Economics of IT – Connectivity, Rural change, and Youth

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The main mechanisms to promote development

Expand the information base, lower information costs and create information goods

SOURCE: WDR 2016
Connectivity
Content
Capability
... between and within countries—in access and capability

**SOURCE:** WDR 2016 team, based on Research ICT Africa surveys (various years) for 10 African countries.
<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>% Urban</th>
<th>% Rural</th>
<th>% All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolivia (2007) a/</td>
<td></td>
<td>77.6%</td>
<td>18.7%</td>
<td>57.0%</td>
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<tr>
<td>Brazil (2009) a/</td>
<td></td>
<td>83.3%</td>
<td>53.2%</td>
<td>78.8%</td>
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<tr>
<td>Colombia (2010) a/</td>
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<td>90.2%</td>
<td>71.7%</td>
<td>86.0%</td>
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<tr>
<td>Ecuador (2010) a/</td>
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<td>82.9%</td>
<td>59.7%</td>
<td>75.5%</td>
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<tr>
<td>Mexico (2007) a/</td>
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<td>66.6%</td>
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<td>55.2%</td>
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<td>82.2%</td>
<td>47.1%</td>
<td>70.4%</td>
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<tr>
<td>India (2011) b/</td>
<td></td>
<td>76.0%</td>
<td>51.2%</td>
<td>59.2%</td>
</tr>
<tr>
<td>Bangladesh (2010) c/</td>
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<td>56.8%</td>
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<td>Tanzania (2010) d/</td>
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<td>45.4%</td>
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<tr>
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<td>55.0%</td>
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<td>South Africa (2008 / 09) f/</td>
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<td>Malawi (2010) h/</td>
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<td>39.0%</td>
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<td>63.4%</td>
<td>29.6%</td>
<td>47.7%</td>
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<tr>
<td>Nigeria (2009) j/</td>
<td></td>
<td>88.3%</td>
<td>60.3%</td>
<td>70.6%</td>
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<tr>
<td>Egypt (2008) k/</td>
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<td>54.1%</td>
<td>27.8%</td>
<td>40.5%</td>
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<tr>
<td>Ehtiopia (2011) l/</td>
<td></td>
<td>65.2%</td>
<td>12.8%</td>
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<td>Uganda (2011) m/</td>
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<td>Senegal (2011) n/</td>
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<td>81.7%</td>
<td>88.4%</td>
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<tr>
<td>Mozambique (2011) o/</td>
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<td>20.0%</td>
<td>34.1%</td>
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<tr>
<td>Nepal (2011) p/</td>
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<td>91.6%</td>
<td>71.9%</td>
<td>74.7%</td>
</tr>
<tr>
<td>Zimbabwe (2011) q/</td>
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<td>90.1%</td>
<td>48.0%</td>
<td>62.2%</td>
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<tr>
<td>Rwanda (2010) r/</td>
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<td>71.8%</td>
<td>35.1%</td>
<td>40.3%</td>
</tr>
<tr>
<td>Cambodia (2010) s/</td>
<td></td>
<td>90.1%</td>
<td>56.2%</td>
<td>61.9%</td>
</tr>
<tr>
<td>China (2010) t/</td>
<td></td>
<td>76.3%</td>
<td>60.7%</td>
<td>67.9%</td>
</tr>
</tbody>
</table>

Rural and urban cell phone penetration (%)

- Peru: Rural: 47.1% Urban: 82.2%
- Bolivia: Rural: 18.7% Urban: 77.6%
- Ethiopia: Rural: 12.8% Urban: 65.2%
- Malawi: Rural: 32.3% Urban: 72.7%
- India: Rural: 51.2% Urban: 76.0%
- Bangladesh: Rural: 56.8% Urban: 82.7%
International comparison of costs of a basic package of mobile telephony (prepaid) in 2009 US $ PPP


Notes: PPP = purchasing power parity. Prices include taxes. Equipment and connection costs are not included. The low-volume basket includes 30 outgoing calls and 33 SMSs per month. The following structure of calls is assumed: local to fixed phones (15%), national (7%), mobile in-network (48%), mobile out-of-network (22%), and voice mail (8%). The estimations assume that 48% of calls take place during peak times, 25% in off-peak times, and 27% during the weekends. The following duration of calls is assumed (in minutes): 1.5 for local and national, 1.6 for mobile on-net, 1.4 for mobile off-net, and 0.8 for voice box. The tariffs are prorated according to the market shares of each operating company.
Available income for telecommunications in Brazil (5% of income) by income decile

Fuente: H. Galperin, Tarifas y Brecha de Asequibilidad de los Servicios de Telefonia Móvil en América Latina y el Caribe (Lima, Peru: Diálogo Regional sobre Sociedad de la Información, 2009), 22.

Note: R$ = Brazilian real.
A significant digital divide remains

6 BILLION without BROADBAND

4 BILLION without INTERNET

2 BILLION without MOBILE PHONES

0.4 BILLION without A DIGITAL SIGNAL

Divides persist between and within countries—in access and capability

SOURCE: WDR 2016 team based on Research ICT Africa and ITU data
Connectivity

Content

Capability
ICT Impact on agriculture

- Extension services
- Market information
- Policy environment, laws, and regulations
- Natural resources and geography
- Health
Have ICTs been adapted to low-income countries, and have they had an impact?

- Information is an indispensable ingredient in decision making for livelihood of households.

- Potential gains for rural households:
  - time and cost saving
  - more and better information, leading to better decisions and reduction of transaction costs (Stigler, 1961; Stiglitz, 1985 and 2002)
  - greater efficiency, productivity, and diversity (Leff, 1984; Tschang et al., 2002; Andrew et al., 2003).
  - lower input costs and higher output prices and information on new technologies (Gotland, et al, 2004)
  - expanded market reach

- Previous work trying to measure the consumer surplus: Saunder et al. 1983, Bresnahan, 1986, Saunders, Warford and Wellenius 1994, etc.
## Results at the Micro Level

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>TECHNOLOGY</th>
<th>LOCATION</th>
<th>IMPACT</th>
<th>STUDY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various crops</td>
<td>Public pay phones</td>
<td>Peru</td>
<td>16% increase in prices</td>
<td>Beuermann 2011</td>
</tr>
<tr>
<td>Various enterprises</td>
<td>Public pay phones</td>
<td>Peru</td>
<td>13% increase in farm income</td>
<td>Chong, Galdo, and Torero 2005</td>
</tr>
<tr>
<td>Various crops</td>
<td>Cell phones</td>
<td>Peru</td>
<td>11% increase in household consumption</td>
<td>Beuermann, Mckelvey, and Vakis 2012</td>
</tr>
<tr>
<td>Maize, potato, olluco, barley</td>
<td>Cell phones</td>
<td>Peru</td>
<td>No positive impact</td>
<td>Nakasone 2013</td>
</tr>
<tr>
<td>Green peas, lima beans</td>
<td>Cell phones</td>
<td>Peru</td>
<td>11–13% increase in average prices</td>
<td>Nakasone 2013</td>
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<tr>
<td>Various products</td>
<td>SMS</td>
<td>Colombia</td>
<td>No positive impact</td>
<td>Camacho and Conover 2011</td>
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<tr>
<td>Various crops</td>
<td>SMS</td>
<td>Colombia</td>
<td>No positive impact</td>
<td>Camacho and Conover 2011</td>
</tr>
<tr>
<td>Maize</td>
<td>Radio</td>
<td>Uganda</td>
<td>15% increase in prices</td>
<td>Svensson and Yanagizawa 2009</td>
</tr>
<tr>
<td>Banana</td>
<td>Mobile phone coverage</td>
<td>Uganda</td>
<td>Somewhat positive impact, depending on distance to district center</td>
<td>Muto and Yamano 2009</td>
</tr>
<tr>
<td>Maize</td>
<td>Mobile phone coverage</td>
<td>Uganda</td>
<td>Somewhat positive impact, depending on distance to district center</td>
<td>Muto and Yamano 2009</td>
</tr>
<tr>
<td>Various products</td>
<td>Grameen/MTN village phones</td>
<td>Rwanda</td>
<td>No positive impact</td>
<td>Futch and McIntosh 2009</td>
</tr>
<tr>
<td>Cowpeas</td>
<td>Cell phones</td>
<td>Niger</td>
<td>No positive impact</td>
<td>Aker and Fafchamps 2010</td>
</tr>
<tr>
<td>Millet</td>
<td>Cell phones</td>
<td>Niger</td>
<td>No positive impact</td>
<td>Aker and Fafchamps 2010</td>
</tr>
<tr>
<td>Groundnuts</td>
<td>SMS</td>
<td>Ghana</td>
<td>9.7% increase in prices</td>
<td>Courtois and Subervie 2013</td>
</tr>
<tr>
<td>Maize</td>
<td>SMS</td>
<td>Ghana</td>
<td>12.7% increase in prices</td>
<td>Courtois and Subervie 2013</td>
</tr>
<tr>
<td>Yams</td>
<td>SMS</td>
<td>Ghana</td>
<td>7% increase in prices</td>
<td>Nyarko et al. 2013</td>
</tr>
<tr>
<td>Maize, cassava, gari</td>
<td>SMS</td>
<td>Ghana</td>
<td>No positive impact</td>
<td>Nyarko et al. 2013</td>
</tr>
<tr>
<td>Various crops</td>
<td>Cell phones</td>
<td>Philippines</td>
<td>11–17% increase in per capita consumption</td>
<td>Labonne and Chase 2009</td>
</tr>
<tr>
<td>Fisheries</td>
<td>Cell phones</td>
<td>Kerala, India</td>
<td>8% increase in fishermen profits</td>
<td>Jensen 2007</td>
</tr>
<tr>
<td>Soybeans</td>
<td>e-Choupal</td>
<td>Madhya Pradesh, India</td>
<td>1–3% increase in prices (average = 1.6%)</td>
<td>Goyal 2010</td>
</tr>
<tr>
<td>Potatoes</td>
<td>SMS</td>
<td>West Bengal, India</td>
<td>No positive impact</td>
<td>Mitra et al. 2012</td>
</tr>
<tr>
<td>Various products</td>
<td>SMS</td>
<td>Maharashtra, India</td>
<td>No positive impact</td>
<td>Fafchamps and Minten 2012</td>
</tr>
<tr>
<td>Eggs</td>
<td>Cell phones</td>
<td>Bangladesh</td>
<td>Positive impact, not specified</td>
<td>Bayes 2001</td>
</tr>
</tbody>
</table>
Results at the Micro Level

WHEN ICT PENETRATION IS LOW, almost any price information—general or specific—tends to have a positive impact on farmer income.

WHEN ICT PENETRATION IS HIGH, price information needs to be more specific to have a positive impact on farmer income, particularly for high-value crops that have a shorter shelf life.

*Numbers in graph correspond to numbered case studies in table.*
Examples of e-Health Services & Applications in Africa

**JustTested** (South Africa, May 2012)

- **Objective:** Giving support and information to people who has just tested (regardless of whether they test HIV positive or negative)
- The service sends 39 messages over the course of three months on the topics of healthy living and addressing HIV and AIDS related issues

**MAMA** (South Africa, May 2013)

- **Objective:** providing support and information to pregnant women and new mothers through 4 channels
- **Results:** 641,771 users in November 2014

**iHRIS** (Uganda, 2007)

- **Objective:** managing health workforce information
- **iHRIS Mobile Reference Dictionary** was developed in 2012 to protect patients from individuals posing as health professionals
- **Results**
  - Currently, 19 countries are using iHRIS with one more in the pipeline
  - More than worldwide 900,000 health worker records are supported
- **Derivative:** mHero (Mobile Health Worker Ebola Response and Outreach) used in Liberia during Ebola crises

Connectivity

Content

Capability
Illiteracy: Can a SMS campaign work?

Source: World Literacy Map created by Tiiliskivi
Digital technologies tend to be:

- **Productivity-biased**
- **Skills-biased**
- **Voice-biased**

Limiting the aggregate gains from the digital revolution

**SOURCE:** WDR 2016 team based on Research ICT Africa and ITU data
Digital technologies hold benefits as well as risks

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individuals</strong></td>
<td><strong>Increased Inequality:</strong> Premium on digital and socio-emotional skills that complement technology will make individuals with low human capital more vulnerable economically and pose a risk of increased inequality between those with and without the means to acquire skills for the new economy.</td>
</tr>
<tr>
<td>• <strong>Jobs:</strong> New technologies generate new jobs, transform old jobs, and create potential productivity enhancements.</td>
<td>• Trust: Erosion of trust due to increasing concerns of security and accuracy of digital media</td>
</tr>
<tr>
<td>• <strong>Access:</strong> Online platforms can expand access to basic services and income earning opportunities for groups of people with a wide range of skills. Improved connectivity, accessibility to high-quality content, and new learning approaches can reshape access to high-quality education outcomes for learners of all ages.</td>
<td></td>
</tr>
<tr>
<td><strong>Firms</strong></td>
<td><strong>Monopolistic Market Structures:</strong> Global platform firms will gain influence as they consolidate the value chains with the potential to expand at virtually no marginal cost. This concentration of market power among a few large firms will raise questions related to privacy, competition and taxation.</td>
</tr>
<tr>
<td>• <strong>Access:</strong> Global online platforms can enable more firms to access global markets and reap the benefits of scale economies, competition, and technology diffusion by reducing search and transaction costs.</td>
<td>• Economic transitions: New production technologies and automation will lead to re-shoring of manufacturing, fragmentation, and protection</td>
</tr>
<tr>
<td>• <strong>Knowledge &amp; Labor Flows:</strong> Knowledge, labor, and digital or physical assets will flow more freely as platforms reduce the need for large numbers of intermediaries.</td>
<td></td>
</tr>
<tr>
<td><strong>Governments</strong></td>
<td><strong>Trust:</strong> Governments’ capacity as a trusted intermediary will be under pressure</td>
</tr>
<tr>
<td>• <strong>Better Service Delivery:</strong> Technology can improve the efficiency, transparency, and accountability of public service delivery, and dramatically reduce corruption.</td>
<td>• New Social Protection: Need for new forms of social protection will create implications for public policy on issues ranging from taxes, basic accountability, updated regulations, new forms of supervision, and social cohesion.</td>
</tr>
<tr>
<td>• <strong>Inclusivity:</strong> New social protection programs tailored to the precise needs of recipients can broaden reach and inclusiveness, including in the most fragile contexts.</td>
<td>• Cybersecurity: New risks associated with cybersecurity</td>
</tr>
</tbody>
</table>
Digital technologies hold benefits as well as risks.
Analog foundations for a digital economy

**NATIONAL PRIORITIES**

**REGULATIONS**
- that promote competition and entry
- Remove barriers to adoption
- Competition regulation and enforcement
- Platform competition

**SKILLS**
- to leverage digital opportunities
- Foundational skills and basic ICT literacy
- Prepare for careers instead of jobs
- Facilitate lifelong learning

**INSTITUTIONS**
- that are capable and accountable
- Mobile phone-based services and monitoring
- e-government delivery and citizen engagement
- Participatory policy making and digital collaboration

**SOURCE:** WDR 2016 team.
Race between technology and complements

Complements: Index of quality of institutions, skills and regulations.

Technology: Digital adoption index - businesses, people and governments.

SOURCE: WDR 2016 team. For more details see figure 5.3 in the full Report.
Three studies

- **From Kids to Kids**

- **From Kids to Parents without ICT**

- **From Kids to Parents with ICT**
  - Nakasone, Torero. (2017). Agricultural Extension through ITs in Schools: Do the cobbler’s parents go barefoot?
From Kids to Kids - Results

- Videos were effective promoting iron consumption
- The messenger plaid a crucial role
- Reduction in anemia rate
- Improvements in cognitive ability
- Improvements in school performance
  - Grades
  - Grade promotion
From Kids to Kids: Results
Why from kids to parents?

- **Upper Intergenerational Transmission of Information:**
  - Abundant Information about the effect of parents on children: emotional competence (Hanson et al 1999), risk & trust (Dohmen et al 2012), education (Behrman et al 1999), health (Case and Paxson 2002).
  - Emerging literature (mostly from sociology and psychology) of the effect of children on parents.
  - Some evidence from language immersion programs (Kuziemko 2014) and marketing (Dauphin et al 2011, Moehling 2005). But, in general, still very limited.
Kids to Parents: Extension


- ICTs can solve many of these shortcomings (ex. Cole and Fernando 2012)

- Problem: Computer-illiterate adult population in rural areas.
Kids and ICTs for Extension: Example (molasses trap for corn armyworm)
Main specification (ITT):

\[ Y_{ij} = \beta \text{Video}_{ij} + \gamma D_i + \alpha_j + \varepsilon_i + \mu_{ij} \]

- \( Y_{ij} \) (0/1) indicates if farm manager of household \( i \) knows (or has adopted) practice \( j \)
- \( \text{Video}_{ij} \) indicates if a student that belongs to household \( i \) was assigned to watch a video encouraging adoption of practice \( j \)
- \( D_i \) is an stratification variable
- \( \alpha_j \) is a dummy variable for practice \( j \)
- \( \varepsilon_i \sim N(0, \sigma_{\varepsilon}) \) is a household random effect
- Additional set of controls (household / farm manager characteristics) in some specifications.
From Kids to Parents - Results

• When the student is taught an agricultural practice: 
  *Farm manager's knowledge of that practice increases by 6-9 pp (20%-30%)*

• *Adoption of the practice increases by 3-5 pp. (16%-23%)*

• **Heterogenous Effects:**
  • *Education:* Smaller gains among less educated responsible HH member (with primary education or less)
  • *Gender:* Larger gains if responsible member is male
  • *Age:* Larger gains if responsible member is younger
Final Comments

• We need significant innovation in data collection to improve access to information

• Three C’s of ICTs: Connectivity, Capability to use it, and Content are essential

• Governments need better data for proper decisions

• ICTs can have an important impact in health and many other sectors but content and level of development of institutions is central

• Still we have a significant access gap!

• Kids can have a significant role in being the bridge of information to their parents