

# Information Technology: Impacts, Cost-Effectiveness and Implications for Design

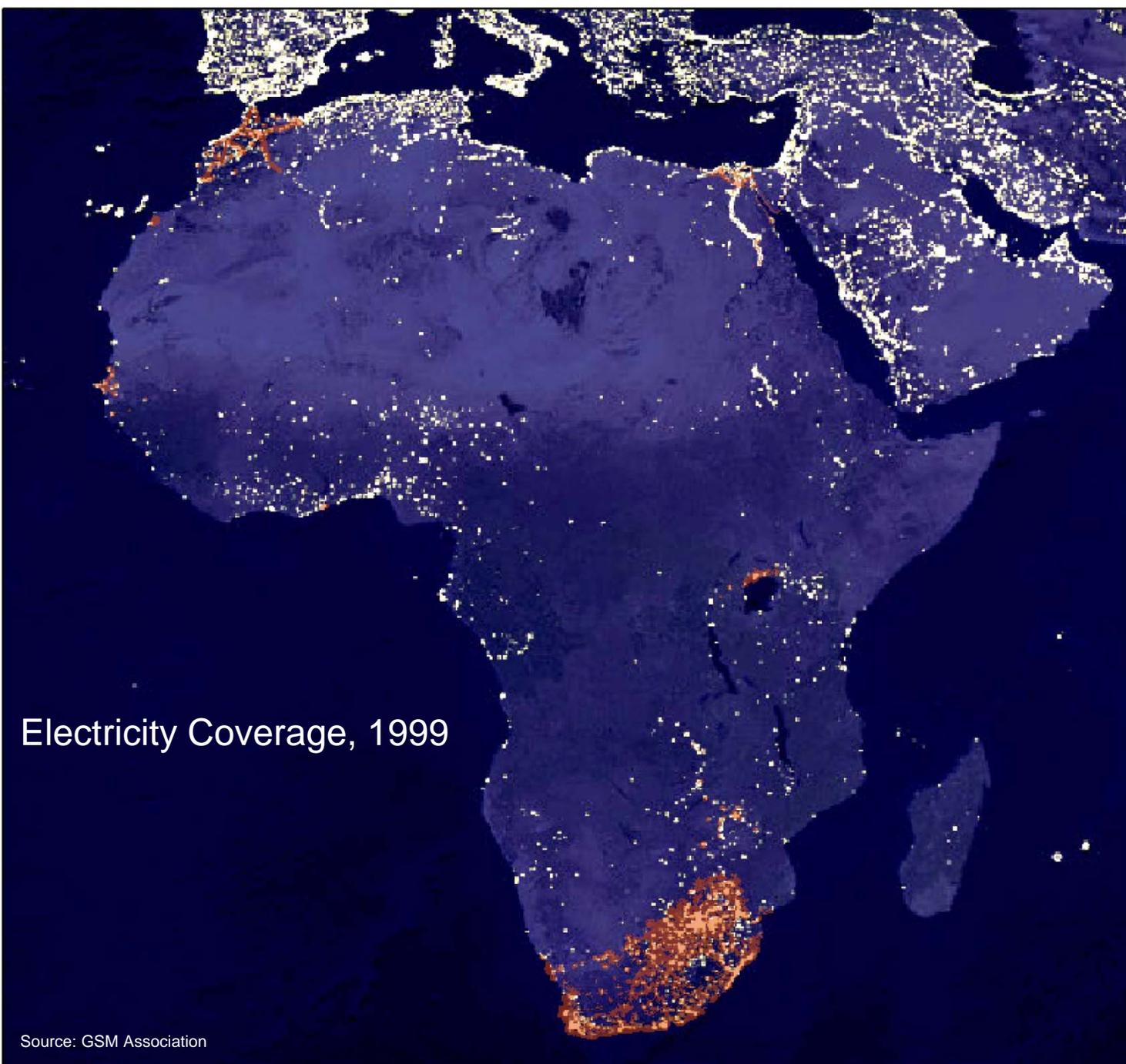


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The Inaugural Impact Evaluation Conference  
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# Infrastructure Investment in Africa: Power, Roads and ICT

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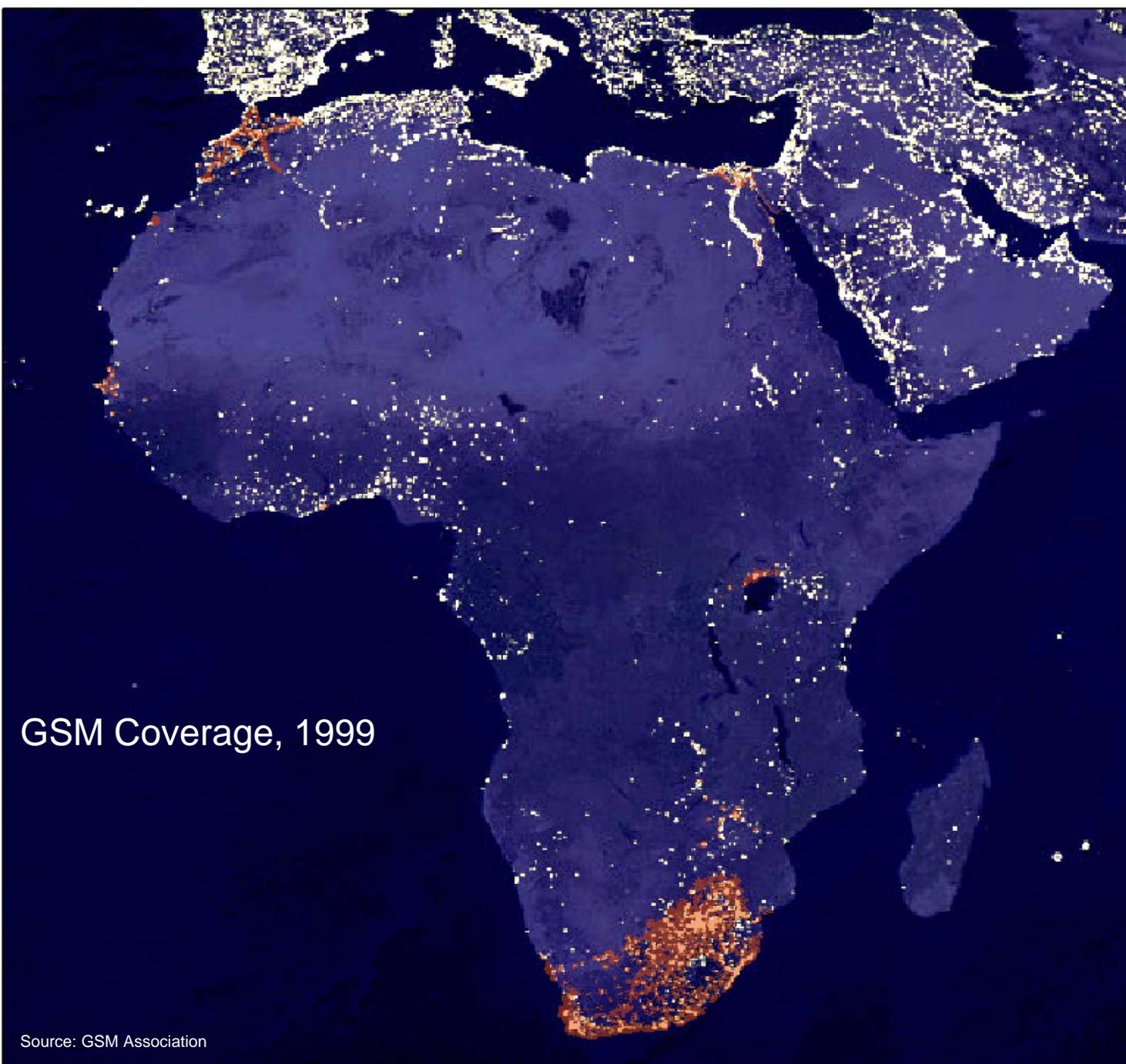




# ICT Infrastructure in Africa

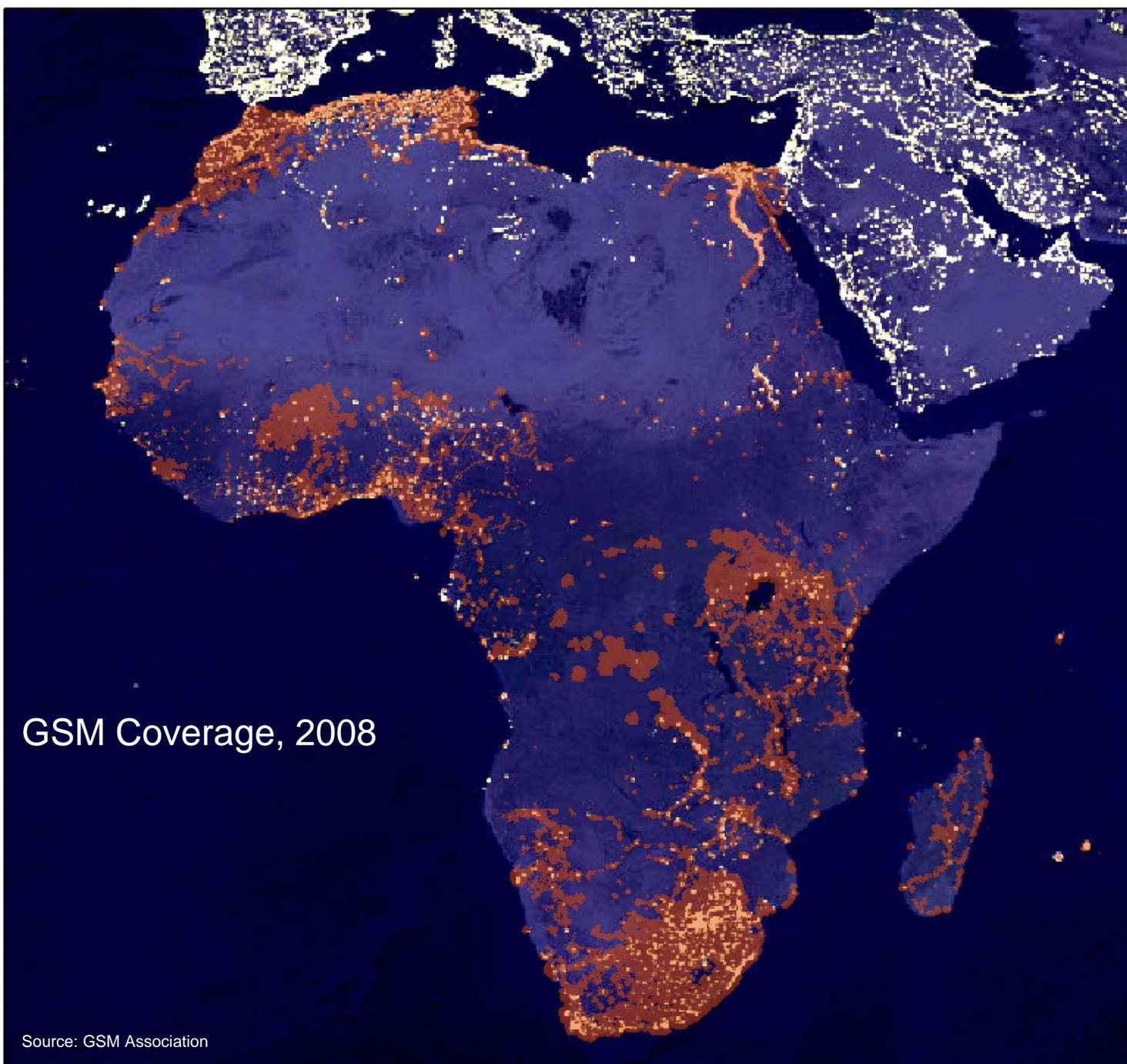
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- 12.6 million landlines in Africa in 2008 (ITU 2009)
  - Less than 1 landline for every 100 people
- 55 percent of the population listens to the radio
- 4.2 percent of the population has access to internet (ITU 2009)



GSM Coverage, 1999

Source: GSM Association

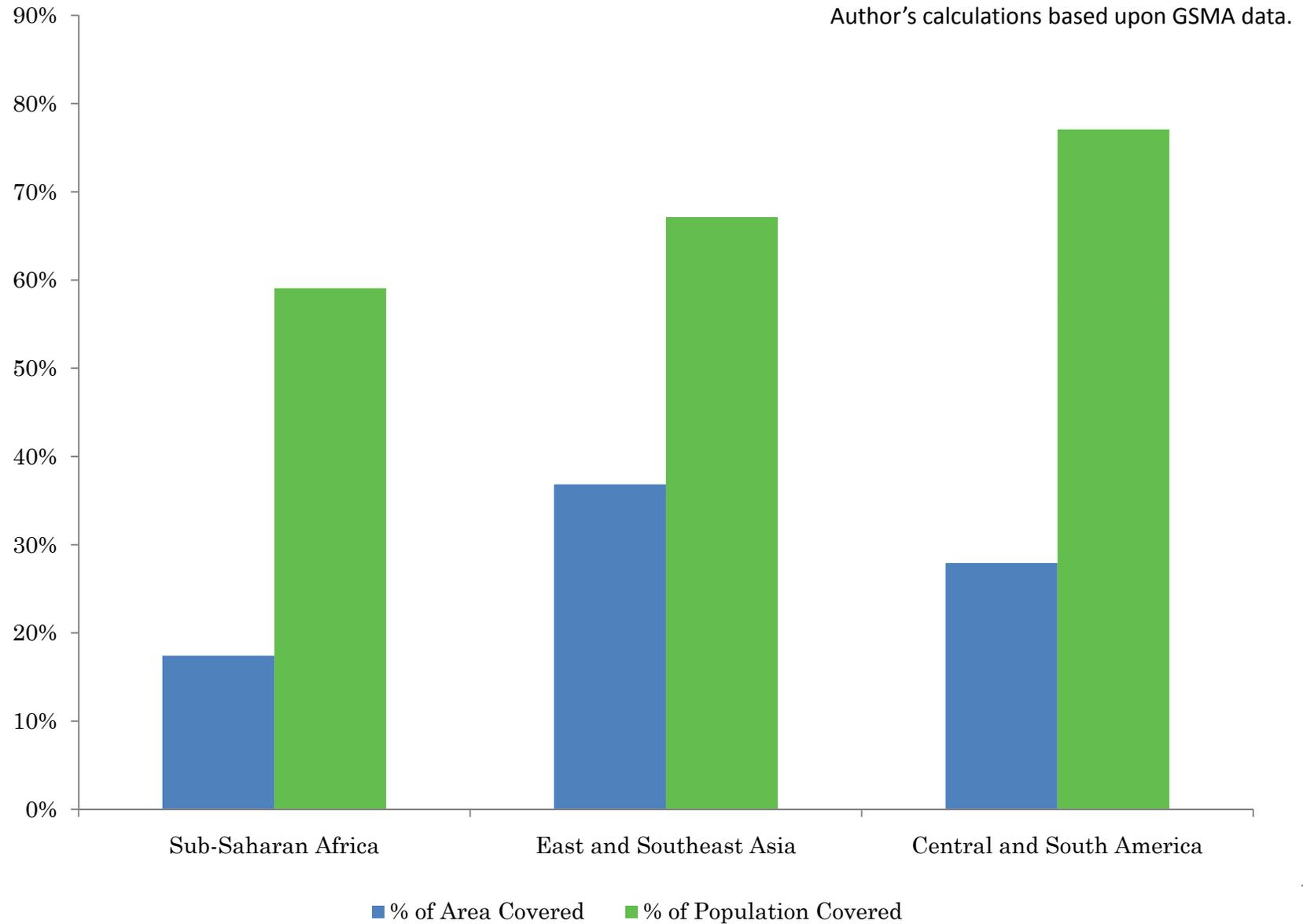


GSM Coverage, 2008

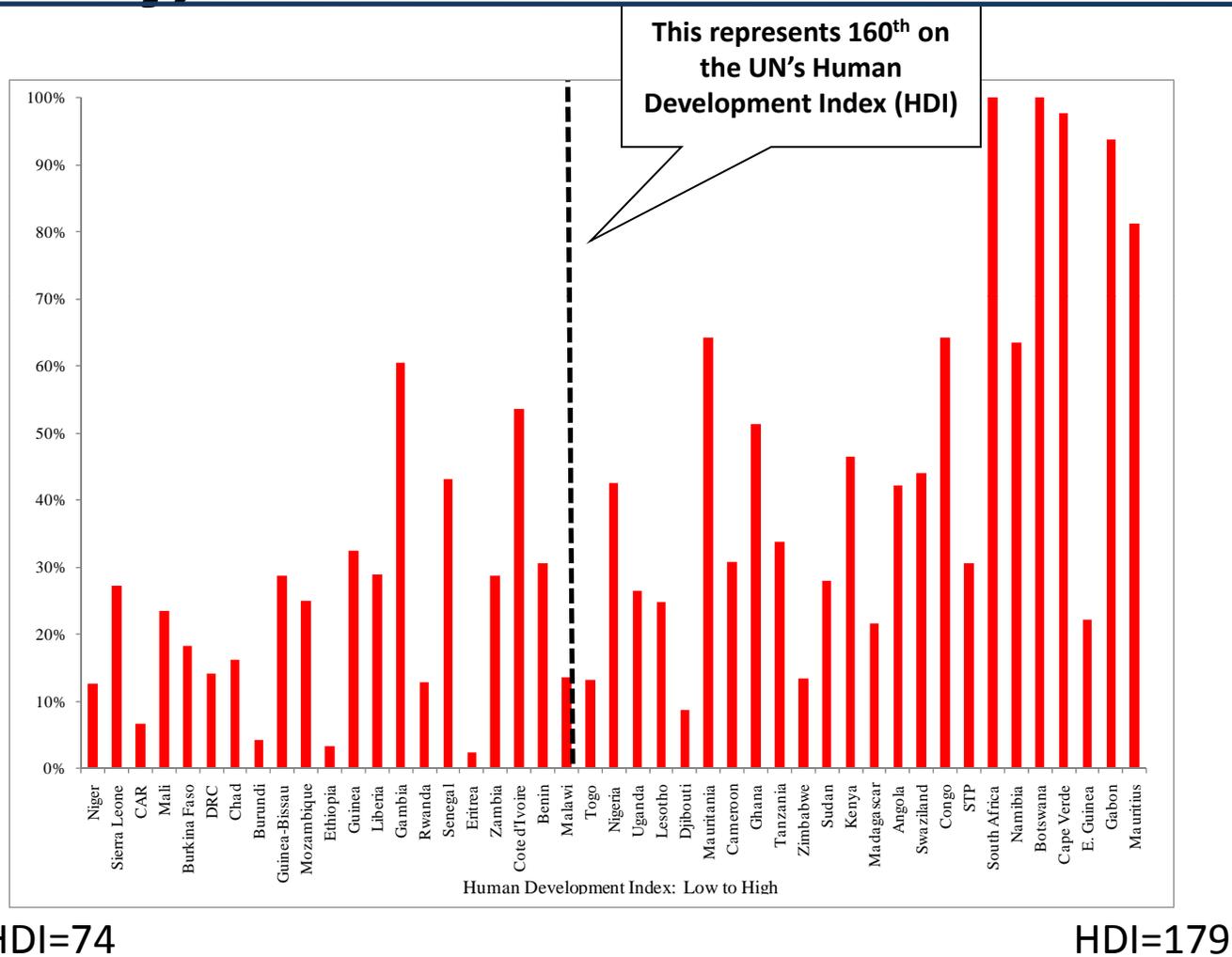
Source: GSM Association

# ICTs in Developing Countries

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# Mobile Phone “Adoption” by Country, 2008

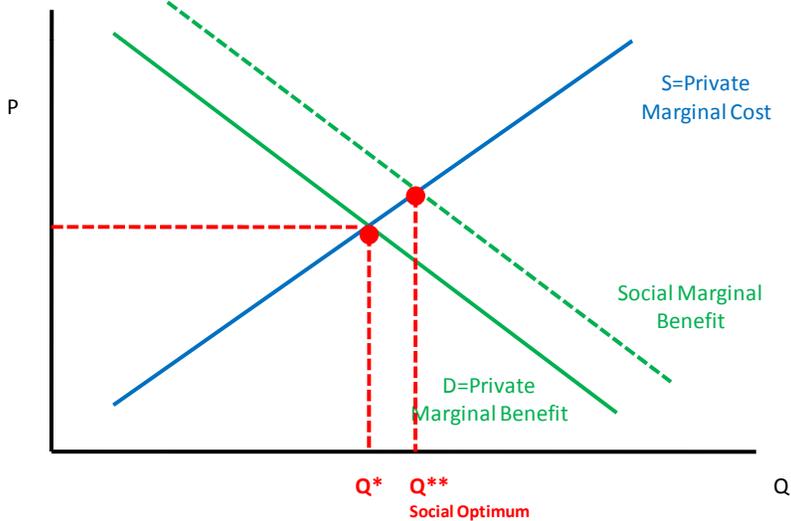


Source: Wireless Intelligence

Are people in developing countries better off because of ICT, particularly mobile telephony?

# Measuring the Impact of ICT

## ICT Infrastructure Investment



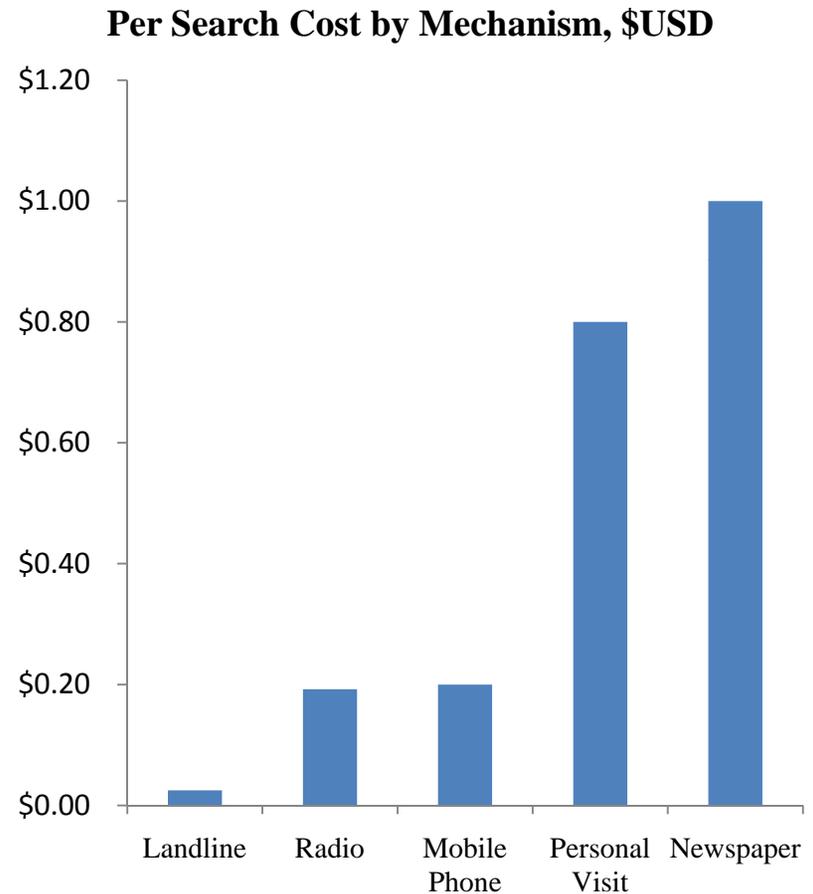
## ICT-Based Services and Development Projects



# Mobile Phones and Communication Costs

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- Mobile phones reduce the costs of obtaining information as compared with traditional mechanisms
- This can reduce search costs, increase contact with other adopters in a social network and perhaps expand those networks



# Impact Pathways of ICT Infrastructure

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- Reduce search costs, increase access to information and improve market efficiency
- Improve coordination between buyers and sellers and improve input and output supply chain management
- Improve communication among social networks and reduce risk (Burrell 2010, Blumenstock and Fafchamps 2011)
- Generate employment
- Facilitate service delivery (insurance, credit, inputs)

# Empirical Research on the Impact of ICT

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- Mobile phones and fish markets in India (Abraham 2007, Jensen 2007)
- Mobile phones and consumer grain price dispersion (Aker 2008, 2010) and farm-gate prices (Aker and Fafchamps 2011)
- Mobile phones and farmer participation in Uganda (Muto and Yamano 2009)
- Internet kiosks and soybean prices in India (Goyal 2010)
- Mobile phones and labor markets (South Africa: Nolen and Klonner 2010, Malawi: Dinkelman et al 2010)

# Empirical Research on the Impact of ICT

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$$Y_{it} = \alpha + \beta mobile_{it} + \gamma X_{it} + a_i + \theta_t + \varepsilon_{it}$$

Price dispersion  
Price levels  
Agents' behavior  
Welfare measures

Omitted variables  
Reverse causality

# Market Efficiency Impacts

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- Mobile phones reduce agricultural price dispersion for specific products and countries
- Stronger impact on perishable and semi-perishable goods (Jensen 2007, Muto and Yamano 2009, Aker and Fafchamps 2011)
- Impact pathways appear to be increased access to information and change in agents' search and arbitrage behavior (Jensen 2007, Aker 2008, Muto and Yamano 2009, Aker and Fafchamps 2011, Fafchamps and Minten 2011)
  - Changes in behavior for firms or farmers depends upon the local context

# Heterogeneous Impacts

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- Mobile phones appear to serve as an (imperfect) substitute for certain types of physical capital
  - E.g., stronger impact for markets that are farther apart and linked by poor quality roads
- Effects by gender, age and education are context-dependent
  - Few heterogeneous effects for traders in Niger
  - Stronger impacts on labor market outcomes for women in Malawi

# Welfare Impacts

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- Overall welfare improves with market efficiency, but how that welfare gain is distributed among different groups (farmers, traders and consumers) is ambiguous
  - Increase in fisherman's profits and a reduction in waste (Jensen 2007)
  - Increase in traders' profits (reduced costs, higher prices) (Aker 2008)
  - Increase in farmers' prices (Goyal 2010)
  - No effect on farmers' price levels, but reduction in intra-annual price risk (Aker and Fafchamps 2011)

# Is ICT infrastructure translating into GDP gains?

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- Existing research suggests a positive correlation between ICT and growth
  - A 10 percent increase in telecommunications infrastructure is associated with a .6-1.5 percent increase in GDP growth (Roller and Waverman 2001, Waverman, Meschi and Fuss 2005 )
- Measurement error and endogeneity problems
- Growth and GDP will not capture potential gains in consumer welfare

# ICT-Based Services and Development Projects

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## Services

- Mobile banking (M-PESA, Zap, G-Cash)

## Development Projects

- Market information systems (Ghana, Senegal, Niger, India)
- Health information systems (DRC, Mozambique, Malawi)
- Early warning (*Ushahidi*)
- Governance (PVT hotlines, voter education)
- Education (Niger, Senegal)
- Cash transfers (Niger)

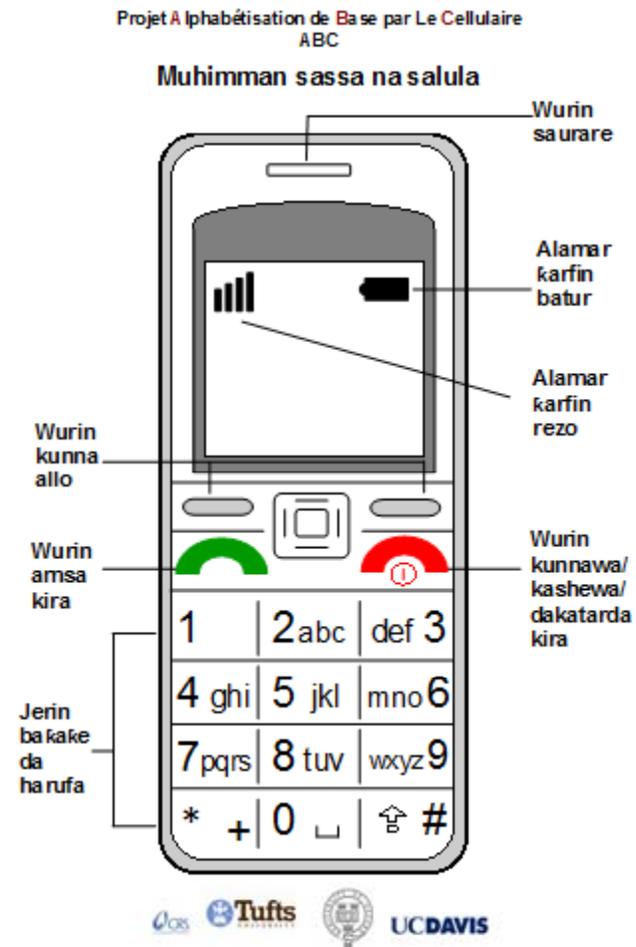
# Impact Evaluations of ICT-Based Innovations

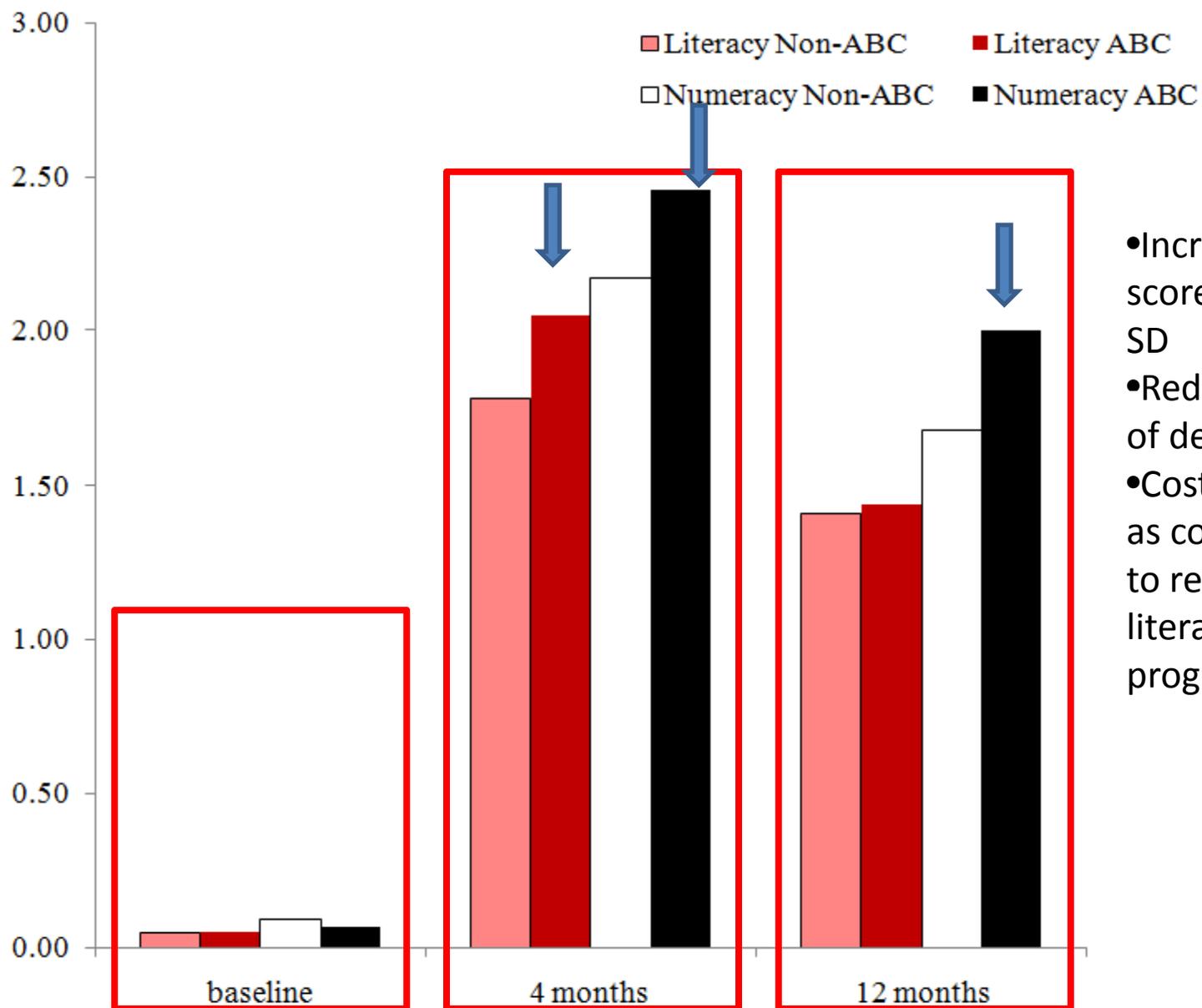
- **Project ABC** (Mobile Phone Literacy): CRS, Tufts and Oxford
- **SMS-Based Market Information:** Niger (CRS, Tufts and Oxford), India (Oxford, Berkeley)
- **Mobile phone cash transfer:** Concern, Tufts, EU



# Project ABC (Aker, Ksoll and Lybbert 2010)

- Randomized evaluation of a mobile phone literacy program
- Students follow the same literacy curriculum, but:
  - Learn where to find numbers and letters on mobile phone handset
  - Learn how to make and receive a call
  - Learn how to send and receive SMS





- Increases test scores by .15 SD
- Reduces rate of depreciation
- Cost-effective as compared to regular literacy program

# What do we know?

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- ICT infrastructure improves agricultural market efficiency, with consistent results across different contexts
- Primary impact pathways appear to be improved access to information and the reduction of risk
  - Yet the impact on market actors' behavior depends upon the context
- Mobile telephony can serve as an (imperfect) substitute for certain public goods (landlines, roads)
  - E.g., if a farmer knows the price but cannot get to the market, this might not translate into welfare gains

# What don't we know?

- How ICT affects *other* economic outcomes and pathways
  - E.g., labor markets, buyer-seller coordination, risk-sharing, job creation
- How welfare gains from ICT are distributed among different groups
- Determinants of mobile phone demand
  - What is the price elasticity of demand? How does the market structure affect pricing schemes?
  - Are mobile phone-related expenditures “crowding out” other household expenditures?
- Cost effectiveness

# Challenges to Impact Evaluations of ICT

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- Disentangling the impact of ICT on development outcomes is a challenge
  - Non-randomized rollout of ICT infrastructure
  - Widespread ICT coverage
  - Multiple channels (and benefits) of impact
  - Other infrastructure investments
  - Measurement error
  - Non-adopters
- Yet rigorous impact evaluations of ICT are needed
  - Engage in partnerships to obtain tower and user data from mobile phone companies
  - Use rigorous impact evaluation techniques for new ICT infrastructure and innovations, including cost-effectiveness analyses

# Potential Areas for the MCC

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- Going the “last mile”: Is mobile phone coverage needed in remote areas?
  - Do the benefits outweigh the costs? Should this be a policy priority for developing countries?
  - If so, who should provide the service? (Mobile phone companies, locally driven towers)
  - What policy mechanisms are needed?
- Pricing of mobile phone handsets and services
  - Voice and SMS prices are nearly equal in India, but strong voice-SMS price differential in many parts of Africa
- Powering mobile phone base stations
  - Solar power and village-level spillovers?

# Potential Areas for the MCC

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- Public-private partnerships for new ICT innovations in public goods
  - Early warning and response (weather, epidemics, violence)
  - Technical advice in health and agriculture
  - ICT as educational tools
- Yet how shall we measure impact?
  - Impacts on income will occur in the longer-term
  - Are other impact measures needed? (consumer welfare, risk)

# Conclusions

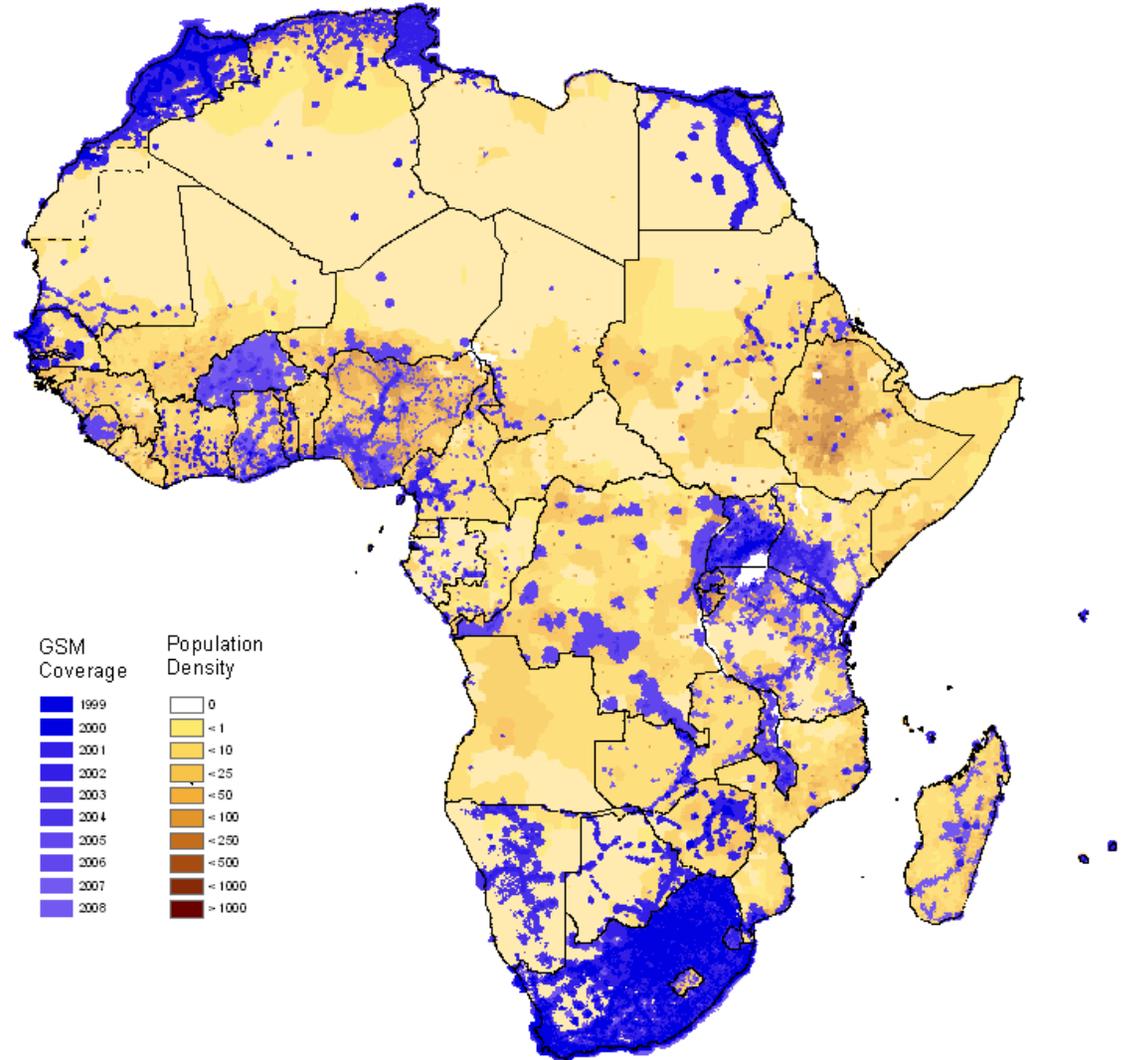
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- Empirical evidence suggests that mobile phones improve market efficiency and increase welfare for specific products and markets
  - Might not translate into GDP or macroeconomic gains
- More rigorous evidence needed to assess the development potential of mobile phones
  - Successes and failures
  - Feedback loop with communities and implementing partners
- The staggering rate of mobile phone adoption can provide lessons for adoption of other technologies (agriculture, water, health)
- Mobile phones are not the silver bullet

# **Additional Slides**

# The Digital Divide (Buys et al 2009)

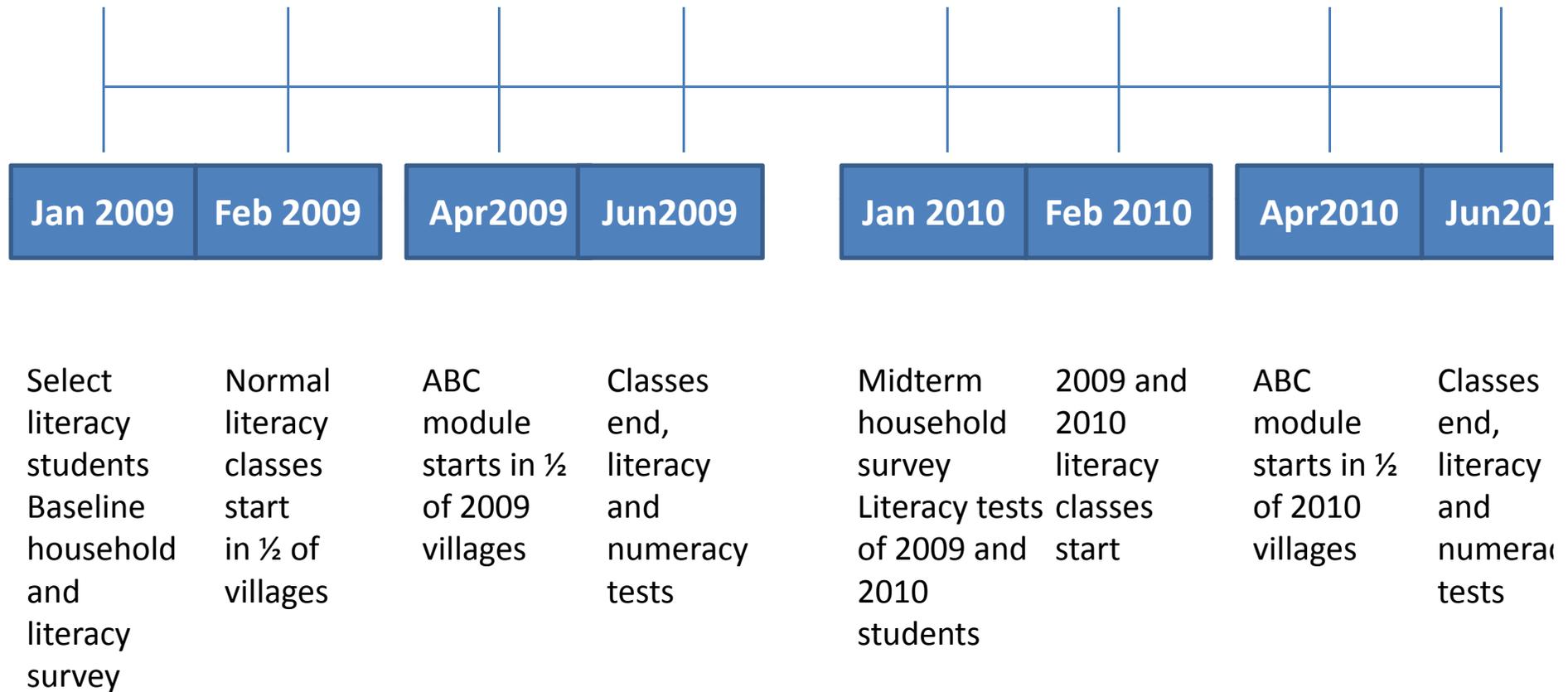
- Demand
- Supply
- Market structure



Source: GSM Association/ Europa Technologies. Population Density data source: Gridded Population of the World (GPW)/ Global Rural - Urban Mapping Project Alpha (GRUMP Alpha).

# Timeline of Project ABC

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# Literacy Tests

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- Level 0:** o t i m u e ta bi
- Level 1:** la di ro le bo ni ku di
- Level 2:** mai rani daka gona kasuwa
- Level 3:** Rabi ta share hilin gida
- Level 4:** Musa manomi ne mai aiki da takin zamani. Yana samun amfani da dama kowace shekara
- Level 5:** Matarshi tana noma rani shekara duka. Yaranshi na zuwa makaranta , shi kuma yana karatun yaki da jahilci
- Level 6:** Musa yana cikin lattijawa masu kawo kokari dan raya karkara. Suna da kungiya mai zaman kanta da ake cema Ci gaban Kakara