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The Digital Divide

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The new economy is sometimes seen as the herald of a truly borderless world, where everyone can profit from the blessings of the Internet regardless of his or her geographical location. However, since the Internet requires substantial prerequisites concerning technical infrastructure and human capital, some worry that the developing countries will be left behind. This contribution addresses the fear of a growing "technological apartheid" between the industrialized and the developing countries and looks at policies to overcome the digital divide. First, however, it clarifies the used concepts for the new economy.

Catchwords and concepts for the new economy

Various catchwords have been coined to capture the essence of the economy-wide consequences resulting from an increased use of processed digital information and from the application of the Internet for a wide array of services (software programming, webpage maintenance, ticket and hotel reservations, on-line information and support, ordering facilities, publishing, indexing or abstracting etc.) as well as transactions (delivering music, movies, documents, literature or software in digital form).[2] The following catchwords aim at different characteristics of this phenomenon but are frequently used as synonyms: "digital economy", "information economy", "knowledge-based economy", "weightless economy", "virtual economy", "Internet economy", "electronic commerce", "e-commerce", "e-conomy", or maybe more capacious "new economy". Some authors have tried to assign distinguishing concepts to this variety. For example, Kling and Lamb (2000) suggest to use the term "information economy" to include all informational goods and services like publishing, research, legal and insurance services, entertaining, and teaching in all of its forms, and the term "digital economy" to address (only) the goods and services whose development, production, sale, or provision is critically dependent upon digital technologies. Furthermore, the term "new economy" is associated for them to the possible consequences of the information economy and the digital economy, namely high growth, low inflation, and low unemployment.

However, in many papers – including the present one – the concept of the "new economy" is wider and includes the characteristics of the "information economy" and of the "Internet economy" as subsets. In the following, the term "new economy" describes an economy where both final output and intermediate input predominantly consist of information and where the modern (digital) information and communication technologies provide world-wide access to almost any available information. These new technologies might have the potential to enable an increase in the productivity of conventional business practices, but also facilitate the establishment of new processes and products. Consequently, the evolution of the new economy should not be considered as being restricted to the information sector, but as a far reaching process that might alter and extend the products and production processes within the whole economy. This means also that the consequences of being excluded from the progress of the new economy might be rather detrimental for (developing) countries.

The new economy broadly defined

The digital divide between countries

The overall rise of the use of the Internet has been exponential. The Internet age has yet arrived only in some parts of the world. Table 1 presents the density of the five main tools of the communication and information era (television sets, telephone mainlines, mobile phones, personal computers and Internet hosts per 1,000 people) according to an

[1]* Kiel Institute of World Economics, Germany. This contribution is part of the research project "New Economy – Trends, Causes and Consequences" funded by the Heinz Nixdorf Foundation.
[2] Panagariya (2000) offers a concise listing of e-commerce services and their significance for developing countries.

income classification of countries. The classification of countries follows the World Bank (2001a): "Low income" are countries with a Gross National Product (GNP) of less than US$ 755 for the year 1999, "lower middle income" are countries with a GNP between US$ 756 and US$ 2,995, "upper middle income" are countries with a GNP between US$ 2,996 and US$ 9,265, whereas "high income" countries are the remaining ones with a GNP of more than US$ 9,266.

Table 1 shows that the gap between the low income and the high income countries increases considerably with the state of technology of the communication and information equipment. Whereas the low income countries achieve with their density of television sets 32 percent of the world average and with their density of telephone mainlines 16 percent, the gap is more pronounced in equipment using digital information: The density of mobile phones in the low income countries is only 3 percent of the world average, the density of personal computers is 6 percent and the density of Internet hosts is even less than half of one percent of the world average. This gap can be denominated "digital divide" (cf. OECD, 2001b). It is also interesting to note that the countries classified as upper middle income achieve quite high density values (above 89 percent) relative to the world average for four categories (television sets, telephone mainlines, mobile phones and personal computers per 1,000 people) but fall to just 32 percent of the world average concerning the diffusion of Internet hosts. Since the Internet hosts contain the data that are world–wide available, the density of hosts in a country indicate how much this country can influence the contents of the Internet.[3]

The gap increases with the state of IT equptment

Table 2 displays the regional distribution of Internet hosts and Internet users and underlines the assessment of a digital divide separating the high income countries from the rest of the world. 90 percent of all Internet hosts are in the EU, the United States, Canada and Japan. These countries have 59 percent of the world total of Internet users. Africa accounts only for 0.25 percent of Internet hosts and, 0.54 percent of the world total of Internet users.

Table 2 also shows that at 63 percent of the world total of Internet hosts and 26 percent of the world total of Internet users, the United States are the decisive country for the spread of the Internet. The United Kingdom and Germany, the two EU countries with the most Internet hosts and Internet users, have only a twentieth of the Internet hosts of the USA. The developing countries have a rather tiny share of the world total in

[3] However, it has to be noted that there is not yet a unique definition of internet hosts and that the methodology of collecting the data about internet hosts still differs significantly from one statistical source to another.

Table 1

The Arrival of the Information Age – by Region

Region	Television sets per 1,000 people		Telephone mainlines per 1,000 people		Mobile phones per 1,000 people		Personal computers per 1,000 people		Internet hosts per 1,000 people	
	1999	in percentage of world average	1999	in percentage of world average	1999	in percentage of world average	1999	in percentage of world average	2000	in percentage of world average
Low Income (GNP per capita less than US$ 755)	**85**	**32**	**26**	**16**	**3**	**3**	**4.4**	**6**	**0.05**	**0.3**
Lower middle income (GNP per capita between US$ 756 and 2,995)	273	102	102	65	**33**	**38**	**17.7**	**26**	**0.36**	**2**
Upper middle income (GNP per capita between US$ 2,996 and 9,265)	304	113	190	120	136	158	60.9	89	**4.85**	**32**
High income (GNP per capita more than US$ 9,266)	693	259	583	369	377	438	345.9	506	98.17	644
World	268	100	158	100	86	100	68.4	100	15.25	100

Note: The bold figures include the data with density values of less than 50 percent of the world average for this indicator.

Source: Own calculations, World Bank (2001a), World Bank (2001b), World Bank (2001c).

Table 2

The World-Wide Distribution of Internet Hosts and Internet Users, August 2001

	Population	Number of Internet Hosts			Number of Internet Users		
	1999 in thousands	August 2001 in thousands	in percent of world total	per 1000 people	August 2001 in thousands	in percent of world total	per 1000 people
EU	**292 751**	**20 197**	**16.85**	**68.99**	**141 231**	**21.15**	**482.4**
Germany	82 100	4 221	3.52	51.41	31 311	4.69	381.4
UK	59 501	4 191	3.50	70.43	27 432	4.11	461.0
Italy	57 646	2 357	1.97	40.88	17 747	2.66	307.9
France	58 620	1 630	1.36	27.80	17 415	2.61	297.1
Netherlands	15 805	1 906	1.59	120.62	10 248	1.54	648.4
Spain	39 410	1 045	0.87	26.51	7 623	1.14	193.4
Sweden	8 857	1 592	1.33	179.76	6 752	1.01	762.3
Austria	8 092	690	0.58	85.30	4 631	0.69	572.3
Belgium	10 226	618	0.52	60.48	4 488	0.67	438.9
Greece	10 538	186	0.16	17.64	4 431	0.66	420.4
Denmark	5 326	534	0.45	100.31	3 807	0.57	714.8
Finland	5 166	958	0.80	185.51	2 913	0.44	564.0
Ireland	3 752	132	0.11	35.21	1 336	0.20	356.0
Portugal	9 989	137	0.11	13.71	1 097	0.16	109.8
NAFTA	**405 307**	**81 778**	**68.21**	**201.77**	**200 270**	**30.00**	**494.1**
USA	278 230	75 682	63.13	272.01	172 391	25.82	619.6
Canada	30 491	5 638	4.70	184.91	24 719	3.70	810.7
Mexico	96 586	458	0.38	4.74	3 160	0.47	32.7
Asia	**3 143 097**	**10 438**	**8.71**	**3.32**	**254 505**	**38.12**	**81.0**
Japan	126 570	6 192	5.16	48.92	52 292	7.83	413.1
China	1 253 595	131	0.11	0.10	26 342	3.95	21.0
South Korea	46 858	520	0.43	11.10	18 567	2.78	396.2
Taiwan	22 092	1 983	1.65	89.75	10 974	1.64	496.7
Hong Kong	6 721	884	0.74	131.46	5 182	0.78	771.0
India	997 515	41	0.03	0.04	4 283	0.64	4.3
Singapore	3 952	261	0.22	66.13	2 343	0.35	592.8
Malaysia	22 710	70	0.06	3.09	1 453	0.22	64.0
Oceania							
Australia	18 967	1 735	1.45	91.48	10 268	1.54	541.3
New Zealand	3 811	409	0.34	107.21	1 705	0.26	447.5
South America							
Brazil	167 967	754	0.63	4.49	14 907	2.23	88.7
Argentina	36 580	264	0.22	7.23	1 529	0.23	41.8
Chile	15 018	90	0.07	5.98	744	0.11	49.5
Africa	**933 153**	**296**	**0.25**	**0.32**	**3 574**	**0.54**	**3.8**
Others	**1 203 664**	**3 756**	**3.13**	**3.12**	**37 097**	**5.56**	**30.8**
World Total	**5 977 972**	**119 884**	**100.00**	**20.05**	**667 622**	**100.00**	**111.7**

Note: The countries are ranked according to the number of internet users. No comparable data about internet hosts and internet users are available for Luxembourg.

Sources: Own calculations, Telcordia (2001b), World Bank (2001d).

The high income countries have 90% of the Internet hosts and 59% of Internet users

Internet hosts and Internet users. Even the two largest developing countries with about 1 billion inhabitants, China and India, own only 0.11 percent and 0.03 percent of all Internet hosts and are the origin of 3.95 percent and 0.64 percent of all Internet users.

The digital divide is also clearly revealed by the number of Internet hosts and Internet users per 1,000 people. Whereas there are 272 Internet hosts and 620 Internet users per 1,000 people in the USA and still 69 Internet hosts and 482 Internet users per 1,000 people in the EU, there are just 0.32 Internet hosts and 3.8 Internet users per 1,000 people in Africa. The corresponding features for China are 0.10 (Internet hosts) and 21 (Internet users) and for India 0.04 (Internet hosts) and 4.3 (Internet users) per 1,000 people.

Economic divide – digital divide

The existing economic divide between the industrialized and the developing countries is, of course, partly the reason for the digital divide between the high income countries and the rest of the world. Lack of computers, unstable electricity infrastructure, shortage of telephones and capacity of telephone lines aggravate the introduction of the necessary information technology for the digital economy. Furthermore, the fees for new software and Internet services are prohibitive for many users in developing countries.

The digital divide is related to growth of the Internet

This digital divide may be smaller than the gap for previous new technological developments (steam engines, telephones, electricity) five or ten years after these innovations came to the markets, since the connection to the world-wide web and the implementation of digital devices require fewer sunk costs than the former main technological waves. In that respect, it could be argued that the digital divide will also diminish with time until the gap in the density of computers and Internet hosts just reflects the different economic development stages during the catch–up process.

The threatening danger of the digital divide is connected to the rapidly rising importance of the Internet. A survey by UNCTAD (2000: 7) places the significance of on-line business for total cross-border trade flows at between a tenth and a quarter of world trade by the year 2003. This scope of forecast reveals the remaining tentativeness concerning the importance of on-line business, but stresses at the same time the overall expectation that e-commerce will become a major component of international business life even if the more guarded estimates turn out to be true. The federation of 67 multinational firms within the "Global Business Dialogue on Electronic Commerce" (2001) foresees, for the year 2005, that on-line business to business will amount to more than US$ 7 trillion annually. Furthermore, the federation anticipates more than one billion Internet users by that date.

If the projected exponential rise of on-line business turns out to be true, the low participation rate of the developing countries in the Internet may impede these countries to profit from the growing total of business activities and will widen the economic gap between nations. Thus, the growing significance of the Internet in the industrialized countries within the last decade and the prediction about the enormous e-commerce potential of international trade highlight the necessity to reduce and overcome any "technological apartheid" that would reinforce the existing economic divide.

It could be argued that the very nature of the Internet allows more optimistic assessments. The latest technological innovations might enable developing countries to install fully digital wireless networks in order to leapfrog expensive analog terrestrial exchanges. For example, Hudson (2000) reports that in Uganda there are now more cellular customers than fixed lines, and that the African Communication Group installs wireless kiosks for Internet access to enable small business to get established in the global market place. There are some success stories where villages in developing countries were able to offer their products directly to consumers in the developed world, thanks to lower barriers to entry and improved contact facilities provided by the Internet. Furthermore, the rapidly increasing exports of software services from Indian firms to OECD countries have almost attained proverbial status in the discussions about the catching-up of developing countries.

The success of the Indian cities of Bangalore, Bombay, Hyderabad and New Delhi in exporting computer software services is based on the relatively advanced capital accumulation as embodied in the local infrastructure and a relatively high level of human capital for certain segments of the population. Yet, theses levels of physical and human capital accumulation are lacking in most other areas of India and also in many other developing countries. Some emerging markets like Brazil, China, Russia, Mexico, and South Korea will be able to establish comparable local hubs of

physical and human capital accumulation that have a comparative advantage in offering software and services for the Internet. Most regions in the developing world do not yet have a broad enough base of educated and trained people and lack until now the required infrastructure to compete in the new economy.

Unfortunately, it is quite likely that – despite some success stories and selective leapfrogging within the developing countries – the new technologies alone will not suffice to close or even significantly narrow the digital divide, since they are heavily dependent on physical capital (for infrastructure, hardware and software), human capital (for installation, maintenance, updates and efficient usage of the computers) and the general economic policy environment (for functioning payment systems, stability).

Strategies to overcome the digital divide between countries

To diminish the digital gap between countries, it is necessary to tackle various issues. On a quite general level – in order to foster overall international e-commerce – it will be important to build up a multilateral regulatory framework that does not discriminate against countries or companies of certain regions. As set out in Piazolo (2001), substantial reforms of the multilateral framework concerning standards, policy coordination and taxation are necessary to establish consistent, transparent, non-discriminatory, simple and enforceable rules. While such rules are desirable per se for international exchange, the new economy reinforces the need for their establishment.

On a more specific level, it is necessary to address the particular concerns that hinder developing countries to participate fully in the new economy. It is especially important to increase the participation of the population of developing countries in the new economy through computer-related education and training. This special training should not only aim at a quite general increase in the levels of human capital, but at the procurement of the required skills for the new economy. The focus on the relevant information technology abilities increases the chances for the occurrence of leapfrogging.[4] At least, the broadened base of computer skills will reduce the widening of the digital divide if advanced applications are introduced that require already a certain level of computer literacy.

The government of India started to emphasize the building-up of engineering and computer skills in the 1950s and 1960s through its Institutes of Technology (cf. Mann et al., 2000: 185). This has laid the foundation for the present Indian export boom in software involving more than 600 specialized companies and employing 300,000 computer experts. Furthermore, some regions in India like Bangalore offer particular tax incentives to software exporters.

For physical capital a similar focus is also necessary, that should take into account the requirements of the new economy. Access to the Internet has to be ensured by taking care of various specific aspects like infrastructure, affordability and reliability. In the context of developing countries, there are various strategies to increase the access potential. Hudson (2000) proposes the use of service obligations, regionally differentiated subsidies, rural telecommunication funds, and the licensing of rural operators. The enhancement of access in rural, remote and low-income areas is not only desirable for the sake of equity, but advisable to ensure overall economic efficiency via network effects.

Infrastructure, skills and low-cost access will narrow the digital divide

The OECD (2001b) stresses, too, that apart from general approaches to reducing the digital divide like extending the infrastructure, skills and information, it will be especially important to offer low cost access. With computers and Internet available at public institutions like libraries, post offices, local and regional government facilities, schools etc., individuals can build up familiarity with the information technology and develop important relevant skills. Especially, the provision of low-cost and subsidized access in schools will help to establish a sound foundation for computer literacy of the future workforce and will improve the diffusion of decisive knowledge for the new economy.

The developing countries can, furthermore, learn from the experience of the liberalization of telecommunication and information technology markets in the high-income countries. These experiences point to considerable growth and a sub-

[4] Of course, the chances for leapfrogging might diminish if the qualified computer specialists from developing countries are then recruited by the industrialized countries as for example through the German Green-Card-Initiative for software programmers.

stantial reduction in user costs in the liberalized market segments. There is now mounting evidence that within developing countries the enhanced competition in telecommunication markets has led to similarly beneficial effects as for example in the wireless telephone networks of several countries (OECD, 2001b). Since many telecommunication market segments within the developing countries are still heavily regulated and monopolized, there is considerable scope for market liberalization and associated economic as well as social benefits.

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