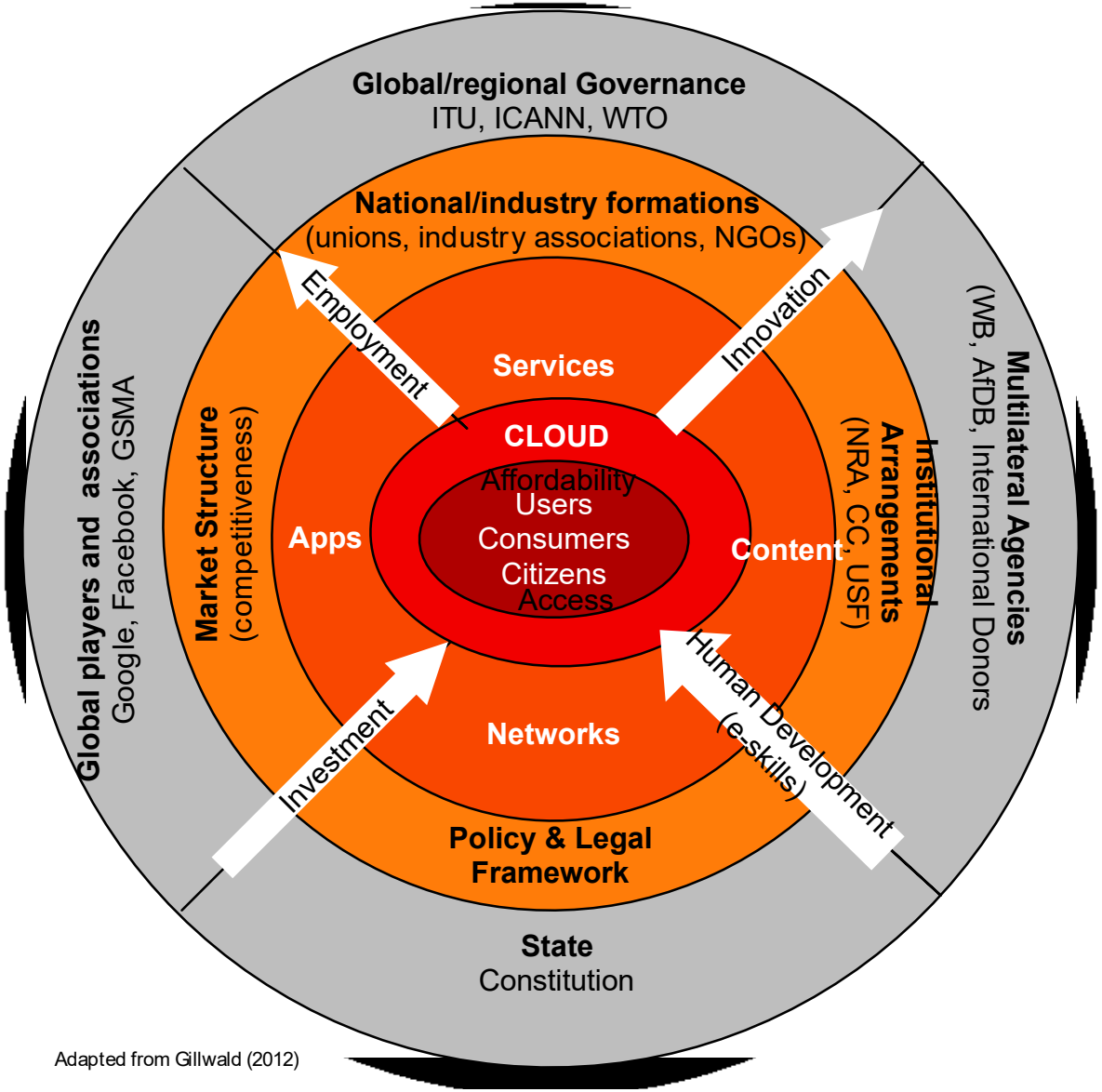
# Session 1- Enabling a Digital Economy in Africa

# We could discuss…

- Changing landscape
- ICT underpinning SDGs
- From national sector silos to ICT ecosystem
- From static efficiency, competition to dynamic efficiency,regulation
- Potential of new technologies – IOT, AI, Blockchain, big data
- Preconditions?
- Where are we?
- What is to be done? And not done…

# …The ICT ecosystem

Internet as a global distribution network, stimulated by convergence between media, telecommunications and IT, facilitated the provision of content (audio visual) over converged IP networks, across multiple devices, with layers of governance at the international, regional and national level.




Adapted from Gillwald (2012)

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# 7 ICT indicators, 6 targets under SDG Goals 4, 5, 9,17

## Most African countries don't have baselines to know progress towards ICT targets

- Target 4a: Proportion of schools with access to the Internet for pedagogical purposes
- Target 4a: Proportion of schools with access to computers for pedagogical purposes
- Target 4.4: Proportion of youth/adults with ICT skills, by type of skills
- Target 5b: Proportion of individuals who own a mobile telephone, by sex (ITU)
- Target 9c: Percentage of the population covered by a mobile network, broken down by technology (ITU)
- Target 17.6: Fixed Internet broadband subscriptions, broken down by speed (ITU)
- Target 17.8: Proportion of individuals using the Internet (ITU)




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# Key technologies?

Do technologies associated with "4th industrial revolution" have development potential? Deployment for government services and information.

- **IoT** - is a network of devices and other entities that primarily deals with the receiving and sharing of data in order to perform its automated tasks
- **Artificial intelligence** –area of computer science dedicated to creating software that can be taught to perform complex procedures by learning new behaviours. **Machine learning** – software trained using the large datasets that are now available thanks to the "**big data**" analytics.
- **Blockchain** – designed as a digital ledger to record all transactions taking place among cryptocurrency users. distributed nature of the technology coupled with a new form of decentralized trust and distributed consensus have potential for development.

# Artificial Intelligence

- policies and regulations;
- inclusive and ethical AI applications;
- infrastructure and skills
- exacerbate existing problems, reinforce structural inequalities, and superimpose biases.

# Artificial Intelligence

## Deployment for government services and information

- maximize social returns while minimizing financial cost
- automated access in multiple languages and dialects,
- high-level decision-making could be enhanced by automating complex assessments that incorporate a range of technical, organizational, and social factors
- *See Smith M & Neupane, S (2018) Artificial intelligence and human development, IDRC*

# AI

## Potential for AI to increase inequality and generate economic disruption, social unrest, and even political instability in the developing world

**Exacerbating societal biases**

- societal biases and assumptions held by designers or in the datasets on which core algorithms are trained can systematically produce results that disadvantage particular (marginalised) individuals and groups

**Threatening privacy**

- Enable the capacity for surveillance, and thereby threaten privacy.

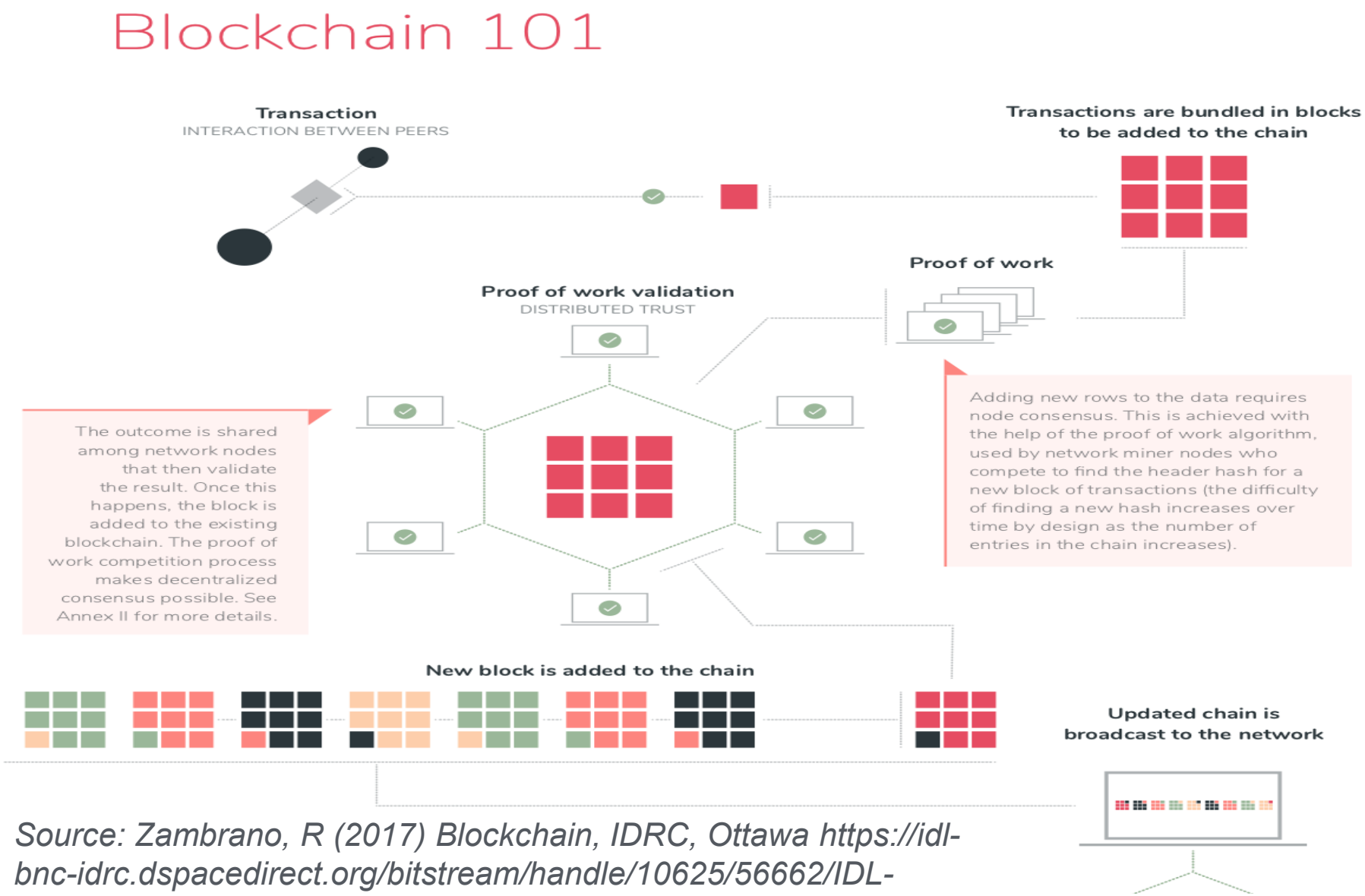
**Loss of jobs**

- Estimates of the extent of job losses due to automation vary greatly, but it is expected that the pace of change will be rapid, giving societies and governments limited time to adjust

**Fake news and misinformation**

- Reliance on online sources of information, misinformation growing threat to stability and democracy. AI applications can facilitate and automate far-reaching propaganda and behavioural manipulation campaigns.

# What is blockchain?




*Source: Zambrano, R (2017) Blockchain, IDRC, Ottawa https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/56662/IDL-56662.pdf*

## Main actors

**Core developers** have write access to the source code.

**Full nodes** have up-to-date copies of the blockchain, validate new blocks and propagate them across the network.

**Miners** are dedicated to running proof of work.

**End users** use the network to do their transactions by using client or wallet software.

**Service nodes** such as wallets, storage, exchanges, and cloud services.

## P2P Technology

In a peer-to-peer network all interconnected nodes are in principle equal. No central server exists, therefore no central point of failure. If one node goes down, all others remain interconnected - and data and information flowing through the network is preserved. Examples: BitTorrent and Napster.

## Cryptography

Blockchain uses public key cryptography: a private key known only to its owner and a public key which is shared with the world. A private key is first generated in random fashion, and is then used to create a public key. The private key is used to encrypt the transaction which can then be decrypted by the intended recipient using the sender's public key. It is mathematically impossible to use a public key to decipher a private one.

# MAIN REQUIREMENTS FOR BLOCKCHAIN

## Infrastructure & infostructure

The blockchain ecosystem requires infrastructure - from telecommunications to the electrical grid, to health and education - all of which need both private and public investments. But it also requires infostructure - such as public key infrastructure, which includes the roles, policies and procedures needed to secure the electronic transfer of information. This kind of infrastructure is often not yet in place in many developing countries.

## Capacity development

Countries require human capacity to develop and deploy new technologies - not only technical capacities but also cross-cutting functional capacities that go beyond ICTs. Users need to be able to manage their private keys and safely store them, which could prove demanding for populations with low levels of education and literacy.

## Policy & regulation

The capacity of government at all levels to develop, implement, and enforce policies within the territory under their control is key. Agile policy environments can facilitate the use of technologies and enable countries to become places where pilots and prototypes are deployed, enhancing expertise and competitive advantage on a global scale.

## Institutions

This includes the 'rules of game' that allow people to undertake activities within a given institutional context. Governance mechanisms are part of this, especially new models based on multi-stakeholder engagement. Blockchain can help improve or support better state institutions, facilitating state decentralization which is a core development issue.

*Source: Zambrano, R (2017) Blockchain, IDRC, Ottawa https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/56662/IDL-56662.pdf*

# Government deployment

- policy and regulation of cryptocurrencies is also becoming increasingly important
- governments to deploy the technology at the state level.
- an issue largely ignored is potential of blockchain technologies to support and enhance the devolution of government within nation-states.
- opportunity for blockchain technologies to support local governments, which usually have limited access to fiscal and human resources.

## Blockchain for Development 101

POTENTIAL AND CURRENT USES OF BLOCKCHAIN

| Public or government services | Private sector services |
|---|---|
| Landtitles | Rebittances |
| Identity services | Agriculture |
| Anti corruption | Food security |
| Electoral processes | Intellectual property rights |
| Aid distribuition and development | |

*See: Zambrano, R (2017) Blockchain, IDRC, Ottawa https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/56662/IDL-56662.pdf*

# Key traits

- **Privacy:** stores no personal information and uses private/ public encryption to authenticate users undertaking transactions -mining personal information for sale to third parties not feasible.
- **Pseudo-anonymity:** Nodes and users do not need to provide names or personal details to be part of the network but no anonymity as linking users to network activity is feasible and can thus lead to revealing their identities
- **Integrity:** d*ata integrity*: virtually impossible to change blockchain blocks. *User integrity*: metadata about the transactions undertaken by a node and/or end user are recorded on the blockchain and can be linked to the user undertaking them - users cannot fool the network.
- **Distributed trust, governance:** successfully bypasses the need for a trusted central authority - trust is spread across the network.
- **Transparency:** All blockchain metadata and information is available to all nodes and users in real-time. It is not possible to hide or redact blockchain information.
- **Security:** Use of blockchains requires cryptographic tools and public/private keys by all participants, being nodes or end users.
- **Sustainability:** Built-in economic incentives provide a clear path for network economic sustainability.
- **Open source:** Software freely available to all, including cryptographic tools - innovations.

# Challenges

Economic, social, civic potential but ready for deployment?

- **Scalability:** blockchain can only add a new block of transactions every ten minutes
- **Block size:** defined by source code, one megabyte which can accommodate 2,200 transactions.
- **High costs:** even though in theory all nodes have the software required to mine the network, only certain nodes in the network can effectively compete in mining nodes.
- **Centralization:** Mining is now centralized with a few nodes controlling a large share of the market
- **Environmental impact:** energy consumption equivalent to 280,000 US households per year.
- **Bandwidth: f**ull nodes that want to be active in the network must have access to the right Internet bandwidth.
- **Usability:** Blockchain technology requires the secure management of public and private keys by end users and nodes - existing solutions are resistant to physical theft and only a few can protect users from malware.

*See Zambrano, R (2017) Blockchain, IDRC, Ottawa https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/56662/IDL-56662.pdf*

# Governance

Who is in charge, who drafts smart contracts (algorithmic transactions that execute pre-defined contractual agreements), and how can all voices be included?

- No one is in charge as, by default, no need for this exists – and everyone is in charge as governance happens by consensus only. Such consensus is based on algorithms that allow users and nodes to almost automatically agree on the outcomes of the process
- **Software coders:** Who does the actual coding? How were they selected?
- **Code comprehension:** While the code is open source, end users must have the capabilities of reading and understanding the code. Most do not so they require intermediaries to do so.
- **Trust vs. governance:** Decentralized and depersonalized trust does not imply enhanced governance. Inequality within a decentralized network (coders, developers, entrepreneurs, hierarchies of users) is thus feasible and real.
- *See Zambrano, R (2017) Blockchain, IDRC, Ottawa https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/56662/IDL-56662.pdf*

# Issues from emerging markets

## Challenges

- Critical skills and infrastructure
- Cross industry collaboration
- Capacity to absorb technologies
- Foreign direct investment

## Opportunities

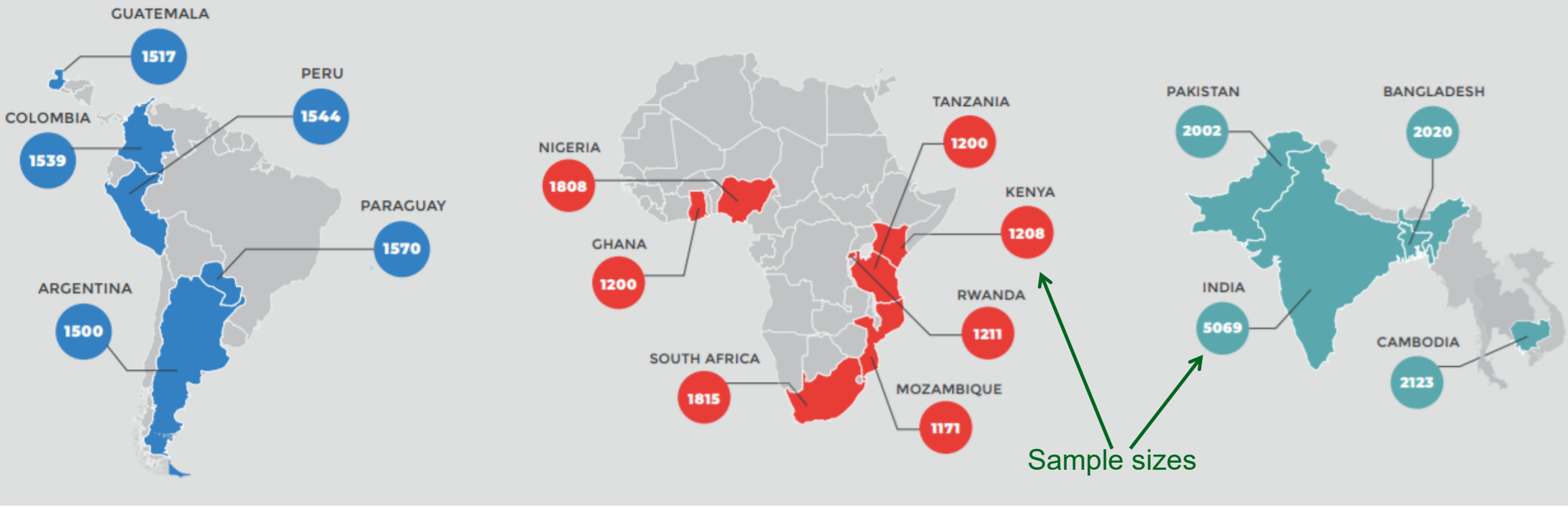
- Demographic dividends
- Population size
- Cheap labour (undermined by automation and increased productivity)

# Pre-conditions to adoption

- **Regulation** – institutions – enabling environment for investment/sector development/new technologies and safe and trusted environment for users
  - **infostructure**, or public key infrastructure - the roles, policies and procedures needed to secure the electronic transfer of information, secure the electronic transfer of information - necessary to use cryptographic tools
- **Supply side** – infrastructure (public and private provisioning)
- **Demand side** – users/citizens - knowledge and skills (human development)
  - **capacity development** -use of these multifaceted, complex tools and management of end user private and public keys eg. Blockchain technology wallets and client software facilitate public key cryptography but users need to manage their private keys and safely store them somewhere.
- **Critical mass** to enjoy networks effects associated with economic growth – improved information flows, reduction in transaction costs, productivity gains

# Where are we?

**Nationally representative surveys of ICT access and use by households & individuals aged 15-65; In 16 developing countries; Data represents 30% of the global population; 28,900 face-to-face interviews; +/-3 margin of error**



# Mobile phone ownership, Internet use tracks GNI per capita

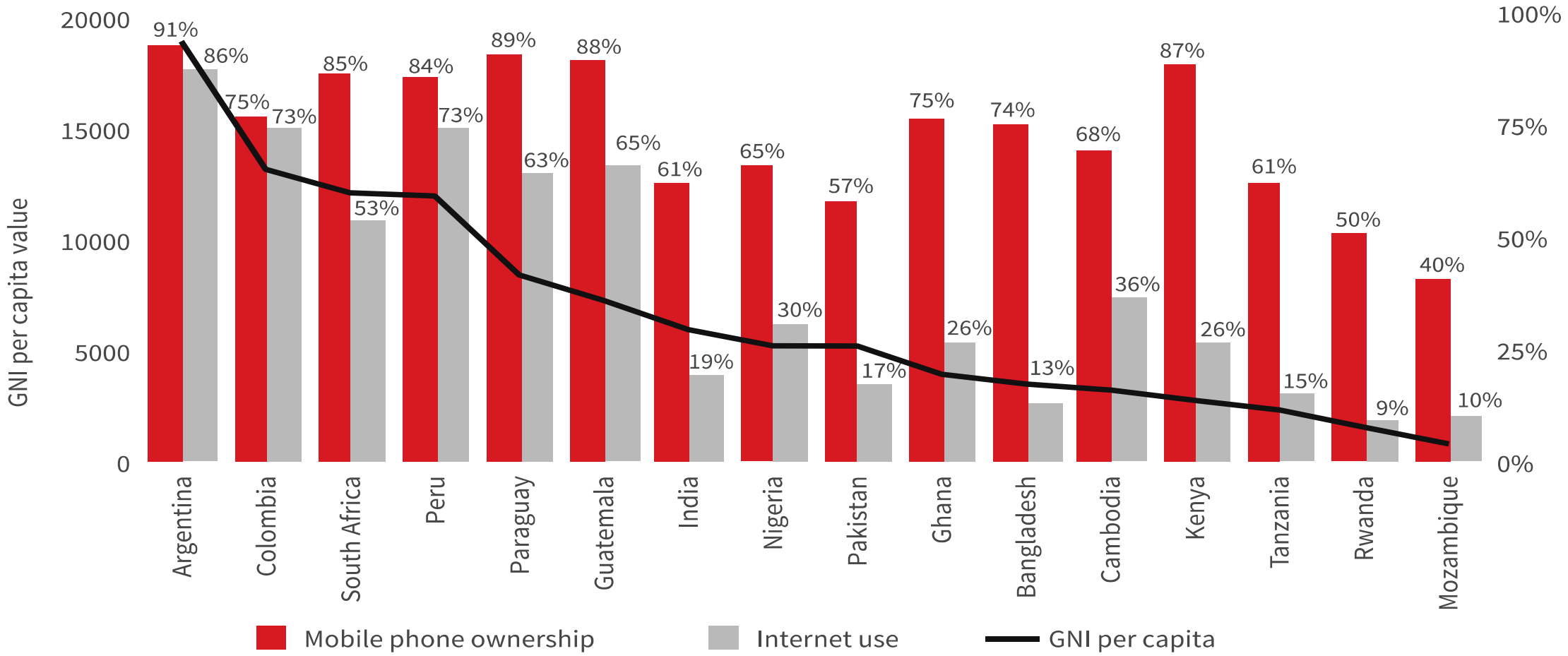



**Figure 1:** Mobile phone ownership, Internet use and GNI per capita

*Sources: RIA After Access Survey, 2017; World Bank, 2018*

# Reasons for not using the Internet

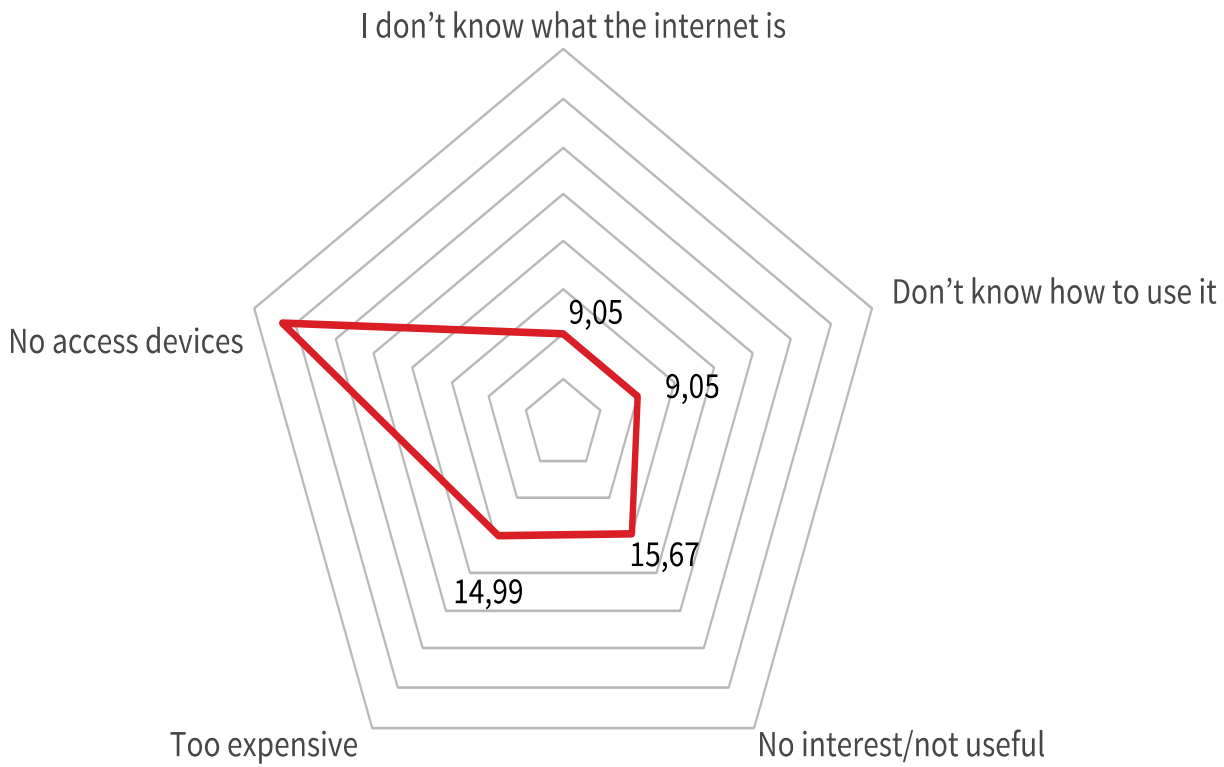



**Figure 25:** Reasons for not using the Internet

*Source: RIA After Access Survey data, 2017*

- Cost of device greatest barrier to getting online
- Using services optimally, data prices (even in countries where low.

# Financial inclusion

## Transition from voice to data supported by other revenue streams such as mobile money

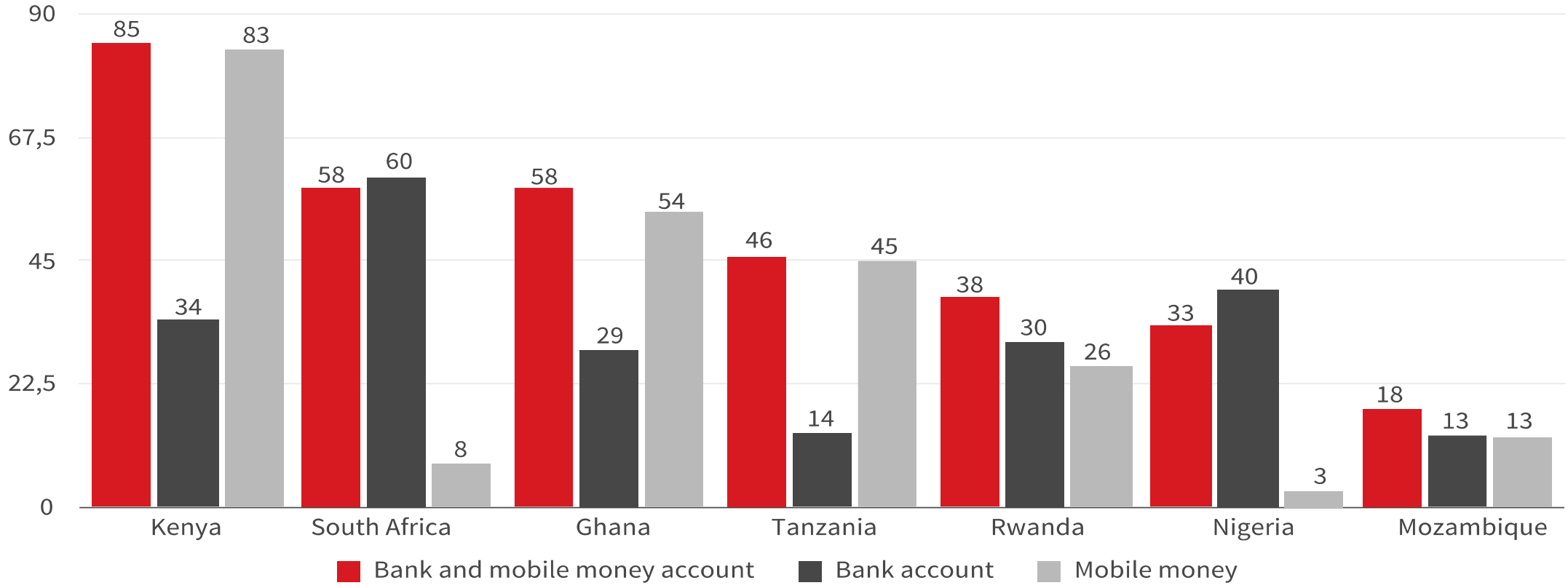
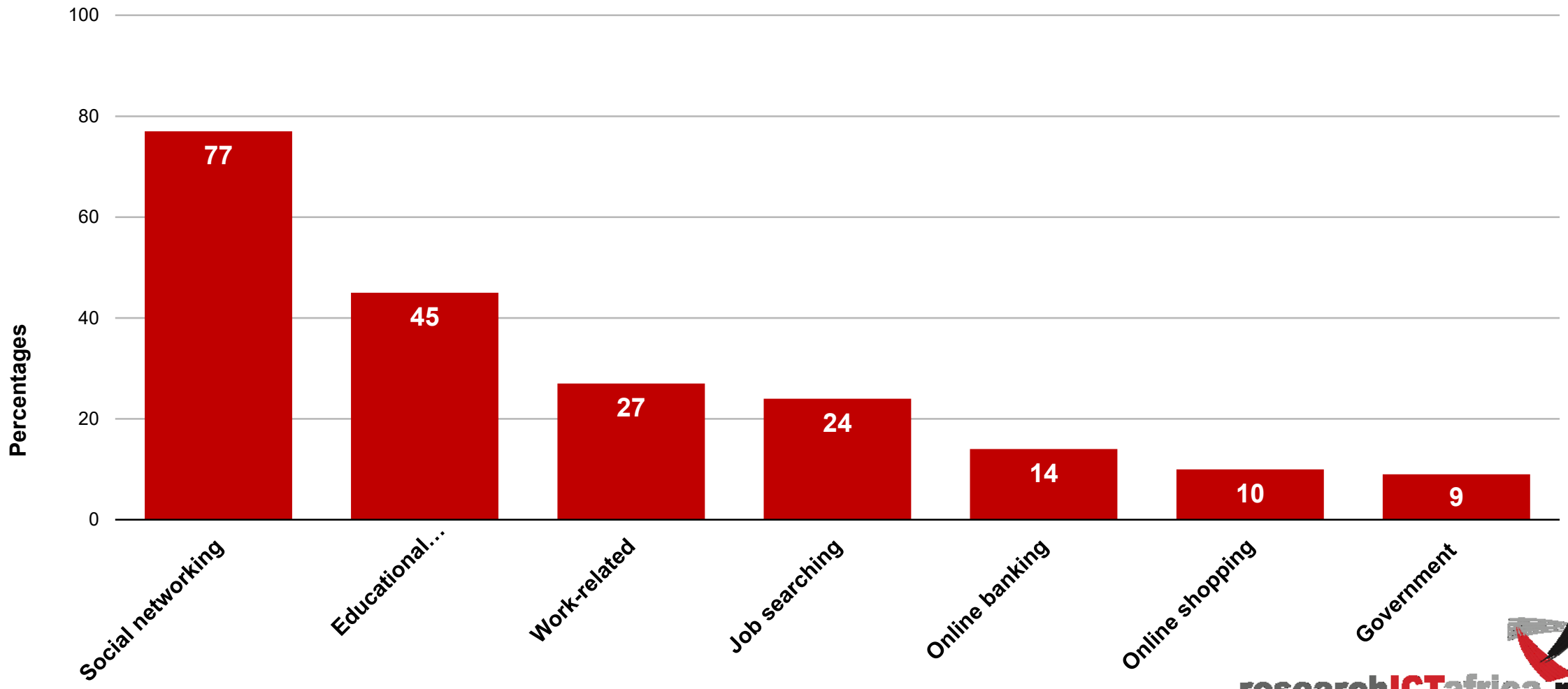



**Figure 26:** Account ownership in seven African countries

*Source: RIA After Access Survey data, 2017*

# Use of Internet for…

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# Very few Internet users doing platform work

## In Africa mostly database outsourcing of manual labour

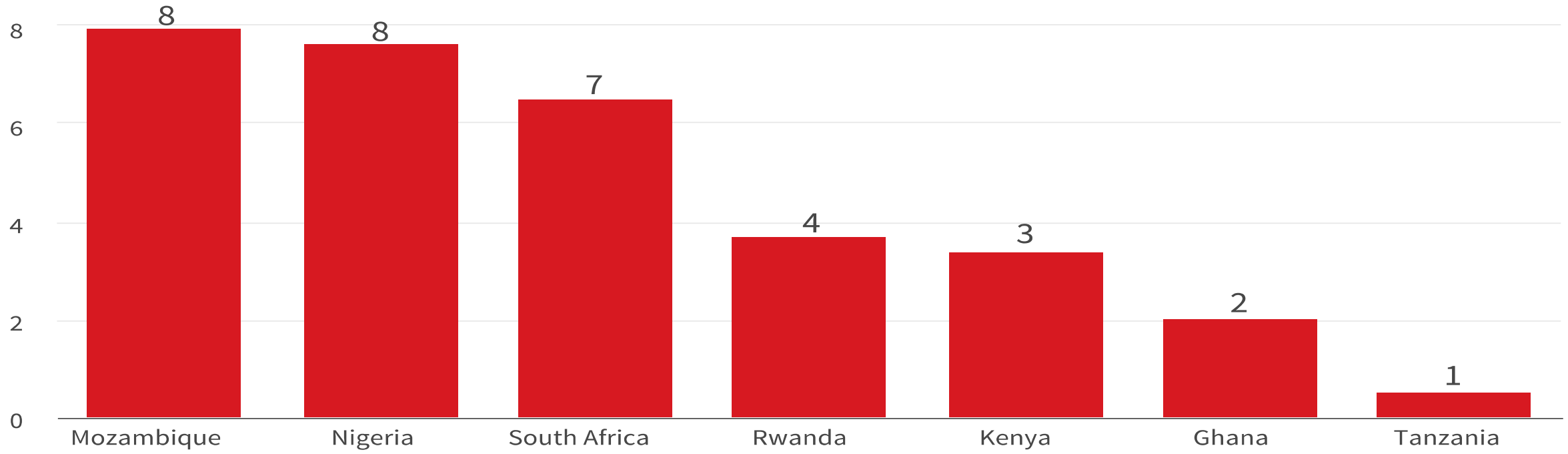
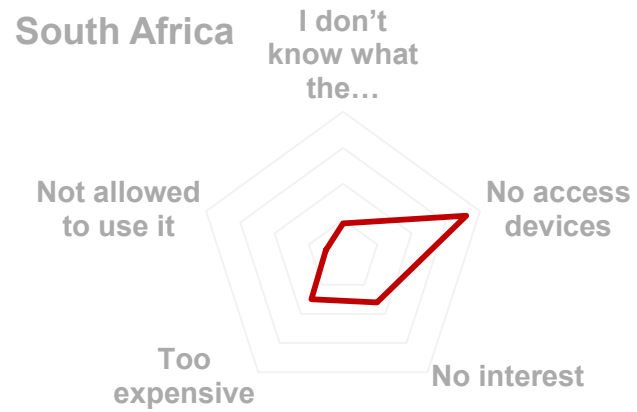


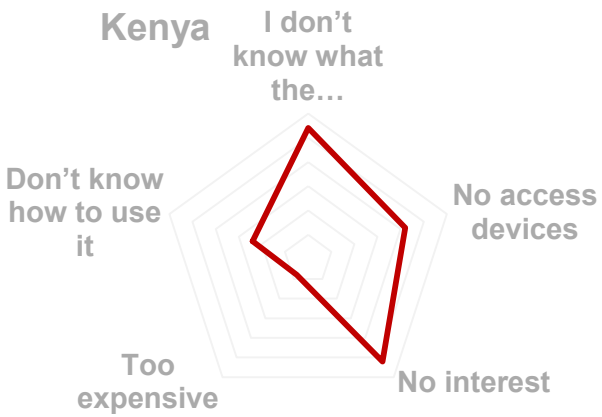

**Figure 27:** Proportion of Internet users engaged in microwork across countries

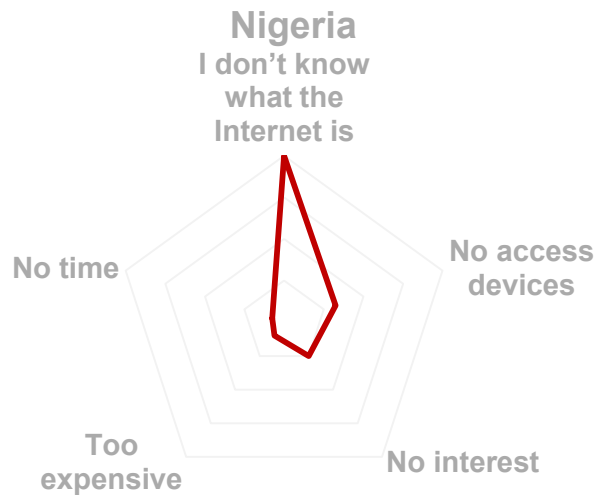
*Source: RIA After Access Survey data, 2017*

# Reason for not using the Internet



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# RIA African Mobile Pricing Index – 1G

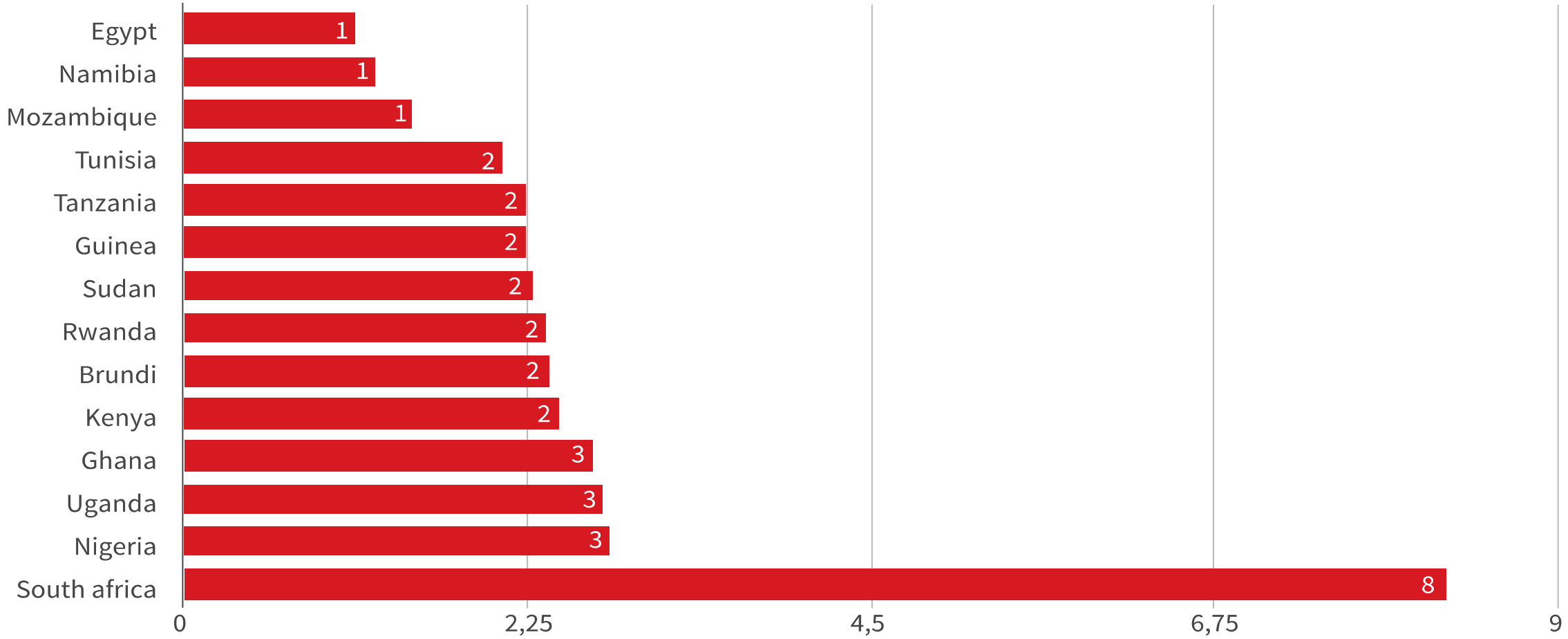
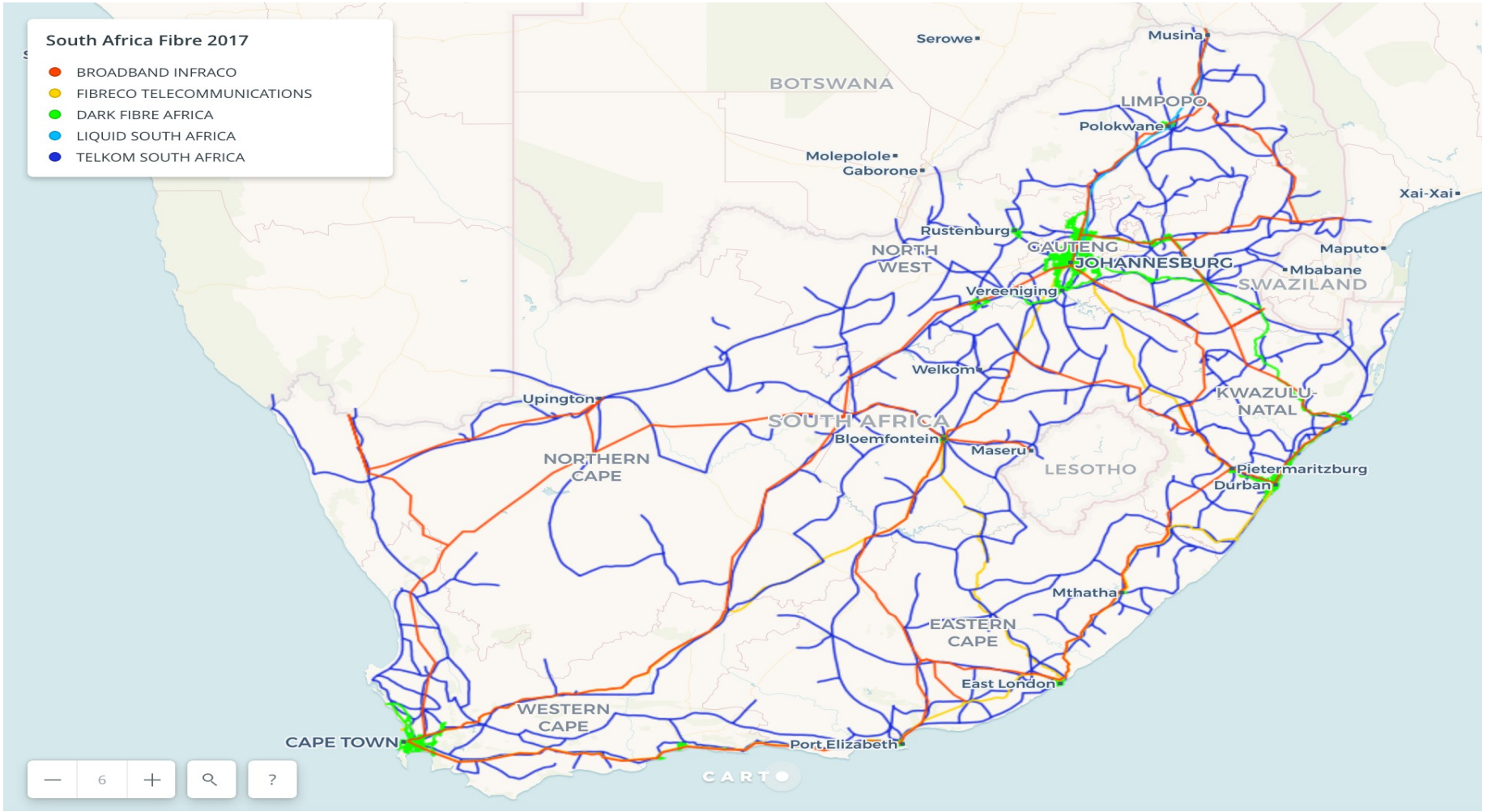


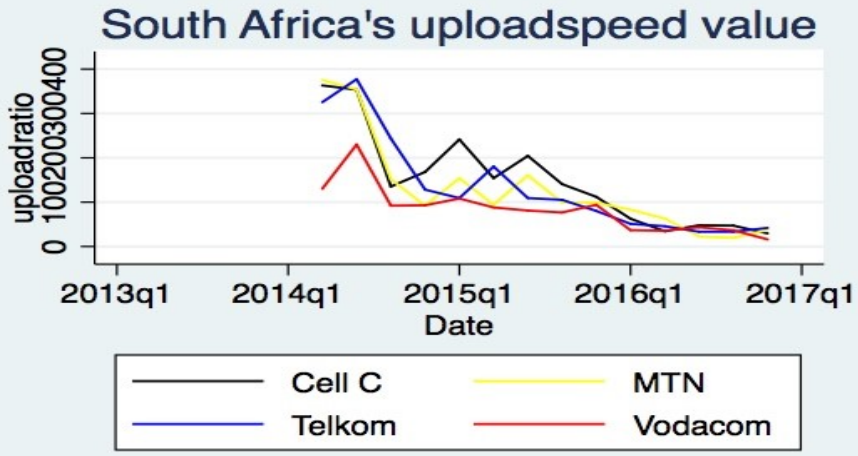

**Figure 8:** SA's cheapest prepaid mobile 1GB baskets compared to Africa's top performers (USD)
*Source: RAMP Index, 2018*

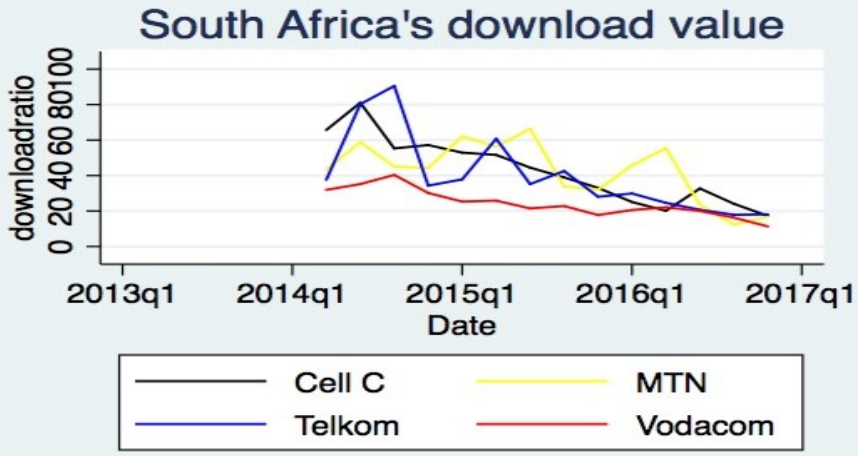
# But better …coverage

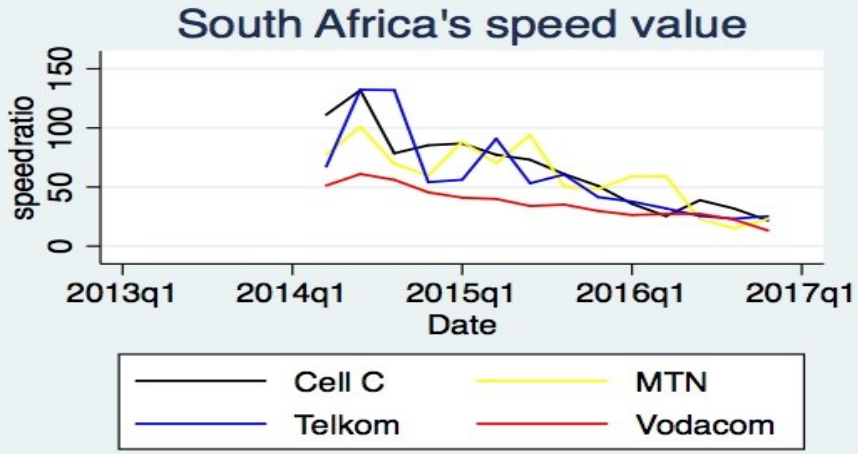



Map shows five major operators: Broadband Infraco SOC Limited, FibreCO Telecommunications, Dark Fibre Africa, Liquid South Africa and Telkom South Africa. From the map, Telkom South Africa has the most comprehensive fibre coverage, reaching most parts of the country, while other operators like Dark Fibre Africa only provide services in major towns/cities.

# Quality adjusted prices, quality matters when assessing data market



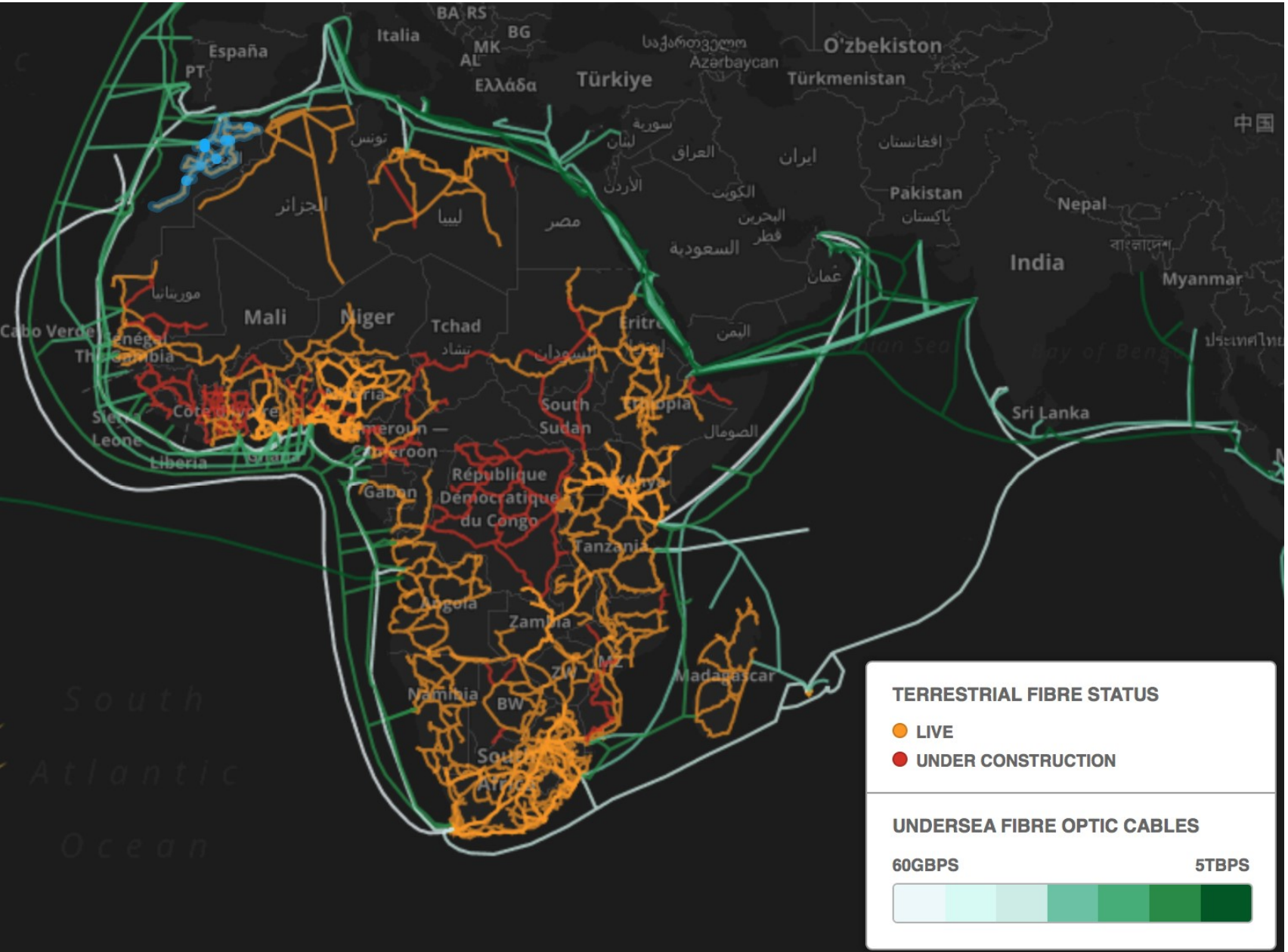




Represents the ratio between the 1GB data basket and the average download and upload speeds, shows that the two dominant operators Vodacom and MTN offer higher quality, respectively.

In the same period Telkom's quality was the lowest. However, since Q1 2016, it seems that smaller operators improved their quality, catching up with dominant operators in Q2 2016 (in line with increased network investments). Vodacom SA's high prices are accompanied by higher Internet speeds, compared to MTN SA and Cell C, which are performing less well on the measure based on average download/upload speed (in Mbps) divided by 1GB basket costs.

# Expanding undersea / terrestrial bandwidth…

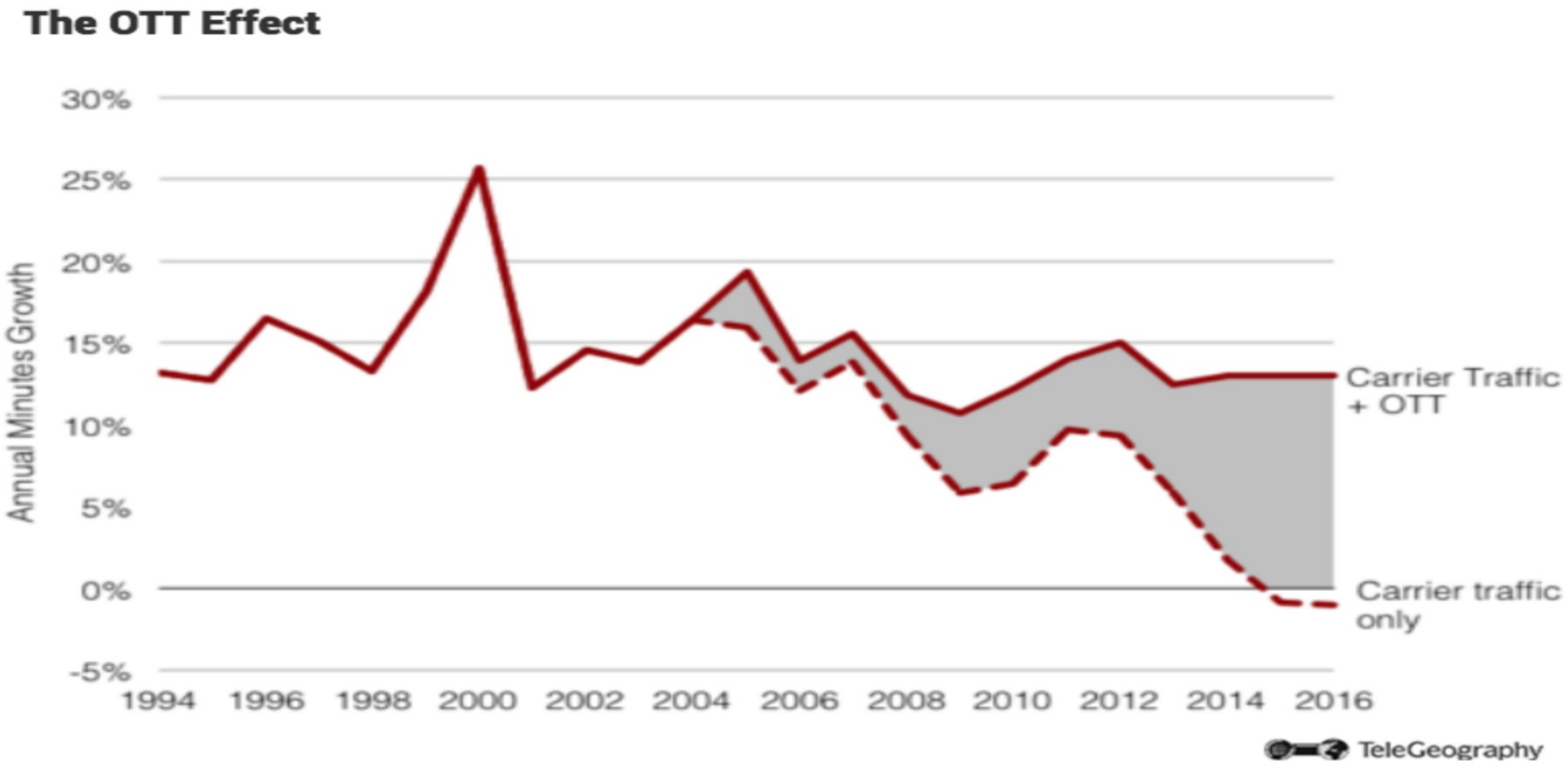



Even in countries where there is over 50% 3G coverage, less than 20% critical mass connected to enjoy network effects – demand challenges greater than supply side.

# Changed market conditions

- saturated voice markets shifting to data
- introduction of low-end smart phone driving data
- declining revenue from traditional services
- operators face becoming ‘dumb pipes’
- multiple new business models emerging from data competition to retain and attract new customers
- zero-rated services, social media bundles, blended bundles, build-your-own-bundle.
- multiple user strategies to access and use Internet – substituted voice and text data services, public wi-fi for updates, U-tube.
- More users, more devices, more services, more demand

# OTT impact of international voice traffic



# Operators responses

Operators retreat and block fail, those that strategically embrace OTTs succeed

- Tried to block or throttle traffic
- Higher data/additional charge to use OTT
- Many operators in Africa block VOIP, Skype, Viber
- Faced consumer resistance and loss to other operators allowing or encouraging use
- In response to decline in ARPUs an traditional revenues providing prepaid products that resemble flat rate pricing and are set on necessary return on investment.
- Zero rated OTTs used to gain market share for new entrants or defend market share against new entrants

# Net neutrality/Zero rating

- Zero Rating plans enable mobile wireless customers to download and upload online content without incurring data usage charges or having their usage counted against data usage limits.
- Number of studies (Layton & Calderwood 2015, Nera 2015) demonstrating that Zero Rating an economically efficient mechanism for increasing consumer welfare
- given unique characteristics of information technology markets, which make it beneficial to offer lower prices and other incentives to expand the size of the market, especially in developing countries where incomes, and market penetration, are low.
- broad-based bans or restrictions on Zero Rating plans are far more likely to harm consumer welfare than improve it(NERA)

# ZR – competition enhancing for MVNO market

- inconsistent that zero rating is rampant across Internet applications and services (e.g. advertising supported games, search, social networks, music streaming etc) but arbitrarily prohibited on mobile broadband services.
- campaigns against zero rating are waged as a way to pressure mobile operators to change their pricing in favor of users who consume high volume video and against those users who have never used the Internet but need an incentive to try.
- Inverted competition argument: Access to WhatsApp is free then it effectively harms other competitors because to access to them must be paid

# What evidence is there of harm?

- a number of marketing techniques that mobile operators need to employ in competitive marketplace and have done for decades.
- ZR is the result of the operator's competitive situation …operators don't deploy zero rating because they can, but because they must.
- Exclusive and non-exclusive products different considerations.
- Wikipedia Zero (non exclusive) tends to be across dominant and competitors.
- Freebasics, primarily Facebook Zero platform that late entrant operator zero rates to distinguish itself and attract customers with the intention of migrating them into data paying customers
- Gateway to open internet (Facebook claims that 50% of zero rated users migrate to paying service, but big data analytics not transparent so difficult to tell.)

# State coordination of objectives: enabling digital economy

## Tragedy of social networking, blogging taxes…

To curb 'gossip' on social media platforms, all Internet subscribers in Uganda are to pay a tax of 200 Ugandan shillings (USD0.05) daily to use social media applications such as Facebook, Twitter, Instagram, WhatsApp and Skype, among others.

- A tax which requires a user to pay USD1.5 per month or USD18.00 per year for daily access of social media apps in addition to the ordinary cost of data.
- All mobile money transactions were intended to be taxed one percent tax but were reviewed down to 0.5%.
- Traditionally secondary and primary tax of 30% on products and services.
- Those who are connected are educated and employed and in a position to monitor, mobilise and critique

- Using Research ICT Africa's Mobile Pricing Index, the cheapest 1GB of data in Uganda is USD2.77.
- Even though this makes Uganda one of the cheapest countries in terms of data products, majority of Ugandans do not use the internet (78%, ITU, 2016).
- Effecting this tax will increase the price of the cheapest data product by a margin of USD1.5 to USD4.27, making it even more unaffordable.
- Furthermore, those who marginally afforded Internet services will be priced out of the market, increasing the percentage of the unconnected.
- Those who are connected are educated and employed and in a position to monitor, mobilise and critique

# Complex adaptive systems/regulation

- ICT ecosystem characterised by exponential technological development and increasing **dependency on connectivity** for positive social and economic national outcomes.
- **Complex adaptive systems** that innovative to circumvent bottlenecks often through disruptive competition
- Need to move from regulation of **static linear value chain** to adaptive, flexible regulation that does not stifle adaptiveness, and innovation.
- Competition regulation (static efficiency) to understanding **dynamic**, complementary relationship between different elements in ICT ecosystem
- Unintended outcomes of **instrumental regulation** for one objective (competition) produce negative outcomes in other (eg. innovation)

# Creating an enabling environment for digital inclusion

- Dependent functional ICT ecosystem as backbone of modern economy needs
- Move policy frame from consumption (users) to production (producers)
- Role of stae to provide enabling environment for optimal use of new technologies/services /local production and innovation (incentives and skills development
- Create conditions for investment and human development necessary for economic growth and job creation
- Retain and stimulate high sunk cost investments through forward looking policy and institutions that enable trusted secure Internet necessary for application and monetisation of innovations

# Recommendations

Current licensing and business model not affordable... Need to new strategies to get Africa online.

- Don’t use evidence and mechanism designed for competitive/mature markets with high income/education uses
- Design institutions and structure markets to meet local resource constrains and conditions.
- Beware of committing to resource-intensive practices with different institutions endowments/markets
- Explore more effective alternative regulatory strategies e.g. Regulatory impact analysis vs. benchmarking, net neutrality vs zero rating, open access vs. private investment.
- More efficient and alternative valuing and allocation of spectrum

# Thank You

## Research made possible



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