

Stamm, Andreas

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A global ICT skills offensive to bridge the digital divide between North and South

- *Information and communication technologies (ICTs) are increasingly penetrating corporate processes, information processing and the exchange of data between individuals, organizations and firms. This trend emanates from large "old economy" enterprises, and it is affecting more and more sectors of the economy and society.*
- *The digital revolution offers developing countries a wide range of opportunities: the use of ICTs and the Internet can improve the supply of information and high-quality educational and medical services to the public, and global networking is creating new economic opportunities and may contribute to democratization and political participation by strengthening organizations in civil society.*
- *In many developing countries the use of ICTs is still hampered by a lack of network connections and hardware. As a result of the interplay of new technological options and a targeted commitment by governments, international organizations, enterprises and non-governmental organizations, however, the technological conditions for the use of ICTs are rapidly improving even in the poorer developing countries.*
- *A crucial obstacle to the use of ICTs will, on the other hand, be the absence of appropriate skills. The training systems in developing countries are not prepared for training experts in sufficient numbers. At the same time, the global shortage of ICT experts is leading to an increase in international migration to the industrialized countries.*
- *As a global labour market in ICT experts emerges, there must be overall, global responsibility for ensuring the renewed and ongoing qualitative development of human resources. As part of an internationally coordinated ICT skills offensive governments, the private sector and non-governmental organizations must help to develop expertise, efficient institutions and international research networks.*

Information and communication technologies are changing the economy and society

The information and communication technologies (ICTs) have become the world's leading key technology. They enable efficiency to be improved and costs reduced in the business community, make new forms of out-of-school learning possible and pave the way for scientific breakthroughs. The networking of computers in an open, global system gives access to information disseminated throughout the world and enables individuals, organizations and enterprises to communicate with one another wherever they may be.

The digital revolution will continue, and the Internet's influence on the economy and society will increase. The disenchantment with ICTs that has been evident since mid-2000 and the poor performance of many technology shares on the stock exchanges are primarily a reflection of unrealistic expectations of the pace and form of the changes which the new technologies would bring. The digital revolution was wrongly equated with the rapid spread of the Internet. What was overlooked was that high-grade ICT applications call for complex hard and software solutions, which take far longer to develop than the standardized networking of Internet computers. Furthermore, the development of technological solutions is not enough on its own. Major efficiency gains and basic innovations call for extensive adjustments to the structure and management of the organizations using them.

The use of ICTs in the economy and society and of the Internet is likely to receive a boost when technological innovations that solve current problems are introduced in the near future. These innovations will permit, for example,

- the faster transmission of large quantities of data by the xDSL method in stationary ICT applications and UMTS systems in mobile applications;

- the verification of electronic transactions with the aid of digital signatures or the secure identification of partners on the Internet with the aid of biometric procedures.

The electronic transaction of business between enterprises will become increasingly important because of the obvious competitive advantages to be achieved through greater efficiency and reduced transaction costs. The commercial use of the Internet will be increasingly promoted by the large "old economy" enterprises and the ICT companies, which are integrating the new technologies into existing business practices and also promoting network-supported solutions that place their external relations with business partners on a new footing.

Opportunities and risks for developing countries

Developing countries too may benefit from using ICTs. Through the Internet they gain access to databases in the industrialized countries. Access to international expertise makes radical improvements possible in medicine and in education and training. Non-governmental organizations (NGOs) and other representatives of civil society can be strengthened, democratization processes and political participation supported. Increasing market transparency creates new openings for enterprises in developing countries to become integrated into the global division of labour and international production and distribution chains.

Through international subcontracting or by producing software of their own, developing countries can service attractive segments of the world market and so create high-quality jobs. Global growth rates are higher in this sector than in others, and there is no sign of saturation. The market is becoming increasingly segmented, giving access to new actors. In 1998/99 the Indian software industry achieved sales of about US\$ 3.8bn and employed

180,000 people. A number of other developing and newly industrializing countries, such as China, Malaysia, Brazil, Costa Rica, Jordan and South Africa, have established ambitious programmes with a view to becoming internationally competitive in software production. ICT companies are relocating some of their software production to developing countries that have appropriate potential in terms of well qualified ICT experts.

Risks arise primarily for developing countries that fail to adjust to economic changes due to ICTs because they lack resources or their development strategies have other priorities. Their producers are in danger of being ousted from their traditional markets once customers change supply chains to ICT-aided systems. Enterprises will become less competitive if they fail to modernize their processes by using ICTs. Where modernization occurs without there being appropriate supply at home, dependence on products and services from the industrialized countries will rise. The labour-saving effects of technological change will occur locally without any compensation in the form of increased employment in the ICT sector.

Developments in hardware and network provision

The debate on the implications of the digital revolution for the developing countries and North-South relations is dominated by the term “digital divide”, meaning the extremely unequal distribution of ICT hardware and Internet access throughout the world. This may further exacerbate existing development disparities: the industrialized countries and some newly industrializing countries are capable of exploiting the efficiency-increasing effects of ICT, whereas the developing countries are becoming further isolated.

An international comparison of access facilities and numbers of users makes interesting reading (see table). It says little, however, about how ICTs can actually be used to promote development. The infrastructure and user densities achieved in the industrialized countries are not, after all, essential for social and economic benefit to be derived from ICTs. In the developing countries it must first be ensured that key actors (schools, training centres, competition-oriented enterprises, NGOs) have access to ICTs. The second step must be to achieve a user density that makes local, regional and national network effects possible through the emergence, for example, of local ICT service providers and of Internet contents of local interest.

The data used for the purposes of international comparison are static and conceal the considerable dynamism in the developing countries’ access to ICTs. While, for example, only 11 African countries had access to the Internet in 1996, all except Liberia and Somalia had access by March 2000. From 1996 to 1998 the density of fixed-line

telephone connections (still essential for the Internet) rose in all low-income countries from 11 to 23 per thousand inhabitants, thus more than doubling in two years. The rates of increase in PC density are similar. This does not mean that the digital divide can be eliminated in the short term, but it does show that the availability of strategic resources of the information age is rapidly improving even in the poorest developing countries. This process will continue in the years to come.

International experience shows that the density of telephone and Internet connections grows rapidly and the prices of the associated services fall sharply where state monopolies are privatized and the emerging market is monitored by an efficient and independent regulatory authority. In a number of developing countries the telecommunications sector was until recently used to finance state bureaucracy, leading to high costs for users and limited reinvestment in the expansion and the improvement of the quality of networks. Many of these countries, including some as populous as Nigeria, have begun to open up their telecommunications markets and to admit private suppliers. This is likely to result in a sharp rise in the density of supply and in an improved Technological price/performance ratio.

Technological innovations in the mobile radio communication sphere are making it easier to provide widespread access to telecommunications services. They are joined by organizational innovations geared to ensuring that optimum use is made of hardware and network provision:

- In Bangladesh Grameen Telecom offers many rural households access to the telephone, with e-mail and the Internet to follow in the future. Grameen Telecom’s partners are 60,000 members of the Grameen Bank, who lease mobile radios and sell telecommunications services in their home villages.
- In Peru there are now more than 600 *telecentros*, where even poor sections of the population have access to e-mail and the Internet. Similar facilities are emerging in many developing countries in the shape of Internet cafés or extended services provided by the telephone companies, although they are usually confined to the urban centres.

A number of public and private actors have meanwhile recognized the problem of the digital divide and initiated countermeasures. Since 1995 the World Bank, for example, has been financing, as part of its Infodev programme, innovative projects in the use of ICTs for economic and social development. In Okinawa in June 2000 the G-8-heads of government adopted a declaration in which the

Key data on the global spread of ICTs (1998)						
	Host computers	%	Internet users ('000)	%	PCs ('000)	%
Africa excl. RSA	12,880	0.0	335	0.2	2,927	0.9
RSA	144,445	0.3	1,266	0.8	2,100	0.6
Latin America	490,643	1.1	6,018	3.9	14,900	4.4
Asia excl. Japan	922,837	2.1	13,183	8.6	40,953	12.2
Oceania	932,590	2.1	3,623	2.4	8,802	2.6
Japan	1,687,534	3.9	16,740	10.9	30,000	8.9
Europe	7,729,581	17.8	45,241	29.4	102,693	30.5
USA and Canada	31,608,635	72.6	67,500	43.9	134,000	39.8
World	43,529,145	100.0	153,906	100.0	336,375	100.0

Source: Author’s own calculations based on ITU data

member countries undertook to make an active contribution to bridging the digital divide. Increasingly, there has also been a targeted commitment by major companies in the ICT sector to develop appropriate ICT applications for developing countries. Under the heading of e-inclusion Hewlett Packard has set up a comprehensive programme to promote poverty-oriented solutions, especially at village level. To this end, it is cooperating with various partners, including the Grameen Bank in Bangladesh and a number of northern and southern NGOs.

Global shortage of ICT expertise a disadvantage for developing countries

A decisive barrier to the widespread use of ICTs will be the growing shortage of ICT expertise and associated key skills. The digital revolution is changing qualification requirements more quickly and more profoundly than other momentous technological innovations in the past (the steam engine, electricity). This is primarily due to its across-the-board impact. Not only high-tech sectors but also such traditional industries and services as transport and storage are undergoing digitization. Efforts are also being made to use ICTs to improve basic social services and to make government more efficient and more transparent (*e-government*).

Consequently, the demand for ICT applications will also grow on a broad front in developing countries. Some of the solutions can be acquired in the world market. Local experts will then be needed for adaptation, implementation and servicing. The activities concerned are frequently expensive and demanding and have to be undertaken by appropriately trained personnel or specialized service providers. However, specific applications are rarely available as package solutions; they are often closely related to regional and national features. A range of software and ICT services adapted to local needs is essential for small firms and other financially weak organizations if they are to be able to modernize. The costs involved prevent them from using what is on offer internationally.

The developing countries' participation in the global information society will therefore very much depend on whether they have the human resources needed for the absorption and creation of ICT-related know-how and its exploitation in the economy and society. The starting conditions are unfavourable. Very few developing countries have adapted their education and training systems to the requirements of increasingly knowledge-intensive development. As a rule, they provide neither broad basic technical training nor the special courses designed to produce highly skilled workers. Vocational training systems are geared to teaching the skills needed in traditional industries, and there are very few ICT-related career profiles. In Africa, for example, there are currently only two supranational training centres specializing in network servicing (one in Senegal for the French-speaking countries, the other in Kenya for the English-speaking countries).

The situation in tertiary and postgraduate training is also problematical. The curricula of most universities in developing and newly industrializing countries continue to focus on the social sciences, courses with a technology bias being few and far between. In 1997, for example,

only about 21% of graduates entering the labour market in Latin America had undergone training in science or engineering, the proportion in the USA being twice as high. Postgraduate training in technical subjects is extremely rare: some 530 doctorates in engineering and technology are awarded at Latin America's universities each year, compared to 575 in Spain alone in 1998. In 1999 only 29 information scientists with doctorates were teaching at Argentine universities.

The shortage of ICT experts is a global phenomenon. For some considerable time the USA has been recruiting huge numbers of skilled personnel from India and other countries. Europe and Japan are increasingly following suit. According to estimates by the International Labour Organization (ILO), some 1.6 million ICT vacancies cannot at present be properly filled in western Europe. In the future the migration of ICT experts from developing and newly industrializing countries is likely to rise sharply.

Migration need not always take the form of a brain drain entirely to the detriment of development. India, China and Vietnam, for example, have benefited both from the networks of relations in industrialized countries built up by emigré experts and from the experience of those who have returned. India's and, more recently, Brazil's experience shows that highly qualified experts are likely to return to their countries of origin if high-quality jobs are created in branches of multinational companies in those countries or if an attractive environment for the establishment of technology-oriented enterprises with a high growth potential emerges. Emigration poses problems where it is very high in relation to the numbers of skilled workers and to training capacities. This is a danger that confronts the small and medium-sized developing countries in particular. An extreme shortage of experts may prevent the emergence of an independent ICT sector in countries of origin and also make them unattractive for technology-oriented direct investment. Unless there is appropriate local dynamism, however, neither the potential network effects of the emigrants nor the increased experience of those returning can be exploited.

A global ICT skills offensive to prevent a widening of the digital divide

As the international migration of qualified ICT experts increases and a global labour market thus forms in this segment, there must also be overall, global responsibility for ensuring the renewal and ongoing qualitative development of the expertise concerned.

The industrialized countries should begin by expanding their own training capacities in the ICT sphere so as to limit the migration of highly qualified experts from developing countries in the medium term. At the same time, they should

- support the developing countries in their efforts to increase their pool of skilled workers, to develop efficient institutions and to become integrated into international scientific networks;
- ensure, by taking support measures, that the developing countries too derive benefit from the international migration of experts. To this end, international networks should be developed and the know-how ac-

quired by experts should be put to the best possible use when they return to their home countries.

These programmes might be partly financed by fees levied on firms and organizations that meet their demand for ICT experts under special immigration programmes (*green cards*).

The developing countries should provide for an adequate increase in spending on technical education and training and also initiate vocational training and university reforms. Appropriate career profiles should be developed, and ICT components should be integrated into existing programmes. Given the rapid changes in qualification requirements, training courses should be modular in structure and supplemented to include components of lifelong learning. Where a private market in ICT-related training schemes emerges, it can be supported by the development of quality standards and methods of certifying training achievements. ICT-related training and research capacities should be developed or expanded at universities. They are needed if international technological advances are to be monitored and exploited in developing countries.

In Germany the activities of certain government departments (the Federal Ministry for Economic Cooperation

Advanced training of IT consultants by the CDG

The Carl Duisberg Society (CDG) runs programmes for the advanced training of IT consultants from developing countries. In an intensive, year-long training programme in Germany 20 young IT experts at a time are prepared for future advisory and training tasks. The programme teaches practical know-how in such vital areas of IT as the Internet, databases and programming languages and includes three months of practical training in the IT departments of German firms, one aim of which is to promote the emergence of networks of contacts with German IT experts. The participants have either a university degree or several years of practical IT experience and are assigned by consultancies, training firms, institutions and organizations.

and Development, BMZ, and the Federal Ministry of Education and Research, BMBF) are already helping to improve ICT skills in developing countries through scholarship programmes run by the DAAD (the German Graduate Exchange Service) and the CDG's advanced training schemes (see box), for example. The BMBF's International Bureau promotes cooperation between the German IT research community and partners in developing countries.

In view of the importance for development strategies that ICT skills will assume in developing countries in the future, these activities should be upgraded and more

closely coordinated. New forms of interinstitutional and public-private cooperation should be adopted, with experts from developing countries, for example, undergoing practical training in public research institutions and ICT firms in Germany. German universities are increasingly introducing English-language courses in information science, especially at postgraduate level. This will provide new opportunities for the advanced training of scientists and managers from developing countries.

Germany should press for a global ICT skills offensive in international fora:

- In the follow-up to the *Digital Opportunities Task Force (DOT Force)* consultations held between the G-8-summits in Okinawa (2000) and Genoa (2001) Germany should take overall charge of human resources development.
- There are plans for a *World Summit on the Information Society (WSIS)*, coordinated by the *International Telecommunication Union (ITU)*, to be held in 2003. Germany should urge that the question of ICT skills be appropriately considered at the WSIS and focus its substantive contributions accordingly.

Dr. Andreas Stamm

Department for Industrialization and Advanced Developing Countries.
Region:
Latin America

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GERMAN DEVELOPMENT INSTITUTE · INSTITUT ALLEMAND DE DEVELOPPEMENT

TULPENFELD 4 - D-53113 BONN TELEFON (0228) 949 27-0 · TELEFAX (0228) 949 27-130

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