Economic Barriers to Development: Cost of access to Internet infrastructure

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# Introduction

The Internet is increasingly viewed as an "indispensable" resource for general development and economic growth (UNDP 1999). Its adoption by governments, organizations and individuals has resulted in the shrinking of spatial and temporal distances between different regions of the world, and has greatly facilitated the "free" and quick exchange of information. Such constrictions of time and space impact upon social and economic interactions at all levels of society. Furthermore, ramifications of this impact are felt by a society, group or individual irrespective of whether or not they use the Internet. The ability to access the Internet, and in particular the costs associated with such access, are therefore important points of consideration. Not only do these costs contribute to the disproportional spread of the Internet across the world's population; they also potentially contribute to uneven patterns of development within, and between countries.

This chapter discusses the cost of Internet access by identifying and describing factors that contribute to the high costs experienced in developing countries. The discussion is categorized according to the technological, market, and socio-economic conditions that exist in developing countries.



# Factors Contributing to Access Cost

Various studies and commentaries exist on the causes and effects of the cost of Internet access in developing countries (Zennaro et al. 2006; Jin 2005; ITU 2003; Ngini et al. 2002; Sarrocco 2002; Petrazzini and Kibati 1999). These studies agree that high cost of access impedes the ability of developing nations to connect to networks of economic growth, and to benefit from infrastructure that can facilitate socio-political development. The contributors to high cost of access include the following:

## Technological conditions: Lack of adequate Internet infrastructure

There is consensus amongst operators and decision makers that the technological conditions prevailing in a country shape the ability of its population to gain access to the Internet. These technological conditions include:

- The level of development of the telecommunications (telecom) infrastructure within the country. In particular the range and choice of access technologies that exist (i.e., technologies that the population can use to access the Internet—fixed line, cellular/mobile, satellite, cable television etc.)
- The spread or deployment of the telecom infrastructure across the country's population.
- The bandwidth capacity of the country's telecom network (i.e., the amount of information or data that can be carried or sent on the telecom infrastructure).
- The number of Internet "host" computers in the country and/or region.
- The presence or lack of regional network backbones between/across countries.
- The presence or lack of Internet exchange points.
- The presence or lack of international network backbone infrastructure.

In most developing regions, the choice of access technologies is predominantly limited to fixed and fixed-wireless lines. Whilst availability of cellular/mobile technologies is increasing, the low bandwidth capacity they offer, and physical attributes of end-user terminals, limit the types of services and applications that can be delivered through them. Optical fibres are generally unavailable (especially in the "last mile" portion of telecom infrastructure), and satellite links are limited and expensive.

Furthermore, telecom infrastructure in developing countries also tends to be concentrated in a few urban areas/cities. This uneven spread or deployment of infrastructure places the rural population at a disadvantage and results in a significant proportion of the population having limited or no access to the Internet[1].

The level of development of the telecom infrastructure in developing countries; in terms of the limited availability of access technologies and uneven deployment of the infrastructure impacts upon the bandwidth capacity that is available in these countries. Low bandwidth is associated with poor telecom infrastructure; and this is illustrated by Table 1 which compares the bandwidth that is available to the population of different regions of the world. Approximately 88 per cent of the total bandwidth available worldwide is located in developed regions of the world. Using the indicator "bits per inhabitants." Table 1 shows that a person living in Europe has access to approximately 570 more bits of bandwidth than someone living in Africa. This situation in Africa is also succinctly described in Zennaro et al.'s (2006) assessment of Internet connectivity in the region. Their study showed that many of the Internet access sites, which (incidentally) were supporting hundreds of users, have less bandwidth than many homes with DSL, cable, or dial-up modems in developed countries. Furthermore, bandwidth is unevenly distributed on the continent with Egypt accounting for approximately one third of Africa's international internet bandwidth. South Africa is the second most connected country on the continent, followed by the more industrialized North African countries—Algeria, Morocco, and Tunisia (IDRC 2005).

[1] For example more than 70 per cent of Africa's population live in rural areas. The level of a country's connectivity infrastructure can also be assessed using the ITU's teledensity indicator—the number of wired residential and business lines per 100 people. Teledensity value that is less than 10 is associated with countries with high connectivity (ITU 2003).

| | International Bandwidth (Mbps) | %of World | Bits per inhabitant | AFRICA Less than other regions [approx] | ASIA Less than other regions [approx] | LAC Less than other regions [approx] |
|---|---|---|---|---|---|---|
| | 2004 | | 2004 | 2004 | 2004 | 2004 |
| **World** | 4,704,468.8 | | 759.0 | | | |
| **Africa** | 5,329.4 | 0.11% | 6.4 | | 0.05 | 0.04 |
| **Asia** | 474,207.3 | 10.08% | 128.3 | 20.0 | | 0.9 |
| **Latin America and Caribbean** | 80,377.0 | 1.71% | 146.3 | 22.9 | 1.1 | |
| **Oceania** | 26,789.6 | 0.57% | 842.0 | 131.6 | 6.6 | 5.8 |
| **Europe** | 2,929,246.0 | 62.27% | 3,643.0 | 569.2 | 28.4 | 24.9 |
| **North America** | 1,188,519.5 | 25.26% | 3,647.9 | 570.0 | 28.4 | 24.9 |

Bits per inhabitant = International Bandwidth/ Population

Source: ITU (2006) World Telecommunications Indicators Database

*Table 1: Distribution of International Bandwidth across Regions*

Although often referred to as ethereal "cyberspace", the Internet is in fact interconnected physical networks of public and private infrastructure and content providers. A key technological requirement of using the Internet is that a user on one network can communicate with users or resources located on other networks. The following technological conditions impact on the ability and efficiency with which developing countries fulfil this requirement.

Internet "hosts" are computers that are connected to the Internet and provide content, information, and e-commerce activities (Roycrof and Siriwan 2003). According to Petrazzini and Kibati "… more than 97 per cent of all Internet hosts are in developed countries that are home to 16 per cent of the world's population" (1999:31). This means that for the majority of people in the world, requests for, and transfer of information and data via the Internet are fulfilled via international connections to computers in developed countries. Furthermore, the cost of transferring information and data via these international connections is borne solely by Internet Service Providers (ISPs) and operators in developing countries (who invariably pass it onto the end user—Chisenga 2000; Adams 1997). These costs can be substantial, for example in 1999, the Asia & Pacific Internet Association (APIA) estimated that as much as US$5 billion per year was accruing to US telecommunication operators as a result of non-US ISPs and operators bearing 100 per cent of the connection cost with the US Internet network as well as of the circuits to the United State.

The number of Internet "host" computers in developing countries and/or regions can therefore have an impact on cost of access. Hosts located in developing regions can serve as storage for information retrieved from other remote computers (a process known as "caching"). Information and data requested by users can then be supplied from content caches located in their country or region, instead of connecting to a host located in a developed region. This would reduce the use of expensive international bandwidth and thereby save on cost.

However, savings through increasing the number of hosts in developing countries/regions to a large extent depend on the presence of regional backbone networks within and across these countries/regions[2] and Internet eXchange points (IXPs). IXPs allow ISPs to exchange Internet traffic between their systems, whilst regional networks facilitate the transfer of traffic between countries in a geographic region. Where IXPs and regional backbones are ill developed or absent, connectivity is accomplished using international routes.

With respect to telephone calls, Dhliwayo (2005) estimates that approximately 90 per cent of calls from African countries to other African countries are routed through Europe or North America at a cost of USD400 million a year. Likewise with Internet connectivity, in the majority of cases, communication between African countries is effected via North America or Europe. Figure 1 below illustrates this scenario and relates to the transfer of data between a specific location in South Africa and various other locations throughout African. As can be seen from the map, few countries within Africa have direct connectivity with South Africa—only Botswana and Zimbabwe; and in some cases, for example Burkina Faso, Internet traffic from South Africa first goes to Europe, then USA before finally reaching its destination (ICFA 2007).

Further compounding the technological conditions described so far is the limited presence or availability of international backbone infrastructure in developing countries. International backbone facilities provide high-capacity network connections between countries and regions and these are currently concentrated in the developed regions of the world. There are fewer submarine fibre cables serving developing regions and the reliance on satellite connectivity has implications on the capacity, speed and cost of access.

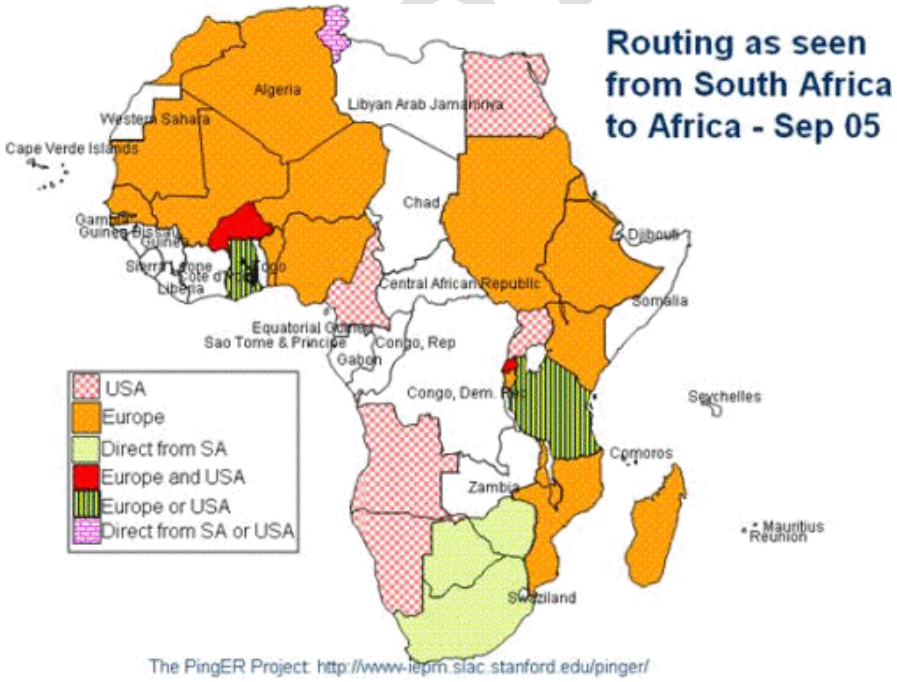


*Figure 1: Illustration of routing between African countries*

[2] This is in addition to the level and reach of telecom infrastructure development within individual countries—i.e., national backbone network.

To summarize, underdeveloped infrastructure has been described as the "main problem" facing developing countries in relation to access cost (Smith 2000). From the developing world's current viewpoint access to the Internet is attained predominantly through limited Internet access facilities and on limited national data networks. Furthermore, demand by users is for proportionally larger volume of international content (as opposed to domestic content), which can only be provided through limited international bandwidth and at significant interconnection costs (Roycroft and Anantho 2003).

## Technological conditions: Access to applications and content

As highlighted in the preceding section, the dominant contributor to the high cost of internet access in developing countries is lack of adequate infrastructure. However, other technological factors contribute to cost, particularly those that determine how effectively people can make use of the Internet once they are able to connect to it. These limiting factors are easier to identify when the structure/architecture of the Internet is described using a "layered model."[3]

This chapter combines Benkler (2000) and Lessig (2001a) interpretations of the layered model which categories the structure of the Internet into three layers—the *Physical Layer* at the base; upon which sits the *Logical Layer* or *Code Layer*; and the *Content Layer*, which represents the topmost level of the model (see Table 2). The physical layer refers to the networks, wires, cables, and equipment that both constitute the physical infrastructure called the Internet, as well as those required to connect users to the Internet. The logical or code layer is comprised of software protocols and applications that determine if, and how access to the Internet is obtained and managed. The content layer comprises the "actual substance of communications" (UNCTD 2006:279)—that is the data or information that is accessible to users via the Internet.

The "success" of the Internet lies in the ability of these layers to function and interface with each other. The physical network is largely private owned (predominantly by large telecom or cable companies), and there are many proprietary applications in the logic or code layer. Also, data and information that exist in the content layer are often protected and exist in different formats. Yet irrespective of who designs, manages, or controls the activities or content in each layer, access to the Internet is accomplished because the various layers have been made to function and interconnect with each other.

Factors that therefore limit or inhibit the collective functioning of the layers impede access, and as such contribute to increasing the cost of access.

[3] Various interpretations of the layered approach exist; these have as there basis the technical Open Systems Interconnection (OSI) model developed by the International Organization for Standardization and the International Electrotechnical Commission. Interpretations of the OSI model include those by Solum and Chung (2003), Werbach (2002), Lessig (2001a), and Benkler (2000).

| CONCEPTUAL LAYER | SUBJECT[1] | GOVERNANCE ISSUES |
|---|---|---|
| Content | Text, data, graphics, audio, video, etc. | Spam, Local content |
| Logical Layer or the Code Layer | Browsers, e-mail clients, anti-virus software, streaming media players, etc. | Data protection, privacy rights |
| | HTTP, FTP, DNS, BioTorrent, etc. | Cybercrime |
| | TCP, UDP, etc. | DNS root server system |
| | IP (IPv4, IPv6) etc. | IP addressing |
| | Ethernet, Wi-Fi | Stability |
| Physical Network | Binary transmission | Access, costs |

Source: UNCTD (2006) *Information Economy Report 2006: The Development Perspective*. United States, New York: United Nations. Page 280

[1] For definitions of protocol acronyms please refer to Annex 1 of UNCTD publication

*Table 2: Conceptual Layers of the Internet*

A selection of such limiting factors is highlighted in Table 2 (under the title Governance Issues). Two of these factors, namely spam, and the cybercrime implications of illegal use of propriety software are now discussed from the perspective of access costs.

*Spam*

Spam refers to unsolicited bulk electronic messages, which can be advertising information or avenues for criminal activity such as "… financial theft, identity theft, data and intellectual property theft, virus and other malware infection, child pornography, fraud, and deceptive marketing" (Wikipedia *nd*). The most common type of spam is email spam but the term is also used in describing unsolicited (and often undesired) messages that are sent to target groups or applications, including instant messaging systems, newsgroups and forums, and sites that provide opportunities for users to contribute—such as blogs, wikis and guestbooks.

Spam is said to thrive because the costs incurred by originators of spam are low; yet, the costs incurred by Internet service providers and users in receiving, storing, and downloading spam is much higher in comparison (OECD 2005). Specific to the cost of Internet access in developing countries, high volumes of incoming and outgoing spam are an addition burden on the already limited bandwidth that is available. Receiving ISPs in developing countries must bear all the cost of receiving, handling, sorting, and delivering spam to users. Furthermore, users in developing countries must bear the cost of downloading spam in their mailbox. As connection to the Internet is often at low speeds and via limited bandwidth capacity, this constitutes an unnecessary cost to both users and ISPs.

Indirect costs are also incurred in the form of the frustration experienced by users in making use of the Internet, and can lead to reductions in trust of the Internet, and loss in productivity of individual and business users. This is in addition to less quantifiable costs that are incurred as a result of users falling prey to spam that are malicious (e.g., corruption or destruction of data as a result of a virus) and/or of criminal intent (e.g., financial loss resulting from fraud or identity theft).

Fortunately, software applications exist to combat spam; and most email applications offer functionality that allows users to filter out spam. Even though the spam would already have been processed by the ISP and downloaded by the user, this can reduce losses in productivity to the user. These applications like the most of those constituting the Logical/Code layer are proprietary and available for (legal) use upon payment of a fee.

*Proprietary software*

Two key issues are raised by proprietary applications in relation to cost of access; these are first the need for adherence to standards that allow for products, services, hardware and software created and owned by different parties to interoperate and work together. This increases (amongst others) the choice that is available to users and the cost benefits associated with the competition such choice engenders (and vice versa). The second relates to the fee paid to use proprietary software and limitations that are placed on the use of such software. In general, propriety software prohibits users from changing and modifying the software, and from redistributing it in modified or unmodified forms.

The high cost of software applications and licenses in relation to the purchasing power of developing country populations has led to high incidences of software piracy in these countries. Acts of piracy are classified under cybercrime; however from the analysis below it can be deduced that the utilization of the Internet and computer networks for socio-economic development in (at least) developing regions has been to an extent *facilitated* by such acts.

> *"By conservative estimates we have 1 million computers in India. If we were to install a legal version of the default operating system and office suite on each of these machines, India would have to pay a single American company approximately $400 million every two years. This excludes client software for desktop publishing, web design, 3D modelling, drafting, animation, audio and video production, integrated development environments, accounting and finance, enterprise management and planning. To this, add the cost of mail, web, file, print, chat, database, application server software which are usually more expensive that client software. Therefore putting legal software on a million odd Indian computers will result in the total value of software imports far exceeding software exports." (Abraham 2003)*

The situation is further complicated by the dependencies that can arise when content is available in a format that requires that users have access to a specific application in order to view and manipulate it, both in the present and in the future. For example, public documents that are distributed solely under a propriety format can in effect increase the cost of access to their intended users.

In response to the limitation posed by propriety software, alternative products such as Free and Open Source Software (FOSS) and alternative licensing regimes (for example Creative

Commons, Copyleft etc.) have arisen that help to reduce the costs and (legal) risks associated with proprietary software and content. These "solutions" are not without their own challenges—for example FOSS is criticized for lacking adequate support for non-technical users and some software products under this category are relatively less mature than their proprietary counterparts (Hoe 2006a). Notwithstanding, they offer what can be considered an affordable means of building information and communications technology capacity which facilitates access to, and use of the Internet, particularly in developing countries.

In summary, analysing the structure/architecture of the Internet using a layered approach highlights areas (in addition to physical infrastructure) in which developing countries face technological challenges to their ability to access and make use of the Internet. These include the affordability of software applications that facilitate access to the Internet and content that is distributed on it. It also includes the extent to which such software applications allow for users to legally modify them for their own use and that of others, and to create their own content. Free and open source software, and alternative licensing regimes that enable copyright holders to grant some or all of their rights to their users are examples of products or mechanisms that reduce these technological challenges, and which can potentially lower the costs that results from them.

## Market conditions

Technological conditions are not the only factors influencing the cost of access. Whilst having infrastructure in place is crucial, service charges[4] for the use of such infrastructure in connecting to the Internet vary according to a country's regulatory and licensing regime, the maturity of its telecom and Internet markets, and the costing methodology adopted by ISPs and telecom operators (Biggs and Kelly 2006; Sarrocco 2002; Afullo 2000; Chisenga 2000).

Market characteristics are therefore another major underlying reason for disparity in global access costs. Characteristics that are discussed below include:

- Regulatory and licensing regimes.
- Competitive structure of telecom and Internet services markets.
- Access to investment capital.
- Pricing policies adopted by operators.

Experience has shown that liberalization and privatization can transform telecom markets. An overview of the historical development of telecom in various countries indicates that deregulation of the sector; decreasing state intervention and participation in the delivery of telecom services; market liberalization; and increased private sector participation have in the majority of cases yielded positive results.

In countries where sector reforms have implemented, the result has been the expansion and modernization of telecom networks. In developing countries, improvements have been recorded in the deployment of fixed networks, but more widely reported has been the explosion of mobile networks.

[4] These services charges typically include usage fees and local call telephone time (but exclude phone line rental).

It is however fixed networks that are (currently) the more critical infrastructure for Internet access; yet growth of such networks has been slow. Table 2 below highlights the compounded growth rates of "main telephone lines"[5] in selected regions between 2000 and 2005. Whilst all regions registered some growth over the five year period, when this is related to their population certain regions appear to have done better than others (in particular South Asia). For example, the 7 per cent growth in fixed lines for sub-Saharan Africa (excluding South Africa) over the period has had little impact on (fixed line) teledensity in the region—which in fact decreased and stood at approximately 3 phones to every 100 people in 2005. A similar decreasing pattern (although with lower rates of growth in fixed lines) was observed in Oceania (excluding Australia and New Zealand) and in Latin America and the Caribbean. Clearly more needs to be done in improving the situation in these regions, and the answer may lie in increased competition within the telecom sector.

**Main Telephone Lines**

| | *Main telephone lines* | | | *Main telephone lines per 100 inhabitants* | | |
|---|---|---|---|---|---|---|
| | *(000s)* | | *CAGR (%)* | | | *CAGR (%)* |
| | *2000* | *2005* | *2000 - 05* | *2000* | *2005* | *2000 - 05* |
| South Asia | 37082.70 | 56921.10 | 14.03 | 2.81 | 2.98 | 11.83 |
| Sub-Saharan Africa (exc. South Africa) | 4538.40 | 5086.40 | 6.68 | 3.42 | 3.02 | 3.94 |
| North Africa | 10230.00 | 3263.36 | 6.68 | 8.05 | 10.46 | 5.24 |
| Central Asia | 6291.60 | 7638.70 | 4.21 | 9.54 | 11.35 | 3.89 |
| Oceania (exc. Australia and New Zealand) | 411.10 | 359.80 | 3.75 | 13.99 | 11.38 | 2.32 |
| Middle East | 18384.10 | 31563.20 | 7.95 | 15.61 | 17.93 | 5.21 |
| Latin America and Caribbean | 76655.90 | 98515.10 | 3.99 | 22.11 | 20.76 | 2.57 |
| East Asia and Pacific | 274873.20 | 496880.20 | 7.69 | 21.89 | 22.59 | 6.63 |

Source: Adapted from ITU ICT Statistics. Available online at http://www.itu.int/ITU-D/ICTEYE/Indicators/Indicators.aspx

*Table 3: Growth in Fixed Lines - Selected Regions*

The opening up of the telecom sector, on its own, is often insufficient in bringing about the development of meaningful competition. Firstly, in many developing countries, regulatory reform is not implemented across all segments of the sector. For example, whilst the market for Internet services is often open to participation by many providers, that for basic telecom services tend to operate under monopoly conditions. The effect is that the decrease in the price for Internet access by end users, which result from competition amongst providers; are cancelled out by the high prices these providers must pay for uncompetitive basic services.

Secondly, achieving meaningful competition may be hampered by restrictive policies and inflexible licensing regimes. In developing countries, this relates in particular to the use of unlicensed bands of spectrum[6] and satellite bandwidth, and means that telecom sectors in these countries are unable to capitalize on benefits that could accrue from technological innovations.

[5] Defined by the ITU as "… telephone lines connecting a customer's equipment (e.g., telephone set, facsimile machine) to the Public Switched Telephone Network (PSTN) and which have a dedicated port on a telephone exchange. Note that for most countries, main lines also include public payphones. Many countries also include ISDN channels in main lines" (2006:3)

[6] That is spectrum that has been set aside for transmission use without a licence.

Thirdly, competition is difficult to achieve where there are difficulties in accessing investment capital (Sarrocco 2002). Due to the substantial investments required in building and/or upgrading national communications infrastructures, there is a tendency for the incumbent operator to dominate the telecom market (ITU 2003). Thus whilst countries are adopting market liberalization reform initiatives and implementing policies that complement such initiatives, some governments have also taken more "active" roles in deploying infrastructure and fostering competition. Several governments have funded the development of Internet infrastructure (in particular broadband) in its early formative years (Jin 2005). In Singapore (via Singapore One) and Korea (Korea Information Infrastructure) for example, government planning and funding have played pivotal roles in the rollout of broadband services. In Korea, the government invested a total of US$11 billion in broadband services between 1998 and 2002 (Belson and Richtel 2003), and in 1999, US$77 million was made available in loans (at the prime rate) to ISPs for investment in access networks (Kim 2002).

Finally, competition can be further enhanced once Internet access technologies are incorporated into the business development strategies of the incumbent operator, dominant players and/or major carriers in the sector. This is because infrastructure deployment becomes a critical factor in the quest to increase market share. Such (market share driven) competition also encourages the adoption of more innovative pricing methodologies. Biggs and Kelly (2006) have argued that growth and expansion of fixed-line broadband markets are strongly influenced by the pricing strategies adopted by operators, and this has been corroborated by other studies on alternative internet access technologies (Madden et al. 2000; Afullo 2000; Adams 1997).

In summary, market conditions within the telecom sectors of developing countries further complicate the challenges that stem from the technological disadvantages these countries face. A combination of obstacles influences the cost of access to the Internet and strategies that are adopted by countries in remedying the situation must take cognisance of this.

## Socio-economic conditions

Obstacles to lowering the cost of access to the Internet are not only technological and market-orientated. Multifaceted socio-economic characteristics of developing countries also exert their influence. Some studies have shown that general patterns of development influence Internet access (Hargittai 1998, ITU 1997, Kelly and Petrazzini 1997). These include:

- Economic wellbeing
- Existing technologies and infrastructure
- Human capital indicators—such as literacy and education levels
- Political stability

"Economics always plays an important role in encouraging the use of technology in developing countries" (Roycroft and Siriwan 2003:65), and the spending capacity of the population is an important factor to be considered in analysing the cost of access. Splitting the cost (to end users) of Internet access into its component parts of (i) setup cost and (ii) operating cost facilitates better understanding of the restraining impact of income.

Setup costs can be high whether the user is in a developed or developing country. However, setup costs relative to per capita income are much higher in developing countries. In such countries a computer is out of the reach for the majority of the population and the most common mode of access to the Internet is via some form of shared access (Adomi 2005; Ngwainmbi 2000).

Operating costs are also high in developing countries, and as pointed out by Petrazzini and Kibati, even where the absolute price difference between developed and developing countries does not appear significant, "the purchasing power of most people in the developing world makes access to Internet services an extremely expensive proposition" (1999:32). To illustrate, in a study of global accessibility of the internet, Ngini et al. found that "…unlimited dial-up monthly access cost of $60 in Ghana represents 3 per cent of the GDP per capita, whereas in the UK the same service would be given at about $12 representing 0.05 per cent of GDP per capita" (2002:333). The difference in price of $48 when adjusted for GDP per capita means that internet users in Ghana spend up to 60 times more for the same type of access as users in the UK. This in itself reflects an improvement (i.e., decrease) in access cost[7]. However, even if the cost of access continues to decline, standards of living in some developing countries are also declining. Low per capita income may therefore continue to be a major restraining factor to access.

The presence or lack of existing technologies and infrastructure also significantly contributes to cost of access. The earlier sections of this chapter emphasized the impact underdeveloped telecommunications infrastructures have on cost of access. Also of critical importance is the country's power infrastructure—in particular electricity supply. Limited availability of electricity supply, frequent breakdowns and associated power outages, disrupt access to the Internet and increase costs (Edoho and Udo 2000).

In the discussion presented so far, "cost" of access has been analysed within a primarily economic/financial context. "Cost" can also assessed from a more social perspective. From this viewpoint; low educational levels, low literacy, lack of computer skills, shortages of technical staff all have an impact on the cost of access (Ngini et al. 2002; Afullo 2000; Jensen 2000; Madden et al. 2000; Hargittai 1999). Ethnicity and language also impact on cost of access. English is the most pervasive language in use on the Internet; however, only one in ten people in the world are English speaking (UNDP 1999) and this figure is projected to decline in the future (Graddol 2004). The possibility therefore arises that sufficient content, in languages understood by the majority of the world's population, may not be available to make access to the Internet *relevant* to inhabitants of developing countries.

Lastly, the level of political stability exhibited by developing countries also exerts an influence on cost of access. Political stability in most cases correlates with economic stability and creates an environment that is conducive for growth and is attractive to investment. Therefore, the more politically stable a country is, the greater would be its chances of attracting investment capital for the development of its infrastructure and services. Low scores obtained by developing countries in governance indicators such as the Political

[7] Petrazzini and Kibati (1999) in their study also adjusted for GDP per capita and found that users in Ghana were paying up to 485 times more for Internet access when compared with users in Finland.

Stability and Absence of Violence Index[8] are indicative of the difficult environment in which initiatives for addressing the cost of access must be implemented.

## Conclusion

It is an established fact that there are more users of the Internet in developed countries which are inhabited by a smaller proportion of the world's population (see Table 3). As a result these countries have benefited both economically and socially from the advantages the Internet bestows—in particular the quick exchange of information and increased efficiency of interaction. The disproportional distribution of the advantages of the Internet further increases the developmental gap between developed and developing countries.

**WORLD INTERNET USAGE AND POPULATION STATISTICS**

| World Regions | Population ( 2007 Est.) | Population % of World | Internet Usage, (Jan 11, 2007) | % Population ( Penetration ) | Usage % of World |
|---|---|---|---|---|---|
| Africa | 933,448,292 | 14.20% | 33,334,800 | 3.60% | 3.00% |
| Asia | 3,712,527,624 | 56.50% | 398,709,065 | 10.70% | 35.80% |
| Europe | 809,624,686 | 12.30% | 314,792,225 | 38.90% | 28.30% |
| Middle East | 193,452,727 | 2.90% | 19,424,700 | 10.00% | 1.70% |
| North America | 334,538,018 | 5.10% | 233,188,086 | 69.70% | 20.90% |
| Latin America/ Caribbean | 556,606,627 | 8.50% | 96,386,009 | 17.30% | 8.70% |
| Oceania / Australia | 34,468,443 | 0.50% | 18,439,541 | 53.50% | 1.70% |
| WORLD TOTAL | 6,574,666,417 | 100.00% | 1,114,274,426 | 16.90% | 100.00% |

Source: Internet World Stats: Usage and Population Statistics
Available online at http://www.internetworldstats.com/stats.htm
Accessed March 12, 2007

*Table 4: World Internet Usage and Population Statistics*

The high cost of access to the Internet therefore has major implications for developing countries, not only in terms of their ability to compete on a global level in economic sectors that are highly influenced by the Internet (e.g., outsourcing industries, software production etc.) and in those that are dependent on it (e.g., e-commerce). High cost of access to the Internet also potentially impacts on the social development of countries, facilitating for example better interaction between individuals, businesses, citizens, and the State. These can result in increased transparency, accountability, and governance of both private/corporate and public affairs.

Initiatives aimed at reducing this *Internet-divide* can be viewed as a reflection (or sub-set) of the imperative to address the broader *development-divide*. It is, therefore, not surprising that the

[8] The Political Stability and Absence of Violence indicator is a measure of "perceptions of the likelihood that the government will be destabilized or overthrown by possibly unconstitutional and/or violent means, including domestic violence and terrorism." Low scores in this variable indicate that citizens cannot count upon continuity of government policy or the ability to peacefully select and replace those in power. See World Resource Institute's EarthTrends Environmental Information Database. Available online at http://earthtrends.wri.org/index.php

conditions influencing the disproportional distribution of the Internet[9] are in general the same as that of any other type of development-orientated divide.

This chapter has assessed these conditions from the perspective of the cost of access to the Internet. It identified and discussed the factors that contribute to the high cost of access experienced in developing countries, showing that they are multifaceted and can present a complex construct of obstacles—technological, market, and socio-economic.

Irrespective of this complexity, significant gains have been made by some developing regions in lowering cost and improving access to the Internet. Although regional variations exist, more Asian countries now have better telecommunications infrastructure. These countries have high-capacity domestic and international backbone networks; more Internet exchange points for routing local traffic and providing peering between ISPs. There are also regional backbones that interlink countries in the region and which also link to international (European and North American) backbones. Furthermore, investments have been made in "last mile" Internet access technologies, in particular broadband.

The improvements described above have been achieved within a largely conducive policy environment. The region has seen less incidences of conflicting policy interests that have characterized other developing regions. Although active participation by governments in the development of the telecom sector has resulted in some conflict in the relationship between governments, domestic and international organizations, progress in terms of deployment of infrastructure has still been achieved. The commitment of governments towards developing the potential of telecoms in general, and in the Internet in particular, is illustrated by the continued presence of international connectivity providers in these countries. Furthermore, initiatives at addressing socio-economic conditions are being implemented, with investments in educational and Internet literacy projects helping to increase the capacity of the population to use the Internet.

The above notwithstanding, even more progress in connectivity and cost is required in a region that appears to have achieved so much. Only approximately 10 per cent of the population in Asia currently use the Internet; this statistic for a region where more than half the world's population lives (see Table 3) demonstrates that the ongoing need to be addressed by developing countries remains poorly underestimated. This raises a number of important challenges for developing countries that are further behind in developing their capacities to connect to and make use of the Internet. Whilst technologies are in general developing to make access more attainable and cheaper, these improvements are also being harnessed by more developed countries to increase the efficiency and effectiveness of their use of the Internet. The importance developing countries place on connectivity and widespread deployment of the Internet amongst their populations, and more importantly their commitment to ensuring that connectivity and use is achieved—through for example, reducing the technological, market, and socio-economic constraints of access—will therefore increasingly determine the nature of the digital and developmental divides between countries.

[9] That is as a physical infrastructure.

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