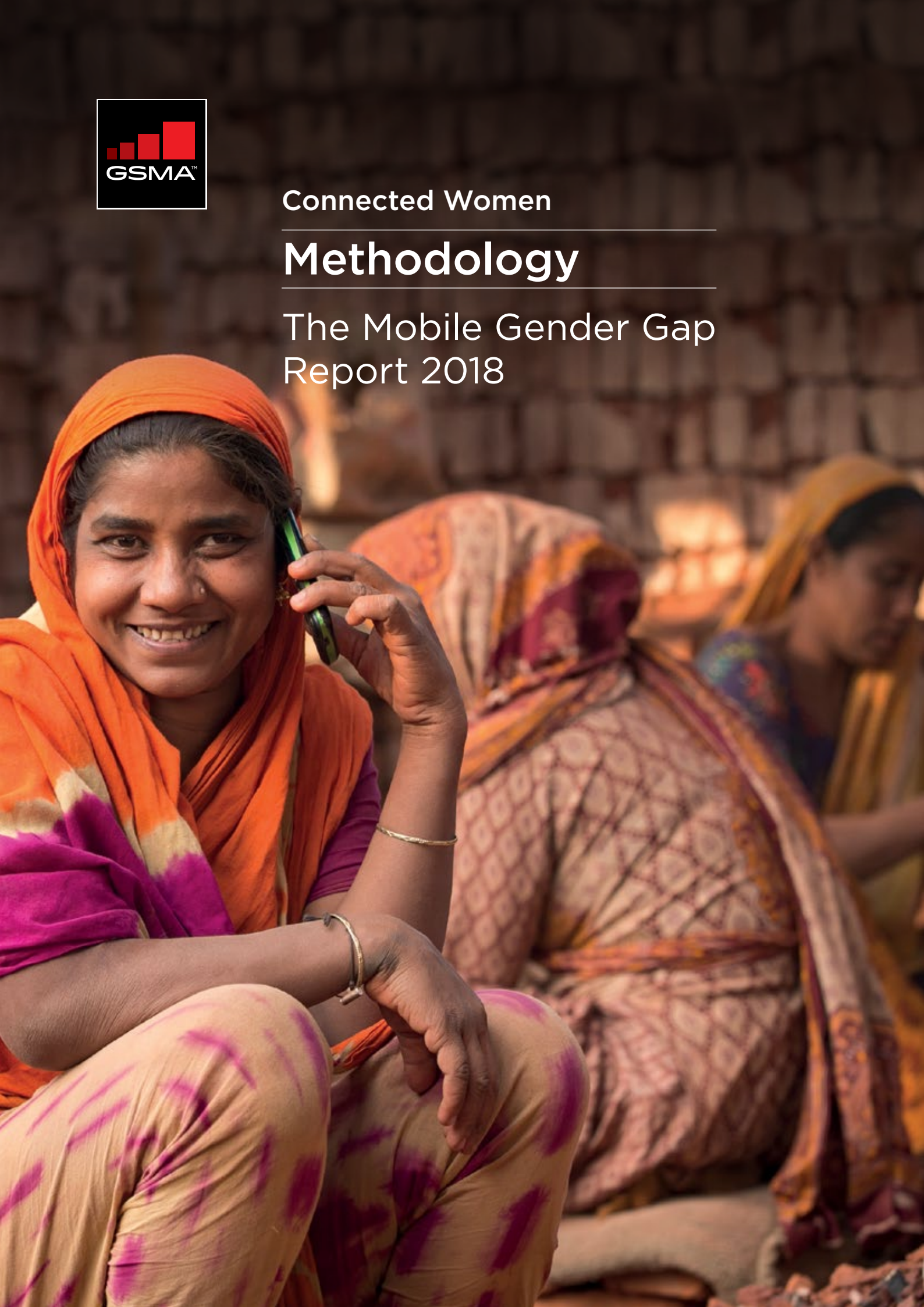

Connected Women

Methodology

The Mobile Gender Gap Report 2018

The GSMA represents the interests of mobile operators worldwide, uniting nearly 800 operators with more than 300 companies in the broader mobile ecosystem, including handset and device makers, software companies, equipment providers and internet companies, as well as organisations in adjacent industry sectors. The GSMA also produces industry-leading events such as Mobile World Congress, Mobile World Congress Shanghai, Mobile World Congress Americas and the Mobile 360 Series of conferences.

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GSMA Connected Women

The GSMA Connected Women Programme works with mobile operators and their partners to address the barriers to women accessing and using mobile internet and mobile money services. Connected Women aims to reduce the gender gap in mobile internet and mobile money services and unlock significant commercial opportunities for the mobile industry and socio-economic benefits for women.

For more information, please visit the Connected Women programme at www.gsma.com/connectedwomen.
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This publication is the output of a project funded by UK aid, Department for International Development (DFID), for the benefit of developing countries. The views expressed are not necessarily those of DFID.

Published March 2018

CONTENTS

Introduction

The GSMA's Mobile Gender Gap Report 2018 quantifies the gender gap in mobile ownership and mobile internet use across low- and middle-income countries. It also investigates the barriers to male and female mobile ownership and use, and compares mobile use by gender across these countries, as well as providing an estimate of the commercial opportunity for mobile operators of closing the gender gap in mobile ownership and mobile internet use in low- and middle-income countries (see Table 1 for definitions of the gender gap and other key terms).

This document is designed as a supplement to the main report. It provides details of three components of the study:

1. The methodology used to conduct the GSMA Intelligence Consumer Survey 2017, on which the findings of the study were based, covering 23 markets that represent 73% of the adult population across all low- and middle-income countries;

2. The methodology used to estimate the mobile ownership and mobile internet gender gap in non-surveyed low- and middle-income countries; and

3. The methodology used to model the commercial opportunity associated with closing the gender gap in mobile ownership and mobile internet use for mobile operators in low- and middle-income countries.

TABLE 1: **DEFINITIONS OF KEY TERMS**

KEY TERM	DEFINITION
ARPU	Average revenue per user. Calculated as recurring revenues divided by total number of unique subscribers.
Low- and middle-income countries	Countries classified as low-income (GNI per capita of $1,025 or less in 2015), also lower-middle-income (GNI per capita between $1,026 and $4,035 in 2015) or upper-middle-income (GNI per capita between $4,036 and $12,475 in 2015) by the World Bank.[1]
Socio-economic class (SEC)	A classification system to indicate the economic and social status of an individual based on factors such as employment, education level and living standards. Exact definitions and classification criteria vary by country.
Unique subscriber	A unique user who is subscribed to mobile services at the end of the period. Subscribers differ from connections in that a unique user can have multiple connections.
Unique subscriber penetration	Total subscribers at the end of the period, expressed as a percentage share of the total market population.
Gender gap	The gender gap in mobile ownership and mobile internet use, calculated using the following formula:

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

1. World Bank Country and Lending Groups, FY 2017. Includes 139 countries in total.

The GSMA Intelligence Consumer Survey 2017

Scope of the survey

The Mobile Gender Gap Report 2018 is based on a nationally representative survey of 23 low- and middle-income countries, conducted as part of the GSMA Intelligence Consumer Survey 2017. Over 25,000 face-to-face interviews were conducted. The countries included in the survey represent over 73% of the adult population in low- and middle-income countries (Figure 1). The survey is representative of the entire adult population of these countries, including both mobile users and non-users.

Figure 1

Surveyed countries used in this report

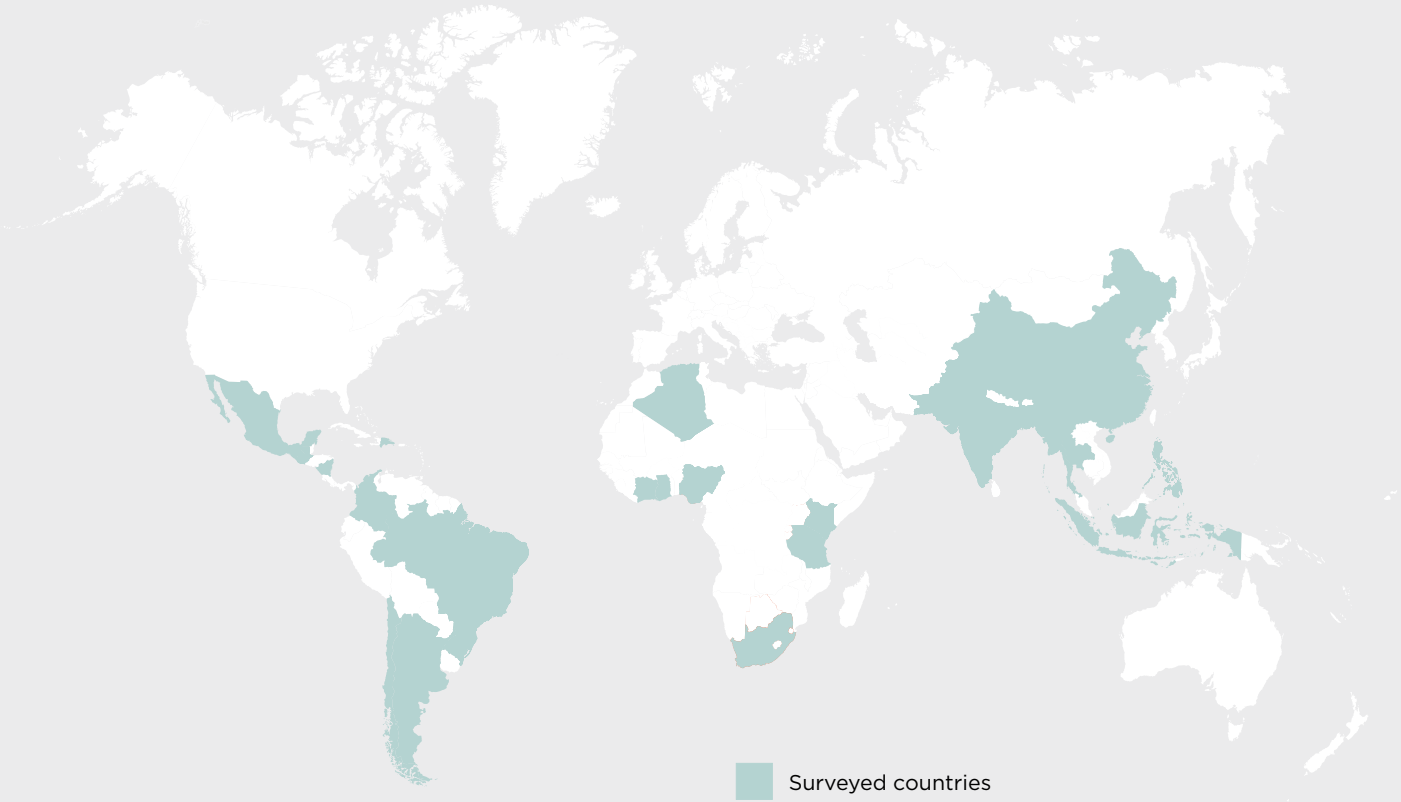

Table 2

Surveyed countries used in this report, by region

AFRICA	LATIN AMERICA	ASIA
Algeria	Argentina	Bangladesh
Côte d'Ivoire	Brazil	China
Ghana	Chile*	India
Kenya	Colombia	Indonesia
Nigeria	Dominican Republic	Myanmar
South Africa	Guatemala	Pakistan
Tanzania	Mexico	Philippines
	Nicaragua	Thailand

* Although Chile is defined as 'high-income' by the World Bank, it was included in the modelling and analysis for this report as a benchmark for other Latin American countries. However, subscriber count and revenue from Chile are not included in the overall gender gap and commercial opportunity calculations.

Sampling and fieldwork

In all countries, a nationally representative sample of the adult population aged 18+ was selected. At least 1,000 interviews were conducted in each country surveyed, with 2,000 conducted in India and China.

To achieve a nationally representative sample, quotas were applied in line with census data on the following metrics:

- Age category;
- Urban and rural distribution; and
- Quotas were applied for socio-economic class (SEC) to ensure a representative portion of lower income respondents were included, except for Tanzania and the Dominican Republic where data was not available.

While a quota was not applied to education (other than where it contributed to SEC classification), it was tracked regionally and nationally during and after the fieldwork as an important indicator of a representative sample.

Sampling points were distributed proportionately between urban and rural areas, in accordance with census data and national statistics offices. To achieve broad geographical coverage and reduce the effects of clustering, a minimum of 100 sampling points were used.

This research used a mix of purposive and random sampling approaches. Depending on the country, sampling points were either randomly distributed – with an administrative area's probability of selection proportionate to the size of its population (random sampling) – or selected to reflect the linguistic, cultural and economic variations of each country (purposive sampling). Local experts and national statistics offices checked the sampling frames to ensure they were valid and representative.

The survey was delivered via interviewer-administered computer-assisted personal interviewing (CAPI) and interviewer-administered pen and paper survey (PAPI). Survey interviews were

conducted in the local language by both female and male interviewers. Interviews were conducted in respondents' homes except in China, where street intercepts were used.[2] Within sampling points, systematic random routes were used for residence selection.

Once the data had been cleaned, it was weighted using a 'random iterative method' (RIM weighting) whereby several non-interlocking quotas were applied in an iterative sequence, which was repeated as many times as needed for the quotas to converge. This corrected any imbalances in the profiles, although weightings (and the resulting impact on effective sample sizes) were minimised as much as possible by controlling key quota variables over the course of the fieldwork.

The sampling approach was designed to achieve full national representativeness where practical. Some more remote rural areas or regions with ongoing unrest or security concerns were excluded from sampling. This may have impacted results – particularly given that mobile phone coverage, access and usage will be different – and likely most limited – in these regions.

2. In China, interviews were conducted in the street due to the prevalence of inaccessible homes, making in-home interviews difficult to conduct.

Extrapolation model

A key objective of the Mobile Gender Gap Report 2018 was to size the gender gap in mobile ownership and mobile internet use across all low- and middle-income countries. While the countries included in the GSMA Intelligence Consumer Survey 2017 comprise the majority of the population of all low- and middle-income countries worldwide, it was still necessary to generate estimates for the gender gap in non-surveyed low- and middle-income countries to provide an overall figure.

To generate these estimates for the non-surveyed countries, the GSMA constructed two extrapolation models: one to estimate the gender gap in mobile ownership and one to estimate the gender gap in mobile internet use. There were three stages to the analysis:

1. Testing a range of independent variables to determine the best predictors of the gender gap in mobile ownership and mobile internet use in surveyed countries using regression analysis;
2. Generating a best-fit equation from the most highly correlated independent variables; and
3. Applying this equation to the non-surveyed countries to generate individual country-level estimates of the gender gap in mobile ownership and mobile internet use.

Testing independent variables

Over 90 independent variables were tested to determine the best predictors of the gender gap in mobile ownership and mobile internet use. Correlation analysis was conducted for all the variables to help reveal the relationship between the gender gaps in the survey countries and the independent variables (see Table 3).

To be tested for inclusion in the extrapolation model, the variables had to meet the following criteria:

- Expected to have a correlation with the gender gap in mobile ownership and/or mobile internet use;
- Within a recent and relatively complete dataset available for all survey countries; and
- Cover a wide range of non-surveyed low- and middle-income countries.

Each equation was tested using several different measures of model fit and accuracy (for example, adjusted R-squared, root-mean-square error and average absolute residuals). The two final equations for mobile ownership and mobile internet use were chosen as they demonstrated the highest level of fit when comparing predicted results with the actual results derived from the survey.

Table 3

A selection of the most highly correlated independent variables tested

MOBILE OWNERSHIP GENDER GAP			MOBILE INTERNET USE GENDER GAP		
Indicator	Source	Correlation with gender gap	Indicator	Source	Correlation with gender gap
Average selling price for handset (% of female GNI per capita)	Strategy Analytics	0.746	The gender gap in Facebook account ownership	Facebook	0.947
The gender gap in Facebook account ownership	Facebook	0.740	Individuals using the internet (from any location) - female	ITU	0.731
Individuals using the internet (from any location) - female	ITU	0.723	Average selling price for handset (% of female GNI per capita)	Strategy Analytics	0.726
Price of cheapest internet-enabled device (% of female GDP per capita)	GSMA Calculation	0.666	% population that does not own more than one radio, TV, telephone, bike, motorbike or refrigerator	OPHI	0.715
Gender Development Index - a measure of gender gaps in human development	UNDP	0.649	Penetration of mobile users (% of market population)	GSMA Intelligence	0.712
Gender ratio for ownership of a financial account (World Bank)	World Bank	0.635	Adult literacy rate, population aged 15 and over	CIA World Factbook	0.711
No schooling (% of female population aged 15 and over)	Barro-Lee	0.633	Gender ratio for ownership of a financial account (World Bank)	World Bank	0.71
Average years of education, primary to tertiary, female	UNDP	0.625	Log of estimated gross national income per capita, female (2011 PPP $)	UNDP	0.705
Log of estimated gross national income per capita, Female (2011 PPP $)	UNDP	0.615	Human Development Index - female - composite statistic used to rank countries by level of human development	UNDP	0.699
Average years of primary schooling for females	Barro-Lee	0.614	No schooling (% of female population aged 15 and over)	Barro-Lee	0.689
No schooling (% of population aged 15 and over)	Barro-Lee	0.609	Female school life expectancy, primary to tertiary	UNDP	0.689
Mobile penetration (% of total population aged 15 and over)	Gallup	0.561	Gender Development Index - a measure of gender gaps in human development	UNDP	0.684
Human Development Index - female - composite statistic used to rank countries by level of human development	UNDP	0.564	Average years of education, primary to tertiary, female	UNDP	0.683

Correlation ranges from 0 to 1, with values closer to 1 representing a stronger correlation

Final extrapolation models

A small number of regression models with both strong explanatory power and statistical significance were identified. The outputs of these models were then cross-validated with third-party data sources, and the ones with the best match were selected as the final versions.

The independent variables used in the eventual extrapolation formulas are not necessarily those that in themselves have the most explanatory power. The regression analysis identified a combination of three variables, which together best estimate the mobile gender gap even though each individual variable may not have been the most strongly correlated with the gender gap.

The key variables identified in the mobile ownership gender gap ($Ownership_{GG}$) regression analysis were:

- **Female Human Development Index** (HDI_f) – a composite indicator of life expectancy, education and per capita income measures used to rank countries by level of human development.[3]
- **Mobile penetration** – percentage of total adult population that owns a mobile phone.[4]
- **Country located in South Asia** (South Asia Dummy) – a dummy variable (i.e. one taking the value true or false) used to capture the disproportionately high gender gap in South Asian countries given other demographic characteristics of the region.[5]

The resultant extrapolation formula for the gender gap in mobile ownership in low- and middle-income countries is expressed by Formula 1.

Formula 1: The extrapolation formula for the mobile ownership gender gap in low- and middle-income countries

$$Ownership_{GG} = 0.492 + 0.209 \times South\ Asia\ Dummy - 0.278 \times HDI_f - 0.327 \times Mobile\ penetration$$

The key variables identified in the mobile internet gap (MI_{GG}) regression analysis were:

- **Female Human Development Index** (HDI_f) – a composite indicator of life expectancy, education and per capita income measures used to rank countries by level of human development.
- **Facebook Gender Gap** (FB_{GG}) – the gender gap in the penetration of active Facebook accounts in the population.[6] Note that since user gender is self-reported it may not be fully accurate, and individuals may have multiple accounts.
- **Country located in South Asia** (South Asia Dummy) – a dummy variable (i.e. one taking the value true or false) used to capture the disproportionately high gender gap in South Asian countries given other demographic characteristics of the region.

The resultant extrapolation formula is given by Formula 2.

Formula 2: The extrapolation formula for the mobile internet gender gap in low- and middle-income countries

$$MI_{GG} = 0.48 + 0.250 \times South\ Asia\ Dummy - 0.665 \times HDI_f + 0.430 \times FB_{GG}$$

3. http://hdr.undp.org/en/content/hdi-female
4. Gallup World Poll 2016
5. A dummy variable is used in a model to represent the presence or absence of a categorical effect expected to have a significant impact on the outcome of a regression, the effects of which cannot be explained by the values of other independent variables. The dummy variable is given a value of 0 or 1 to represent its categorical presence or absence (i.e. a country either is or is not in South Asia). For both gender gap models, a dummy variable was used to indicate whether the country is in South Asia.
6. Facebook Audience Insights, December 2017

The resultant models were tested by comparing them to the mobile gender gaps results from the surveyed countries. The extrapolated models estimated a gender gap that was, on average, within +/-5 percentage points of those from the survey (see Table 4 for full comparison of modelled and survey results). For Pakistan, for example, the model predicted a 39% gender gap in mobile ownership and a 69% gender gap in mobile internet use, compared to surveyed gender gaps of 45% and 70% respectively.

Once the gender gap in mobile ownership and mobile internet use had been estimated for non-surveyed countries using this extrapolation, the ratio of male and female uptake of each was applied to adult unique mobile subscriber and unique mobile internet subscriber estimates from GSMA Intelligence. This generated the overall number of male and female mobile owners and mobile internet users, on which the estimate of the gender gap across low-and middle-income countries was based.

A small number of low- and middle-income countries were not included in the extrapolation model due to a lack of available data. Estimates for these countries were therefore not included in the total figure for low- and middle-income countries, and did not contribute to regional averages. Excluded countries made up less than 2% of the total population of low- and middle-income countries.[7]

Table 4

Surveyed versus modelled results of mobile ownership and mobile internet use gender gaps in a selection of face-to-face surveyed countries

Actual and modelled gender gap: mobile ownership and mobile internet use	MOBILE OWNERSHIP		MOBILE INTERNET USE	
	Surveyed gender gap	Modelled gender gap	Surveyed gender gap	Modelled gender gap
Bangladesh	33%	32%	63%	62%
Brazil	-2%	0%	5%	-5%
China	-1%	-1%	4%	3%
Colombia	0%	1%	4%	1%
Côte d'Ivoire	15%	11%	40%	40%
India	23%	30%	68%	63%
Kenya	7%	6%	37%	28%
Mexico	5%	7%	10%	0%
Pakistan	45%	39%	63%	69%
Tanzania	9%	14%	41%	33%

7. Eleven countries were excluded due to a lack of available data, including North Korea, Syria and Somalia.

Estimating the commercial opportunity for mobile operators

One of the main objectives of this study was to quantify the commercial opportunity for mobile operators based on closing the gender gap in mobile ownership and mobile internet use in low- and middle-income countries. A model was constructed to estimate the 12-month revenue opportunity in each low- and middle-income country using the surveyed and extrapolated mobile ownership and mobile internet figures, and then all the results summed.

The overall commercial opportunity was first estimated in each low- and middle-income country individually by combining two components:

1. Closing the mobile internet usage gap: the additional revenue from increasing female mobile internet uptake to be equal to male, resulting in increased female average revenue per user (ARPU)

2. Closing the mobile ownership gap: the additional revenue from adding new female subscribers until the rate of mobile penetration in every country is the same for women as for men

Table 5 shows the metrics used to calculate these two components.

Table 5

Key input metrics to model the commercial opportunity

METRIC	DEFINITION	CALCULATION
$ARPU_{Data}$	Total annual recurring revenue from data services divided by total data subscribers. Derived from 2017 reported operator data.	$\frac{\text{Data revenue}}{\text{Total mobile internet subscribers}}$
$ARPU_{Basic}$	Total annual recurring revenue from all non-data services (including voice, SMS, value-added services) divided by total mobile subscribers. This revenue is assumed to be generated by all subscribers, both mobile internet users and non-users. Derived from 2017 reported operator data.	$\frac{\text{(Total recurring revenue – Data revenue)}}{\text{Total mobile subscribers}}$
Mobile internet uptake	The proportion of mobile owners that use mobile internet (%).	$\frac{\text{Total mobile internet subscribers}}{\text{Total mobile subscribers}}$
Total subscribers	Total number of unique mobile subscribers in a market.	Mobile penetration × Total population
Male/Female	Male or female-specific indicators are designated by an *m* or *f* subscript.	E.g. Female ARPU = $ARPU_f$

Note that all metrics are calculated at a country level. Revenues have been aggregated across all mobile operators in a country to account for individuals owning multiple SIMs. Metrics are drawn from a combination of reported mobile operator data, the results of primary research and the results of the extrapolation models described in the previous section.

Estimating the components of the commercial opportunity

Closing the mobile internet usage gap

The revenue opportunity associated with **closing the mobile internet usage gap** was calculated for each low- and middle-income country in two stages:

1. Estimating male and female ARPU based on relative levels of mobile internet uptake; and

2. Estimating the additional revenue from increasing female ARPU until it was equal to male ARPU for all subscribers.

For the first stage, country-level male and female ARPU was estimated using the following steps:

- ARPU estimates associated with 'basic' and data services were taken from GSMA Intelligence, based on operator-reported and modelled data (referred to as $ARPU_{Basic}$ and $ARPU_{Data}$ respectively)
  - It was assumed that each of these values was the same for men and women.

- Male ARPU was estimated by adding two components (see Formula 3):
  - Basic ARPU ($ARPU_{Basic}$); and
  - Data ARPU ($ARPU_{Data}$) multiplied by **male** mobile internet uptake.

- Female ARPU was calculated using the same approach, adding two components (see Formula 4):
  - Basic ARPU ($ARPU_{Basic}$); and
  - Data ARPU ($ARPU_{Data}$) multiplied by **female** mobile internet uptake.

Estimated female and male ARPU ($ARPU_f$ and $ARPU_m$) was calculated for each country using the following formulas:

Formula 3: Estimating male ARPU

$$ARPU_m = ARPU_{Basic} + Mobile\ internet\ uptake_m \times ARPU_{Data}$$

Formula 4: Estimating female ARPU

$$ARPU_f = ARPU_{Basic} + Mobile\ internet\ uptake_f \times ARPU_{Data}$$

For the second stage in calculating the revenue opportunity associated with closing the mobile internet gender gap, the difference between estimated male and female ARPU ($ARPU_m$ – $ARPU_f$) was multiplied by the number of female subscribers.

Formula 5: The revenue opportunity from closing the mobile internet usage gender gap

$$Closing\ the\ mobile\ internet\ usage\ gap = (ARPU_m - ARPU_f) \times Total\ subscribers_f$$

Closing the mobile ownership gap

The revenue from **closing the ownership gap** was calculated as the result of multiplying the increase in the number of female subscribers resulting from equalising male and female mobile penetration by ARPU.

Formula 6: The revenue opportunity from closing the mobile ownership gender gap

$$Closing\ the\ ownership\ gap = (Mobile\ penetration_m - Mobile\ penetration_f) \times Population_f \times ARPU_m$$

Note that the commercial opportunity associated with closing the ownership gap is calculated using male ARPU ($ARPU_m$), as it is assumed in the previous step of this model that male and female ARPU have been equalised.

The two components described above were added together to determine the total commercial opportunity:

Formula 7: The total estimated commercial opportunity from closing the mobile gender gap

$$Commercial\ opportunity = Mobile\ internet\ usage\ gap + Ownership\ gap$$

Caveats to commercial opportunity estimates

Whilst this approach draws on actual operator data, and efforts have been made to ensure the resultant figure is a realistic and representative reflection of the commercial opportunity for mobile operators, there are some caveats (some of which are likely to offset each other):

- Estimated female ARPU does not take into account any lower spending on mobile services among female users compared to male.[8] This approach therefore does not account for either the differences between men and women in the average volume of data usage or the revenues from the use of other services, such as voice or SMS.
- New subscribers acquired during the process of closing the mobile ownership gender gap have also been assumed to have the same ARPU as existing customers. However, in reality, ARPU will likely be lower for newly acquired customers.
- This model only represents the commercial opportunity for the population over the age of 18.
- It has been assumed that the basic service revenues generated by mobile internet subscribers is equal to those generated by non-mobile internet subscribers. It could be hypothesised, however, that core service revenues would be lower for mobile internet users due to the substitution of "over-the-top" alternatives for core operator services, making the ARPU differential between data users and non-users less pronounced than this model estimates. However, it is also possible that data users' greater overall mobile usage may result in higher spend on basic services as well, having the inverse effect.
- The model also represents the opportunity if mobile operators were to close the mobile gender gap immediately (in 2018), but in reality this would actually be a far more gradual process. This model and the revenue figure generated are therefore intended only to be indicative of the scale of the commercial opportunity available to mobile operators, not a forecast of actual revenue increases to be achieved.

8. Previous research and analysis suggest that mobile usage and spending levels would be lower on average for women in low- and middle-income countries. See, for example, GSMA, 2015, "Bridging the gender gap: Mobile access and usage in low- and middle-income countries".

Comparison to previous GSMA Connected Women work

There are a number of methodological differences in this study which mean that its findings should not be directly compared to those from the GSMA's 2015 report, "Bridging the gender gap: Mobile access and usage in low- and middle-income countries".[9]

The key differences that limit comparison between the two studies are:

- Age categories: the 2015 study included the population over the age of 15, whereas the 2018 study covered those over the age of 18. Given age distribution in many low- and middle-income countries, the population aged 15-18 make up a significant share of the population, and the change may materially impact on the results;
- Differences in the underlying survey countries: the estimated gender gap for all low- and middle-income countries and for different regions have been generated from models relying on surveys conducted in different sets of countries;
- Changes to the World Bank's categorisation of low- and middle-income countries have meant that global and regional gender gaps do not represent the same underlying countries;
- There are differences between the two studies in the structure, routing and wording of the questionnaire;
- Methodological differences in the extrapolation model: while a similar process of regression analysis was used, ultimately a different set of variables was selected for the extrapolation of the mobile ownership gender gap to non-surveyed countries in the 2018 report compared to 2015;
- Differences in input data, methodology and assumptions used in estimating the commercial opportunity for mobile operators in closing the mobile gender gap mean that the figures in the two studies cannot be directly compared.

9. GSMA, 2015, "Bridging the gender gap: Mobile access and usage in low- and middle-income countries."

www.gsma.com

GSMA HEAD OFFICE
Floor 2
The Walbrook Building
25 Walbrook
London EC4N 8AF
United Kingdom
Tel: +44 (0)20 7356 0600
Fax: +44 (0)20 7356 0601