Bridging the digital divide by bringing connectivity to underserved areas of the world
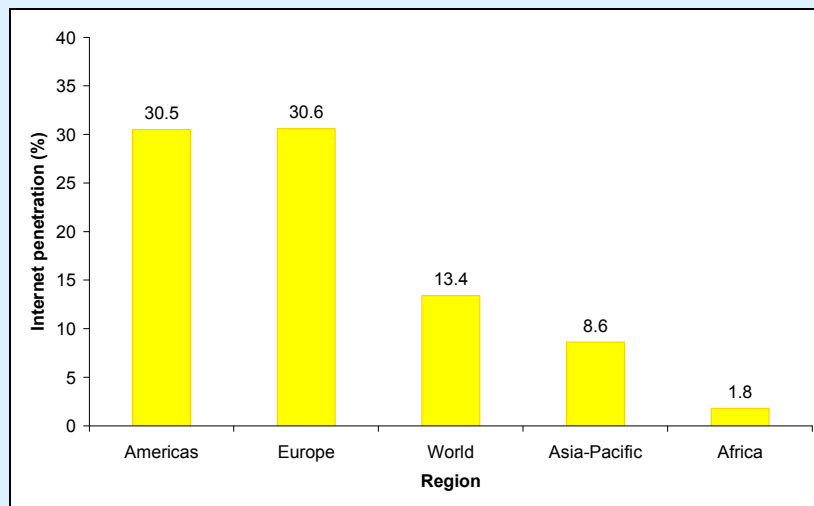
By Adrian Pais

1 Introduction

A common definition of the digital divide is "the socio-economic difference between communities in their access to computers and the Internet"[1]. While some view this definition as simplistic[2], most would agree that the digital divide does exist in today's world and stifles social and economic development in affected communities. To demonstrate the digital divide, Figure 1 shows the Internet penetration for various regions in 2004. Remarkably, the entire continent of Africa has fewer Internet users than France alone[3].

This paper proposes mechanisms for bridging the digital divide. The digital divide is inherently very complex as it is intertwined with a plethora of social, cultural, political, economic, and technical factors, many of which are unique to particular communities[4]. Therefore, this paper focuses on the factors which are considered to be most important in bridging the digital divide.

Figure 1: The digital divide

Internet penetration by region in 2004

Source: *WSIS - Digital divide at a glance*, ITU, 2005. Available: http://www.itu.int/wsis/tunis/newsroom/stats/

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2 Mechanisms for bridging the digital divide

Telecommunications and economic prosperity are mutually related to each other and therefore the digital divide cannot be considered as an entity on its own but must be viewed in the context of overall development efforts. The unifying vision that ***telecommunications can empower people to meet their needs*** must be held by all stakeholders if communities are to value technology as a means of achieving ***sustainable*** prosperity.

Four fundamental mechanisms must be implemented and coordinated to bridge the digital divide, outlined below.

2.1   Independent regulatory environment with zero tolerance towards corruption

A country's telecommunications strategy, policy and regulatory framework must be developed through a consultative process and encourage investment by ***minimising barriers to market entry*** and ***reducing risk*** for market players, e.g. through tariff subsidies and minimal prohibitions on foreign ownership.

Countries facing the digital divide are often dogged by corruption. The ***eradication of corruption*** at all levels is a prerequisite for creating a framework that is transparent, fair and amenable to economic growth.

The liberalisation of the telecommunications sector in many countries has stimulated competition between operators and a consequent reduction in cost to users. An ***independent*** (operationally and financially autonomous) telecommunications regulator that ensures a transparent and efficient process for relevant issues (e.g. operator licensing) is critical in ensuring fair competition and increasing connectivity. For example, Morocco despite being the poorest country in its region had the highest telecommunications uptake in recent times, largely due to the presence of the region's most independent regulator[5] (Figure 2).

Telecommunication services in developing countries are usually limited to densely populated, urban areas. Regulators must give incentives for extending services to rural areas, e.g. royalties could be given to operators who increase rural connectivity levels or a specific rural licensing process could be developed.

Figure 2: Morocco moving ahead

A comparison of total telephone subscribers for countries in North Africa
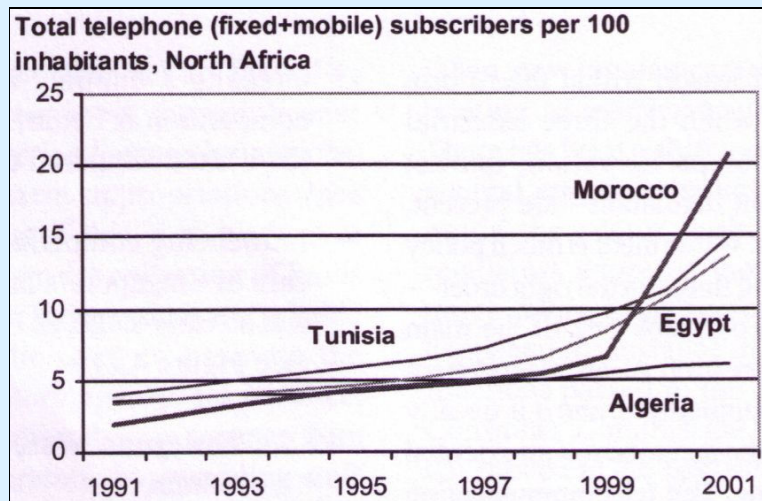
Source: *World telecommunication development report: reinventing telecoms*, ITU, 2002.

2.2   Long-term investment philosophy

After a network expansion to serve rural areas in Zambia, mobile operator Celtel stated that while they might not realise short-term profits in rural areas, the company had a ***long-term*** investment philosophy[6]. This sets a great example for other operators and is a key stimulator for telecommunications growth.

An independent study[7] has demonstrated a viable business case for rural mobile coverage in Mali; assuming an average revenue per user (ARPU) of \$3/month and 6 inhabitants/km^2, overall payback is reached in 7 years. Although this may be considered a long time, the mobile service is likely to contribute to economic growth, thereby increasing both demand and ARPU in the long-term.
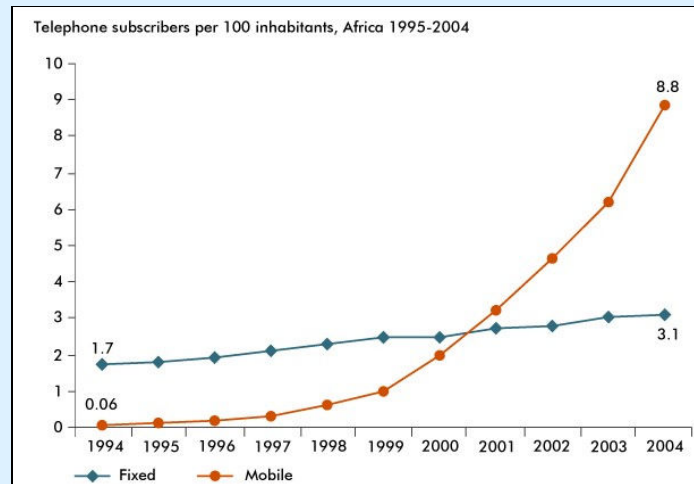
2.3 Cost-effective technical solutions

Cost-effective technical solutions make it financially viable to provide connectivity to underserved communities and make services more affordable for users. Due to their high cost, traditional fixed lines are economically unfeasible for serving geographically isolated regions with low population density. To this end, the uptake of mobile telephony in Africa (Figure 3) demonstrates that *wireless technologies* show great promise in extending coverage cost-effectively.

Operators must strive to minimise cost; e.g. in mobile networks CAPEX efficiency can be achieved by sharing sites with other operators while OPEX efficiency can be achieved by upgrading systems remotely or reducing power consumption[7]. Equipment manufacturers must develop tailored solutions for rural areas to adapt the technology to local constraints (e.g. power supply, climate, and geography).

Wi-Fi and WiMAX are emerging wireless technologies that can leapfrog the lack of infrastructure in rural areas. Wi-Fi is used for 'last-mile' coverage and operates in free, unlicensed spectrum[8]. WiMAX has a coverage range of several kilometres and offers fixed/mobile access and backhaul solutions[9]. Its all-IP platform makes it ideal for low cost voice-over-IP services. With parallel efforts to provide basic services such as electricity in rural areas, power line communications is also an excellent prospect[10].

Figure 3: Mobile telephony outstrips fixed lines in Africa

A comparison between fixed line and mobile uptake in Africa

Telephone subscribers per 100 inhabitants, Africa 1995-2004

Source: *WSIS - Digital divide at a glance,* ITU, 2005. Available: http://www.itu.int/wsis/tunis/newsroom/stats/

2.4 Partnerships and supporting infrastructures

Investment, regulatory frameworks and connectivity are meaningless if people in underserved communities do not value technology as a way of meeting their needs. *Partnerships and supporting infrastructures 'plant the seeds' that sprout confidence and empowerment in people at the 'grassroots' level*.
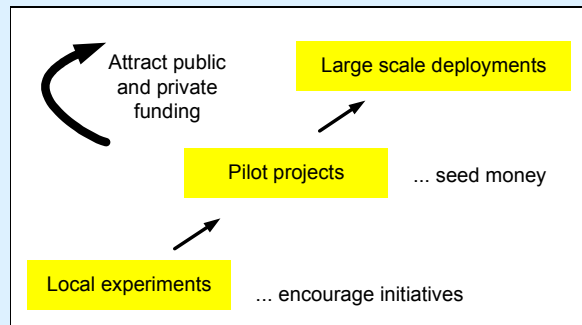
One such model is a partnership between a community and private enterprise (i.e. public-private partnership) that identifies services of value to the local community (Figure 4). Seed funds may then be injected by private enterprise to develop such services if economically viable. In this context, technology is considered as a tool rather than an end in itself, because it is primarily based on usage and directly benefits the community.

An excellent example is a mobile phone service for farmers in rural areas of Senegal[11] which provides the 'live' price of produce in Dakar. Using this service, they are able to set fair prices for their produce, improve their understanding of the market and create new business opportunities.

Apart from public-private partnerships, cooperation is required from many parties including government, private sector, international organisations and civil society (Figure 5).

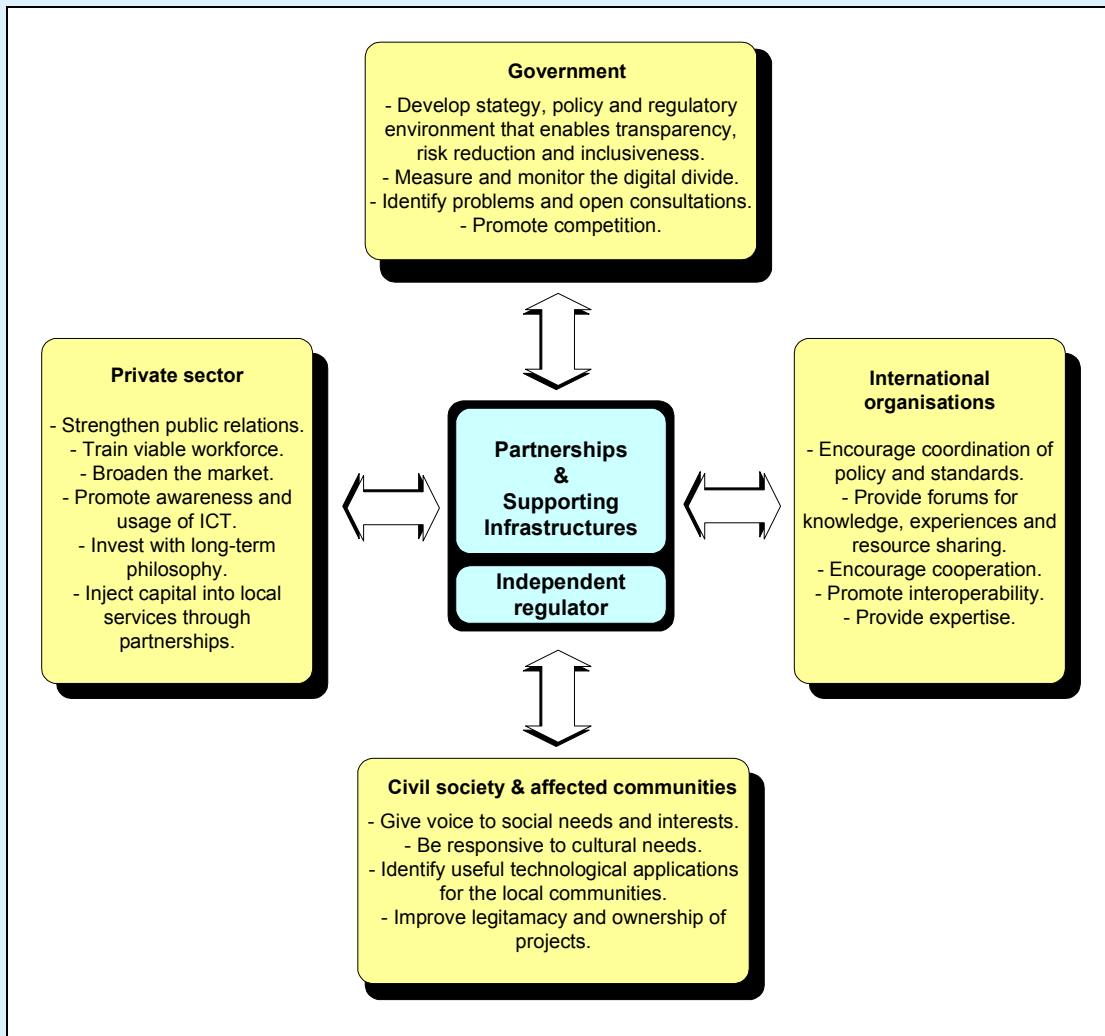**Figure 4: Empowering people through public-private partnerships**

Developing useful services for communities

Attract public
and private
funding

Large scale deployments

Pilot projects   ... seed money

Local experiments   ... encourage initiatives

Source: *Bridging the digital divide: An opportunity for growth in the 21st century*, Alcatel, 2004.

Figure 5: 'Networking' between partners

Role of the various partners in bridging the digital divide

Government
- Develop stategy, policy and regulatory environment that enables transparency, risk reduction and inclusiveness.
- Measure and monitor the digital divide.
- Identify problems and open consultations.
- Promote competition.

Private sector
- Strengthen public relations.
- Train viable workforce.
- Broaden the market.
- Promote awareness and usage of ICT.
- Invest with long-term philosophy.
- Inject capital into local services through partnerships.

Partnerships & Supporting Infrastructures

Independent regulator

International organisations
- Encourage coordination of policy and standards.
- Provide forums for knowledge, experiences and resource sharing.
- Encourage cooperation.
- Promote interoperability.
- Provide expertise.

Civil society & affected communities
- Give voice to social needs and interests.
- Be responsive to cultural needs.
- Identify useful technological applications for the local communities.
- Improve legitamacy and ownership of projects.

Source: Adapted from T. Kelly & L. Perez-Chavolla, *Multi-stakeholder partnerships for bridging the digital divide*, ITU, 2005.

3   Conclusion

Bridging the digital divide requires good governance from leadership at all levels coupled with the vision that technology empowers people to meet their needs. Four mechanisms are critical to bridge the digital divide: *independent* regulatory processes with *zero tolerance towards corruption*; *long-term* investment philosophy; *cost-effective* technical solutions and; partnerships and supporting infrastructures to *empower people*. The children of Africa wait for leaders to deliver.

[1] "Digital divide" defined in Wikipedia online encyclopedia: http://en.wikipedia.org/wiki/Digital_divide

[2] Mark Warschauer believes that much of the discussion about new technologies has focused on the oversimplified notion of a "digital divide". He attempts to relate social inclusion to technology in "Technology and Social Inclusion: Rethinking the Digital Divide", MIT Press, 2003.

[3] *WSIS - Digital divide at a glance*, ITU, 2005. Available: http://www.itu.int/wsis/tunis/newsroom/stats/

[4] Lisa Servon, "Bridging the Digital Divide: Technology, Community and Public Policy", Blackwell, 2002.

[5] *World telecommunication development report: reinventing telecoms*, ITU, 2002.

[6] Kingsley Kaswende, *Telecommunication landscape in region has changed*, Zambia Post newspaper, Feb 17 2006. Available: http://www.postzambia.com/post-read_article.php?articleId=6658

[7] *Promoting Private Sector Investment and Innovation to Address the Information and Communication Needs of the Poor in Sub-Saharan Africa*, Alcatel, 2005. Available: http://www.alcatel.com/sustainable/DigitalBridge/

[8] Larry Press, *Wireless Internet Connectivity for Developing Nations*, First Monday, Volume 8, Number 9, Sep 2003.

[9] Guy Cayla et. al, *WiMAX: An efficient tool to bridge the digital divide*, WiMAX Forum whitepaper, Nov 2005. Available: http://www.wimaxforum.org

[10] *Addressing the digital divide with IPv6-enabled broadband power line communications*, Internet Society, 2003. Available: http://www.isoc.org/briefings/013/briefing13.pdf

[11] *Bridging the digital divide: An opportunity for growth in the 21st century*, Alcatel, 2004. Available: http://www.alcatel.com/doctypes/articlepaperlibrary/pdf/ATR2004Q3/S0408-Bridging_opportunity-EN.pdf

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