur, whereby those developing countries bypass the costs associated with the early stages of development, or the heavily time-related investments previously required, or, further still, bypass the early stages of industrial development altogether, in countries where ICT skills are available.

In developing countries, the barriers to access to telecommunications are lowering. Technological leapfrogging in ICTs will continue to occur, as wireless systems and mobile telephony become more widely used substitutes for the older, more expensive and less accessible systems of fixed-wire telecommunications. This now appears to be happening, as there is evidence of a relation between national income and the degree to which mobile telephony has become a substitute for rather than a complement to fixed-wire telecommunications: in a wealthy country such as Sweden, mobile and fixed-wire telephony are complementary, but the poorer the country, the more mobile telephony has become a substitute for fixed-wire telecommunications. In Cambodia, for example, 85 per cent of all telephony is through mobile devices. Technological infrastructure aside, there are several channels through which ICTs' contribution to economic growth in developing countries could occur; these are summarized in box 1.

Finally, it can be argued that connectivity is irrelevant to the three billion people in the world who live on under two US dollars a day. For an estimated two billion people, access to fresh water or electricity is a daily challenge of more fundamental concern than access to the information society. Discussion of ICTs in relation to development clearly cannot ignore the priority of needs in much of the developing world. Nor can it be assumed that, irrespective of their economic advantages, ICTs can somehow be a substitute for development. Nevertheless, the existence of a hierarchy of priorities does not necessarily entail trade-offs when these priorities are addressed. To the extent that ICTs could be a valuable tool in accelerating development, policy-makers should consider applications of ICTs at the same time as they consider other national priorities. Clearly, for the economic advantages summarized in

Box 1. Economic advantages of ICTs particularly relevant to development

- The Internet expands the scope and scale of market opportunities. By acquiring knowledge of markets and prices, etc., small firms could expand their market presence or improve their performance.
- Lower barriers to entry for new business start-ups in terms of lower physical equipment costs and capital costs are important for would-be entrepreneurs. In intangible products such as software, knowledge and innovation are more critical than access to financial capital. Similarly, telecentres, or simple mobile phone rental, can create many jobs with minimal investment.
- ICTs encourage the outsourcing of activities that could be captured by developing countries as they fit into global value chains. Developing countries could exploit their own comparative advantages, one of which might be their location in a complementary time zone. Closer, more integrated relations between developed and developing countries could result.
- The development of information-based products allows developing countries to leapfrog into higher-value-added, higher-income industries. Moreover, where information-based products are intangible there is less need to rely on the existence of good physical infrastructure for supply or distribution, for example.
- The language of 75 per cent of the content of the Internet is English, and this is both an opportunity and an obstacle for developing countries seeking to develop their own Internet content, and to trade in, for example, indigenous music or other cultural or information-based products. When Internet use rises in a given location, the Internet becomes local and local content then predominates over foreign content.

box 1 to be realized, a minimum set of policies and conditions needs to be in place. It is to these policies and conditions that discussion now turns.

Influence of developing countries' policy priorities on successful entry into the information economy

Differences in national income do not fully explain differences in the spread and use of ICTs. As observed earlier, several other influencing factors may be traced back to policy guidance and direction. Analysis of 15 national cases in the ILO's *World Employment Report 2001* found that progress in three policy spheres — education and skills, industry and trade policy, and infrastructure — was particularly relevant in developing countries that have made substantial inroads into the information economy.[4] To begin with, however, it is important to have a national strategy on ICTs. Indeed, the Internet itself originated in the 1960s as part of a US Department of Defense national strategy on military research.[5] Governments that have recognized the signif-

[4] The cases referred to in this section are discussed in Chapters 5 and 6. The national case studies on which the Report's discussion is based can be accessed through hyperlinks on the CD-ROM version of the Report.

[5] The Advanced Projects Research Agency Network (or APRAnet) was created in 1969, originally linking four computers at the University of Utah and Stanford University.

icance of ICTs for economic growth and employment generation have not been inclined to take a piecemeal approach. Rather, they have evolved a comprehensive, coherent national strategy to harness the technologies to these beneficial ends.

Successful strategies do not seek to replace the dynamism of markets with the heavy hand of the State, but they do acknowledge that the market alone is unlikely to spread the advantages of ICTs broadly enough. The most comprehensive strategies place emphasis on equitable access to ICTs by citizens (Malaysia and Estonia), online services of the State as a means of improving governance (China and Chile), as well as economic uses of ICTs. Mobile Internet units visit disadvantaged schools in Malaysia, for example; Estonia has attained 100 per cent connectivity in its school system; and, in China, local government services are being put online as a means of demonstrating the technologies' uses to ordinary citizens.

In some countries, separate government structures have been integrated to ensure that the approach to ICTs is properly coordinated. In China, for example, the Ministry of Post and Telecommunications, the Ministry of Electronics Industry, and the agencies in charge of the information network in the Ministry of Radio, Film, and Television and the State Radio Regulatory Commission were all merged in March 1998, to form the Ministry of Information Industry. In Pakistan, in October 2000, the newly created Ministry of Science and Technology and Information Technology absorbed the Pakistan Telecommunication Authority, previously under a different ministry, in order to create a multimedia communications network at affordable prices. Similarly, in Malaysia the Ministry of Energy, Communications and Multimedia was created in 1998, to ensure a coordinated approach to the convergence of the communications and computing industries.

Such changes in government structures coincide with particularly comprehensive policy approaches. Among the most far-reaching are those adopted by Singapore and Malaysia. Malaysia's national ICT framework, for example, which is part of the country's long-term development plan (Vision 2020), foresees an evolution from heavy reliance on electronics assembly to a knowledge economy based on innovation. The ICT framework addresses the human resources and the infrastructure needed for this to occur. The third strategic element in this approach is reliance on the market to determine the course of product development.

The status or quality of many national strategies may be open to debate, but the fundamental point is that such a strategy exists for, without one, it is unlikely that the gains from ICT use will be more evenly spread. And adopting a passive policy stance toward the communications revolution does not enable countries to avoid the risks associated with it. For example, procurement bidding by some major enterprises and even some governments now occurs only online. If an online presence is becoming a prerequisite for participation in certain markets, then limited connectivity could endanger some enterprises' viability and some countries' links to the world trading system.

Education, learning and skills

No developing country has made substantial progress in the information economy or achieved entry into global value chains in information and knowledge-based services without an educated, skilled workforce. Figure 8 reflects this strong linkage between the use of ICTs and school enrolment levels. Though this is merely a correlation and not conclusive proof, evidence of the relationship between educational attainment and ICT use is widespread for individual countries (ILO, 2001, chapters 2 and 7). It is thus clear that the knowledge economy to which ICTs give access rests fundamentally on levels of educational attainment and on skills. For example, one estimate of the cost of the shortage of ICT skills currently prevailing in the European Union calculates a foregone GDP growth of US$106 billion since 1998 (ILO, 2000, p. 10).

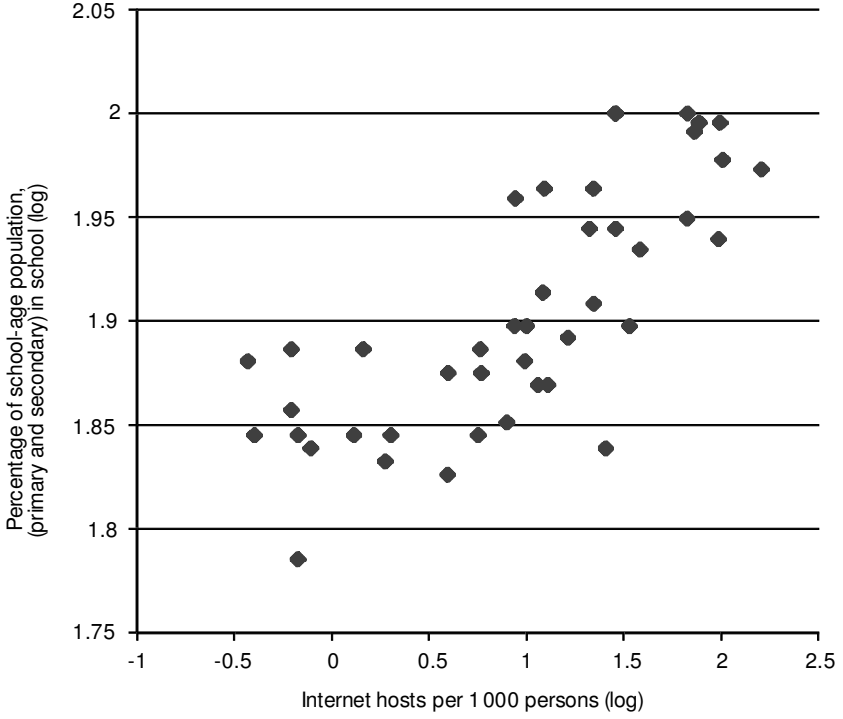
Nevertheless, participation in ICT markets can be achieved on the basis of a full range of skills. Moreover, developing countries can create jobs in ICT markets at the same time as they develop higher ICT skills. Thus, for example, the Indian software industry, which has enjoyed growth in excess of 50 per cent per year since the mid-1990s, currently employs 180,000 people and generates over US$4 billion in annual revenue; at the same time well over 250,000 Indians are employed in data-entry and data-processing jobs. At an even lower skill level, India has created 600,000 jobs in telecentres providing community-based phone access, for which only minimal educational attainment is required (ILO, 2001, chapters 4 and 6).

As lower skill levels (such as data entry) have a high level of labour absorption in ICT markets — and per capita investment is required to create them — it makes sense in terms of employment policy to encourage several entry points into these markets. Making productive use of ICTs does not necessarily imply a very time-intensive, "linear" investment in education: it is often enough just to know what is needed and where to learn it. Thus, many of those who design software or conform it to different uses do not even have formal qualifications or a diploma in the field. Furthermore, though this lies beyond the scope of this article, ICTs greatly multiply access to education and the sources of learning.[6]

However, there are several reasons why it remains important to encourage the acquisition of higher-level skills, such as software use and development, and knowledge of hardware. First, the most profitable and secure niches in international ICT markets are heavily skill-dependent. India owes the success of its software industry in large part to its long-term investment in higher education, and to the 55,000 graduates in science and engineering it produces annually. The physical location of the most dynamic ICT markets

[6] Examples of "picking up" what is needed and applications of distance learning through the Internet are discussed in ILO (2001), chapter 7.

Figure 8. Relation between school enrolment and Internet hosts, all European countries (East and West)



Source: ILO, 2000, figure 2, p. 9.

is often close to pools of available skills. Thus, just as Silicon Valley's proximity to Stanford University and other institutions of relevant higher learning in California is no coincidence so, too, the growth of the ICT industry in Bangalore, India, and in Xian, China, is related to its proximity to long-established science and engineering institutions.

Costa Rica invests 6 per cent of its GDP in basic and higher education and technical training; 18.5 per cent of its labour force has a tertiary education, and the illiteracy rate is only 3.5 per cent. Few developing countries can compare with these statistics. In addition, around 16,000 persons per annum are trained in software use in Costa Rica. In large measure because of the educational qualifications of its workforce, that country was able to attract foreign direct investment from major multinational enterprises in ICTs, notably Intel Inc., but also the Taiwanese hardware producer, Acer Inc. So significant have been these investments that exports by these enterprises have made a major contribution to GDP growth in Costa Rica.

The second reason why knowledge of hardware and software is essential is to be able to adapt ICTs to their most profitable uses, whether in domestic or global markets. As the economic advantages of ICTs extend across the economy and are no longer confined to the ICT sector, software and system maintenance skills become important for all enterprises. Thus, for example, Ireland's rise to prominence as both user and developer of software relied on the wise use of the European Social Fund's investments in the Irish education system, as well as on the Industrial Development Authority's strong focus on developing the software industry. Tax incentives were also granted for training provision. Similarly, Singapore subsidizes 70 per cent of the cost of continuing education for its software developers, thus subsidizing national investment in future wealth creation. Nevertheless, ICT jobs that do not necessarily require high levels of education rely on those that do: an Internet café or telecentre may create jobs and be highly used, but when the equipment breaks down it can only be repaired by appropriately skilled workers.

A final reason why higher-order skills in software and maintenance are a necessary component of a policy on ICTs is that exclusive reliance on less skilled niches in global markets may make countries vulnerable to loss of comparative labour cost advantage — a characteristic that data entry shares with the garment industry — or to technological change. Data-entry jobs, for example, could become obsolete with voice-recognition technology.

Industry and trade policy: Facilitating market access

The regulatory framework for the encouragement of e-commerce (such as authorization of electronic signatures, or payment and taxation facilities) remains incomplete in most countries of the world, and this is a brake on growth of the wider commercial applications of ICTs. One promising development in Malaysia is the growth of "online malls" — or single websites that regroup a variety of individual e-businesses. Beginning with the Jaring Mall in 1996, by the end of 1998 there were 20 online malls selling Malaysian products. Key to their growth was the development, with the assistance of Malaysia's national bank, of an electronic payment system. A government-owned enterprise, MIMOS Berhad, has created a secure server environment for online business, and this has also become a catalyst for e-commerce growth: one private estimate anticipates an explosive rate of e-commerce growth in Malaysia from US$60 million in 1999 to US$3.5 billion in 2004.[7]

Though e-commerce is in its infancy in most developing countries, through their industrial and trade policies governments can nevertheless offer assistance in the growth of ICT-related industries themselves. In Senegal, for example, the public telecommunications authority, Sonatel, has promoted the creation of private telecentres that have not only created 10,000 jobs in under

[7] International Data Corporation (1999), cited in John (2001), p. 25.

a decade, but have also increased Sonatel's revenues, since community access to telecommunications is both more profitable and, as in most developing countries, more feasible than individual telephone lines. The telecentres offer public access to telephony, email and photocopying services. It is likely that, in addition to direct employment, the centres generate positive externalities in the local economy as well.

Several governments have encouraged the growth of information processing for export through the creation of specialized zones. Given the well-educated, English-speaking workforce in Barbados, for example, the Government and the Barbados Investment and Development Corporation identified information processing as a strategic sector for growth. By 1997, 2 per cent of the workforce was employed in this sector, in some 2,500 jobs. Similarly, in Jamaica "digiports" or free-trade zones for digital work have been created, offering incentives such as low-cost premises, tax concessions, and 100-per-cent profit and dividend repatriation rights.

The Brazilian Software Export Programme (SOFTEX 2000) was created in 1993 by the National Technology R&D Council and the Ministry of Science and Technology, with the assistance of the UNDP. The programme has established 20 regional SOFTEX centres through which software developers can have access to workstations and the Internet, training opportunities, and technical and marketing support. In a country where venture capital is exceedingly scarce, Brazil's programme has been very successful in raising investment capital for start-ups (US$80 million in 1998 alone). India's Software Technology Parks, also sponsored by the Government, share some features with the Brazilian programme. Built around a high-speed satellite linkage, the parks provide collective use of resources and technical support extending to entrepreneurial skills and access to credit.

As early as 1988, China started its Torch Programme to encourage the commercialization of R&D innovations in scientific institutions and laboratories. By 1992 the programme had created 52 development zones and encouraged individual scientists and entrepreneurs to establish "new technology enterprises" (NTEs) drawing on the common facilities of these zones. An estimated 100,000 highly educated innovators had moved into these zones by the early to mid-1990s. The zones are credited with having given birth to the Chinese software industry. Although originally intended for new technology ventures of various types, some two-thirds of the NTEs went into software development. Seventeen of China's top 20 computer and software companies began as NTEs in the early 1990s.

National trade policies need to ensure that imported inputs can be made available at affordable prices, in order to encourage the growth and competitiveness of domestic industries, such as software development. Such policies run risks in so doing and are not without tradeoffs. In both Brazil and India, for example, the dismantling of high tariffs sheltering the domestic computer hardware industry undermined its competitiveness. In an increasingly open world economy, the absence of comparative advantage is rapidly felt. As a

general rule, successful policies have sought to facilitate entrance into markets, rather than to select markets themselves.

Telecommunications infrastructure

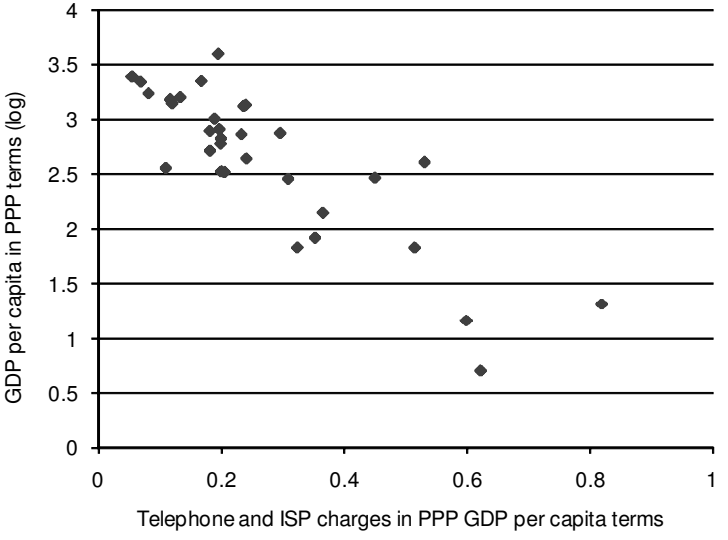
Telecommunications infrastructure is the third sphere where it is vital to make correct policy decisions, for the information economy to expand. Access and affordability are prime concerns in many developing countries although, as noted above, the advent of wireless mobile telephony is changing this. Two empirical relationships are nevertheless important. First, telephone costs tend to be higher in poorer countries when per capita GDP is expressed in purchasing power parity terms (see figure 9). Second, the more expensive the access charges (comprising local telephone calls and Internet service provision (ISP) fees), the less the Internet is used (see figure 10).

There are many reasons for the inverse relation illustrated in figure 9. One is the network effect: in most developing countries there are proportionately fewer subscribers to the telecommunications system than in industrialized countries, and telecommunications costs are inversely related to the number of subscribers. But government policies in this sector also appear to matter. Declining costs are being driven by technological change both in communications devices and in telecommunications infrastructure. Also, the decline of telecommunications as a national monopoly and the resulting rise of privatization and competition are driving prices downward worldwide, as well as increasing access. Over 90 developing countries opened their telecommunications markets to the private sector in the period 1990-98 (World Bank, 2000, p. 22).

Despite all these factors, only a minority of developing countries have fully liberalized their telecommunications sector, and many face a major dilemma as they contemplate doing so. For the settlement fees received by a national telecommunications system often represent a major contribution to the state budget and to foreign exchange earnings. Liberalizing the telecom market would entail foregoing these earnings, at least in the short term, before alternative sources of tax revenue emerge from the greater commercial activity that more affordable telecommunications are intended to generate.

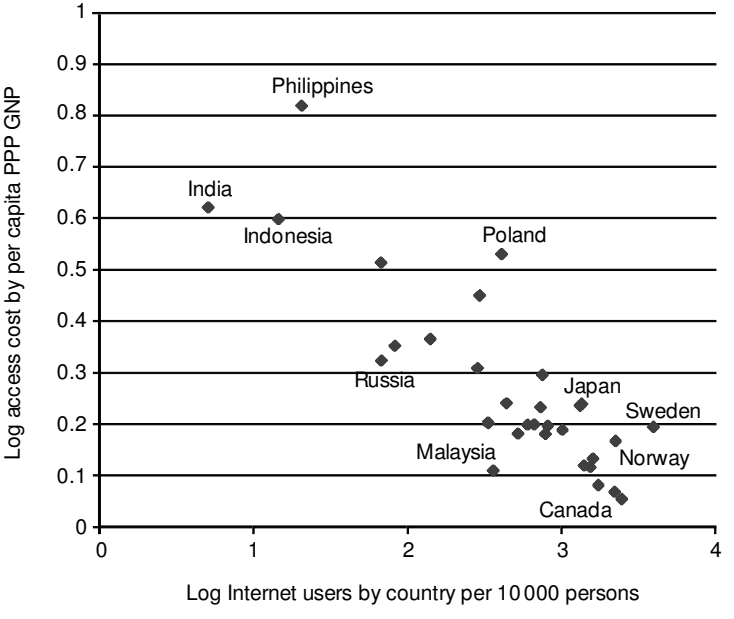
Access, education, and assistance to lower the cost of market entry are the policy fundamentals found in developing countries that have seriously committed themselves to the information economy. However, such initiatives are unlikely to be sufficient in all countries. Moreover, although there are grounds for thinking that absolute economic gains are associated with participation in the communications revolution, *relative* gains — catching up with the leaders — are likely to elude most countries. A strict cleavage between industrialized and developing countries may not remain the pattern as ICTs spread. If they apply appropriate policies and endowments, some countries, or locations within them, may make substantial progress in this respect; without such action other countries and locations may fall further behind. Therefore, if the digital divide is not to worsen existing patterns of inequality, both

Figure 9. GDP per capita and Internet access charges



Source: Constructed on the basis of data from UNESCO, 2000.

Figure 10. Internet use and price of access, selected countries, 1998



Sources: Constructed on the basis of access cost data from ITU, *Internet Diffusion Trends*, 1998, cited in , UNESCO, 2000, p. 287; and Internet usage data from ITU, 1999.

national and international efforts will be required. There is now widespread recognition of this throughout the development community.

International initiatives

This recognition, however, is still fairly recent and, despite the proliferation of initiatives, little is actually known about the effectiveness of programmes and projects. Most United Nations agencies are affected by ICTs, either through the use they make of them or because of their implications for the substance and delivery of technical cooperation programmes. For example, through its Trade Points Programme the United Nations Conference on Trade and Development (UNCTAD) has sought to promote electronic commerce for small businesses in developing countries, ensuring their integration into international markets and value chains. The World Bank's various initiatives in this area include the Information Development Programme (InfoDev), which endeavours inter alia to disseminate policy advice on ICT for development and on best practice. The International Telecommunications Union (ITU) has signed a memorandum of understanding with Oracle Corporation and Cisco Systems for the creation of 50 training centres worldwide. The ILO is exploring further how ICTs can be harnessed for the delivery of technical cooperation. Promising examples in this regard include the use of online, interactive learning modules to promote vocational training, as has occurred through the ILO's programmes both at headquarters and at its International Training Centre, in Turin.

In 2001 there will be two initiatives of broader significance than the so-far uncoordinated efforts by the international community. One is the ICT Task Force and Trust Fund, created in July 2000 by the United Nations' Economic and Social Council (ECOSOC), which "recognized the key role of partnerships, involving national governments, bilateral and multilateral development agencies, the private sector and other relevant stakeholders in putting ICTs in the service of development" (United Nations Economic and Social Council, 2000, para. 3). Their mandate is summarized in box 2. The Task Force will remain under the oversight of ECOSOC but will operate outside the United Nations structure, seeking to exercise a "matchmaking" function, bringing donors and projects together. As such, its main objective is coordination: "[T]he problem that the Task Force is established to address is not the global digital divide per se, but rather (a) the inconsistency and the uncoordinated character of the present multitude of efforts to bridge the divide, and (b) inadequacy of resources that are currently engaged in bridging the divide, which is at least partly due to (a)" (ibid., Annex 1, para. 9).

Another initiative is the Digital Opportunities Task Force, or DOT Force, which was created by the G8 states in Okinawa, also in July 2000. The DOT Force was set up with a temporary secretariat and is jointly administered by the World Bank and the UNDP; as with the ICT Task Force, it seeks to match donors with projects promoting ICTs for development. It is likely that,

Box 2. Mission and tasks of ECOSOC's ICT Task Force and Trust Fund

Mission

- Provide leadership in helping to formulate strategies for ICT development and putting them at the service of development for all;
- Forge a strategic partnership between the United Nations system, private industry and financing trusts and foundations, donors, countries with ICT programmes and other relevant stakeholders;
- Mobilize new resources for ICTs-for-development activities and projects;
- Administer a Trust Fund to be established and funded on the basis of voluntary contributions.

Tasks at national level

- Establish a transparent and consistent legal and regulatory framework;
- Develop the basic infrastructure necessary for connectivity and promote access to ICTs for all, by supporting the provision of public access points;
- Establish use of ICTs in public institutions, such as government departments and agencies, schools, hospitals, libraries;
- Generate, develop and enhance local content transmitted by ICTs by, inter alia, the introduction of local language character sets;
- Reduce connectivity costs, by means inter alia of market-based mechanisms and competition;
- Promote investment in the ICT sector;
- Make the necessary investment in human resource development, and strengthen the institutions and networks for the production, acquisition, absorption and dissemination of knowledge products;
- Develop technical training in order to secure national capacities to administer information systems and develop sustainable ICT projects;
- Promote the digital enhancement of the existing mass media and develop strategies to link established technologies, such as radio and television, with new technologies, such as the Internet;
- Promote the creation of technological incubators linked to universities and centres for research.

Tasks at international level

- Promote programmes to intensify South-South cooperation in ICTs-for-development projects, including enhancing direct connectivity between developing countries;
- Promote measures to increase the number of computers and other devices providing Internet access in developing countries;
- Explore ways of facilitating access to training in ICTs;
- Explore ways of promoting and facilitating investment in the research and development of technologies, products and services that would assist in raising literacy and skill levels in developing countries;
- Facilitate the transfer of ICTs, in particular to developing countries, and support efforts towards capacity-building and production of content;
- Encourage research and development on technology and applications adapted to specific requirements in developing countries, including distance learning, community-based training, digital alphabetization, tele-medicine, interoperability of networks, and natural disaster prevention and mitigation;
- Explore and define ways of enhancing use of ICT by small and medium-sized enterprises in developing countries and in countries with economies in transition, as these enterprises are a major source of employment, and also ways of strengthening their competitiveness in the emerging global economy.

Source: United Nations Economic and Social Council, 2000, Annex 2, Priority areas of action and types of activities. For more information, visit www.un.org/esa/coordination/ecosoc/itforum

once inaugurated, DOT Force projects will come under the coordination of ECOSOC's ICT Task Force.

Concluding remarks

This article has attempted to evaluate the economic and employment consequences of ICTs. These are critical to development and to poverty reduction, though the influence of both ranges wider still. The overall implications of ICTs are also critical. As a meta-technology, ICTs' pervasive effects hold implications not just for the labour market but also for access to learning and health care, for cultural and political awareness, for the transparency and accountability of organizational governance structures (including government agencies), and for social cohesion. NGOs, public and private interests, entities at international and local levels are all interested in one way or another in the promotion of these different dimensions of development. The international coordination of efforts to narrow the digital divide and to promote development may well prove a vital link in improving their effectiveness.

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