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Reducing the Digital Divide: A Critical Focus

Rajah Rasiah **Banji Oyelaran-Oyeyinka**
Institute for New Technologies
United Nations University (UNU/INTECH)
rasiah@intech.unu.edu Oyeyinka@intech.unu.edu

Abstract

This paper examines the developmental divide manifested in the digital divide between the North and the South and indeed within regions and countries. We suggest that the most fundamental problem preventing a reversal of the divide is access, exacerbated by the widespread low levels of skills and knowledge in poor countries. In addition, industry stands to lose considerable benefit from the poor communication infrastructure that characterizes developing countries. The paper suggests a number of policy and institutional directions for bridging the digital divide.

Key Words: digital divide, information communication technology, developing economies

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Introduction

The explosive diffusion of microchips into a wide range of industries – simplifying, smoothening and stimulating efficiency and reach – brought great promise to raise new growth opportunities as well as bring greater equity. The gap between sunrise and sunset among industries to a large extent was reduced as high technology producing industries were increasingly matched by high technology using industries who used both advanced manufacturing as well as advanced materials technology to raise efficiency and quality levels (Mytelka and Smith, 2002). In addition, the architecture of computers and the internet has stimulated the decentralization of value chains so much that small and medium firms now enter and exit relatively quickly its different segments. The miniaturization process also promised to lower costs and spread access to connect larger sections of the globe's masses.

However, in spite of its tremendous potential, a wide section of the globe's masses remain disconnected from information and communication technologies (ICT). Hence, a number of commentators have voiced concerns over this problem and have sought different strategies to address it (Pohjola, 2001; Kraemer and Dedrick, 2002). However, it is argued in this paper that the development of information and communication infrastructure is the single-most important strategy to enable the disadvantaged masses connectivity and participation in the process. This is not at all a novel strategy as its roots go back to the century old developmental problem of access. By confining analysis to the lack of access and seeking solutions by focusing on it the paper merely seeks an informed assessment of the most fundamental problem

presenting the divide while acknowledging that presence and importance of other factors.

This paper does not seek to address exhaustively all the factors that account for the digital divide currently affecting the world. Instead, it argues that the most fundamental problem preventing a reversal of the divide is access, and that unless this problem is resolved the majority will remain disconnected. The rest of the paper is organized as follows. The next section discusses the origin and the unique differences 20th century information and communication technology has offered to a dispersal of development opportunities, with profound efficiency implications. The subsequent section examines the digital divide to situate the fundamental problems associated with connecting the disconnected, which is followed by an assessment of infrastructure building in the disadvantaged economies. The next section concludes.

Origin and Transformation

The ability to communicate and transact using a computer from any corner of the world made possible with the introduction of the internet has intensified globalization and global integration. Information and communication technologies (Information and communication technologies) have - either through donor agencies or deliberate government initiatives - proliferated across economies. The invention of the transistor in 1946 in the Bell laboratory had threatened to accentuate inequalities between high tech and low-tech industries. The developments since, especially after the introduction of personal computers and notebooks have radically shifted global opinion. Information and

communication technologies have added to the technologies that have been transforming the dichotomy once used to differentiate sunset (e.g. steel and garments) and sunrise (e.g. electronics and scientific instruments) industries. Software development has become the central driver of steel and garment manufacturing efficiency even in developing locations such as India and Indonesia (see Lal, 2002; Rasiah, 2004). However, despite the capacity of Information and communication technologies to enable links, large parts of the globe have remained unconnected. This section locates the advent of information and communication technology in a historical perspective, and provides its unique equity-instilling and integrative dynamics. Information and communication technology has actually transformed production substantially giving rise to the globalization initially of multinational operations under the same ownership, and subsequently decentralized activities under different ownership.

Hunting and gathering societies were essentially egalitarian with little control over the environment. The early transition involving technology development did not aggravate seriously inequalities between societies, though stark differences in social position and living standards defined the ruler and the ruled in individual societies. Western technological supremacy achieved through industrialization with its epi-center in Britain gradually spread to other countries – through copying and the transfer of tacit knowledge embodied in humans and machinery and equipment (Chang, 2002). Various modes of industrial policy efforts helped disperse modern industrialization to Sweden, Italy, France, United States, Germany and Japan (see Reinert, 2002; Johnson, 1982; Freeman, 1989). Despite the dislocation and destruction wreaked by colonial

incorporation, some developing economies enjoyed considerable synergies from the imports of machinery and equipment to stimulate the switch to factory systems (see Desai and Kumar, 1988). Factory systems – especially mass production since the advent of Henry Ford's conveyor belts - heralded productive capacity that aggravated inequalities societies further (Lipietz, 1980). Mechanization raised concerns over both highly unequal societies at the national and international levels, but also on the factory floor where Luddites feared the loss of jobs. Doomsday advocates went a step further by predicting the robotization of production so much so that humans will be confined to services (including R&D), sports and recreational activities. The famous movie series – Mighty Micro – is a good example. Yet, despite crisis-plagued capitalist business swings, these speculations have not materialized. Even in arguably the most advanced nation, i.e. the United States where critical innovations in ICT gave the world the first transistors, computers and internet, there have always been jobs created in some regions even at a time when overall unemployment in the country rose.

Technological transformation from the advent of telecommunication networks, transistors and supersonic jets helped integrate the world better and offered the stimulus for the globalization of industrial production especially from the second half of the 20th century. The integrated circuit was among the new wave technologies Perez (2001) documented to spur new growth over 24-25 years in the 1950s. Improvements in telecommunications technology encouraged the dispersal of industrial production so that low value added labor-intensive stages were decomposed and relocated in host-sites endowed with political stability, good basic infrastructure and large reserves of literate

labor. Where the initial basic infrastructure and political stability could not be guaranteed across the country, export processing zones (EPZs) with specially developed basic infrastructure and security sprung up across developing economies to attract multinational affiliates. Shannon International Airport in Ireland was the first EPZ in the world, Kaohsiung in Taiwan was the first in Asia, followed by the island of Singapore, Hong Kong, Masan and Inchon in Korea (Muto, 1977). The Asia Productivity Organization, United Nations Industrial Development Organization and World Bank subsequently began promoting aggressively EPZs across the developing economies. Malaysia had over 10 EPZs in 1990 (Rasiah, 1993). The number of EPZs has since mushroomed in Thailand, Indonesia and Philippine, and even in the underdeveloped economies of Kenya and Uganda.

From moribund type EPZ production, Taiwan, Korea and Singapore in the developing world emerged as dynamic tigers capable of learning and innovating. EPZ-oriented foreign driven production quickly became virtually unimportant in Korea and Taiwan as government support induced the successful development of local firms by the 1970s and 1980s. From imitation, Taiwan and Korea scaled the daunting currents of technology to compete effectively in a number of ICT-related industries. Taiwan is today one of the chief producers of scanners, motherboards, notebooks and a range of other components (see Lin, 2003). Taiwan Semiconductor Manufacturing Companry (TSMC) and United Microelectronics Company (UMC) have entered successfully into wafer fabrication. Korea’s Samsung is at the frontier of DRAM microchips. While local firms have dominated technological catching up and the take up of patterns in Taiwan and Korea, Singapore engendered

the conditions to attract foreign R&D operations *a la* Ireland. Malaysia, Brazil, Mexico, Costa Rica and South Africa have attempted to attract foreign R&D operations in electronics with some success but confined largely to product enhancement and process technologies (see Rasiah, 2004).

Digital Divide

It is now generally accepted that the notion of the typical modern corporation as the creator of new innovation no longer holds. Learning and innovation occurs at different levels and the agents involved can come from myriad organizations. Software writers often operate in small numbers, sometimes individually and in some cases even when they are still schooling. Hence, inequality is not embedded in the nature of information technology. Information technology has found its use in both scope as well as scale driven industries. Micro and small firms specialize in a range of supplier services for Nokia in Finland and several software firms in Bangalore. The Silicon Valley is a haven for new firm creation and inter-firm coordination and cooperation. Dell for example has outsourced all manufacturing operations from its home-site in the Silicon Valley (Best, 2001). In fact, in Taiwan (e.g. Asus, Vanguard and Tatung) medium sized firms operate at the technology frontier supplying completely knocked down (CKD) parts for computers as well as assemblying computers for brand holders using original equipment and original design capabilities of their own (see Rasiah and Lin, 2003). Software has also been specially developed to coordinate garment production operations among small firms in India (see Lal, 1999; Rasiah, 2004). The large steel plants of Pohang Steel Company (POSCO), China

Steel and Nippon Steel use information technology to power centrally controlled operations. Similarly process innovations using integrated circuits and software programs run oil palm processing plants in Malaysia and cement production in Korea. It is now clear that it is not inherent that advances in information technology create inequalities or that its utilization favors large firms.

Communication requires the installation of infrastructure, e-.g. telecommunications cables, which a number of Sub-Saharan African economies (e.g. Niger, Chad and Burkina Faso) and other poor economies such as Burma and Bhutan in Asia, and Honduras and Haiti in Central America cannot afford. Malawi and Mozambique could not even afford proper telephone lines in 2004 to ensure reliable calls. Somalia and Sudan were no better. Large sections of people in Chad and Cambodia remain physically disconnected from even developments in their capital cities. It is primarily in the installation of information communication infrastructure - that the focus should be as it carries both scale and public good properties. Switzerland and Japan lead among the economies where data is available on information and communication expenditure per capita (see Table 1). Indonesia and India had the lowest figure in 2000, but it is very likely that a number of Sub-Saharan African economies have even lower expenditures per capita than these economies. Yet, the inequality involving expenditure on information and communication technology between Switzerland (US$3,482) and Indonesia (US$16) was enormous – a huge 220 times in 2000. Of the 49 economies in Table 1, 23 had the per capita expenditure on information and communication technology against that of the United States falling over the period 1995-2000. This gap was not as large when viewed from expenditure shares in

GDP: Switzerland, which did not enjoy the highest share in GDP among the countries where data was available spent 10.3% of GDP against Indonesia's 2.2% (see Table 2).

Vast sections of the globe's masses remain unconnected owing to the lack of ICT infrastructure, and hence lack access to communication networks that is so critical to interactive learning and exchange of information. The British Broadcasting Corporation (BBC) reported in 1999 that 80% of the world's people have never heard a dial tone, let alone surf the web (BBC News, October 1999). A fairly good indicator of the problem can be viewed from access to main telephone lines per 1,000 people where data is available for most countries (see Table 3). Bermuda and Cayman Islands had the highest densities in 2000 but that is only because these tiny Islands had small populations. Although there was no data to check on ICT expenditures, interviews with Carribean officials suggest that the shares in GDP are likely to be low. Congo, Afghanistan, Chad and even Uganda face severe problems of access. The problems are manifold, manifesting as a national problem in economies such as Mali and Mauritania, but standing out as an obstacle in major concentrations of inhabitants in economies such as India and Indonesia. Although pockets of people even in advanced economies such as the United States and United Kingdom are disconnected, the incidence in these economies is small and it generally does not exclude those captured in the utility curves. Whereas the problems in most parts of Sub-Saharan Africa, Asia and Latin America is one of a lack of access, the narrow segments unconnected in developed economies is a consequence of essentially consumer choice. Of course the poor are also found in the developed

economies but the numbers disconnected from ICT are limited, and they inhabit sites endowed with good infrastructure.

Exclusion owing to a lack of connections has severely restricted the insertion of disadvantaged populations in the global economy. The lack of ICT-led enabling function has obviously constrained disconnected masses from enjoying information as well as the capacity to communicate effectively. Whereas starving populations will have no immediate utility for computers and internet, firms that indirectly contribute to the welfare of people through the taxes they pay if it trickles down to the poor, can certainly raise efficiency levels with the enabling role of ICT. Whereas highly wired Taiwanese firms enjoy instant access to prices and sources of machinery and equipment to import, disconnected Nigerian and Nepalese firms lack that ability.

Explaining the Development Divide

At the heart of the digital and ultimately, the development divide are access and equity Issues. At the individual and organizational level, the effective diffusion and use of ICTs is dependent on the availability, affordability of, as well as accessibility to, computers and other at the industry level, access to telecommunications network infrastructure. At the more fundamental level, individuals require basic numeracy and literacy skills as well as specific IT knowledge in order to fully use ICTs. Much of the population in the developing world is illiterate, while a significant number has never used a telephone. The divide is not only between the advanced and developing nations; there is considerable gap between the urban and rural population as well as between the affluent

and the poor within the cities where the ICTs are mostly available. Internet Service Providers (ISPs) locate their facilities largely within major cities where telecommunication infrastructure is located.

Again the increasingly widening inter-country disparities in the access and user intensity of the Internet is due as much to regulatory factors, tariffs structures, levels of technological development, and educational levels as much to socio-economic differences. For example in 1997, corporate access to a 64 Kb line was $350 per month, while in Italy and France the average was $2500 per month. In the United States, 20% of all households had Internet access while only 5% of households in Western Europe had such access. In a study on the diffusion of the Internet in African universities, (Oyelaran-Oyeyinka and Adeya, 2003) costs were an important binding constraint. For this reason, income, a factor displaying wide disparities across countries creates, as much as education does, equally wide differences between the different social groups within countries. It is for these reasons that distinct demographic differences have appeared among Internet users across countries.

As we concluded in an earlier study, "high levels of GDP, strong presence of Internet hosts, an effective network of telephone are indispensable to the diffusion of the Internet and by extension to all innovations. However, network capacity without an educated citizenry may not lead to the required transformation into the network society" (Lal and Oyelaran-Oyeyinka, 2004).

Table 1: Information and Communication Technology Expenditure Per Capita, 1995-2000 (US$)

	1995	1996	1997	1998	1999	2000
Argentina	271	267	280	295	294	317
Australia	1524	1683	1805	1816	1938	1922
Austria	1343	1353	1319	1471	1532	1697
Belgium	1455	1513	1475	1655	1726	1769
Brazil	121	165	212	234	274	289
Bulgaria	36	32	36	46	54	61
Canada	1402	1485	1582	1678	1815	1911
Chile	191	218	253	277	321	360
China	17	20	22	31	38	46
Colombia	85	116	170	199	209	228
Czech Republic	299	325	332	363	417	453
Denmark	2156	2249	2143	2416	2539	2778
Egypt	19	22	24	27	33	36
Finland	1384	1456	1437	1609	1702	1835
France	1559	1591	1543	1667	1757	1916
Germany	1538	1522	1452	1616	1698	1798
Greece	423	465	472	512	577	659
Hong Kong, China	1389	1643	1848	1820	1900	2085
Hungary	169	189	201	346	396	431
Iceland	927	920	1008	1166	1363	1386
India	8	7	8	13	16	18
Indonesia	22	23	24	9	14	16
Ireland	1047	1161	1193	1378	1481	1676
Italy	791	877	867	929	976	1068
Japan	2228	2377	2510	2486	2860	3118
Korea, Republic	514	669	605	432	522	641
Malaysia	221	257	248	215	232	259
Mexico	113	135	149	152	168	189
Netherlands	1691	1735	1688	1943	2054	2198
New Zealand	1383	1423	1481	1476	1719	1771
Norway	1874	2012	2035	2171	2302	2445
Philippines	28	33	34	27	33	38
Poland	71	85	96	188	218	248
Portugal	502	540	526	602	642	743
Romania	15	16	20	26	33	38
Russia	42	49	58	51	54	63
Singapore	1920	2177	2386	2348	2031	2104
Slovak Republic	131	140	141	220	248	291
Slovenia	275	293	311	366	443	476
South Africa	210	219	224	230	259	256
Spain	553	609	576	640	674	731
Sweden	2029	2194	2162	2445	2466	2674
Switzerland	3063	3044	2839	3201	3331	3482
Thailand	75	87	73	52	63	71
Turkey	44	63	80	100	135	149
United Kingdom	1460	1557	1735	1884	1977	2187
United States	2119	2259	2399	2662	2792	2926
Venezuela	126	131	144	172	193	196
Vietnam	10	13	18	17	22	25

Source: World Bank (2002)

Table 2: Information and Communication Technology Expenditure in GDP, 1995-2000 (%)

	1995	1996	1997	1998	1999	2000
Argentina	3.60	3.50	3.40	3.60	3.80	4.10
Australia	7.60	7.60	8.20	9.30	9.30	9.70
Austria	4.60	4.70	5.20	5.70	5.90	7.20
Belgium	5.30	5.70	6.20	6.70	7.10	8.00
Brazil	2.70	3.30	4.20	4.90	8.70	8.40
Bulgaria	2.30	2.70	3.00	3.10	3.60	4.10
Canada	7.00	7.20	7.50	8.40	8.60	8.40
Chile	4.20	4.60	4.90	5.60	7.10	7.80
China	2.90	3.10	3.10	4.20	4.80	5.40
Colombia	3.20	4.30	5.80	7.40	10.10	12.00
Czech Republic	5.90	5.80	6.50	6.70	8.10	9.30
Denmark	6.20	6.50	6.70	7.30	7.70	9.20
Egypt.	1.90	2.00	2.00	2.20	2.30	2.40
Finland	5.50	5.90	6.00	6.40	6.80	7.80
France	5.80	6.00	6.50	6.90	7.20	8.70
Germany	5.10	5.20	5.60	6.20	6.60	7.90
Greece	3.80	3.90	4.10	4.50	4.90	6.10
Hong Kong, China	6.10	6.70	7.00	7.50	8.00	8.80
Hungary	3.90	4.30	4.50	7.50	8.20	8.70
Iceland	5.90	5.50	6.00	6.90	8.30	7.80
India	2.10	1.80	1.90	3.10	3.50	3.80
Indonesia	2.10	2.00	2.20	1.90	2.00	2.20
Ireland	5.70	5.80	5.40	5.90	5.90	6.70
Israel	5.66	4.97	5.05	6.31	7.36	Unavailable
Italy	4.10	4.10	4.30	4.50	4.80	5.70
Japan	5.30	6.40	7.30	8.00	8.00	8.30
Korea Republic.	4.70	5.90	5.70	6.30	6.00	6.60
Malaysia	5.00	5.40	5.40	6.60	6.70	6.80
Mexico	3.70	3.90	3.60	3.50	3.40	3.20
Netherlands	6.30	6.60	7.00	7.80	8.10	9.40
New Zealand	8.40	7.90	8.50	10.70	11.90	13.60
Norway	5.60	5.60	5.80	6.60	6.70	6.90
Philippines	2.60	2.80	3.00	3.00	3.20	3.80
Poland	2.20	2.30	2.60	4.60	5.40	5.90
Portugal	4.70	4.80	4.90	5.40	5.60	7.10
Romania	0.90	1.00	1.30	1.40	2.20	2.30
Russia	1.80	1.70	1.90	2.70	4.30	3.70
Singapore	6.90	7.30	7.80	9.00	9.60	9.70
Slovak Republic	4.00	4.00	3.90	5.50	6.80	7.50
Slovenia	2.90	3.10	3.40	3.70	4.40	5.20
South Africa	5.70	6.40	6.50	7.70	8.40	8.60
Spain	3.70	3.90	4.00	4.30	4.40	5.10
Sweden	7.50	7.40	8.00	9.00	9.00	10.40
Switzerland	7.00	7.30	7.90	8.70	9.20	10.30
Thailand	2.70	2.90	2.90	2.80	3.20	3.60
Turkey	1.60	2.30	2.60	3.30	4.70	4.80
United Kingdom	7.60	7.70	7.70	7.90	8.10	9.10
United States	7.50	7.70	7.70	8.20	8.20	8.10
Venezuela	3.50	4.20	3.70	4.20	4.40	3.90
Vietnam	3.60	4.10	5.00	4.80	6.10	6.50

Source: World Bank (2002)

Table 3: Main Telephone Lines Per 1,000 People, 1995 and 2000

	1995	2000		1995	2000		1995	2000		1995	2000
Afghanistan	1	1	Djibouti	13	15	Lao PDR	4	8	Romania	131	175
Albania	12	39	Dominica	241	294	Latvia	279	303	Russia	169	218
Algeria	41	57	Dominican R.	75	105	Lebanon	110	195	Rwanda	1	2
Am. Samoa	185	211	Ecuador	61	100	Lesotho	9	10	Samoa	47	47
Andorra	438	439	Egypt	47	86	Liberia	2	2	Sao Tome & P.	20	31
Angola	5	5	El Salvador	50	100	Libya	59	108	Saudi Arabia	94	137
Antigua & B.	388	499	E. Guinea	6	13	Liechtenstein	633	608	Senegal	10	22
Argentina	162	213	Eritrea	5	8	Lithuania	254	321	Seychelles	174	235
Armenia	155	152	Estonia	277	363	Luxembourg	567	750	Sierra Leone	4	4
Aruba	335	372	Ethiopia	2	4	Macao	374	404	Singapore	412	484
Australia	492	525	Faeroe Is.	505	554	Macedonia	179	255	Slovak R.	208	314
Austria	472	467	Fiji	84	106	Madagascar	2	3	Slovenia	309	386
Azerbaijan	85	104	Finland	543	550	Malawi	4	4	Solomon Is.	17	18
Bahamas	300	376	France	560	579	Malaysia	166	199	Somalia	2	2
Bahrain	242	250	French Poly.	221	221	Maldives	57	91	South Africa	101	114
Bangladesh	2	4	Gabon	30	32	Mali	2	3	Spain	385	421
Barbados	345	437	Gambia	18	26	Malta	459	522	Sri Lanka	11	41
Belarus	192	269	Georgia	102	139	Marshall Is.	57	59	St. Kitts & N.	363	569
Belgium	462	498	Germany	513	611	Mauritania	4	7	St. Lucia	210	313
Belize	134	149	Ghana	4	12	Mauritius	132	235	St. Vincent & G.	165	220
Benin	5	8	Greece	494	532	Mayotte	47	88	Sudan	3	12
Bermuda	737	870	Greenland	351	468	Mexico	94	125	Suriname	132	174
Bhutan	9	20	Grenada	260	332	Micronesi.	73	81	Swaziland	23	32
Bolivia	33	61	Guam	461	478	Moldova	130	133	Sweden	680	682

Bosnia & H.	60	103	Guatemala	29	57	Mongolia	35	56	Switzerland	634	727
Botswana	41	93	Guinea	1	8	Morocco	42	50	Syria	68	103
Brazil	85	182	Guinea-Bissau	7	9	Mozambique	3	4	Tajikistan	45	36
Brunei	240	245	Guyana	54	79	Myanmar	4	6	Tanzania	3	5
Bulgaria	305	350	Haiti	8	9	Namibia	51	63	Thailand	61	92
Burkina Faso	3	4	Honduras	27	46	Nepal	4	12	Togo	5	9
Burundi	3	3	Hong Kong	532	583	Netherlands	524	618	Tonga	67	99
Cambodia	1	2	Hungary	211	372	Netherlands A.	366	372	Trinidad & T.	168	231
Canada	598	677	Iceland	555	701	N. Caledonia	236	237	Tunisia	58	92
Cape Verde	56	126	India	13	32	New Zealand	473	500	Turkey	211	280
Cayman Is.	627	821	Indonesia	17	31	Nicaragua	22	31	Turkmenistan	71	84
Central A.R.	3	3	Iran	86	149	Niger	2	2	Uganda	2	3
Chad	1	1	Iraq	32	29	Nigeria	4	4	Ukraine	161	201
Chile	127	221	Ireland	363	420	N. Mariana Is.	322	505	UAE	288	391
China	33	112	Israel	417	482	Norway	568	532	United Kingdom	502	589
Colombia	100	169	Italy	433	474	Oman	79	89	United States	607	700
Comoros	7	10	Jamaica	116	199	Pakistan	17	22	Uruguay	195	278
Congo D. R.	1	0	Japan	496	586	Panama	116	151	Uzbekistan	68	67
Congo, Rep.	8	7	Jordan	58	93	Papua N. G	11	13	Vanuatu	25	34
Costa Rica	144	249	Kazakhstan	119	113	Paraguay	35	55	Venezuela	114	108
Cote d'Ivoire	9	18	Kenya	8	10	Peru	47	64	Vietnam	11	32
Croatia	283	388	Kiribati	26	40	Philippines	21	40	Virgin Is.	512	570
Cuba	32	44	Korea D.R.	50	46	Poland	148	282	Yemen.	12	19
Cyprus	539	647	Korea R.	412	464	Portugal	367	430	Yugoslavia	191	226
Czech R.	236	378	Kuwait	226	244	Puerto Rico	321	332	Zambia	9	8
Denmark	612	720	Kyrgyztan	79	77	Qatar	223	268	Zimbabwe	14	18

Source: World Bank (2002)

Bridging the Divide

Several institutions have targeted ICT as a vehicle for empowering the masses. Empowerment of course leads to greater and more direct participation of the masses in the processes of development and governance. However, as noted throughout the paper empowerment can only be meaningfully realized when access is available. A multi-level approach is necessary to overcome the problem of access to information communication technology. Most of these approaches are deeply rooted in the agenda of a number of United Nations organizations seeking to bridge the digital divide. This section discusses some of the strategies necessary to achieve this goal.

Development Policy

It is obvious that there is a need to spread the installation of information communication infrastructure to the disadvantaged developing economies. The inequalities shown in especially Tables 1 and 3 cannot be allowed to worsen if the disadvantaged are to achieve access. This is very much an old problem that resonates with the divide between the privileged and the underprivileged (see Myrdal, 1957; Lewis, 1955; Brandt, 1980). Hence, while important and commendable efforts are taking place to engage a wide spectrum of the masses on other critical issues related to ICT (e.g. pricing, content, and the legal and statutory architecture related to governance), a major initiative is necessary to address the persistence of absolute poverty both between economies and within economies. Whereas it is obvious that the majority in Chad and Cambodia lack access to basic needs, the masses also face similar

problems in the highly unequal economies of Brazil, Mexico, South Africa and Philippines.

The lacuna in efforts to raise connectivity threatens to keep the disadvantaged disconnected from access information and engagement in a participative mode. As most development or macroeconomist would tell, until basic consumption is met, households would be reluctant to spend money on computers, telephone lines and other related information communication technologies. However, the productive capacity of regional and national economies rely extensively on good infrastructure and it is in the long-run interests of the masses that these issues gain currency over simply the alleviation of absolute poverty in static short-run terms. In addition, unless information and communication infrastructure exists, it will simply be too expensive even for financially endowed households to install ICT at home or even in villages. The public good characteristics of such technologies obviously make government-led development more welfare enhancing than simply private driven allocation of such infrastructure (see Arrow, 1962). Although liberalization – including in the privatization of ownership – helped increase fixed and mobile telephone lines, it has not helped lower prices for consumers in Brazil (Cassiolato and Szapiro, 2003). Another example is the recognition of the benefits of participating in open source software (OSS) packages. However, engagement in such projects for the disadvantaged is not even a remote possibility without government support (Aicherning, 2003).

It is insufficient to discuss ICT in isolation and as a specific issue. It must be at the core of initiatives to empower the masses, but before that the infrastructure and access to it must precede it. Hence, the systematic

installation of ICT must become a major pillar of overall national development policy among least developed economies. The rapidly developing second-tier industrializing economies of Malaysia, Mexico, China, Chile, Thailand and Brazil have targeted ICT as an integral part of development policy.

Small and medium firms

As the infrastructure is widened and deepened, efforts must be taken to stimulate the utilization of ICT by small and medium size firms. Efforts must be taken to remove policy biases against small firms: e.g. incentives for firms with large employment and investment levels. The synergies associated with connectivity and coordination enables small and medium firms to achieve systemic efficiency in some industries comparable to large firms. ICT also offers the flexibility and agility to specialize on the basis of scope to minimize long run resource misallocation problems.

New firm creation and entrepreneurship is best engendered in an environmental setting dominated by small and medium size firms so that opportunities can be spread to a wider spectrum of society. This paper drove the point that all industries – irrespective of whether they are technology creating or technology using or modern or traditional – have become increasingly knowledge-intensive. Hence, the industries to target in least developed economies can range from farming and cottage industries such as small scale paddy cultivators, family fisherman, baskets, ceramic and pottery and garment to bakeries and beverage processing. Italy and Taiwan offers arguably the best example of small firms driving the national economy (Brusco, 1982; Becatini, 1990; Piore and Sabel,

1982; Lin, 2003). Information and communication technology can help even rural farmers monitor prices of both their output and their inputs, raise quality and output levels of production. Swaminathan (2004) articulated how his foundation has brought the frontiers of new technology to the masses in India by applying ICT in the diffusion of modern paddy varieties that are resistant to drought and diseases, and at the same time nutritious, and how fisherman use ICT to detect ocean waves and fish shoals to aid fishing.

Building the information and communication infrastructure and subsequently creating policies to promote small and medium firms will go a long way to spur new firm creation and vibrant growth-driven clusters. Traditional industries will receive a major fillip to raise their value added.

International Cooperation

Several organizations continue to play important roles to raise awareness over its importance with the United Nations leading the way. In fact webs-sites specially defined to provide a discourse on the need, special programs, and applications related to ICT now fill the internet. These initiatives include the basic issue of how ICT help simplify, expand and improve education, communication, governance and businesses, but also stimulate learning and innovation in an evolutionary sense (see Oyeyinka and Adeya, 2003; Oyeyinka and Lal, 2003). While awareness creation and useful experiences related to assisting the disadvantaged are filling the web-pages, there is still the old debate on access left unfulfilled. Access remains very much a developmental question. Awareness and

sharing of information do not reach the majority of people unconnected from ICT owing to poor infrastructure.

A number of international initiatives exist to bridge the digital divide. The United Nations Institute for New Technologies (UN-INTECH, 2003) in Maastricht produced an interesting technology policy brief that underlined the diffusion of technologies for development. Funding agencies such as the United Nations Development Program (UNDP), United Nations Education, Scientific and Cultural Organization (UNESCO), World Bank and the International Development Research Cooperation (IDRC) have put up funds for research targeting the diffusion of information communication technology in especially least developed economies (LDCs). Information communication technology brings to fore the same old North-South question of wealth disparity between nations. Sending donations to the LDCs is not the way to attract the active participation of the masses in both the process and the benefits information communication technology offers. There is a need to rethink international relationships that can engender more equitable flow of gains from trade so that domestic initiatives merge with international efforts to correct these imbalances.

International cooperation should go beyond the promotion of information and communication technology in poor economies. Participation can only be meaningful if cooperation is extended to the development of information and communication technology infrastructure. It inevitably requires international cooperation to stretch to national development policy agendas. In other words, international cooperation should be located within national development policy. The present global trading framework, especially the WTO, allows LDCs a

much longer and lenient time schedule to introduce liberalization measures. However, liberalization cannot be the panacea – especially when these economies have little resources to benefit from insertion in the global economy (see Lall, 2003). Alternative mechanisms that can offer the ammunition to shake up poor economies to achieve the growth necessary to eventually self-finance the installation of information and communication technology infrastructure are necessary.

Conclusions

Given the promise information and communication technologies offers, the euphoria over its benefits and spread is understandable. Commendable initiatives to raise awareness and to share experiences from a diverse set of economies have already been institutionalized through such global organizations as the United Nations.

ICT enjoys properties that can engender greater equity, but unless the infrastructure for its use reaches a wider spectrum of the globe's population it will continue to exacerbate the technological divide between the rich and the poor – between and within economies. Hence, initiatives to reverse the digital divide must include addressing the very core issue of bringing access to the masses, i.e. development space for poor economies to engender the growth required to fund the installation of information and communication technology infrastructure.

Poor economies can only embark on a systematic framework to develop the requisite infrastructure when growth can be induced, a process which historically has been circular and progressive. Empowerment, and erecting the necessary instruments to engender ICT

diffusion to all sections of societies, can only follow so that the masses can participate directly in shaping the nature of their engagement in the process. This is not an easy task as it is brings back the old development debate on reducing global inequalities. Unlike a number of technologies, ICT offers a cheaper and egalitarian option than the technologies of the past.

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縮減數位落差：一個批判的焦點

Rajah Rasiah & Banji Oyelaran-Oyeyinka
聯合國大學新興科技研究所

摘 要

本文檢視介於南北半球之間、區域或國家之內的數位落差所顯現的發展落差。我們認為，落差情況難以逆轉的最根本問題繫乎於基礎數位進路之缺乏，這個問題因貧窮國家普遍的低技術水平和知識而更加惡化。此外，開發中國家的工業在極差的傳播條件下也平白斷送相當多的利基。本文提出一些政策和制度方向冀望能因此而縮短數位落差之現狀。

關鍵字：數位落差、資訊傳播科技、發展中經濟。