The global information infrastructure: empowerment or imperialism?

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ABSTRACT *The hope has arisen that the internet will ultimately evolve into a Global Information Infrastructure (GII). The GII will create a global information marketplace and in the process narrow the poverty gap and eliminate many of the geographic obstacles to prosperity and equality. However commerce—primarily US commerce—is driving the development of the internet. As a result investors will want a return on their money in the form of access to new markets. Many countries will have to accept privatisation and competition wholeheartedly. Also, sooner or later local resources will have to replace external funding and external technical expertise. Many countries lack the regional, social and economic integration found in the USA and in addition have deep political, linguistic and cultural divisions that do not exist in the USA. This article examines issues of connectivity, language and content and concludes that in reality the internet concentrates economic activity and power more narrowly in one group. As a result there is a real risk that we are moving towards a two-tier technology society that perpetuates the old distinctions between North and South.*

NUA Internet Surveys have estimated that, as the new millennium begins, same 304 million people around the world are connected to the internet (NUA, 2000). The Computer Industry Almanac puts the number higher, at around 490 million people (Computer Industry Almanac, 1999). Datamonitor puts the number even higher and projects that by the year 2003 the number of internet users around the world will be in the region of 545 million (Datamonitor, 1999). eMarketer projects 228 million by 2002 (eMarketer, 2000). Although the accuracy—or the basis of calculation—of some of these projections might be questioned,[1] there is no question that the development of the internet is a historical prime mover. Like the alphabet and the printing press the internet is a technology that has influenced other technologies. It has also had a direct impact on the world of ideas by creating a space in which new forms of expression can flourish. An amusing example occurred in Brazil in early 1994 when a popular soap opera aired an episode on television in which a gypsy woman protested at her people's repressive treatment of women. She used the internet to reach for help and found a charming handsome millionaire businessman. Brazilian internet mania was born!

The internet appears to have the potential of fulfilling the philosopher Isaiah

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Berlin's belief that society should strive not to agree with each other but to understand each other. Since online users perceive that they do not have to identify themselves ethnically, religiously or politically, they feel free to influence, discuss and resolve issues and policies that affect their varied communities. The interconnectivity offered by the internet has enabled minority groups to share their struggles with the rest of the world most notably in Mexico, in the USSR and in the Balkans. In 1995 Mexican President Ernesto Zedillo announced the start of a military offensive aimed at capturing the Zapatista leader Subcomandante Marcos (Rafael Sebastian Guillen) and bringing the rebellion in Chiapas to a decisive close. Within hours the President's words were on the internet via the rebels' fax machines and laptop computers. Many thousands of faxes were sent directly to the president's office. The government ordered its troops to halt. In addition the Catholic Church human rights office in San Cristóbal gathered information about human rights abuses and sent the information to an internet server in Mexico City for distribution across the networks. As Guillen pointed out, what governments should really fear are not rebels in the jungle but a communications expert.

In 1991 while Boris Yeltsin and his supporters were in the Russian White House news bulletins, including Yeltsin's edicts, were sent out on the internet. These bulletins were picked up by the Voice of America (VOA) and sent back to the USSR by radio.

During the 1995 conflict in the Balkans the ZaMir network connected Zagreb, Sarajevo and Belgrade. The server was based in the German city of Bielefield. It connected to central terminals in the three Balkan cities and picked up email messages. People separated by the conflict were able to keep in touch; and information about war crimes distributed. During the 1999 conflict in Kosovo and Serbia Bosnet played a similar role (*http://www.bosnet.org/*). Both sides in the 1999 conflict fought the war on the internet as well as on the ground, making attempts to control information coming out of Yugoslavia pointless. Of course each side presented its own viewpoint. Official Serb positions could be found at the Pristina Media Centre. The Kosovo Press represented the viewpoint of the Kosovo Liberation Army (KLA). Father Sava Janic, a Serbian orthodox monk, still runs an extensive web site that supports Kosovo Serbs and argues that one form of oppression in Kosovo has been replaced by another form of oppression (http://www.decani.yunet.com).

The above are only some examples of the power of the internet. It is interesting that most countries that have allowed internet access have tolerated freer expression online than is permitted in the local news media. Stories that newspapers have declined to publish because of political pressure have circulated widely on the internet. It has become a headquarters for every type of political action from plans for corporate boycotts to tactical deliberations; and it is used in disputes all over the world from Peru to Ecuador to the Tibetan Information Network out of London distributing information to Tibetan exiles. It is used to support separatists in Chechnya, Nigeria and East Timor. Citizens of Arab countries have debated and conversed with Israelis in 'chat rooms' and online forums at times when it is difficult or impossible to have face-to-face contact.

It has also helped relief efforts in places such as Kobe, Japan; and in Denmark all public authorities have an email box to which all citizens and companies can send letters. Of course, while we can argue that the internet opens up the world as never before, it can also be used to promote propaganda and hatred and to legitimise oppressive regimes that use it to market themselves to the world.

In one way all this is nothing new. Information technology has always been a potentially revolutionary and feared weapon. Almost as soon as the printing press was invented government and churches tried to regulate it. Controlling the flow of information has always been of primary concern in armed and political conflicts. During the cold war years radio programmes from West Germany were beamed into East Germany; and the West regularly broadcast from Hong Kong into China.

However, the information technology tools of radio and television are centralised and dependent on the assignment of frequencies. Thus they are subject to government control in that governments can jam unauthorised signals. The internet on the other hand is decentralised. Anyone can build an information network of his/her own to circumvent local and government-influenced media outlets. As a result, there has been a significant shift in both the way in which information can be distributed and the speed with which it can be distributed. Goods have always moved. People have always moved. Ideas have always moved. Cultures have always changed. However, it took television 13 years and the telephone 75 years to acquire 50 million users. It took the internet five years. Thus the internet is not only a technology that affects other technologies but it is also a kind of knowledge market impervious to the efforts of states to control it (Wiilkinson, 1995).

The hope has arisen that this internet—this network of networks—will ultimately evolve into a Global Information Infrastructure (GII). The vision is that the GII will enable a massive acceleration of economic and social development that will narrow the poverty gap and eliminate many of the geographic obstacles to prosperity and equality.[2] Potentially the notion of 'country', currently defined as an area distinguished by its people, its geography or its culture, may even be rethought.

But will the Global Information Infrastructure ever be truly global? A case could be made that currently the world internet map still resembles a mediaeval mariner's chart. Africa has many blanks; the Far East still has conspicuous holes, as does Eastern Europe and South America. eMarketer does project that during the first decade of the new millennium a change will occur and that the number of non-US users will greatly increase, with more users becoming connected in Europe, the Asia–Pacific Rim and South America (eMarketer, 2000). However, it is commerce—US commerce—that is driving the development of the internet. US business wants to increase consumer spending in all fields of retail. As a result there is a commitment by the US federal government to the development of a high-speed network that is designed to carry voice, data and video. Multimedia services are bandwidth hungry so money is coming in from a variety of sources, such as the telephone companies and cable TV providers, computer manufacturers, and software developers. In addition, traditional commerce can no longer expand foreign markets fast enough to absorb American products. The

USA, therefore, is working to accelerate the process of connecting all countries to the internet so as to allow large multinational corporations—based in the USA—to enter markets around the world. The argument is that, if internet connectivity and access is in place, other benefits can follow. Connectivity that can promote and handle e-commerce can also provide telemedicine, distance education, and agricultural help with pest control, farm practices and drought management. Electronic access can minimise rural–urban distinctions. Information can cure illness and bring food.

The USAID Leland Project is an interesting example of aid to Africa with a view to opening up markets for the developed world through the internet. The Leland Initiative is a five-year $15 million US government-funded project to connect African countries to the internet (USAID Leland Initiative, 1999). In order to qualify for Leland aid a country must allow service delivery by private providers and permit an unrestricted flow of information. Internet service providers (ISPs) working as part of the Leland project pay about $2000 per month to connect to the internet, compared with $12 000 per month in countries with state-controlled service.

John L Mack, director of African and Middle East trade and development policy at the US State Department, summarised the goal of the project as 'trade not aid'. He also added that interconnectivity was a powerful force for democracy, although in fact there is no empirical evidence linking already developed electronic media such as radio and television to the spread of democracy. Admittedly this may be because of state control of radio and television in many countries.[3] Other projects that aim to help developing countries participate in electronic commerce and attract foreign investment are the International Telecommunication Union (ITU) Electronic Commerce for Developing Countries (EC-DC) project (http://www.itu.ch/ECDC/) and infoDev (http://www.worldbank.org/infodev) set up by the World Bank. Both the ITU and the World Bank are encouraging the participation of private sector organisations through partnership agreements.

Sooner or later, however, local resources will have to replace external funding and external technical expertise. In addition investors will want a return on their money in the form of access to new markets. For this to happen countries will have to accept privatisation and competition wholeheartedly. However, internet provision is not as simple in the rest of the world as it is in the USA. Consider the following.

—Roughly two-thirds of the internet population resides in the USA and Canada (World Bank, 2000).
—Southeast Asia is home to 23% of the world's population but to only 1% of internet users (Netwizards, 2000).
—Two hundred and eighty million people live in the Middle East and only 1.1 million are online, with half of those living in Israel. Thus only 0.7% of the total population is online (DITnet, 2000).
—More than 97% of all Internet hosts are in developed countries that are home to only 16% of the world's population (Petrazzini & Kilati, 1999).
—One half of humanity has never made a phone call (World Bank, 2000).

—Seventy percent of telephones and 80% of revenues belong to 16% of the world's population (World Bank, 2000).
—Thirteen percent of the world's population resides in Africa (United Nations Population Division, 1998) but in some African countries teledensity is as low as one telephone per 1000 people (World Bank, 1999).[4]
—Many US companies have faster connections than entire countries.
—There are more telephone lines in Manhattan than in sub-Saharan Africa.
—The NASA mission to Mars has more internet connectivity than most Caribbean islands.

Problems vary from country to country but the most pervasive issues that must be addressed everywhere are connectivity, language and content.

Connectivity

It is true that there is absolutely no point in discussing the pros and cons of internet access if there is no way to become fully connected. The internet is dependent on the telephone network (made up of the cost of the line and the cost of local and long-distance charges), the availability and affordability of access equipment (in Bangladesh the cost of a modem is equal to the cost of a cow) and, at an even more fundamental level, the pervasiveness of telematics (the mixing of hardware and software with human skills, organisational skills and knowledge transfer). In addition it is not enough just to have a telephone network. The telephone network must also be able to handle an internet backbone. This is a network cable with very large throughput capacity, dedicated to internet traffic, and usually leased from the public network.

There are two main problems. Some countries have connectivity within the country and just need to connect to the international internet backbones; others also need to improve access to connectivity within the country. This means greatly improving network infrastructures—a task that can often be difficult. For example, the average delay in obtaining a phone in Ethiopia, Azerbaijan, Haiti and the Sudan is 10 years; in Algeria 7.9 years; in Bulgaria, Honduras and Nepal 7.6 years; in Bangladesh 6.6 years; and in Kenya 5.6 years (World Bank, 2000). The cost of connecting to the international internet backbones can also be high. This is because the developing country ISPs have to pay the full cost of connection to backbones in other countries (typically the USA), including costs for peering and transit traffic. Ironically it usually costs less to connect to the USA than to connect with other countries within a region. Of course, once a connection is established it can be used by all users from anywhere in the world. Thus US ISPs and users obtain free connectivity to overseas sites.

In the absence of suitable network cabling some countries have used low-cost store and forward electronic communications. The Tool Foundation in Amsterdam used such a system in several African countries. It installed single PCs with modems at several central regional points and made these PCs gateways or Tool access points (TAPs) for a whole region. The central TAP in Amsterdam called the regional TAPs and picked up the email they contained, and sent it to other TAPS or onto the networks. The Tool Foundation is, however, no longer active.

FidoNet is another point-to-point and store-and-forward email wide area network which uses modems on a direct-dial telephone network and which is still in use in many African and Central American countries (http://www.fidonet.org). While some access is better than no access, point-to-point and store-and-forward systems do not permit full use of the internet. For a truly global information infrastructure the networks must be web-enabled.

For countries without high-speed networks, undersea cables and satellites can help with the connectivity problem. For coastal states that already have an internal network in place, connecting to a cable landing point is likely to involve only small additional costs. For land-locked countries, or for countries with too small a demand to justify a cable landing point, the costs of connecting to a cable may offset entirely the initial cost advantage. For example, no one single African country generates enough traffic to justify the construction of a cable linking it to any other country or group of countries. For these countries, satellite systems may be the preferred transmission option. Satellites have an advantage in that they can potentially offer a means of connecting to the network via mobile handsets. This can be an important consideration for areas with a dispersed population. Satellites can also price capacity asymmetrically. It may be that the ideal connectivity is a hybrid of landlines, undersea cable and satellite (Flanagan, 1999; Global Satellite Services, 1999; Gohring, 1999; Mason, 1999; Space and undersa projects struggle, 1999). For example, Teleglobe Globeinternet (http://www.gi.teleglobe.net) has teamed up with various partners such as Telstra to offer a high speed internet connection between Australia and the USA via a hybrid system of cable and satellite.

Undersea cable systems

Cable systems are more cheaply laid on land than under the sea, mainly because the repeaters are accessible and can be powered independently of the cable itself. For cables that are laid on land, the number of fibre pairs per cable is not limited by the extremely high standard of reliability required in the design of undersea repeaters. As a result, undersea cables have traditionally been used only between continental landmasses, where terrestrial links are not feasible.[5] The costs of undersea cable schemes vary according to many parameters: route length, capacity, number of locations served and network design. Traditionally, terrestrial and submarine cable systems have been installed and operated by groups of operators on a co-operative basis, with the scale of investment by each operator tied to anticipated usage. Recently the commercial basis on which cable systems are planned and installed has changed. Several recently developed systems, such as FLAG (see below), have been initiated as private commercial ventures by groups of investors rather than by operators themselves. Others, such as Project Oxygen (see below), are being planned and marketed by organisations that expect to raise the funds required for the scheme from investors, the operators the scheme is intended to serve, and other users. These project promoters expect then to receive their returns in the form of a share of the investment funds raised and management fees for supervising operation and maintenance of the system on behalf of the investors.

Countries can access submarine cable schemes directly or indirectly via another country. Direct access is achieved at the landing point for the cable. For direct access to be feasible, sufficient capacity must be ordered to justify the cost of a cable landing point. Similarly, for a land-locked country, connecting to a submarine cable system requires an evaluation of the costs and capabilities of alternative transmission options. Cross-border links can be via terrestrial cable or microwave or satellite. Some countries will decide that direct satellite links with destination countries are more appropriate than indirect connection through a cable scheme.

The main undersea cable systems are: 1) Fiberoptic Line Around the Globe (FLAG) used by Sprint, AT&T, China Telecom, MCIWorldCom, and Deutsche Telekom. FLAG is eight times longer than the Great Wall of China. It has the potential to reach 75% of the world's population through 14 landing points in 11 countries; 2) Global Crossing— Atlantic links the USA, the UK, the Netherlands and Germany; Pacific links the USA and Japan; Mid-Atlantic links New York, Florida, Bermuda and the Caribbean; and Pan Europe will have 18 centres including London, Amsterdam, Frankfurt, and landing points in the USA, Asia and Latin America; Project oxygen—plans to link 171 countries with 265 landing points. Phase 1 has 99 landing points in 78 locations. This will be a very fast cable with speeds up to 1.2 terabits per second.

Undersea cable systems in development

US/China fiber cable. Planned to run between two points in China (Shanghai and Shantou) and two points in the USA (Bandon, OR and San Luis Obispo, CA). It will also land in South Korea, Guam and Japan.

APAN. The Asia–Pacific Advanced Network will link the member countries of Asia Pacific Economic Cooperation (APEC). The member countries are Australia, Brunei Darussalam, Canada, Chile, People's Republic of China, Hong Kong, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, the Philippines, Russia, Singapore, Taiwan, Thailand, USA and Vietnam.

APCN2. The Australia Pacific Community Network 2 will connect people in the Pacific Islands region, including Aotearoa, New Zealand, Papua New Guinea, Melanesia, Polynesia and Micronesia.

Southern cross cable. This will connect Australia, New Zealand, Hawaii, and the US west coast.

Satellites

Currently less than 1% of network access used by ISPs comes from satellites.

This is expected to change within the first five years of the twenty-first century as new types of satellites are deployed.

Satellite systems consist of a space segment, comprising the satellites, and an earth segment, which includes all ground-based equipment. The satellite itself is a radio transmitter and receiver powered by solar energy and held in position by special motors. The earth segment consists of:

—operation centres that monitor the movement of the satellite and correct its orbit when necessary;
—gateways that are the points of connection between the satellite and the public national network;
—earth stations which communicate with the satellites. These can be very small aperture terminals (VSATs) or even mobile handsets with the ability to connect to the cellular wireless network.

Before looking at the types of satellites more closely some general issues should be borne in mind. First, electronic data can take as long as half a second to travel up and down to Earth from certain kinds of satellites. This is called inherent latency. When TCP (the transmission protocol used by the internet) encounters this delay it believes that there is a back-up in the system. The protocol then disrupts the electronic acknowledgments that the receiving computer must relay to the computer sending the data in order to confirm that the messages are being received correctly. As a result connectivity is lost. This can be corrected by a technique called spoofing, where a false acknowledgment is sent to the user equipment so that it will keep on transmitting. Often, however, this involves modifying TCP/IP settings.

Second, because of the time it takes for the signal to travel up to the satellite and back data travelling by satellite can be slower than data travelling by fibre. So for example 128 kbit/s by satellite is slower than 128 kbit/s by fibre.

Third, the high speeds advertised by satellite operators often refer to downstream capacity only. Upstream capacity is usually much less. Finally, bandwidth may be shared among many users. Typically the bandwidth numbers provided by the satellite company refer to the maximum number of users that the dish can handle. The actual speed depends on how many users are online at the same time.

Satellites can be divided into three main technical types. Geostationary or geosynchronous Earth orbit satellites (GEOs) move eastward along the equator at a constant altitude of about 36 000 kilometers and are always visible from a fixed point on earth. The great distance between the geosynchronous orbit and the Earth's surface means that the satellite can cover a large area (called a footprint). At a minimum, only three GEO satellites are needed to provide global coverage. Spaceway (backed by the Hughes Network Systems), Astrolin (backed by Lockheed Martin) and Cyber Star (backed by Alcatel and Loral Space and Communications), are planning to launch GEOs over the next few years to provide extensive internet access.

At the altitude required to achieve the geostationary effect, the time for a signal to be transmitted to and received from the satellite is about a quarter of a second. This delay is noticeable but tolerable in conversation. However, it does cause inherent latency problems for internet transmission that has to be overcome by spoofing.

Medium Earth Orbit (MEO) satellites revolve around the Earth at around 10 000 kms from the surface. The shorter distance to earth means less reduction in amplitude of the signal coming from the satellite. In consequence, the satellite can be smaller as less power is required to reach Earth. Alternatively, if power levels are maximised, lighter transmitter/receivers can be used. Communication signals may be transmitted and received from MEO satellites by mobile telephones. About 10–12 satellites are needed to provide global coverage with a MEO system.

The altitude of a Low Earth Orbit (LEO) satellite is roughly 1000 km above the surface of the Earth. There is no significant transmission delay and the strength of a signal is high. Terminals to transmit and receive communication signals can be correspondingly lighter, although more satellites are needed to provide global coverage than in MEO or GEO. This increases the complexity of the system, for calls must be transferred from one satellite to another as satellites disappear over the horizon. The largest LEOs, however, are able to offer real-time video transmission. LEOs can also be used for global mobile personal communication services (GMPCS). In a GMPCS network, the satellite may perform two different functions. It may be used for transmission within the network, including direct transmission between satellites; and it relays signals between users' handsets and an access point in the network (the gateway). GMPCS systems have been designed to operate with fewer service providers than other satellite systems—ideally only one in each region rather than in each country. The absence of a GMPCS gateway in most countries may cause problems for the national regulatory authorities. It is difficult to license a mobile satellite service provider who has no infrastructure and no domestic point of interconnection with the existing public network. For such countries, regulation will focus on the use of radio frequencies for communication between satellites and handsets. However, one of the largest GMPCS network providers, Iridium World Communications, filed Chapter 11 bankruptcy in August 1999. The reasons were slower than expected subscriber growth and technical problems (Satellite Telco Crashing, 1999).

The ability to link mobile or wireless phones to satellite networks can help poorer countries overcome the lack of traditional copper phone lines. A radio transceiver connecting groups of phones linked by wires (called wireless loops) in a building or a village can be connected to the main telecommunications network. A cellular telecommunications study conducted by the Cellular Telecommunications Industry Association reported that wireless connections in 1998 made up 255 of all phone lines in Asia and Latin America. The Cellular Telecommunications Industry Association also reports that the use of wireless phones grew in Africa from one million in 1996 to 3.7 million in 1998; in Asia (not including Japan and the Middle East) from 17.3 million in 1996 to 60 million in 1998; and in Latin America from seven million in 1996 to 20.9 million in 1998. Figures also show an increase in Eastern Europe (notably in Bulgaria, Hungary, Slovakia and the Czech Republic), China, Guatemala and the Philippines. The Pacific islands of Tonga and Niue are making their whole telecommunication system wireless (Frauenheim, 1999). El Limon in the

Dominican Republic has gone online using spectrum digital radio to connect to a phone line and modem many miles away, which in its turn connects to a modem bank in Santo Domingo. The project (called the Little Intelligent Communities) is a partnership among Motorola, the MIT Media Lab, and the Instituto Tecnológico de Costa Rica. The plan is to replicate the project in 25 poor villages in Central America (http:// *www.media.mit.edu/unwired*; http://www.lincos.net).

Wireless connections do, however, suffer from the same problems as regular phone systems, namely concentration on major metropolitan areas, power supply which can be limited or prone to outages, and lack of parts and skilled technicians. In addition, although costs are falling, connection fees alone typically cost from US$100 to $150 per month, which is a lot when one considers that, for example in a country such as Guatemala, the annual income for a large part of the population is US$1580.

Main satellite organisations

Satellites are managed by both public and private companies (Satellite Services, 1999). The use of public satellites for international communications is handled by organisations established under treaty. The first satellite organisation was Intelsat, established in 1968, and it is still one of the largest. It provides global service on a co-operative commercial basis among national operators. The treaty organisations such as INTELSAT have a common method of organising their satellite systems. While the treaty organisation owns the satellites and operations centres that control them, the earth stations used for providing public services are owned and operated by the national operator in each member country. To participate, an operator must be designated by its government and sign an earth station operating agreement. Each such signatory then leases satellite capacity from Intelsat, and takes an investment share in Intelsat that corresponds to its utilisation of the system. Capacity is priced at a level that ensures an agreed rate of return on investment. This system is designed to ensure that the benefits of economies of scale in the procurement and operation of satellites are passed on to the operators who have invested in them and who use them.

PanAmSAt (http://www.panamsat.com/) and VITAsat (*http://www.vita.org/*) are examples of private satellites. VITAsat is a LEO satellite which, during the time that it passes over a particular spot on Earth, gives users the chance to connect to the internet. It is used by many humanitarian and aid organisations to gain connectivity to the networks. In development are several broadband satellite systems, notably Skybridge (http://www.skybridgesatellite.com) and Teledesic (http://www.teledesic.com). Skybridge (backed by Alcatel and Mitsubishi) aims to permit the entire world to communicate by satellite by 2003 using many LEOs on the Ku bandwidth frequency. This is a frequency between 11 and 14 GHz that requires smaller ground antennas, usually no more than four feet in diameter. Teledesic (backed by Bill Gates, Craig McCaw and Boeing) plans to cover 95% of the Earth's landmass, offering 64 Mbps on the downlink and up to 2Mbps on the uplink. Initially the project hoped to launch 420 satellites; the number has since varied from 120 to 288. It will use the Ka bandwidth frequency, which operates from 18 to 31 GHz.

More than connectivity

Developing or modernising a telecommunications infrastructure requires more than just simply installing phone cables. Many countries have developed a national internet strategy but lack of co-operation among countries means under capacity in international links. For example there is no common policy regarding an information infrastructure in Europe (despite the European Union), Africa or Asia.

While a poor telecommunications infrastructure acts as a barrier to developing the internet, the high costs associated with connect time is another obstacle in the path of ordinary citizens. ISP charges vary greatly—between US $10 (typically for email only access) and $100 a month. Charges depend on the market, the varying tariff policies of the public telecom operators (PTOs), and the different national policies on access to international telecommunications bandwidth. For example, Ghanaian ISPs pay roughly $2500 for a half- circuit but Kenyan ISPs pay $8000 for the same use of a half circuit because of extra charges levied by the PTO. These charges are passed on to the users. Location within a country also plays a part. For example, Starcom, a Ugandan ISP, charges $30 for email only services in the capital Kampala and $50 in Jinja and Mbale, two smaller cities in the interior. Currently, the average total cost of using a local dial-up internet account for five hours a month in Africa is about $60 per month (usage fees and telephone time included, but not telephone line rental). According to the Organisation for Economic Cooperation and Development, 40 hours of internet access in the USA costs $20 a month including telephone (OECD, 2000). Although European costs are higher (on average $45), these figures are for four times the amount of access and all these countries have per capita incomes which are at least 10 times greater than the African average (Jensen, 2000). In addition, Eastern Europe, Africa and Asia have all shared problems of state centralisation, regulatory hurdles, artificial protection of local government-controlled telecommunication monopolies, and licensing requirements (often explicit permission is required to install certain kinds of telecom equipment).

It is true that in parts of Europe national telephone monopolies are crumbling. The EU ruled that telephone services must be opened up to competition by 1998, although several countries complained and got an extension to 2003. If telephone tariffs are reduced governments argued that they would lose revenues (although this has not in fact been the case in the UK). In a June 2000 study the IDC points out that at least many Western European countries are moving to subscription free and unmetered access services (IDC, 2000). However high international rates are still often used to offset cheap local calls.

The problem becomes even harder to solve when one realises that there is one computer for every 9000 people in sub-Saharan Africa. In India between one and two million people have access to a computer in a population of 950 million (World Bank, 2000). Businesses in many underdeveloped countries face substantially higher costs for computer and telecommunications equipment than their counterparts in developed economies. For example, a basic PC is at least 50% more expensive in Africa than in the USA. This is largely because of government duties and taxes that have kept the prices of high-tech equipment high.

Thus computers become a very expensive proposition, especially when one compares the relative cost of wages between the two countries. Adjusting for wage rates, a computer in Africa becomes about six times more expensive than in the USA. Looking at this from a different perspective, the cost of a computer in Zimbabwe is about 10 times the Zimbabwean per capita GDP whereas in the USA it is about 1/10th of the per capita GDP. In Zambia the cost of a computer is typically six years of wages and in Tanzania a computer costs three times an average professional's monthly salary. In addition in Africa there is a lack of foreign currency with which to buy secondary equipment and it is often difficult to find replacement parts.

While connectivity is one of the most important issues, there are other matters to consider if a global information infrastructure is to become a reality. The goal of a GLL should be access to information and communication, not just to the Internet *per se*. Therefore the issues of multiplicity of languages and the pressing need to develop local content in local languages become very important, as does hardware design. Western-style keyboards and browsers are not ideal for inputting or displaying non-Latin character sets. Improved browser capability, which enables users to read non-Roman script, is helping to alleviate language barrier problems. Foreign language newspapers are the major contributors to the growth of non-English language content growth, rapidly catching up on their US counterparts. In addition, in order to meet the anticipated demand for translation services, a growing number of ISPs, portals and newspaper publishers are developing existing or new translation search engines on their sites. Web sites in Spanish, Portuguese, German, Japanese, Chinese, Korean, Dutch, Italian, French and the Scandinavian languages can be found and the Computer Industry Almanac reports that as of 1999 only 54% of internet users are English-speaking (The Language of the Web, 2000). In 1998 Narrowline Research had found the figure to be 94% (Narrowline Media Research Group, 1998).

However, almost all the research companies agree that internet users are a well educated elite who can type, know English and are computer literate. Project Atlas found that, although most survey respondents said they preferred to visit web sites in their local language, the degree to which this was so varied considerably. For example, 80% of the respondents in India favoured English-language sites, as did almost half the respondents in Hong Kong and the Netherlands (Project Atlas, 1999). Clearly the argument that the increasing availability of local content will in turn benefit the local user market remains to be proven. Ironically, one might also ask the question: if more local content is developed in local languages will the global nature of the internet change?

Empowerment or imperialism?

An important question to ask is whether investing in technological infrastructures in various countries will inherently lead to better lives for the people who live there. After all there are more cars in Manhattan than in sub-Saharan Africa, but no-one is suggesting sending more automobiles to Africa. Many developing countries are struggling with just providing adequate medical and education facilities for their citizens. It is true that an information infrastructure can help provide at least remote access to these facilities, especially in countries where many people reside in rural areas with poor access to doctors and schools. But of course many health problems require nothing more than access to clean water.

A key issue seems to be the degree of correlation between poverty and lack of access to information. The World Bank argues that there is a strong correlation and it points to the relationship between foreign direct investment (FDI) and communication infrastructure. The more telephone lines per capita, the greater the FDI per person (World Bank, 2000). India is a country that has started along this path. Various information processing centres using satellite earth stations have been set up, notably around Bangalore and in the state of Andhra Pradesh, which has set up a state-wide online information system (*http://www.andhrapradesh.com/*).

The World Bank emphasises that increasingly the internet is becoming a prerequisite for economic development. The competitiveness of developing countries will depend on their ability to exchange information globally. Companies that can quickly access information about conditions in export markets can respond rapidly to changing prices. An excellent example is the Cocoa Board in Ghana and the Ivory Coast, which has used the internet to tie its cocoa producers to customers in world markets. The internet also allows companies such as World2Market.com, Importnow.com, and Onenest.com to open up geographically fragmented markets in places such as Bangladesh, Papua New Guinea and Gozo.

Economic development has traditionally been associated with the movement from rural agricultural societies to urban industrial ones. But industrialisation brings the corresponding problems of urbanisation. The World Bank believes that there may be a way to jump to a knowledge-based society without passing through all the various stages of industrialisation.

> A global society is emerging with pervasive information capabilities that make it substantially different from an industrial society; much more competitive, more democratic, less centralized, less stable, more able to address individual needs and friendlier to the environment. (World Bank, 2000)

Ideally, developing countries may even be able to join the Information Age at a more developed stage. Digital lines are automatically being laid in some countries, whereas developed countries are caught up in the expensive process of converting analog lines to digital. Libraries in particular could benefit by abandoning the effort of trying to acquire expensive books and periodicals and strive for internet access in order to gain access to information on an equal footing.

However, the ever-present danger of the ‘trade-not-aid’ route is that countries will become even more import dependent. Many countries are simply not capable of selling enough national products and services in the global markets. In addition, if the ratio of professional workers to the total working population in a country remains low, as it does in many developing countries, it is difficult to see how market-driven internet development can go beyond the small groups that constitute the professional classes. Do we need to take care that the internet revolution does not create a knowledge caste system? Such a system could further widen the gap between the well educated elite and the poorly educated masses that have sought refuge in religious militancy in countries such as Egypt and Algeria.

Could it be that the old division between the North and the South is reflected in this new internet world?[6] Paula Uimonen of the United Nations Research Institute for Social Development feels that the internet is mainly a tool of a transnational 'virtual elite' and that it can indeed have a polarising effect (Uimonen, 1997). The United Nations Development Programme report for 1999 concurs and points to the elitist nature of internet society (United Nations Development Program, 1999). The report is concerned that there will be a two-tier technology society. The first society (the North?) has access to plentiful information at low cost and high speed; the second society (the South?) has its quality of access impeded by time, cost, uncertainty of connection and outdated information. The next 10 years will tell us if there is indeed strength in the argument that information in itself does not feed, clothe or house the world, but does have the capacity to create wealth that can be converted into food, clothing and shelter. Or will the relentless demands of US business mean that the GLL leads to a widening of the poverty gap, concentrating economic activity and power more narrowly in one group and further alienating large areas of the world from participating in the global economy?

Notes

1 Were the figures derived from primary research? What testing techniques were used? Was there a research bias?

2 This vision was clearly articulated at the International Telecommunication Union (ITU) World Telecommunication Development Conference in Buenos Aires in 1994 (ITU, 1994).

3 There is however evidence that greater access to print media is associated with higher levels of democracy in Africa (Ronning, 1994).

4 Teledensity is obtained by dividing the number of main phone lines in a country by the population of a country and multiplying the result by 100.

5 The main organisations involved with undersea cables systems are Tyco Submarine Systems (which has acquired AT&T Submarine Systems), KDD Submarine Cable Systems, Alcatel Submarine Networks (formed from a merger of Alcatel Cable and the British company STC), and the Marubeni Corporation.

6 Before 1990 the West was known as the first world, the Communist bloc the second world, and the developing counties of Africa, Asia and Latin America as the third World. The concept was derived from the three estates of French society before the Revolution in 1789. After 1990 the term North is used to refer to the industralised, developed countries; and the term South to the underdeveloped areas of the world.

References

Computer Industry Almanac (March 1999) *Worldwide Internet Users Estimate and Forecast*, excel spreadsheet (http://www.c-i-a.com/forecasts.htm).

Datamonitor (August 1999) *Powering the Internet Revolution*, report (*http://www.datamonitor.com/content/ToC/DMTC0620.htm*).

DITnet (March 2000) Number of internet users in Arab countries edges towards two million (online), available at http://www.ditnet.co.ae/itnews/newsmar2000/newsmar20.html (June 20, 2000).

eMarketer (March 2000) *eGlobal Report*, (http://www.emarketer.com/estats/s eglob toc.html).

Flanagan, Patrick (1999) New undersea cable ventures creating bandwidth explosion, *Dedham*, 33 (6), pp 15, 18.

Frauenheim, Ed (1999) New wireless technologies have global impact, *TechWeek* 4 October p 11.

Global Satellite Services (1999) Internet in the sky, *Data Communications*, 28 (10), pp 45–46.

Gohring, Nancy (1999) Heaven help us, *Telephony*, 31 May, pp 94–96.
IDC (2000) Western European internet access industry continues to reinvent itself (online), available at *http://www.idc.com//emea/press/PR/ECM060800PR.stm* (June 20 2000).
International Telecommunication Union (1994) What is the GLL? (online), available at http://nii.nist.gov/gii/whatgii.html (June 20 2000).
Jensen, Mike (2000) Africa internet status (online), available at http://www3.sn.apc.org/africa/afstat.htm (June 20 2000).
The Language of the Web (2000) (online), available at http://cyberatlas.internet.com/big picture/demographics/article/0, 1323,5901 150 171 00.html (June 20 2000).
Mason, Charles (1999) Global reliability, *America's Network*, 1 January, pp S4–S6.
Narrowline Media Research Group (1998) (online), available at *http://www.internetworld.com/daily/stats/1998/05/2801-languages.html* (20 June 2000).
Netwizards (January 2000) Internet domain survey (online), available at http://www.isc.org/ds/WWW-200001/report.html (June 20, 2000).
NUA Internet Surveys (March 2000) How many online? (online), available at http://www.nua.net/surveys/how manu online/index.html (June 20, 2000).
OECD (2000) OECD internet access price comparison (online), available at http://www.oecd.org/dsti/sti/it/cm/stats/isp-price99.htm (June 20 2000).
Petrazzini, Ben & Kibati, Mugo (1999) The internet in developing countries, *Communications of the ACM*. June 42(6), p 31.
Project Atlas (1999) (online), available at http://www.idc.com/Telb/projectatlas.htm (June 20 2000).
Ronning, Helge (1994) *Media and Democracy: Theories and Principles with Reference to the African Context* (Harare: Sapes Books).
Satellite Services (1999) Internet in the sky (online), available at http://www.data.com/issue/990707/satellite.html (June 20 2000).
Satellite Telco Crashing (1999) (online), available at http://www.wired.com/news/business/0, 1367, 21233,00.html (June 20 2000).
Space and undersea projects struggle (1999) *Euroweek*, 30th April, p S8–S9.
Uimonen, Paula (1997) Internet as a tool for social development (online), available at *http://www.unrisd.org/infotech/publicat/inet97.htm* 20 June 2000.
United Nations Development Program (1999) *Human Development Report: Globalization with a Human Face* (http://www.undp.org/hdro/99.htm).
United Nations Population Division (1998) *World Population Growth from Year 0 to 2050* (online), available at http://www.popin.org/pop 1998/4.htm 20 June 2000.
USAID Leland Initiative (1999) USAID Leland Initiative (online), available at *http://www.info.usaid.gov/leland/index.html* June 20 2000.
Wilkinson, Paul (1995) quoted in *Newsweek*, February 27 p 40.
World Bank (2000) *World Development Indicators*, CD-ROM (http://www.worldbank.org/data/wdi/index.htm).
World Bank (1999) Internet Economic Toolkit for African Policy Makers (online), available at http://www.worldbank.org/infodev/projects/finafcon.htm (June 20 2000).