



ICT access, use and impacts in the Global South

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17 October 2018
Int'l Conference on ICTs & Rural Development
Bali, Indonesia



LIRNEasia: a pro-poor, pro-market Asia Pacific think tank; focus on infrastructure policy and regulation

- Mission
 - *Catalysing policy change through research to improve people's lives in the emerging Asia Pacific by facilitating their use of hard and soft infrastructures through the use of knowledge, information and technology*
- Past work in Indonesia
 - Benchmarking of local back-haul prices
 - Tele-use at the Base of the Pyramid surveys: ICT access and use by the poorest in society
 - Telecom Sector Performance Review: analysis of telecom sector's performance
 - Telecom Regulatory Environment (TRE) surveys: opinion survey of sector stakeholders on regulatory and policy environment

Countries we engage with

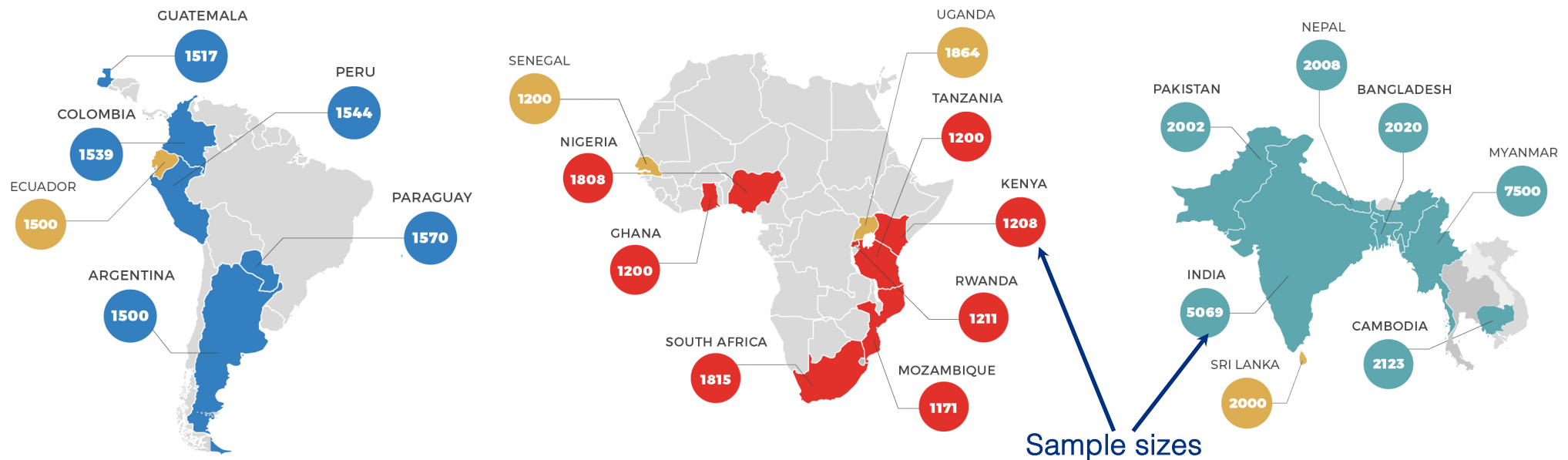


THE STATE OF CONNECTIVITY (OWNERSHIP, USE)

AfterAccess: Nationally representative surveys of ICT access and use by households & individuals aged 15-65 across Global South

- Rigorous sampling method, comparable across countries
- Predominantly common questionnaire with local customization
 - Structured, closed-ended responses administered face-to-face using mobile devices
 - User-based (rather than subscription-based) data allowing for disaggregation by urban-rural, gender, SEC, age, etc..
- Asian countries by LIRNEasia. Africa by Research ICT Africa. Latin America by DIRSI
- Funded by IDRC (Canada), SIDA (Sweden), Ford Foundation
- See detailed Sample Frame and sampling methodology at <https://lirneasia.net/after-access>

To date 18 countries (covering >30% global population); 38,005 face-to-face interviews; +/-3 margin of error; 22 countries by Dec 2018



Not shown in slides today:

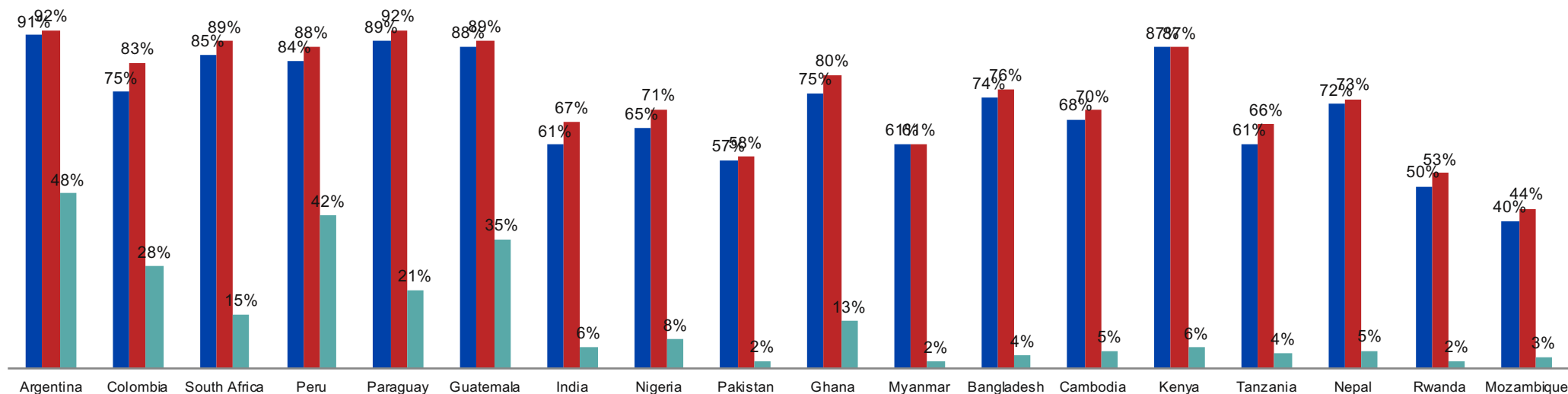
- Sri Lanka, Senegal, Uganda & Ecuador
- Surveys just completed/surveys about to start/data being analyzed
- Watch www.afteraccess.net or www.lirneasia.net

CONNECTIVITY and DEVICE OWNERSHIP

Majority of the 15-65 population in the countries surveyed have a mobile phone + SIM card; Negligible computer ownership

Mobile phone, SIM card & desktop or laptop ownership (% of aged 15-65 population)

■ Mobile phone ■ SIM card ■ Desktop/Laptop



Q1: Do you own a mobile phone?

Q2: How many active SIM cards do you have, (SIM cards that you used in last 30 days)?

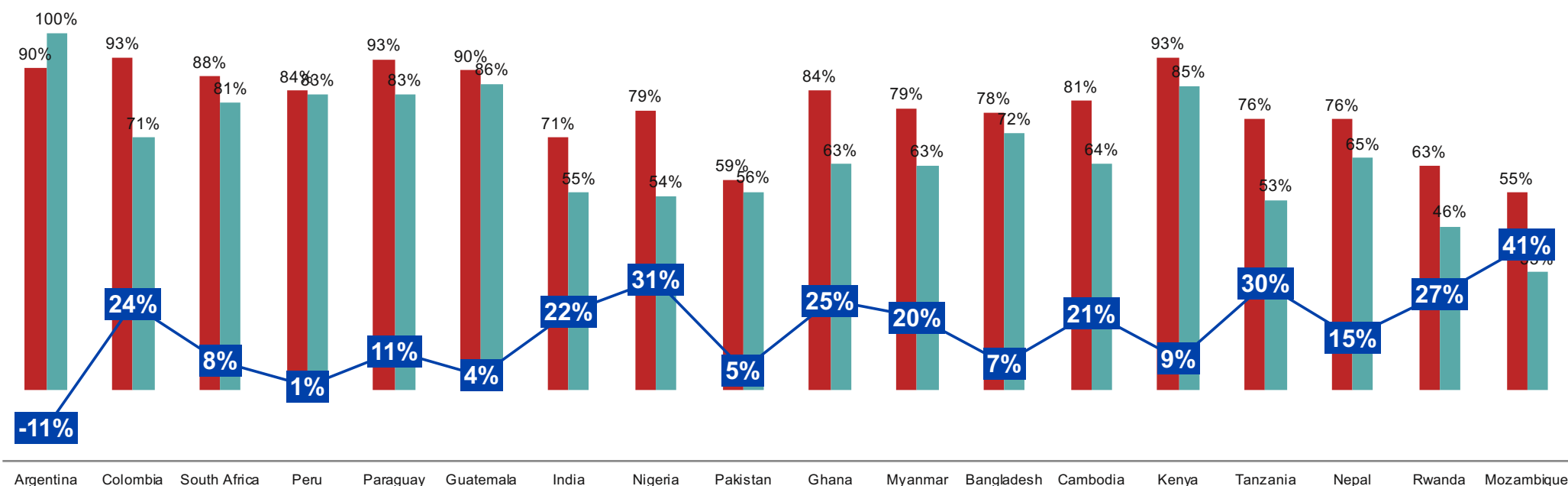
Q3: Do you own a personal Desktop computer or Laptop?

Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Myanmar	Bangladesh	Cambodia	Kenya	Tanzania	Nepal	Rwanda	Mozambique
All respondents	1,240	1,425	1,610	1,478	1,357	1,407	5,069	1,706	2,002	1,145	7,204	2,020	2,123	1,179	1,102	2,008	1,118	1,091

Lower mobile phone ownership among rural dwellers: African performs the worst

Mobile phone ownership (% of aged 15-65 population)

■ Urban ■ Rural ● Gap



$$\text{Urban rural gap in ownership (\%)} = \frac{\text{Urban mobile phone owners (\% of urban population)} - \text{Rural mobile phone owners (\% of rural population)}}{\text{Urban mobile phone owners (\% of urban population)}}$$

Q: Do you own a mobile phone?

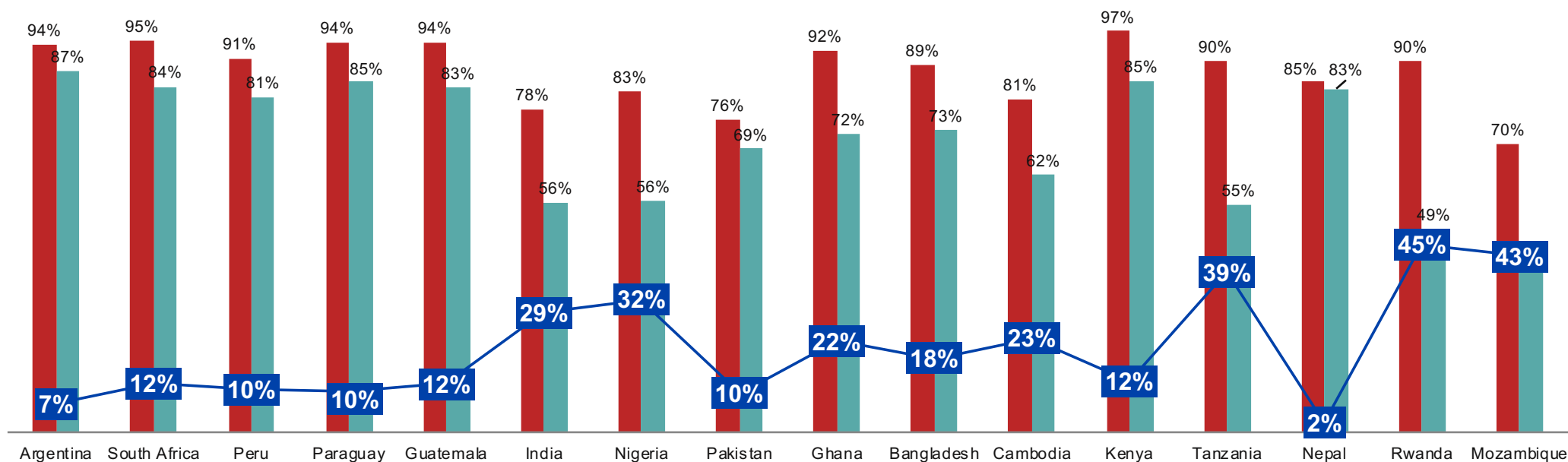
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All respondents	1,208	32*	986	439	1,050	765	1,178	300	824	533	550	857	2,200	2,869	1,147	661	793	1,209	721	479	3,477	3,727	808	1,212	897	1,226	727	481	720	480	940	538	711	500	718	453

Phone ownership between above-average & below-average income earners sometimes very high

Mobile phone ownership (% of aged 15-65 population)

■ Above average income ■ Below average income — Gap

$$\text{Income gap in ownership (\%)} = \frac{\text{Above average income phone owners(\%)} - \text{Below average income phone owners(\%)}}{\text{Above average income phone owners (\%)}}$$



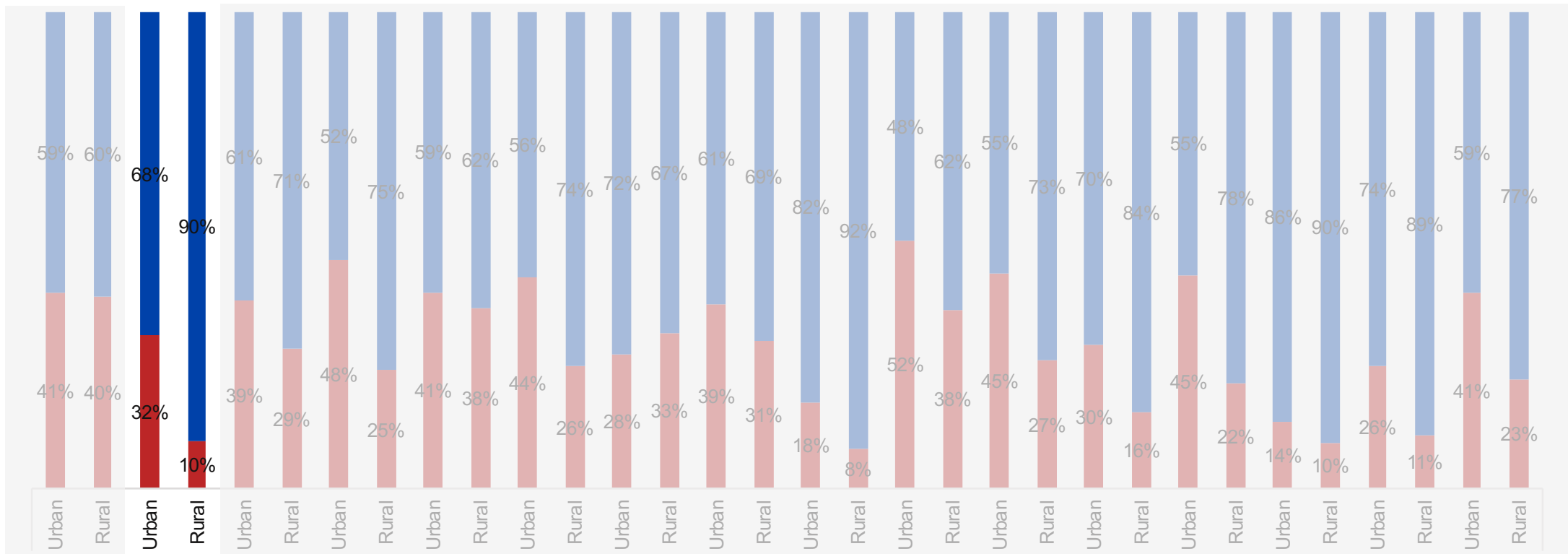
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In rural areas, majority are poor – so a concentration of poverty/lack of affordability. E.g. South Africa

Income level among urban-rural population (% of aged 15-65 population)

■ Above average income ■ Below average income



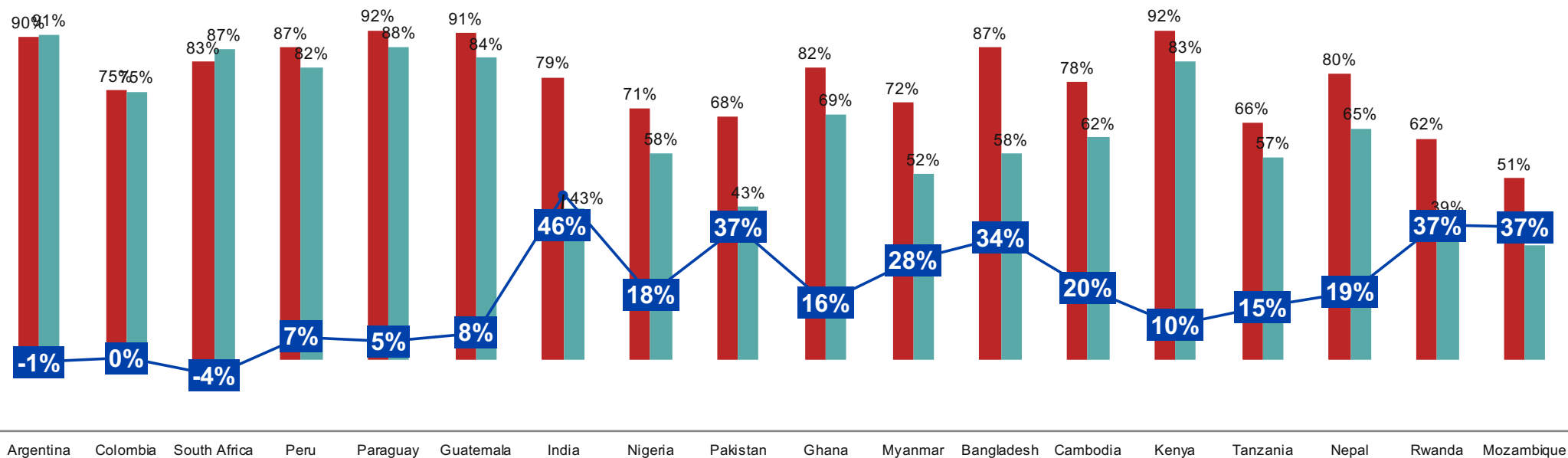
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Gender gap greater than urban-rural gap in Asia. In India, women almost 50% less likely to own a phone compared to men

Mobile phone ownership (% of aged 15-65 population)

Male Female Gap

$$\text{Gender gap in ownership (\%)} = \frac{\text{Male phone owners (\% of male population)} - \text{Female phone owners (\% of female population)}}{\text{Male phone owners (\% of male population)}}$$



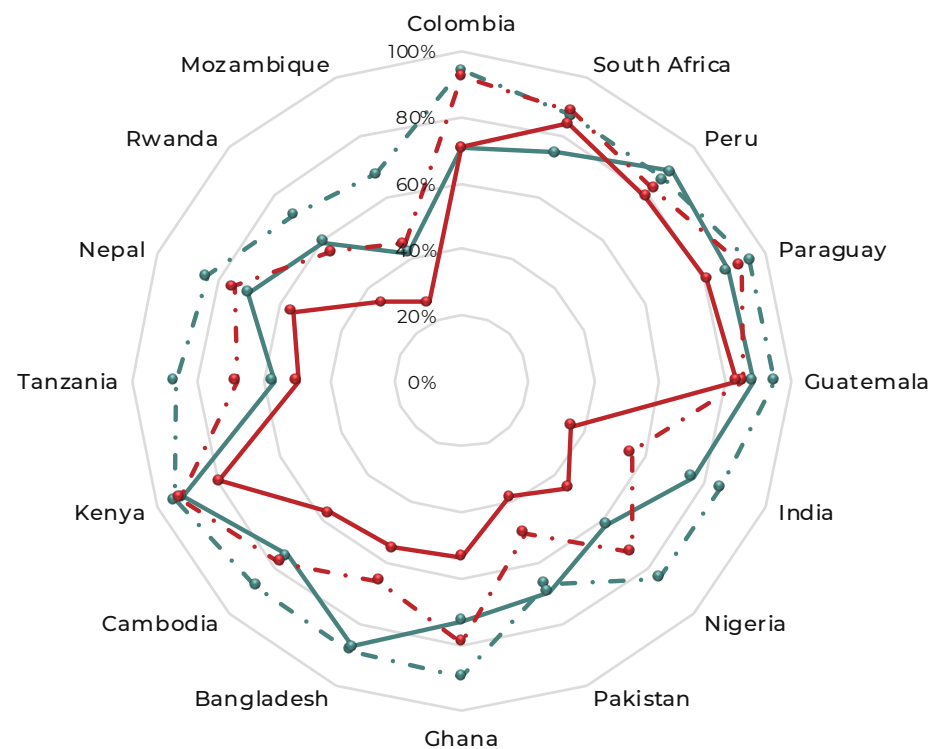
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	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female		
All respondents	478	762	487	938	795	1 020	508	970	879	478	656	751	2 478	2 591	912	896	1 060	942	547	653	3 818	3 386	1 092	928	735	1 388	544	664	531	669	912	1 096	556	655	527	644

Combined marginalization: rural women have lowest level of mobile ownership except in South Africa

Mobile phone ownership (% of aged 15-65 population)

Urban men Rural men Urban women Rural women

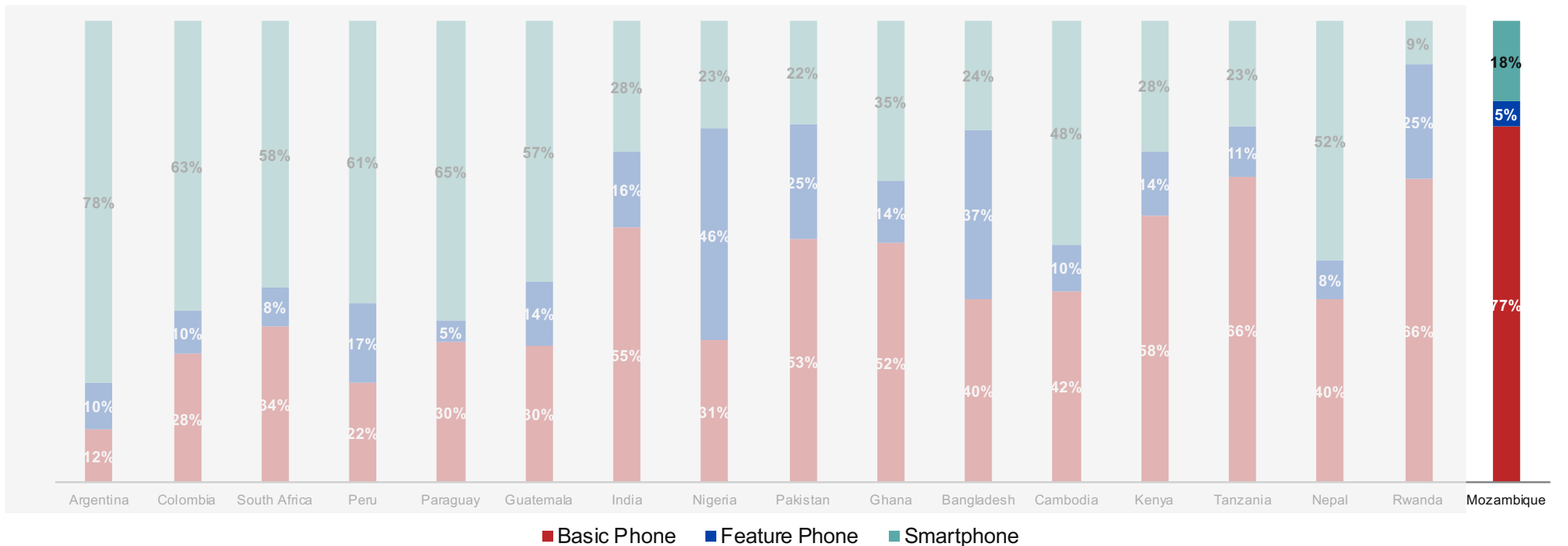


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Basic phones that cannot access Internet still dominate in Asia and Africa.
E.g. 77% of all phones in Mozambique are basic phones

Mobile phone ownership (% of aged 15-65 mobile phone owners)



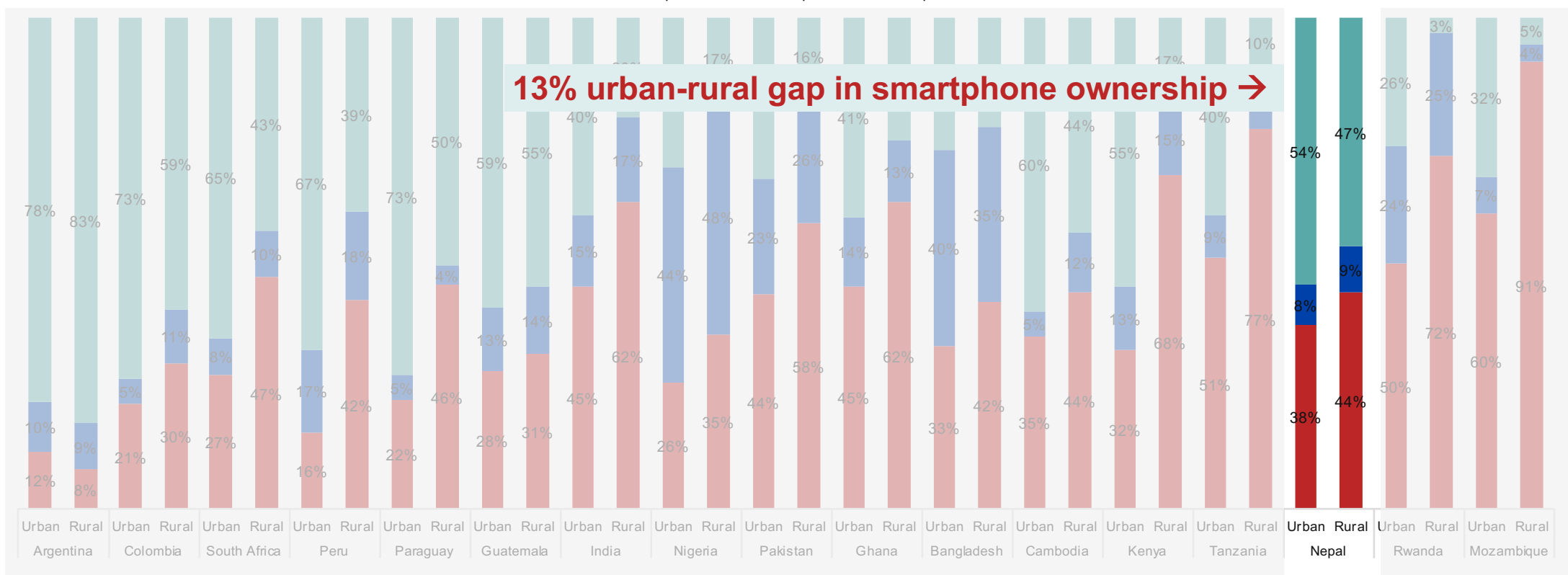
Q: What type of mobile is it?

Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Tanzania	Nepal	Rwanda	Mozambique
Mobile phone owners	1,116	1,297	1,398	1,234	1,209	1,214	3,252	1,123	1,208	901	1,531	1,526	1,054	761	1,478	635	632

Smartphone penetration lower in rural areas: e.g. in Nepal, 54% in urban, 47% in rural → 13% gap

Mobile phone ownership (% of aged 15-65 mobile phone owners)

Basic phone Feature phone Smartphone

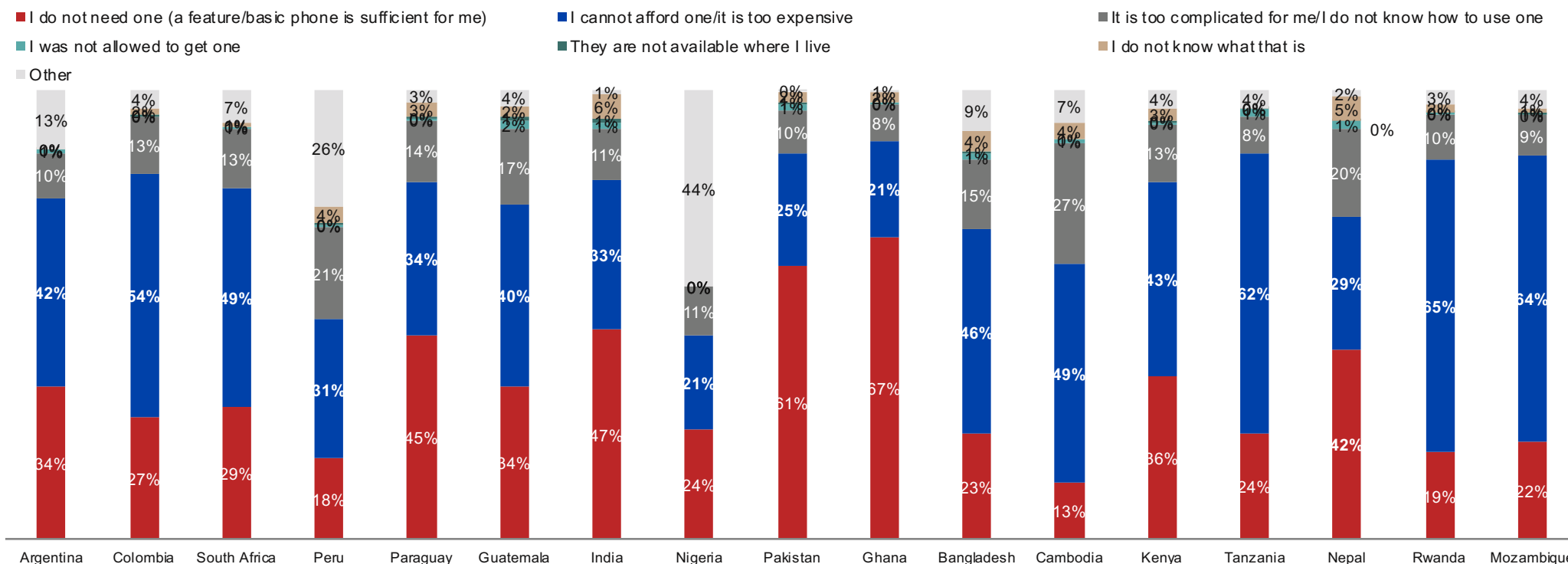


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Inability to afford, lack of need, and not knowing how to use are the two three reasons for not owning a smart phone

Reason for not owning a smartphone (% of aged 15-65 non-smartphone owners)



Q: Please tell me the primary reason why you have chosen not to obtain a smartphone or touch phone handset?

IP-IER

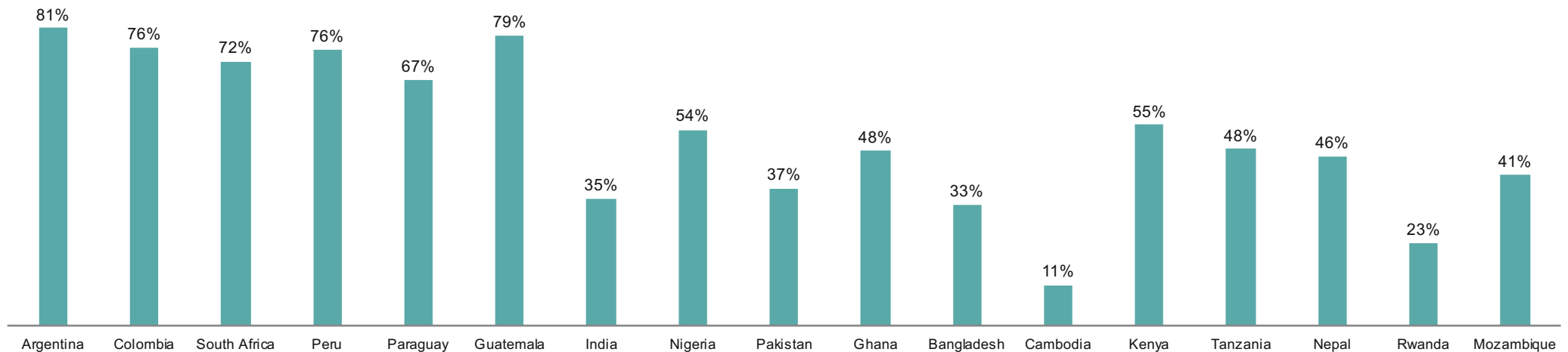
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Non-smartphone owners	246	433	633	476	456	537	2378	20	872	1186	595	780	646	513	701	506	448

“INTERNET” USE

Significant percentage of population 15-65 don't know of/haven't heard of the Internet

Internet awareness (% of aged 15-65 population)

■ Internet awareness



Q: Do you know what the Internet is?

Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Tanzania	Nepal	Rwanda	Mozambique
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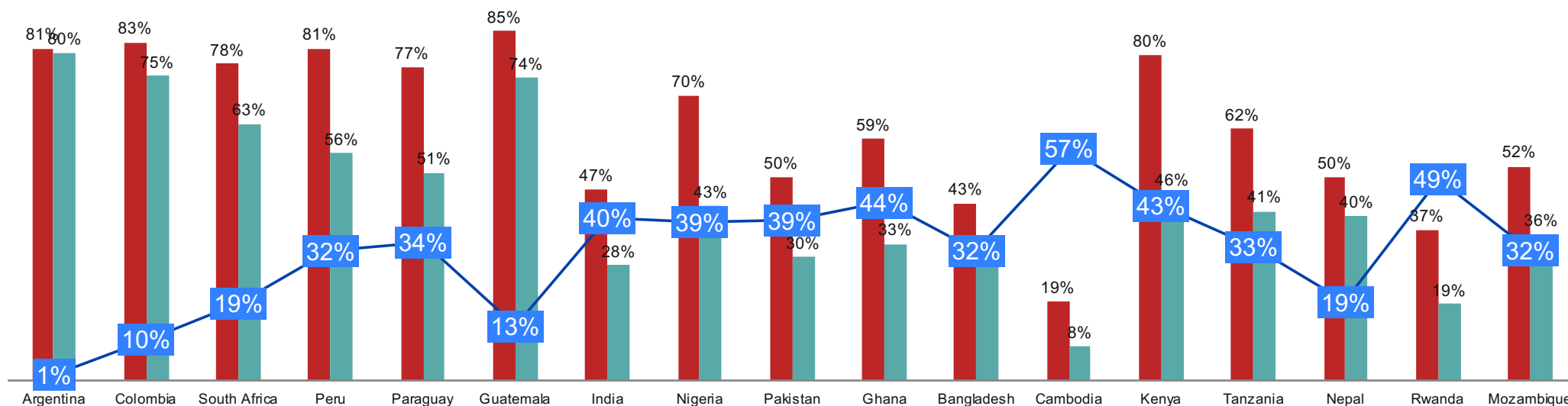
.....and rural dwellers are consistently less aware of the Internet

Internet awareness (% of aged 15-65 population)

Urban Rural Gap

Urban rural gap in Internet awareness (%)

$$\frac{\text{Urban people aware of the Internet (\% of urban population)} - \text{Rural people aware of the Internet (\% of rural population)}}{\text{Urban people aware of the Internet users (\% of urban population)}}$$



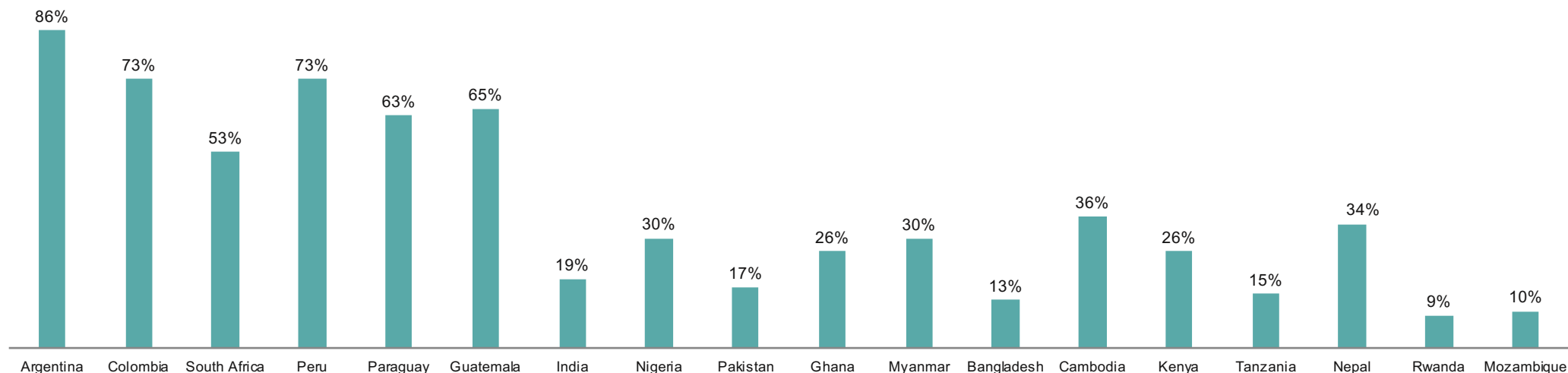
Q1: Do you know what the Internet is?

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Low awareness → low use. South Asia performs worse than many poorer African countries in the study

Internet awareness and use (% of aged 15-65 population)

■ Internet use



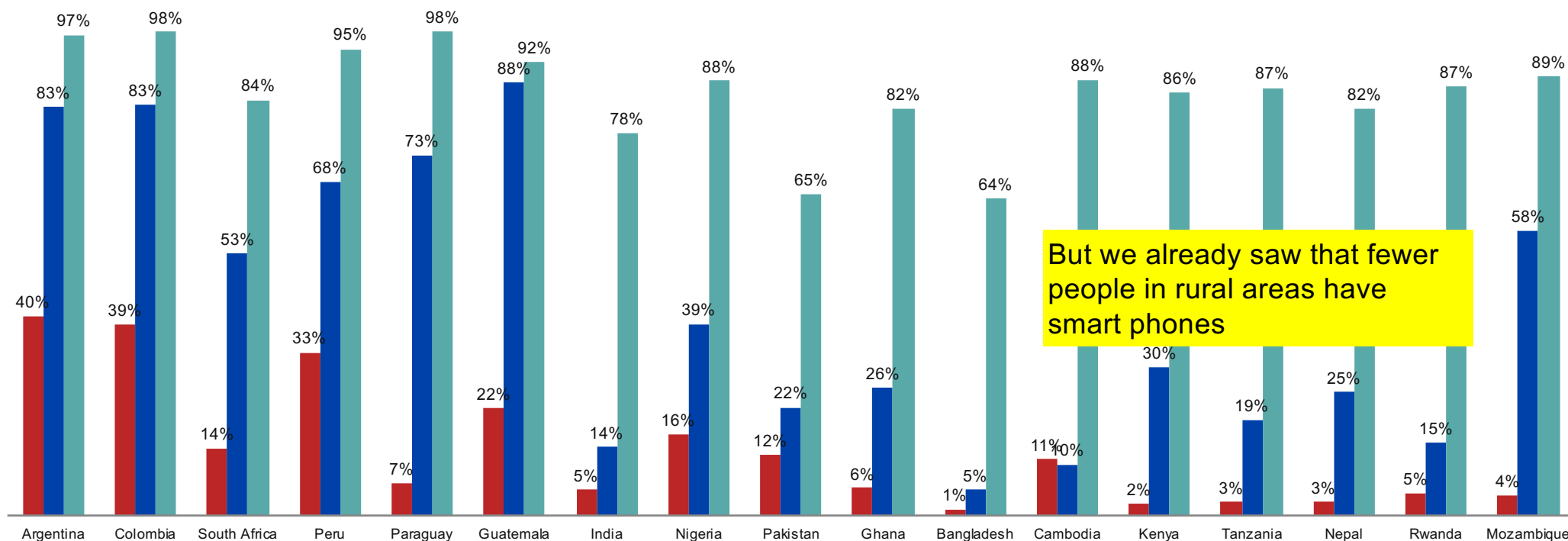
Q: Have you ever used the Internet (Gmail, Google, Facebook, email)?

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Smartphone owners are the highest users of the Internet

Internet usage (% of aged 15-65 mobile phone owners)

■ Basic phone ■ Feature phone ■ Smartphone



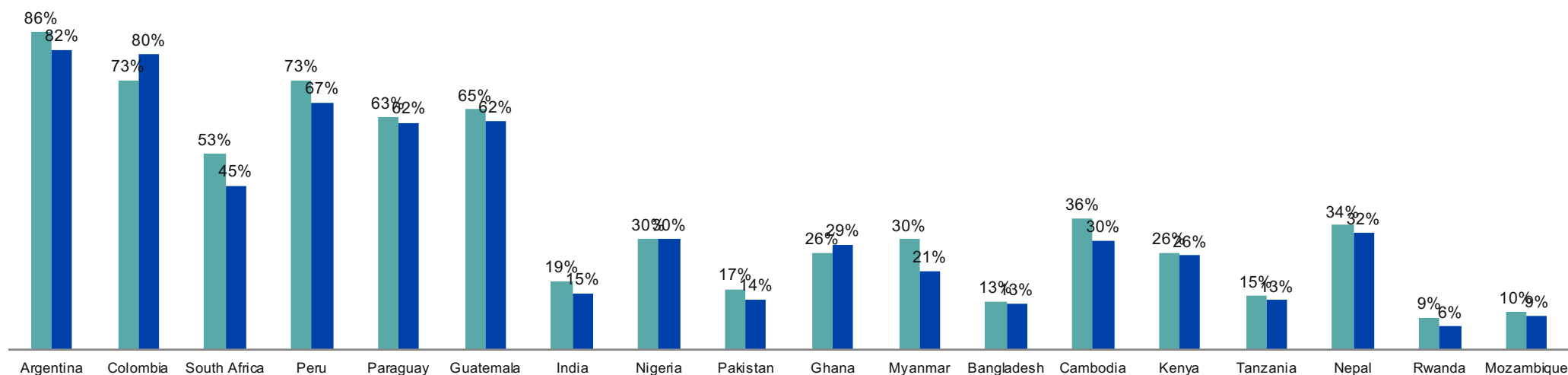
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Internet use ≈ Social media use

Internet and social media use (% of aged 15-65 population)

■ Internet use ■ Social media use



Q1: Have you ever used the Internet (Gmail, Google, Facebook, email)?

Q2: Do you use social media like Facebook, WhatsApp, Twitter etc..?

Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Myanmar	Bangladesh	Cambodia	Kenya	Tanzania	Nepal	Rwanda	Mozambique
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High gender divide in Internet use: e.g. In Bangladesh, women 62% less likely to have used the Internet compared to men

Internet use (% of aged 15-65 population)

■ Male ■ Female ■ Gap

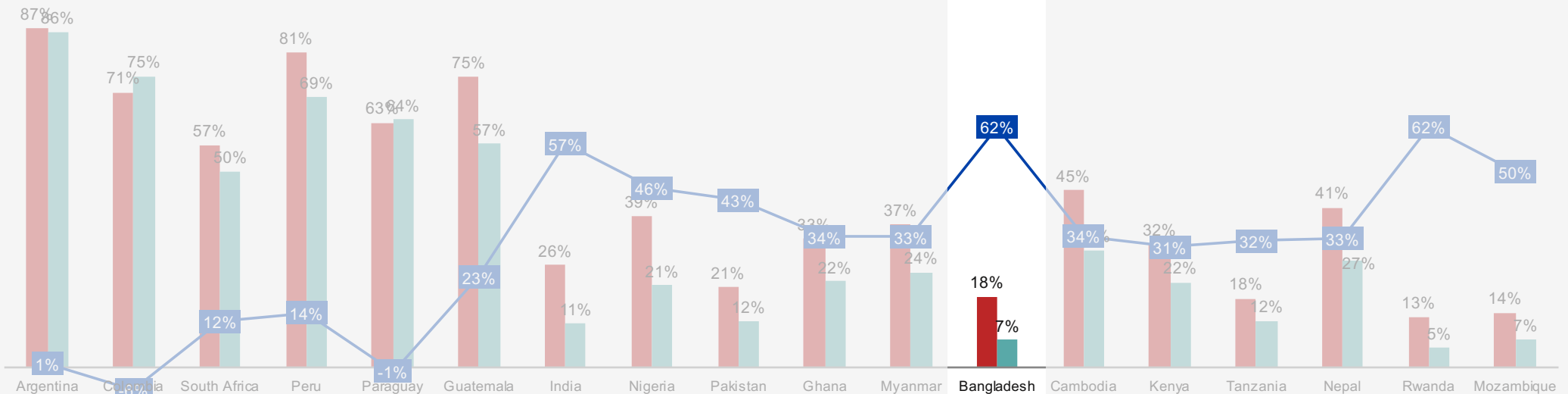
Gender gap in
Internet use (%)

Male internet users
(% of male population)

Female internet users
(% of female population)

=

Male internet users (% of male population)

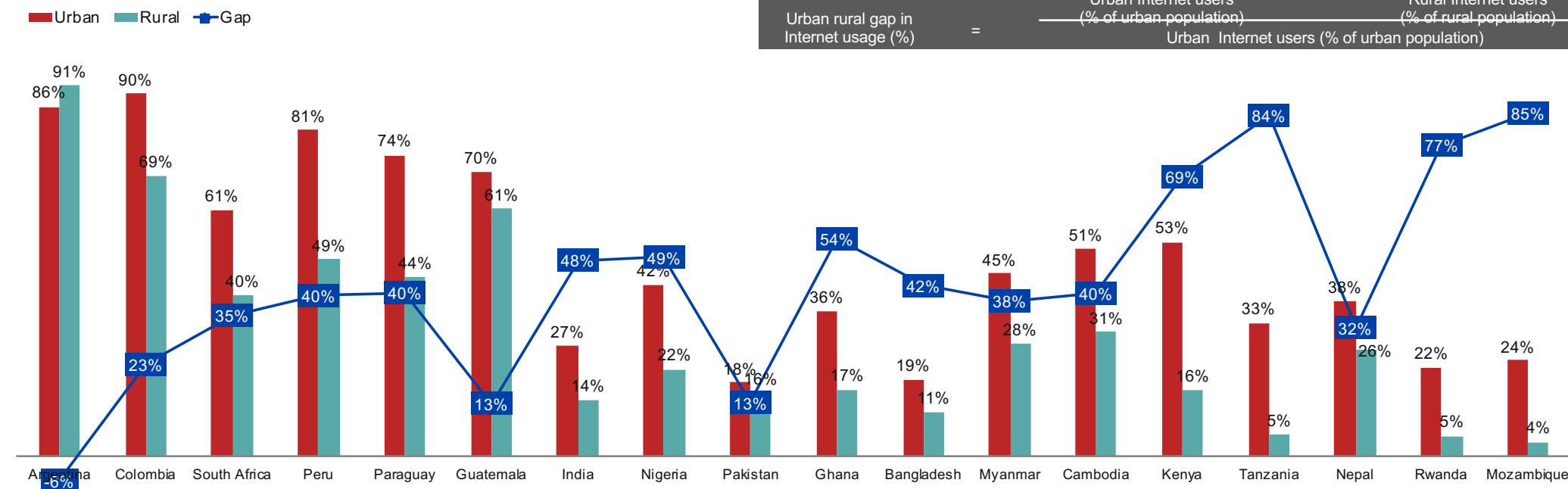


Q: Have you ever used the Internet (Gmail, Google, Facebook, email)?

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Rural dwellers much less likely to be online than urban; and urban-rural divides as high as gender divide

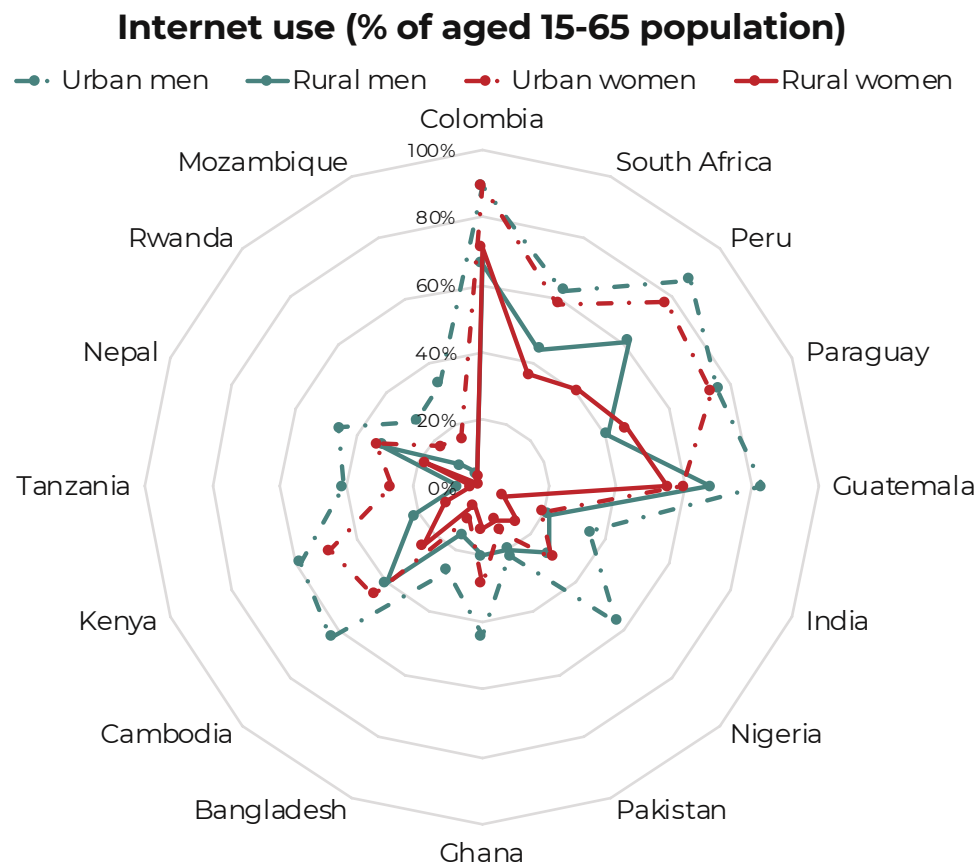
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Lowest level of Internet use among the rural women



Q: Do you own a mobile phone?

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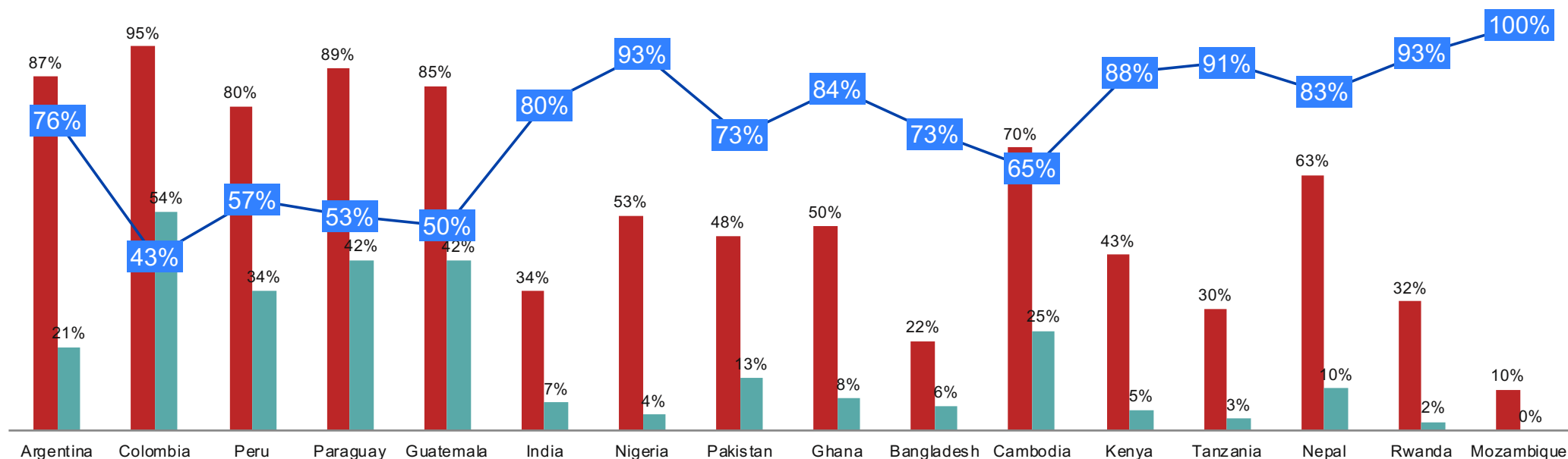
Significant difference in Internet use between high educated among less educated

Internet use (% of aged 15-65 population)

■ Secondary or higher education ■ Primary or no education ● Gap

$$\text{Education gap in Internet use (\%)} = \frac{\text{Internet users among users with secondary or higher education (\%)}}{\text{Internet users among users with primary or no education (\%)}} = \frac{\text{Internet users among users with secondary or higher education (\%)}}{\text{Internet users among users with primary or no education (\%)}}$$

And we know that rural areas have more less educated people than urban areas

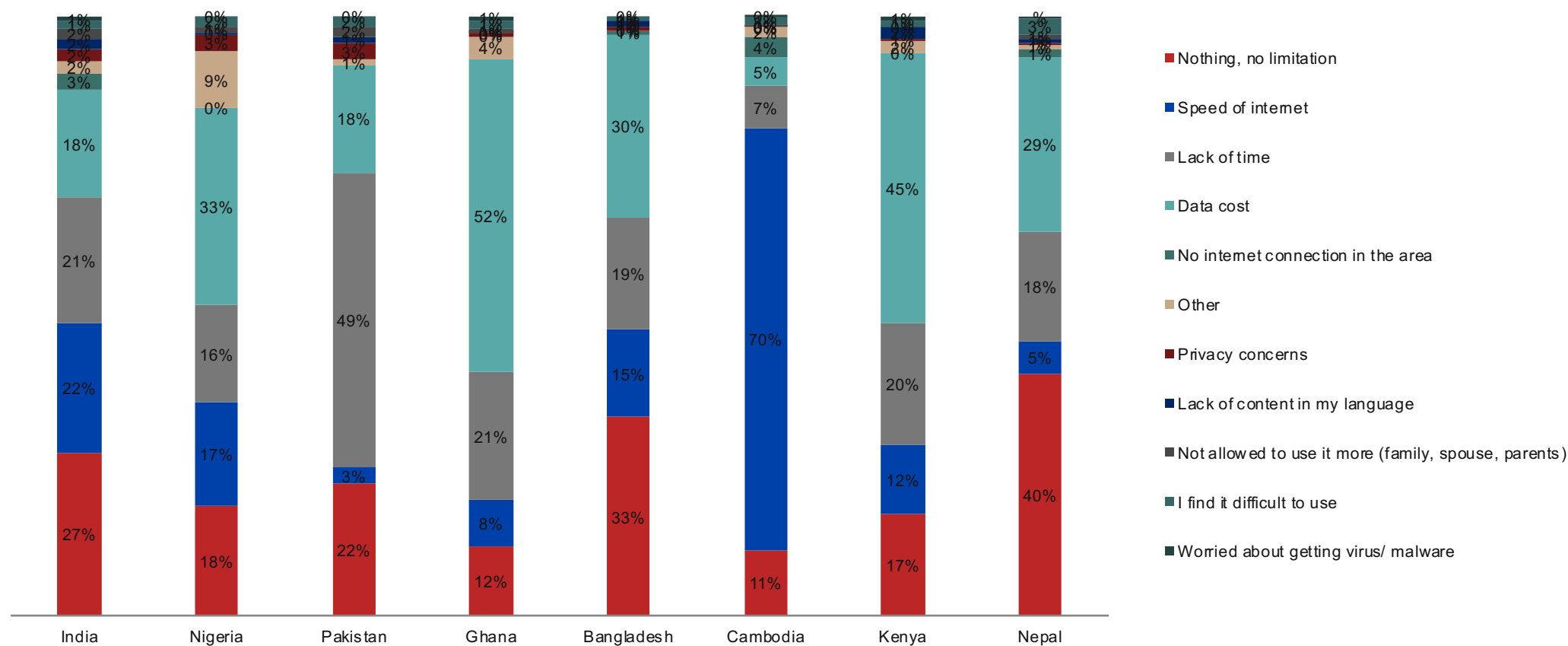


Q: Have you ever used the Internet (Gmail, Google, Facebook, email)?

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What limits more use among current users? Data cost, followed by lack of time and poor Internet speed

Limitations for Internet usage (% of aged 15-65 Internet users)



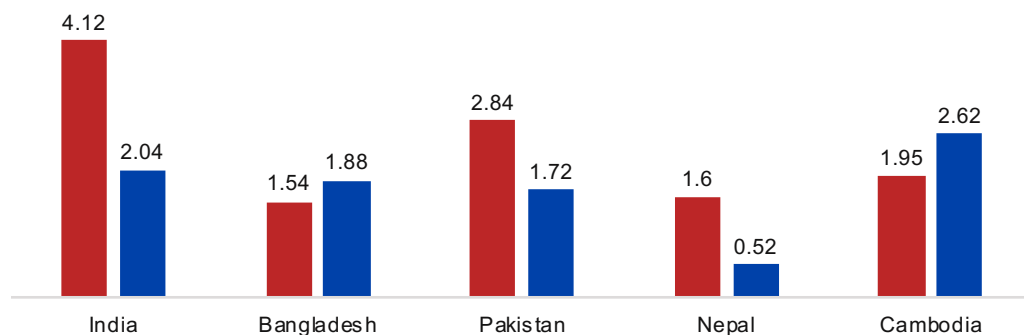
Q: What is your main limitation for your use of the internet? (Single response question)

Base	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Nepal
Internet users	919	529	427	311	266	804	440	692

We tested BB performance of all major mobile operators. Rural areas perform poorly (speeds slower; latency higher; more network errors).

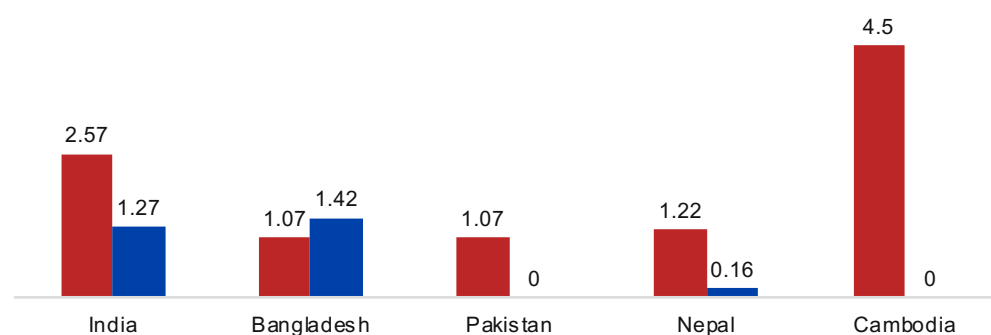
Average Download Speed (Mbps)

■ Urban ■ Rural



Average Upload Speed (Mbps)

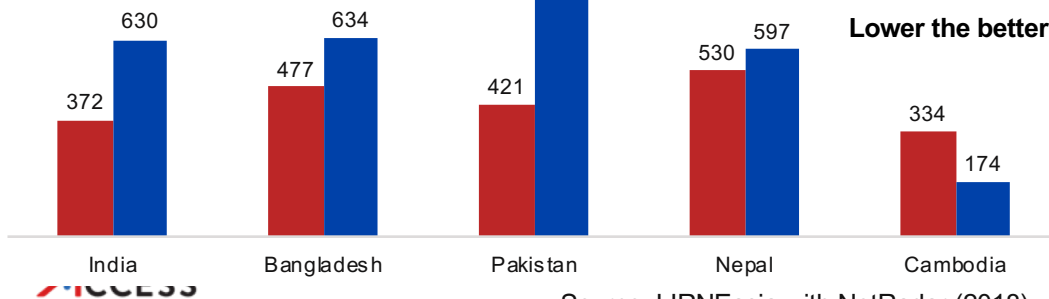
■ Urban ■ Rural



Average Latency (ms)

■ Urban ■ Rural

Lower the better



Source: LIRNEasia with NetRadar (2018)

Network errors

■ Urban ■ Rural



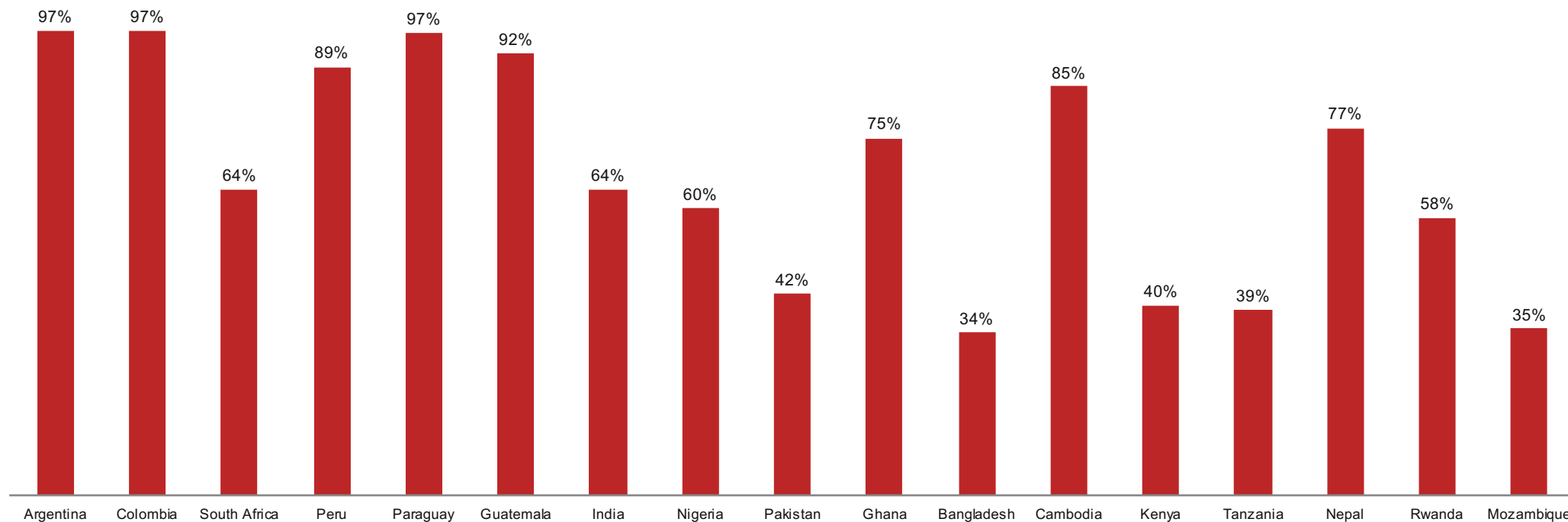
Network errors = incomplete pings, network unavailability, etc.

Note: Very low sample size of rural BB QoS readings in PK and KH
 Number of readings (taken in all survey locations – i.e. nationwide):
 India 24,920; Nepal 24,515 Bangladesh 10,815

WHAT DO USERS DO WHEN ONLINE?

A majority use apps (not browsers)

App use (% of aged 15-65 feature or smartphone owners)



Q: Are you using these types of mobile apps on your phone?

Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Tanzania	Rwanda	Nepal	Mozambique
Feature or smartphone owners	982	1,020	1,552	972	809	846	1,397	795	571	458	936	878	1,074	789	660	903	667

Which apps? Texting apps, social media apps and VOIP calling apps dominate

App use (% of aged 15-65 feature or smartphone owners)

	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Tanzania	Nepal	Rwanda	Mozambique
Social networking apps (Such as Facebook, WhatsApp, Instagram, Snapchat, Twitter, LinkedIn, line)	95%	94%	52%	82%	88%	87%	48%	52%	25%	68%	19%	71%	30%	22%	70%	12%	20%
Messaging or chat (text) apps (Whatsapp, Skype, Viber, Line, Talkray, Telegram, Facebook messenger)	89%	86%	45%	77%	90%	78%	46%	43%	25%	64%	22%	50%	26%	17%	67%	16%	28%
Voice apps (Whatsapp, Skype, Viber, Line, Talkray) for voice	89%	86%	45%	77%	90%	78%	42%	43%	24%	64%	17%	27%	26%	17%	41%	16%	28%
Entertainment apps (movie trailers, celebrity gossip, radio station guides,)	27%	43%	24%	44%	28%	37%	43%	28%	13%	40%	13%	51%	17%	28%	38%	30%	16%
News apps (local news, national headlines, technology announcements, sport)	49%	41%	25%	60%	38%	51%	33%	37%	12%	44%	8%	36%	16%	16%	37%	17%	15%
Game apps (puzzles, charades, etc.)	19%	32%	32%	31%	18%	34%	34%	31%	15%	46%	13%	37%	16%	9%	34%	9%	17%
Educational applications (dictionary, learning tools)	34%	39%	27%	55%	25%	50%	30%	36%	10%	53%	8%	32%	16%	12%	29%	7%	14%
Search tool apps (Maps, directions, phone numbers, recipes, etc..)	51%	49%	30%	56%	32%	47%	29%	28%	16%	43%	7%	23%	19%	19%	24%	18%	12%
Weather apps (local forecasts, natural disaster updates)	57%	42%	26%	51%	46%	37%	22%	18%	11%	32%	3%	24%	10%	4%	15%	2%	12%
Business apps (calculate, convert, translate, etc..)	28%	22%	13%	45%	21%	26%	26%	25%	14%	30%	15%	51%	13%	26%	11%	24%	8%
Trading or E-commerce apps (selling and buying online e.g. ebay)	43%	23%	8%	36%	16%	18%	19%	8%	12%	18%	3%	6%	9%	6%	3%	4%	5%
Transport apps (public transportation info, taxis, Uber)	31%	15%	10%	35%	10%	22%	17%	6%	17%	13%	2%	1%	9%	4%	3%	5%	6%
Payment gateway apps (e.g. PayPal)							15%		7%		1%	2%			4%		

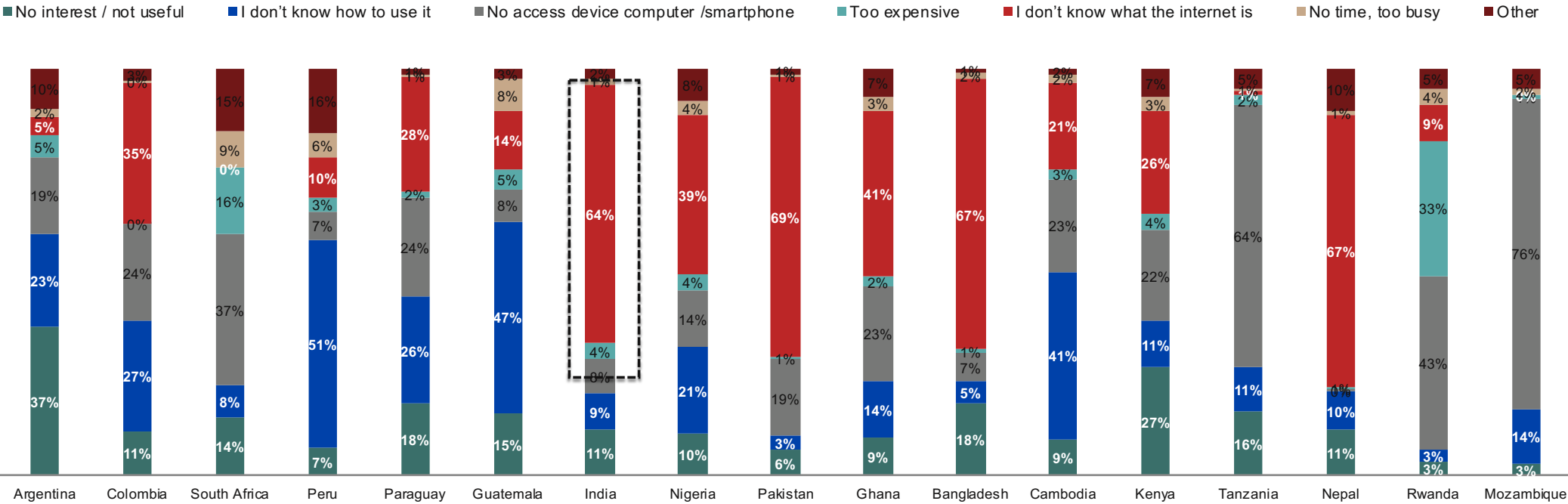
Q: Are you using these types of mobile apps on your phone?

Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Tanzania	Rwanda	Nepal	Mozambique
Feature or smartphone owners	982	1,020	1,552	972	809	846	1,397	795	571	458	936	878	1,074	789	660	903	667

NON INTERNET USERS

Why are people not using the Internet? Not knowing what the Internet is dominates in Asia; Followed by not knowing how to use the Internet. Not having a device dominates in Africa.

Reasons for not using the Internet (% of non-Internet users aged 15-65)



Q: What is the main reason why you do not use the Internet?

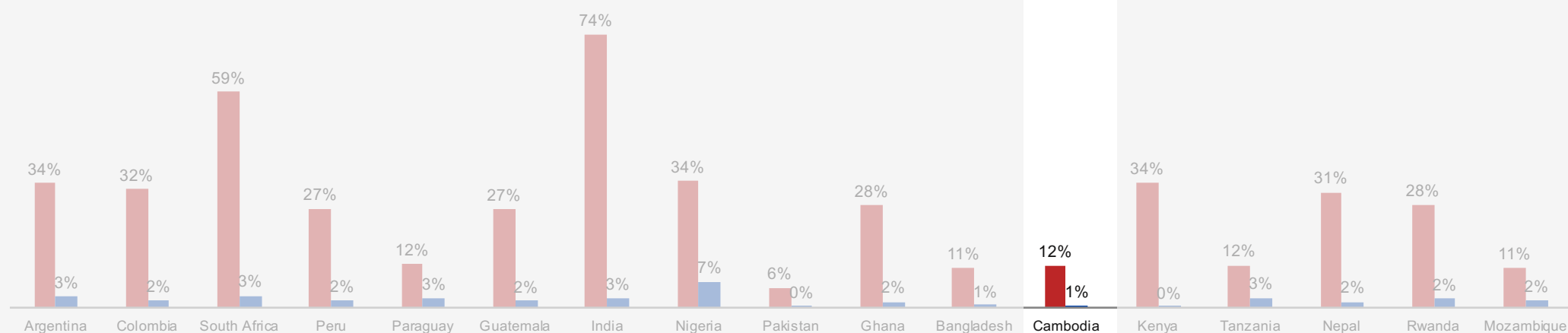
Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Tanzania	Nepal	Rwanda	Mozambique
Non-Internet users	192	248	317	391	536	484	4,150	1,177	1,575	837	1,754	1,320	741	319	1,316	151	319

BANKING AND MOBILE MONEY

Very low level of owning bank accounts in some countries; e.g. only 12% of the aged 15-65 population in Cambodia have their own bank account

Access to bank accounts (% of aged 15-65 population)

■ I have my own bank account ■ I use someone else bank account

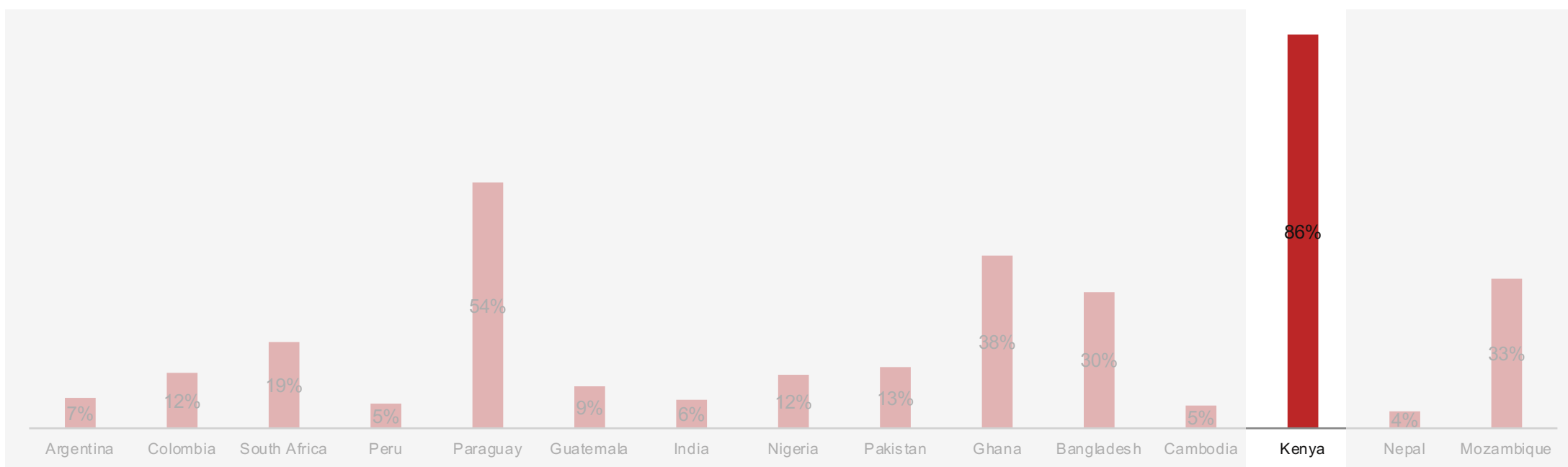


Q1: Do you have access to a bank account?

Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Tanzania	Nepal	Rwanda	Mozambique
All respondents	1,240	1,425	1,610	1,478	1,357	1,407	5,069	1,706	2,002	1,145	2,020	2,123	1,179	1,102	2,008	1,118	1,091

Low use of mobile financial services across countries; but Kenya performs well

Mobile money usage (% of aged 15-65 mobile phone owners)



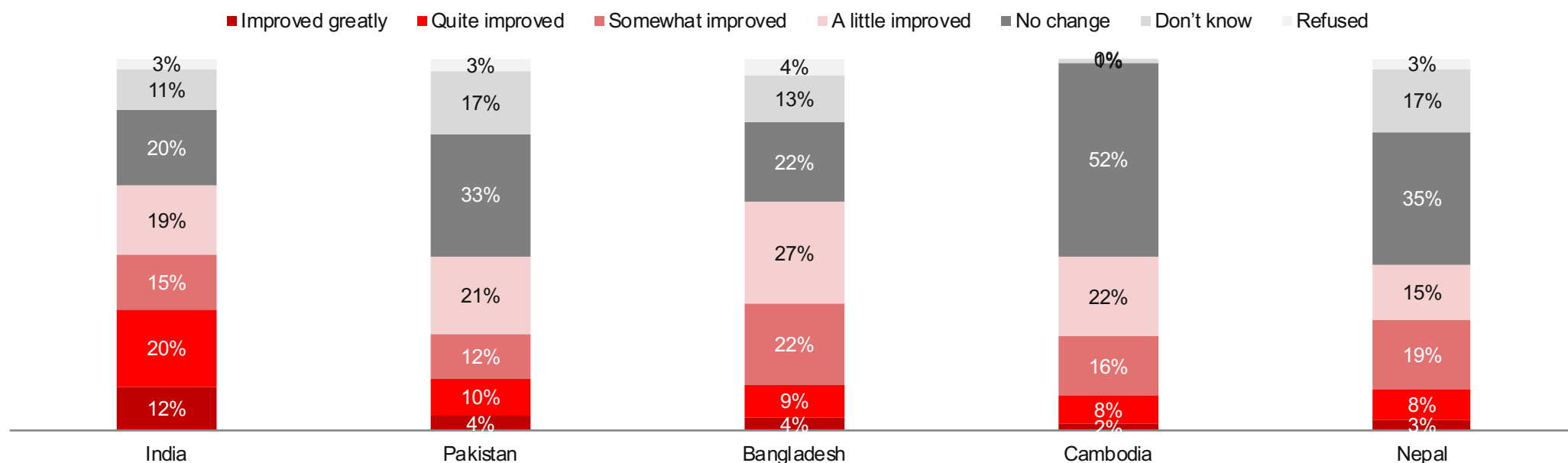
Q: Do you ever use mobile phone for financial transactions: to send or receive money?

Base	Argentina	Colombia	South Africa	Peru	Paraguay	Guatemala	India	Nigeria	Pakistan	Ghana	Bangladesh	Cambodia	Kenya	Tanzania	Nepal	Rwanda	Mozambique
Mobile phone owners	1,116	1,297	1,398	1,234	1,209	1,214	3,252	1,123	1,208	901	1,531	1,526	1,054	761	1,478	635	632

WHAT PERCIEVED IMPACTS OF THIS ACCESS+USE?

Many see their economic/financial status/well being has improved at least a little due to use of mobile phones; but few see it greatly improved

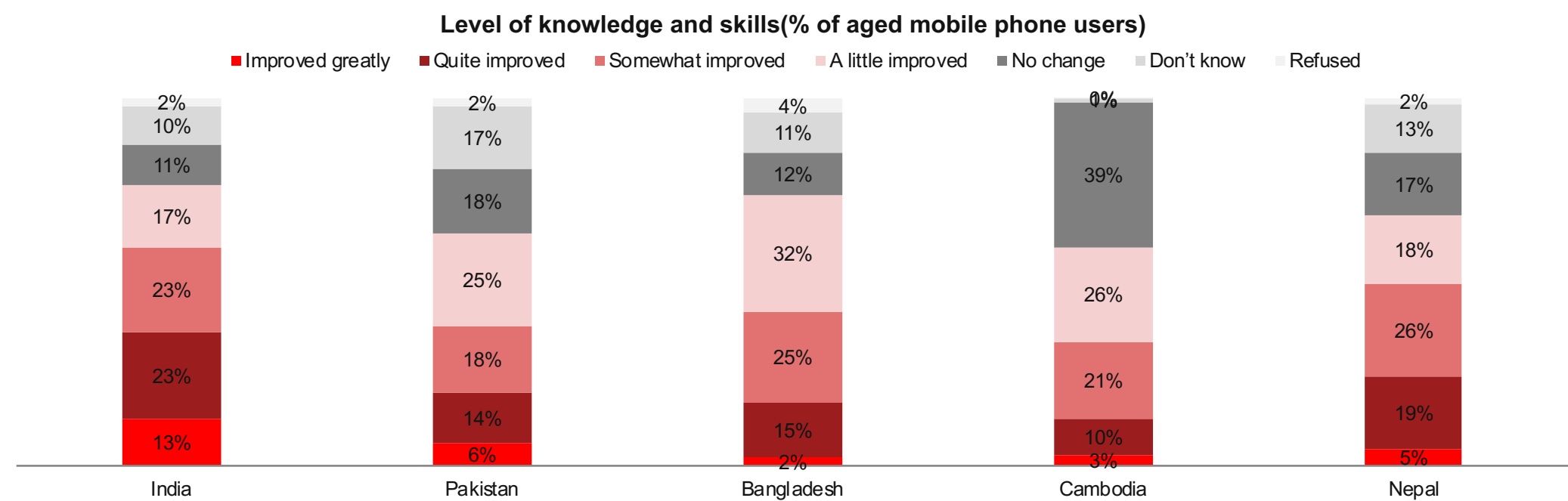
Economic/financial status or well being (% of aged mobile phone users)



Q: Please tell me to what extent your usage and access of a mobile improved the following, if at all? This can include mobile use through voice or data, and need not have been your own mobile. Please give answer with the help of this scale: Your economic/financial status or well being

Base	India	Pakistan	Bangladesh	Cambodia	Nepal
Those who used a mobile phone in last three months	4,002	1,404	1,209	1,611	1,619

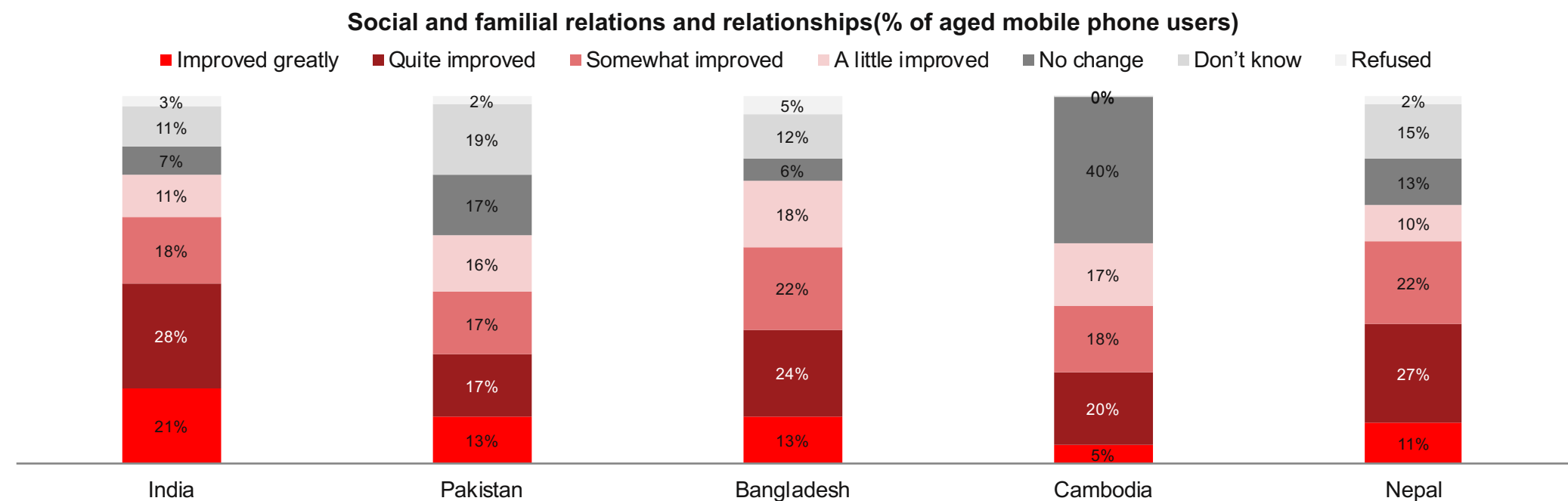
Many see at least small improvements in their level of knowledge and skill due to the use of mobiles phones. But few feel very strongly +ve



Q: Please tell me to what extent your usage and access of a mobile improved the following, if at all? This can include mobile use through voice or data, and need not have been your own mobile. Please give answer with the help of this scale: Your level of knowledge and skills?

Base	India	Pakistan	Bangladesh	Cambodia	Nepal
Those who used a mobile phone in last three months	4,002	1,404	1,209	1,611	1,619

Social and family relations also improved to varying degrees. Appears high in the South Asian countries with high labor migration



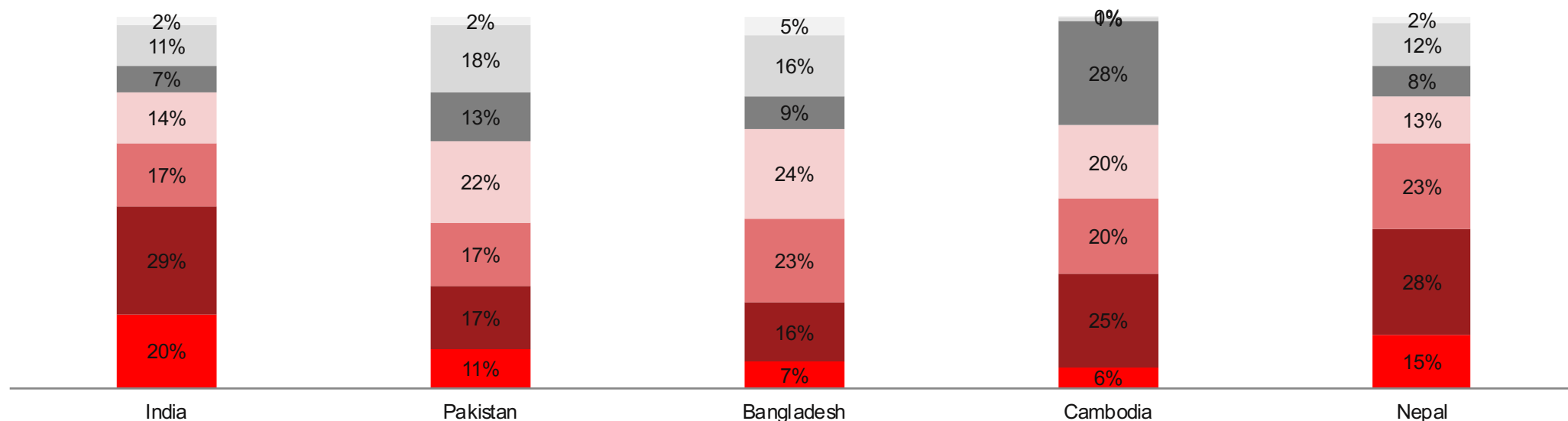
Q: Please tell me to what extent your usage and access of a mobile improved the following, if at all? This can include mobile use through voice or data, and need not have been your own mobile. Please give answer with the help of this scale: Your social and familial relations and relationships?

Base	India	Pakistan	Bangladesh	Cambodia	Nepal
Those who used a mobile phone in last three months	4,002	1,404	1,209	1,611	1,619

The highest and most consistent +ve impact is the ability of mobile users to act in an emergency

Ability to act or contact others in an emergency (% of aged mobile phone users)

Improved greatly Quite improved Somewhat improved A little improved No change Don't know Refused

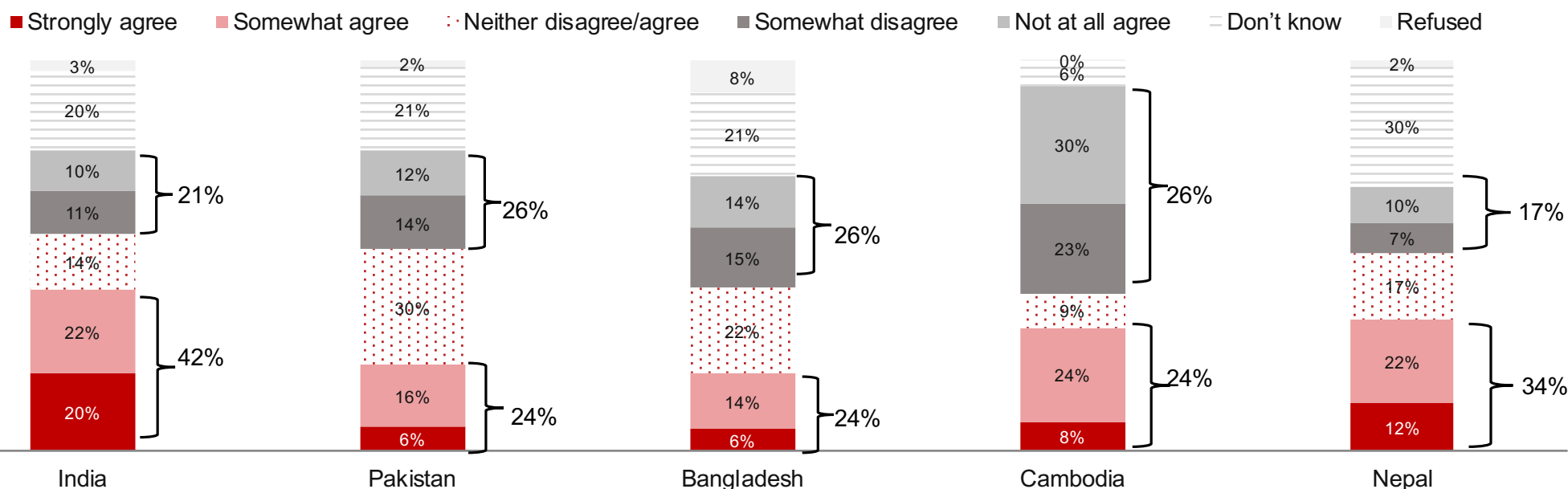


Q: Please tell me to what extent your usage and access of a mobile improved the following, if at all? This can include mobile use through voice or data, and need not have been your own mobile. Please give answer with the help of this scale: Your ability to act or contact others in an emergency?

Base	India	Pakistan	Bangladesh	Cambodia	Nepal
Those who used a mobile phone in last three months	4,002	1,404	1,209	1,611	1,619

Opinion is split on the negatives, except in India, where many agree that mobiles + Internet cause social division. In all countries, many without a strong opinion.

They cause people to become divided, socially politically, etc..(% of aged mobile phone users)

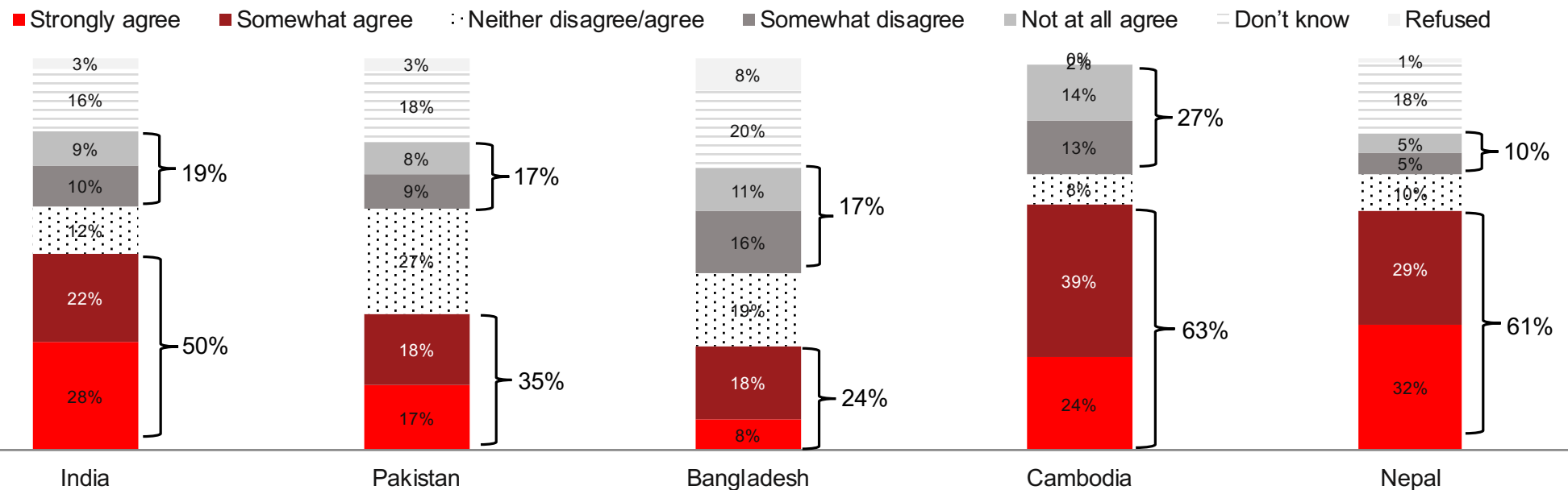


Q: Here are some of the concerns that people sometimes have about access to and use of mobiles and online/Internet services. Please tell me to what extent you think these are problems, with the help of this scale: They cause people to become divided, socially politically, etc..

Base	India	Pakistan	Bangladesh	Cambodia	Nepal
Those who used a mobile phone in last three months	4,002	1,404	1,209	1,611	1,619

Addiction to mobiles + Internet is a concern for many

People get addicted to using them(% of aged mobile phone users)

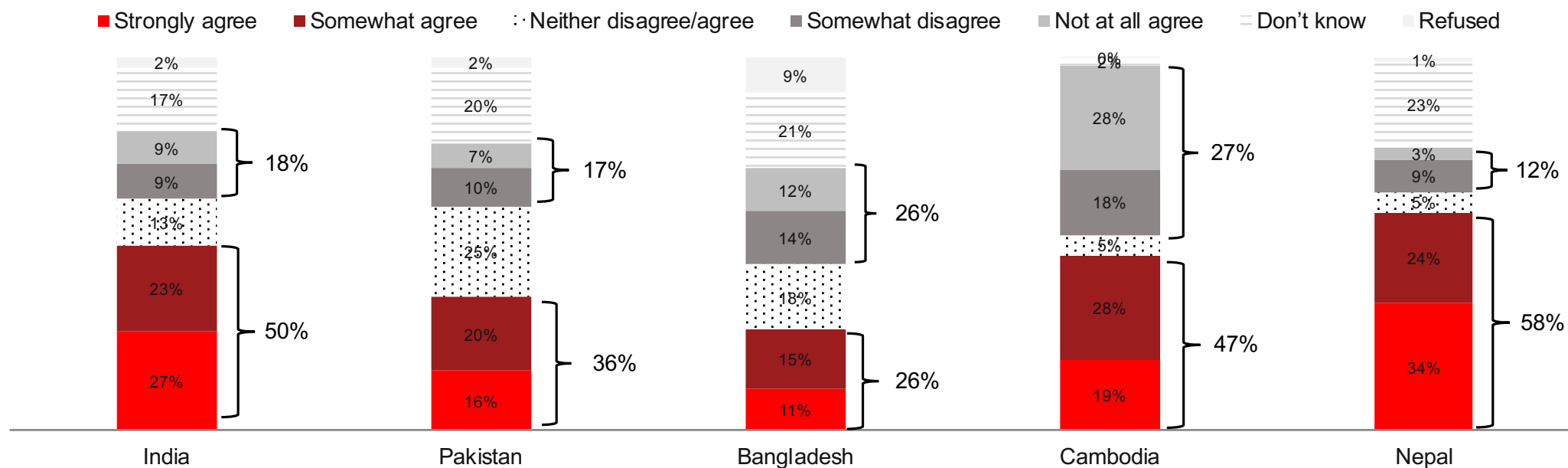


Q: Here are some of the concerns that people sometimes have about access to and use of mobiles and online/Internet services. Please tell me to what extent you think these are problems, with the help of this scale: People get addicted to using them

Base	India	Pakistan	Bangladesh	Cambodia	Nepal
Those who used a mobile phone in last three months	4,002	1,404	1,209	1,611	1,619

Many also worry about children's exposure to inappropriate content

Children are exposed to inappropriate content(% of aged mobile phone users)



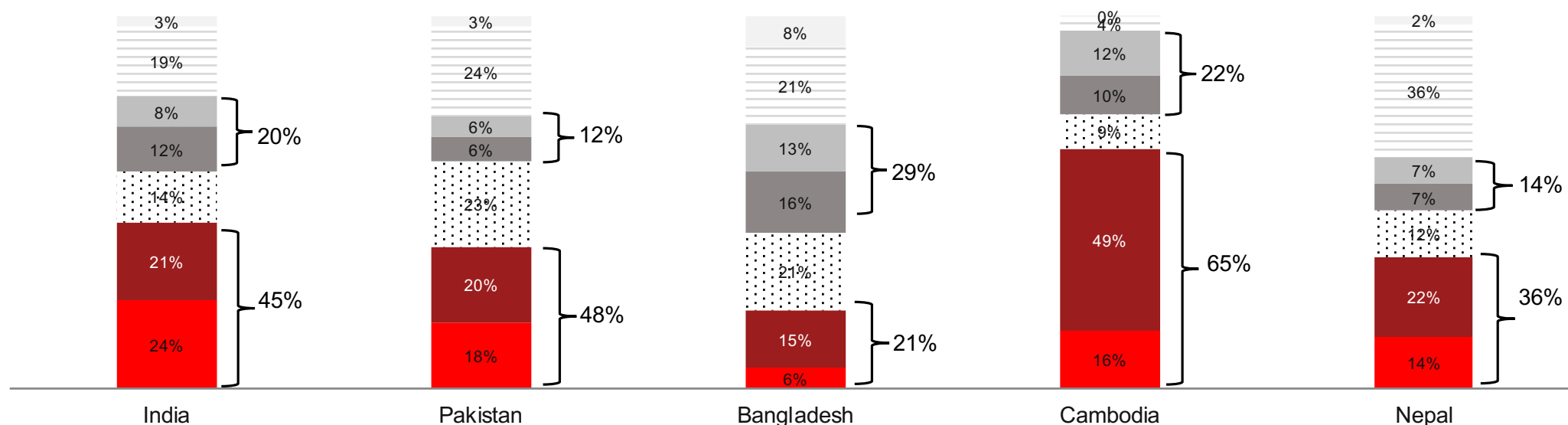
Q: Here are some of the concerns that people sometimes have about access to and use of mobiles and online/Internet services. Please tell me to what extent you think these are problems, with the help of this scale: Children are exposed to inappropriate content

Base	India	Pakistan	Bangladesh	Cambodia	Nepal
Those who used a mobile phone in last three months	4,002	1,404	1,209	1,611	1,619

Majority worry about their private information being seen by others

Private information can be seen by others through the mobile and Internet(% of aged mobile phone users)

Strongly agree Somewhat agree Neither disagree/agree Somewhat disagree Not at all agree Don't know Refused



Q: Here are some of the concerns that people sometimes have about access to and use of mobiles and online/Internet services. Please tell me to what extent you think these are problems, with the help of this scale: Private information can be seen by others through the mobile and Internet

Base	India	Pakistan	Bangladesh	Cambodia	Nepal
Those who used a mobile phone in last three months	4,002	1,404	1,209	1,611	1,619

ARE ANY OF THESE IMPACTS MEASURABLE?

Systematic Review: of Economic Impacts of Mobile Telecom in Rural Areas and Low and Middle Income countries

- A specific methodology of identifying, reviewing and synthesizing existing studies
 - From the world of medical science (pharmaceutical trials) ; Now done in social sciences
- We reviewed all English language literature between 2000-2014
 - published +unpublished; peer reviewed + grey
- Following Campbell and Cochrane Collaboration approaches to SRs
- Included ONLY quantitative studies that enable establishment of impact in the form of effect sizes
- Published in special issue of Journal of Information Technology and International Development (along with 3 other SRs)
 - **Stork, C., Kapugama, N., & Samarajiva, R. (2018). Economic impacts of mobile telecom in rural areas in low- and lower-middle-income countries: Findings of a systematic review. Information Technologies & International Development(Special Section), 14, 191–208**

Systematic Review of Economic Impacts of Mobile Telecom in Rural Areas and Low and Middle Income Countries

PICO Framework	Description
Participants	Countries: Low- and lower-middle-income countries Individuals: Any age group, gender, ethnicity, or income group, in rural areas Households: Rural households Businesses: Any size, informal and formal, in rural areas Markets: In rural areas
Interventions	Network coverage Access to handsets or SIM cards Services, content, and applications
Comparisons	Coverage of an area vs. uncovered area by mobile telecommunication services Adoption vs. non-adoption of mobile telephony Use vs. non-use for services and applications Treatment group vs. control group
Outcomes	Individuals: Income or savings Households: Household income Businesses: Profit, productivity
Study types	Longitudinal Panel studies Experimental and quasi-experimental designs Living labs (creation, prototyping, validating, and testing of new technologies, services, products, and systems in real-life contexts)
Timeframe	2000–2014

The process –ending up with studies using quantitative methods with measurable effect sizes

- Initial search by information scientist yielded 14,128 hits/studies
- Of these, 3,196 published prior to 2000, and 1,951 were duplicates: All these not considered.
- Remaining 8,981 subjected to title + abstract review
 - Studies using Qualitative methods eliminated (studies using quantitative method retained)
 - Unrelated studies (e.g. search term “mobile” referring to labor mobility) eliminated
 - Studies on higher income countries eliminated
- 48 Studies selected for critical appraisal
 - Macro- studies and those on urban areas eliminated
- 14 Studies selected for review and synthesized using quantitative methods (meta analysis)

Three types of Interventions assessed: infrastructure devices, content

Intervention	Study/Authors
Mobile network coverage	<ul style="list-style-type: none"> - Jensen (2007) - Klonner & Nolen (2008) - Muto & Yamano (2009) - Aker (2010) - Aker & Fafchamps (2011) - Beuermann, McKelvey, & Sotelo (2012)
Mobile phone Ownership	<ul style="list-style-type: none"> - Labonne & Chase (2009) - Blauw & Franses (2011)
Receiving information via mobile phone	- Zanello, Shankar, & Srinivasan (2012)
Price and weather information using text messages (SMS technology)	- Camacho & Conover (2011)
Free 1-year subscription to Reuters Market Light service, market and weather information delivered via SMS	- Fafchamps & Minten (2011)
Ban on bulk SMS for 12 days	Parker, Ramdas, & Savva (2012)
Having made use of ICT-assisted agricultural extension services	Fu & Akter (2012)

Infrastructure interventions – mobile coverage reaches populations that previously lacked connectivity

Access-device interventions – mobile phone or SIM bought by users or provided by third parties

Content interventions: Content and application made available, used

Results of Network rollout (and people self-arranging themselves with mobile phone use): positive development impact.

- Markets work better:
 - Producers (fishers) better off, buyers better off, wastage/unsold fish reduce
 - Market participation by farmers in remote areas increase
 - Price dispersion reduces
- Households and individuals better off:
 - Employment increases
 - Household assets increase
 - Income, expenditure and assets of rural consumers increase
 - Wage income increases
- All but one study account for non-random rollout decisions of network operators
- Results are generalizable

Results of owning and using access-devices (mobile phones): positive development impacts. But most results are not generalizable

- Households were better off in one study
 - Growth rate of per-capita income (measured using per-capita consumption as a proxy) higher for mobile-using households (compared to those that didn't use mobile)
- Another study finds households better off, YET results are not generalizable
 - Because of non-random selection of households
- Farmers are better off too and get higher prices for crops, but the study is not generalizable
 - Small, non-random sample
- Another finds weak evidence that mobile phones yield search costs and attract farm-gate buyers; but the results aren't generalizable

Result of using applications, content and services: low effect sizes (insignificant +ve development impacts) or show no + ve impacts

- Farmers receiving agricultural information (market price, climate information etc..)
 - Sales price obtained by farmers in treatment group no different to control group
 - Crop value added or crop losses by farmers in treatment no different to control group
- One study finds positive impacts of receiving market information
 - Price dispersion increased when market information was not available for a period of 12 days due to a technical problem

Similar (small effect sizes) as well as a paucity of good studies found in other systematic reviews:

- Impact of mobile money
- Impact of connective devices on urban micro small and medium enterprises
- Impacts of ICT tools in learning outcomes

HOW TO INCREASE EFFECT SIZES? – THE NEED FOR ANALOG COMPLEMENTS IN ACHIEVING DIGITAL DIVIDENDS

ICTs only partial solution. Non-ICT solutions are key. Example, reducing income volatility faced by farmers



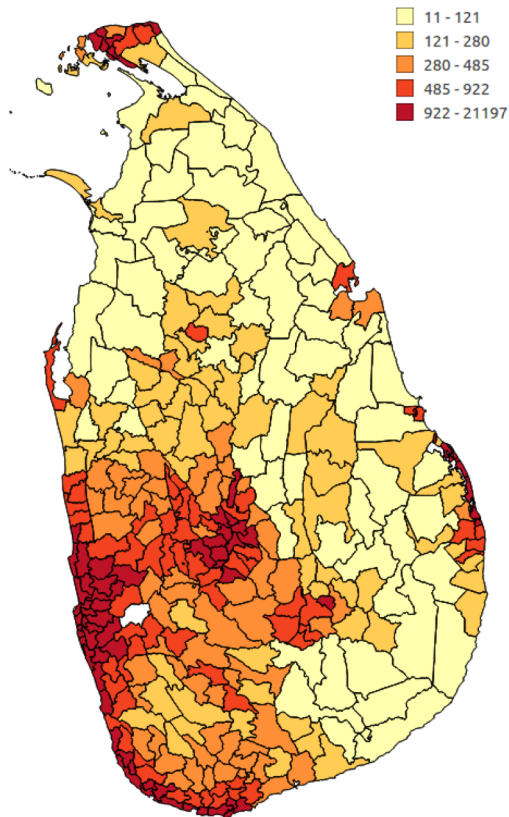
- Market information – a partial solution to the volatile prices faced by farmers
 - Volatility can even increase if only prices are given
- Short term needs: Cold storage (chain)
- Long term solution: forward contracts that are enforceable
- But forward contracts required modelling/predicting expected yield per plot
 - This requires data: weather data, soil quality, seed sales, cultivated land area,etc..
- ICTs can help: satellite images + drones above land plots + weather data + other data....
 - e.g. Work by WorldBank/Stanford (on satellite imagery to predict small-plot yield)
 - E.g. New experiments (Farm Beats) by Microsoft/Gates work on phone + drone/helium balloon + sensors

But for now, the most common (or only) “IoT” in our region is people walking around with cell phones

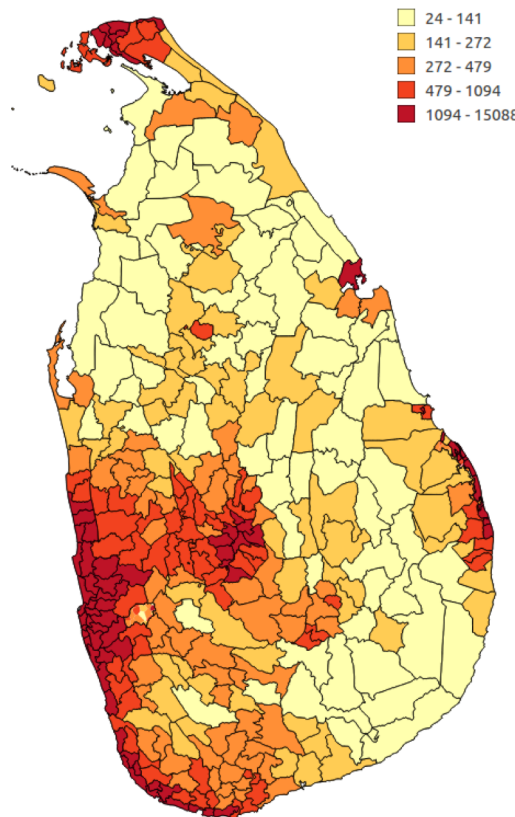
- Leaving a trace on mobile telco networks when ever a mobile phone is on
 - VLR (Visitor Location Register): data record created even if they don't use the phone for an active call
 - Large volume of data – frequently deleted by telcos
- Leaving a trace when ever a phone call is made/received, SMS is sent/received, data/internet session is active
 - CDRs (Call Detail Records)
- LIRNEasia negotiated access to historical, pseudonymized CDR meta-data from multiple mobile telecom operators in Sri Lanka (i.e. “mobile network big data”)
 - Not the content of the call; But meta data like location, time, pseudonymized unique ID of the caller and callee etc..
- We use it to help development decision making:
 - To understand traffic Predict where poor people live (to understand where govt service delivery centers should be located)
 - To understand where people live an where they work and how they travel
 - To understand how land use changes – commercial areas vs. residential areas (instead of waiting for 4-5 years for surveys)
 - To predict populations on a near-real-time basis (instead of waiting for a census every 1 yrs.)

Example 1: MNBD data can give us granular & high-frequency estimates of population density

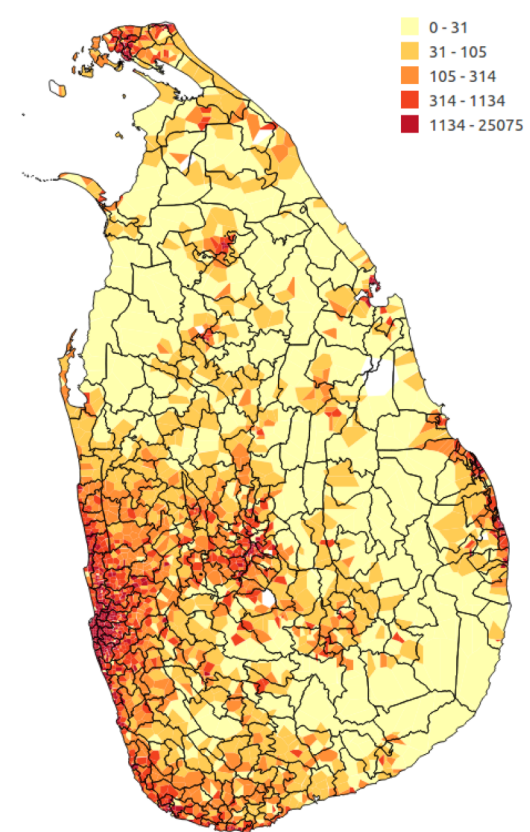
**DSD population density from
2012 census**



**DSD population density
estimate from MNBD**



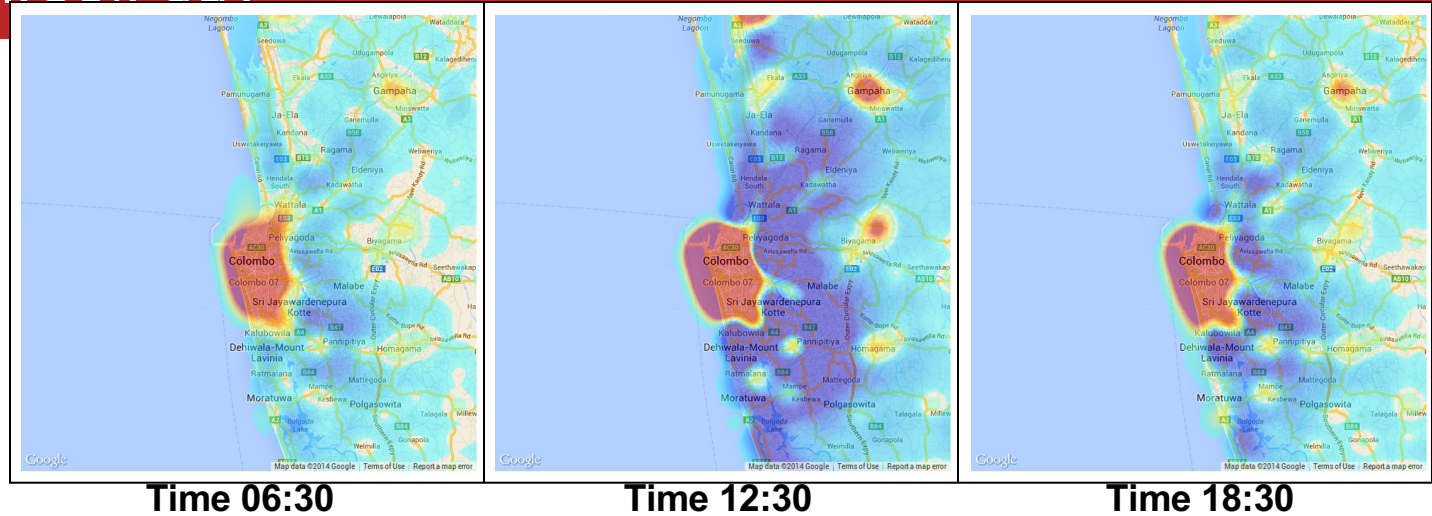
**Voronoi cell population
density estimate from MNBD**



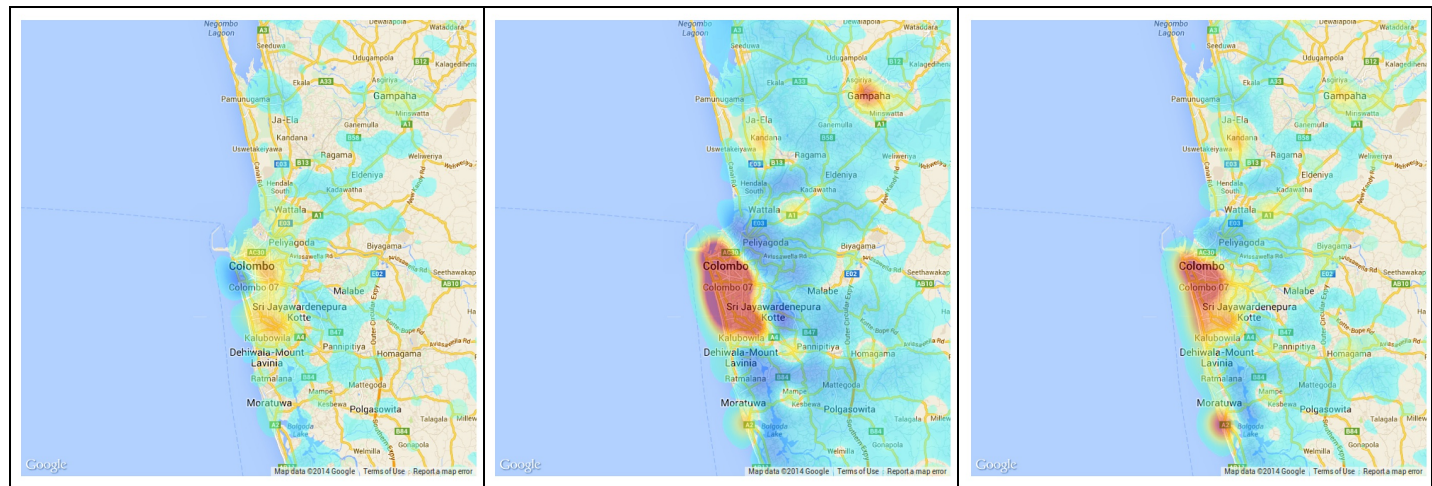
Example 2: Population density at any time of day. Changes in Colombo region week end vs week day

Pictures depict the change in population density at a particular time relative to midnight

Weekday



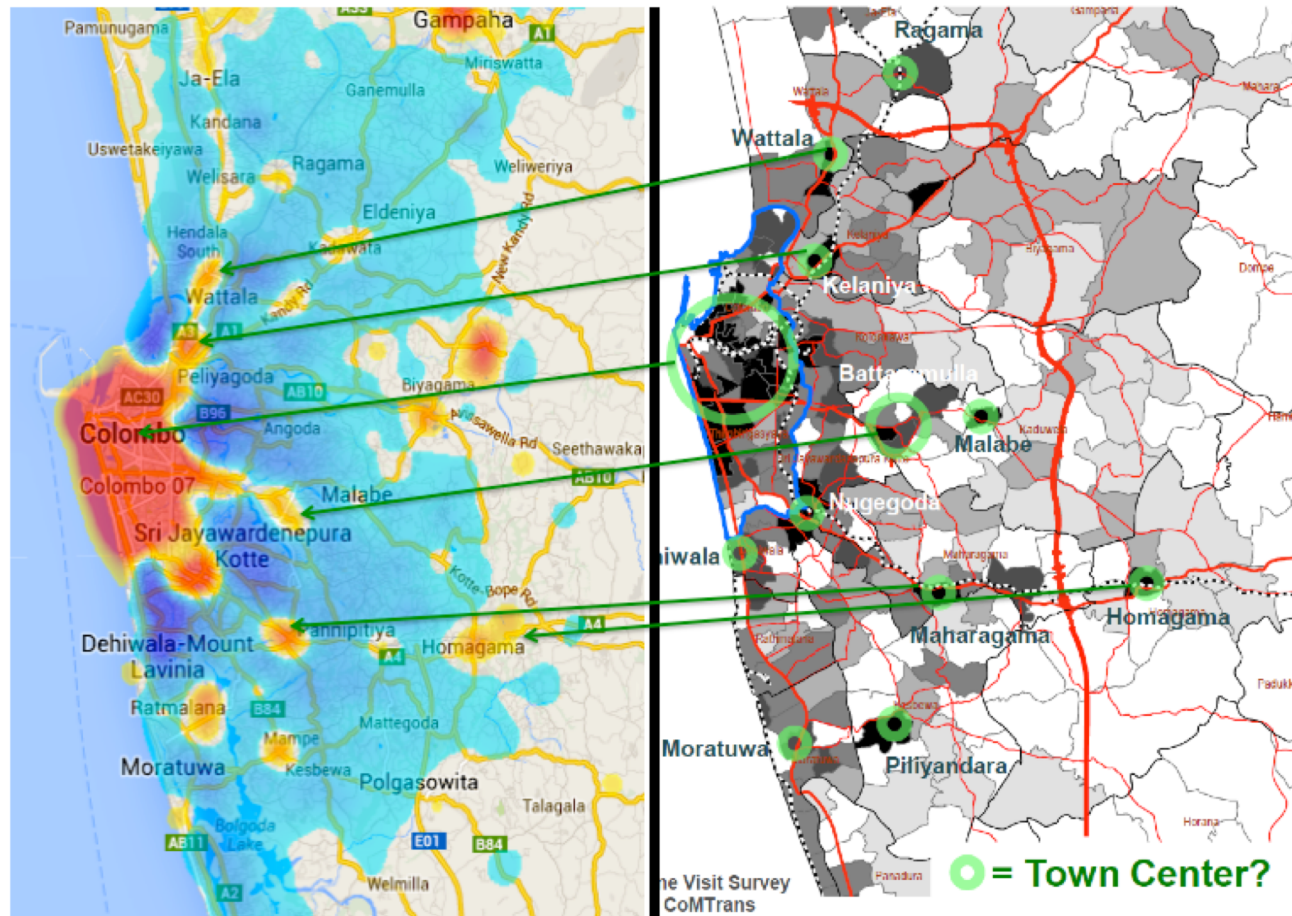
Sunday



Decrease in Density

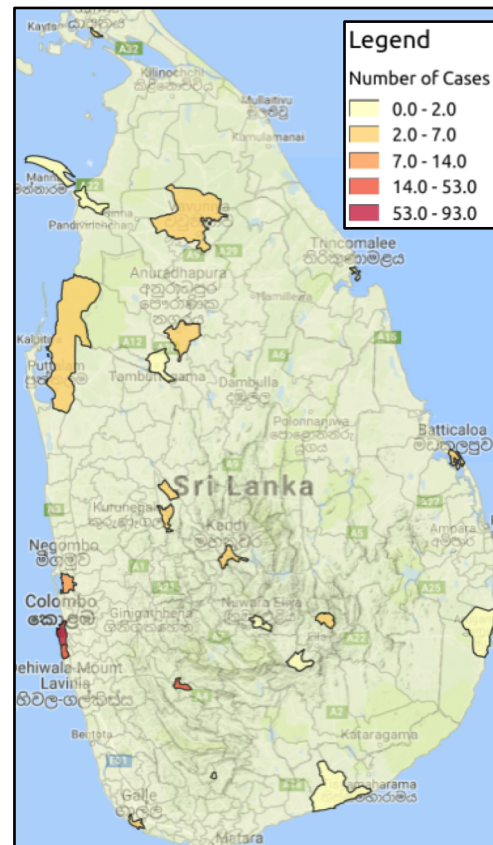
Increase in Density

Our findings closely match results from expensive & infrequent transportation surveys; are cheaper & can be produced as needed

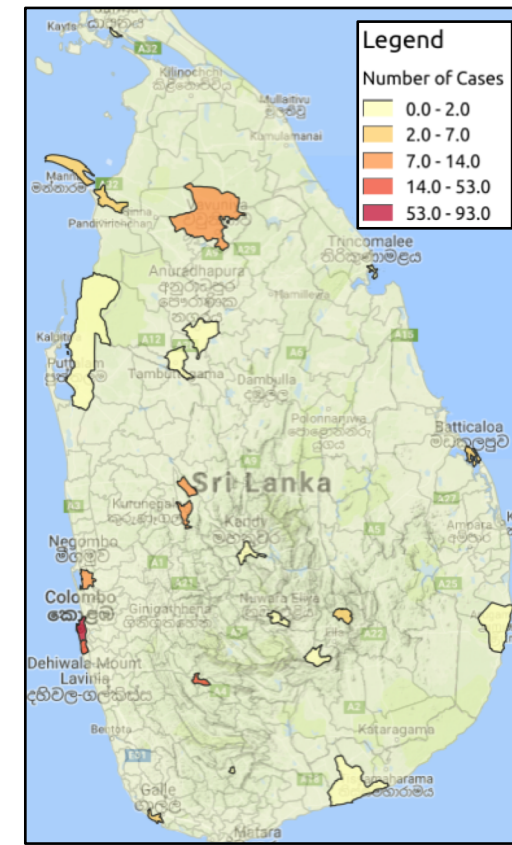


Example 3: Predicting spatial spread of dengue – data from multiple sources

- Data: Mobile network big data, temperature, rainfall, normalized difference vegetation index (NDVI) derived from satellite imagery, dengue incidence data
- Prediction done for some major towns and cities across Sri Lanka
- Forecast mostly accurate:
 - Overestimated for Puttlam & Kandy, and underestimated for Anuradhapura & Kurunegala
- Models suggest Colombo (economic capital of country) is the main driver



Predicted Cases



Actual Cases

This type of analysis is well within reach of Indonesia – Your govt. already had the foresight to set up an innovation lab. That fulfills the main need-skills.

- **Skills:** Pulse Labs Jakarta (formerly UN Global Pulse)
 - Data scientists who have done sophisticated analysis in other countries
 - Already working on FinTech/financial inclusion of micro-enterprises in Indonesia
- **The data:** Negotiable from multiple sources
 - Private sector data: Given as Data philanthropy? Other models models of data sharing
 - Govt. open data: requires leadership (MCIT/KomInfo/other)
 - Other scientific data: can be purchased (e.g. satellite imagery) or obtained through international networks
- **Hardware:** Easiest to acquire
- **Data sharing policies:** that take into account privacy, marginalization and competition issues
 - Opportunity to experiment in Indonesia, using global best practices on data sharing

THANK YOU

