Information and Communications Technology – Global Issues

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What is the Digital Divide?

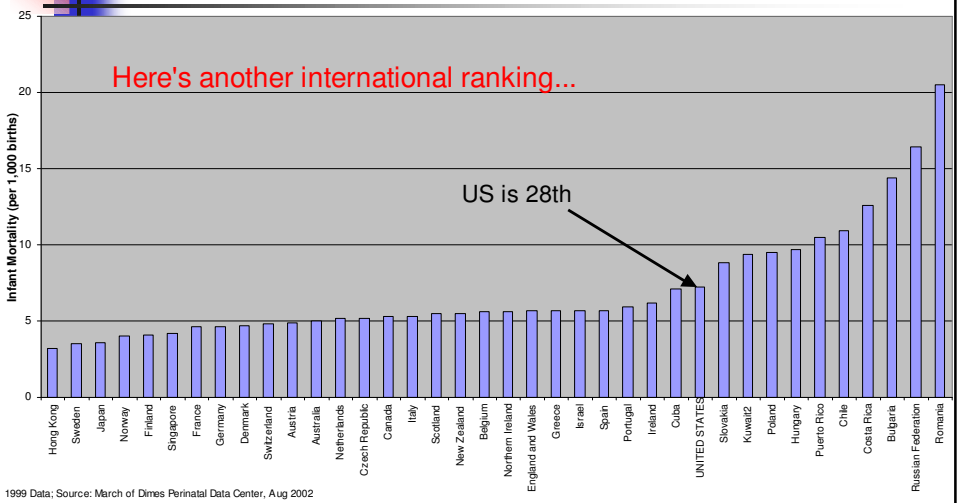
"Digital Divides are not just the result of economic differences in access to technologies (*Have's* vs. *Have-Not's*), but also in cultural capacity and political will to apply these technologies for development impact (*Do's* vs. *Do- Not's*)."

– Markle Foundation Report (2003)

It is not just a Developing Country issue per se

- US ranks about 11th or 14th in the world (broadband per 100 person)
  - (Korea ranks number 1)
- It mirrors other divides
  - Economic, social, age, gender, geography, etc.

There are other Metrics and Divides



1999 Data; Source: March of Dimes Perinatal Data Center, Aug 2002

Value of Knowledge and Technology

- Services Sector growth rates > Manufacturing > Agriculture (GDP basis)
- Every "commodity" exporter has seen low development
  - Congo
  - Nigeria, Middle East
  - Russia/USSR
  - What of China?

Millennium Development Goals

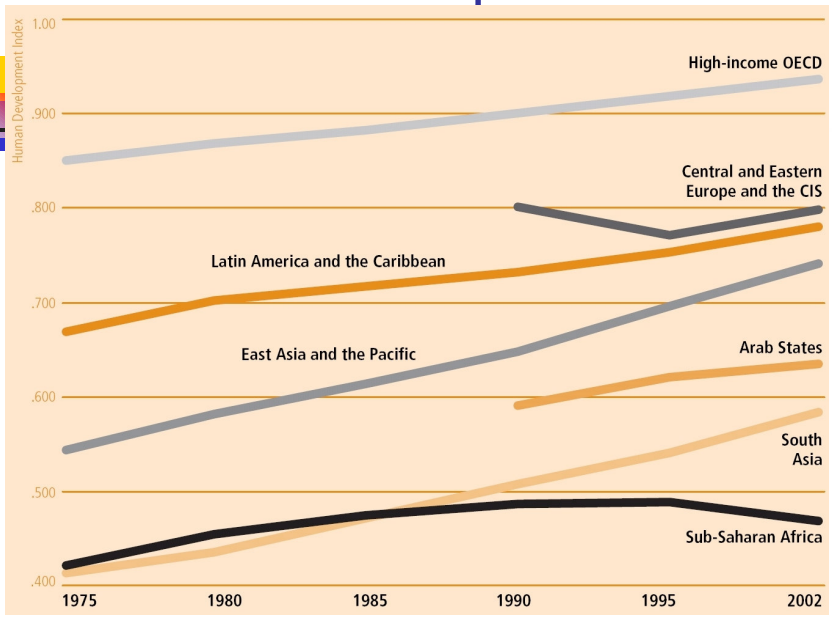
"We will spare no effort to free our fellow men, women, and children from the abject and dehumanizing conditions of extreme poverty, to which more than one billion of them are currently has subjected."

United Nations Millennium declaration – September 2000

MDG (cont.)

- Eradicate extreme poverty and hunger
- Achieve universal primary education
- Promote gender equality and empower women
- Reduce child mortality
- Improve maternal health
- Combat HIV/AIDS, malaria, and other diseases
- Ensure environmental sustainability
- Develop a global partnership for development

Human Development Indices

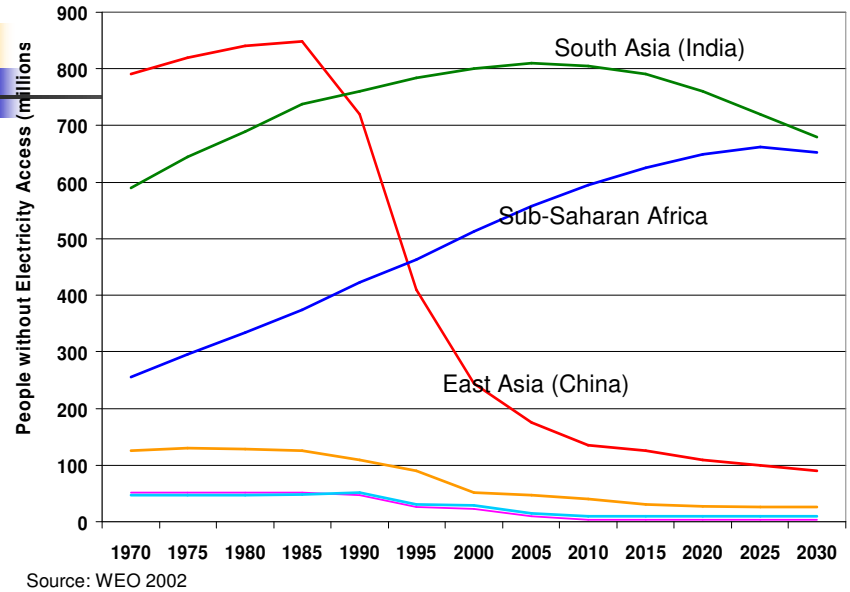


Source: UNDP Human Development Report 2004

ICT – A Means or an End?

- World Summit on Sustainable Development, August 2002, in Johannesburg was groundbreaking
  - Use of principles of sustainability relating to development
  - Understanding of the importance of technology, especially ICT
- But still, limited scientific analysis for the business case for ICT and advanced technologies
  - Correlation vs. Causality

Access to Electricity



Source: WEO 2002

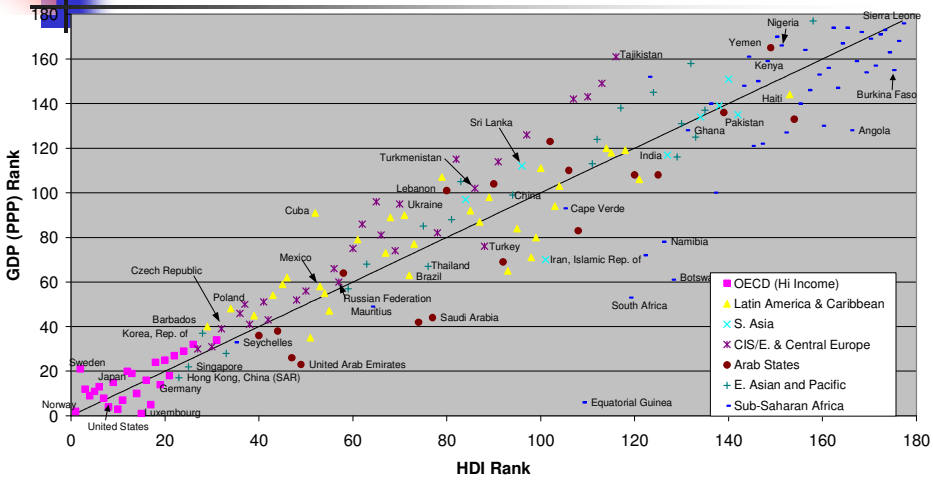
How to achieve development?

- China provides a number of insights
  - Limited Democracy
  - Central Control with increasing autonomy to provinces and local authorities
  - Economic growth was probably KEY
  - LDC issue - State Owned Enterprises
    - Inefficiency
    - Corruption
    - Poor allocation of capital and resources
    - Limited understanding of technology
      - Policies
      - Education / Investment
      - Tendering

Free Rider Effects

- Are traditional economic measures enough?
- Externalities
  - Critical issue if ICT is more a means than an end
  - Mid-day Meal Program in India example
- Public Goods
- Network Effects

GDP vs. HDI (Ranks)

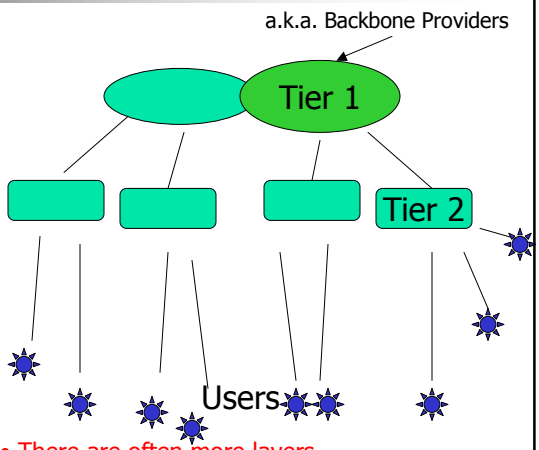


What Makes the Internet tick?

- The Internet runs on 3 things (stylized view):
  - Standards (protocols) for data-centric design
    - Expectations of how things should work together
      - Layering
    - Robustness Principle
      - "Be liberal in what you accept, and conservative in what you send." – Jon Postel
    - Resiliency – distributed architecture
    - Limits Monopolies
    - NO ONE OWNS THE INTERNET
  - Trust
    - Addressing schemes and registration
    - End-to-end design
  - Boundaries
    - Limits of Responsibilities
    - Inside the core, is like a black box ("The Cloud")

What is the Internet?

- The global (public) network built from hundreds and thousands of internetworking independent networks.
- No single entity "runs" the Internet
- Operates on standards
- Built on a modified hierarchical structure
- Packet Switching



- There are often more layers
- There can be interconnections other than at a backbone

Structures of the Industry

- Government Dept.
- Government company (PTT)
  - PTT: Abbreviation for postal, telegraph, and telephone (organization). In countries having nationalized services, the organization, usually a governmental department, which acts as its nation's common carrier.
- Regulated Monopoly
- Competition
  - IXC – Inter Exchange Carriers
  - ILECs – Incumbent Local Exchange Carriers (Baby Bells)
  - CLECs – Competitive Local Exchange Carriers
    - Overbuilders
    - Unbundled Network Elements (Open Access)

"Call Completion" / Transaction Charges

- Mail – postage stamp mechanism
- Telephony – cost sharing mechanisms (vary)
- Internet?

- What are the costs?
  - Calling – sharp falls over time
  - Mailing – increasing over time
  - Faxing – not going away anytime soon
  - Email
    - Is it really free?
      - Access
      - Upstream TCO (ignoring SPAM, for now!)
      - Time

Peering – Internet "Call Completion"

- Where backbones come together
  - Major design issue (relates to cross-connection)
- Public Peering – fallout of the public history of the Internet
  - Network Access Points (NAPs)
    - Started with 4, but now there are more
    - Usually done by equals
      - Give as much traffic as receive
- Private Peering
  - Commercial (private)
- International peering is more limited (links are much more expensive)

Issues in the Internet

- Scalability
  - Internet is growing* at 100-300%
  - Running out of IP addresses – esp. LDCs
    - Long term solution: IPv6
      - 128 bit addresses (millions per square meter)
  - Protocols and equipment are straining
- Security
  - Distributed Denial of Service – example of an attack
  - Viruses
  - Spam
  - Privacy
- Quality of Service
  - Voice/Video

Why is Connectivity so Expensive in Developing Countries?

- Issues of scale – few users
- International Gateway bottlenecks
- Licensing fees and duties
- Monopoly carrier (de-facto, often)
- Poor design

- And many more reasons…
- Optional reading at:

  http://www.contrib.andrew.cmu.edu/~tongia/FiberAfrica--ending_a_digital_divide.pdf

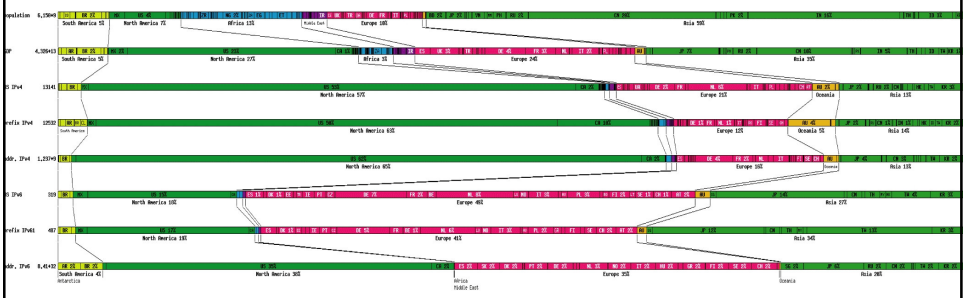
4 Dimensions of the Digital Divide

- Awareness
  - What is it, and what can one do with it?
- Availability
  - Is it offered to me?
- Accessibility
  - Can I realistically use it (including issues of literacy and language)?
- Affordability
  - Globally, ICT is 6.6% of GDP (telecom, hardware, and software)
  - What percentage of income does access cost worldwide?

Improvements are needed in all Dimensions of ICT

- Computers
  - Life cycle analyses
  - Interface
- Connectivity
  - Broadband?
- Content
  - Locally relevant information
- (human) Capacity
  - Literacy
  - e-Literacy
- Are mobile phones an answer?

Comparative Statistics



CAIDA (2003)

Digital Divide Issues (Discussion)

- What is it?
  - Broadband?
- How is it measured?
- Dimensions of the Divide
- Policy Recommendations
  - Universal Service Obligations (?)
  - Special Taxes (transnational) (?)
  - New technology solutions required (?)

The Imperative

- Developing countries are starved of resources for human development
- Developing nations are poor; around 2.5 billion people earn less than $2 a day*
- The infrastructure is inadequate or unavailable
- Technologies to overcome these deprivations are often unknown, untested or not deployed in the developing world

- *PPP

Source: Millennium Development Goals, UN Human Development Indicators

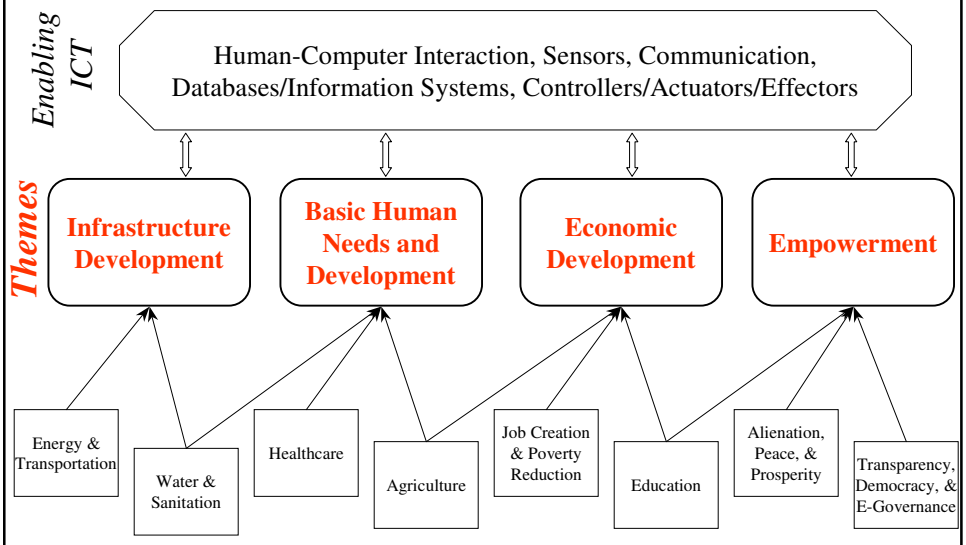
ICT as an Enabling Technology

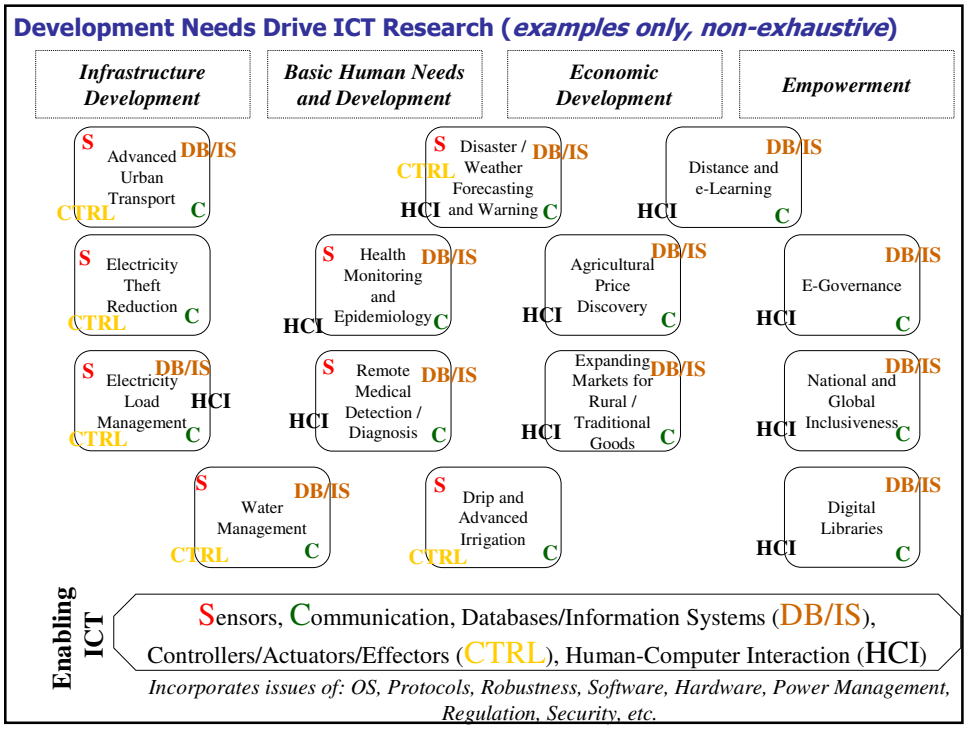
- Information and Communications Technology (ICT) is an all-purpose technology
- The growth of ICT technology – bandwidth, computational speed and storage – is spectacular
- Leap-frogging technologies do not demand a large or preexisting resource base
- Successful applications have emerged but remain largely untapped for sustainable development

The Vision

- ICT is not the cure-all to the world's problems
- *But* it can be a powerful tool to facilitate and enable affordable solutions for
  - Infrastructure Development
  - Basic Human Needs and Development
  - Economic Development
  - Empowerment
- However, appropriate ICT is not yet available for many Sustainable Development needs

ICT and Development





Consider a Kiosk (in rural Africa)

- What would be the challenges?
  - Hardware
  - Connectivity
  - Software
  - Electricity
  - Theft
  - Demand (value proposition)