Connected Women

Methodology

The Mobile Gender Gap Report 2019

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Introduction

This document is intended to provide greater explanation of the methodology behind the GSMA *Mobile Gender Gap report 2019*.[1] The GSMA's *Mobile Gender Gap Report 2019* is part of an annual series that calculates the gender gap in mobile ownership and mobile internet use across low- and middle-income countries (LMICs).[2] This accompanying methodology report describes the analysis and modelling undertaken for *The Mobile Gender Gap Report 2019* as well as highlighting key areas of methodological change year-on-year.

This document is designed as a supplement to the main report, providing details of the analytical and research methodologies used including:

1. Analysis of the GSMA Intelligence Consumer Survey 2018, on which the findings of the study were based. The survey covers 18 countries representing 69 per cent of the total adult population across all LMICs.
2. The extrapolation models which provide estimates of the gender gaps in mobile ownership, mobile internet and spend on mobile services in non-surveyed LMICs.
3. The modelling for calculating the commercial opportunity associated with closing the gender gap in mobile ownership and mobile internet use in LMICs in the next five years.
4. The modelling for estimating the economic impact associated with closing the gender gap in mobile internet use in LMICs in the next five years.
5. Analytical approaches to investigate the results from the usage and barriers questions in the GSMA Intelligence Consumer Survey.
6. The approach for analysing both GSMA Intelligence Consumer Survey data and third-party data longitudinally to determine whether the mobile gender gap has changed.

Comparisons to previous GSMA Connected Women work

Due to refinement in the wording and structure of the questionnaire year-on-year and the changes in underlying methodology outlined in this document, caution should be taken in drawing conclusions about country-level, year-on-year changes from *The Mobile Gender Gap Report 2018*.[3] Any trends identified in this year's report are based on longitudinal assessments of GSMAi and third-party gender disaggregated data and have been deemed significant on a case-by-case basis.

1. GSMA (2019), *The Mobile Gender Gap Report 2019*.
2. See Table 1 for definitions of the gender gap and other key terms.
3. GSMA (2018), *The Mobile Gender Gap Report 2018*.

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 (LMICs)	Countries classified as low income (GNI per capita of $995 or less in 2017), lower-middle income (GNI per capita between $996 and $3,895 in 2017) or upper-middle income (GNI per capita between $3,896 and $12,055 in 2017) by the World Bank.[4]
Mobile internet user	A "mobile internet user" is a person who has used the internet on a mobile phone at least once in the last three months.[5] Mobile internet users do not have to personally own a mobile phone, and therefore can be non-mobile phone owners who use mobile internet by accessing it on someone else's mobile phone.
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. Note that this methodology report also refers to unique subscribers as mobile owners and mobile phone owners. These terms are used interchangeably in the report to mean a person who has sole or main use of a SIM card, or a mobile phone that does not require a SIM, and uses it at least once a month. The vast majority of SIM owners also have sole or main use of a handset (an average of 94 per cent across the sample countries).
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 (also referred to as SIM ownership), mobile internet use and spend on mobile services calculated using the following formula:

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

4. The World Bank Country and Lending Groups FY 2019, includes 137 countries in total.
5. Respondents were asked the question: "Have you ever used the internet on a mobile phone? Please think about all the different ways of using the internet on a mobile phone. Just to confirm, people are using the internet on their mobile phones when they do any of the following: visit internet websites (e.g. Google or Amazon), visit social networking websites (e.g. Facebook, Twitter, YouTube, Weibo), send emails or instant messages (e.g. WhatsApp, Snapchat, WeChat, LINE) or download apps." Mobile internet users are those who answered "Yes, I have used the internet on a mobile phone in the last three months".

The GSMA Intelligence Consumer Survey 2018

Scope of the survey

The Mobile Gender Gap Report 2019 is primarily based on a nationally representative survey of 18 LMICs conducted as part of the GSMA Intelligence Consumer Survey 2018 (see Table 2). Over 20,000 face-to-face interviews were conducted. The countries included in the survey represent over 69 per cent of the adult population in LMICs (see 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 in this report

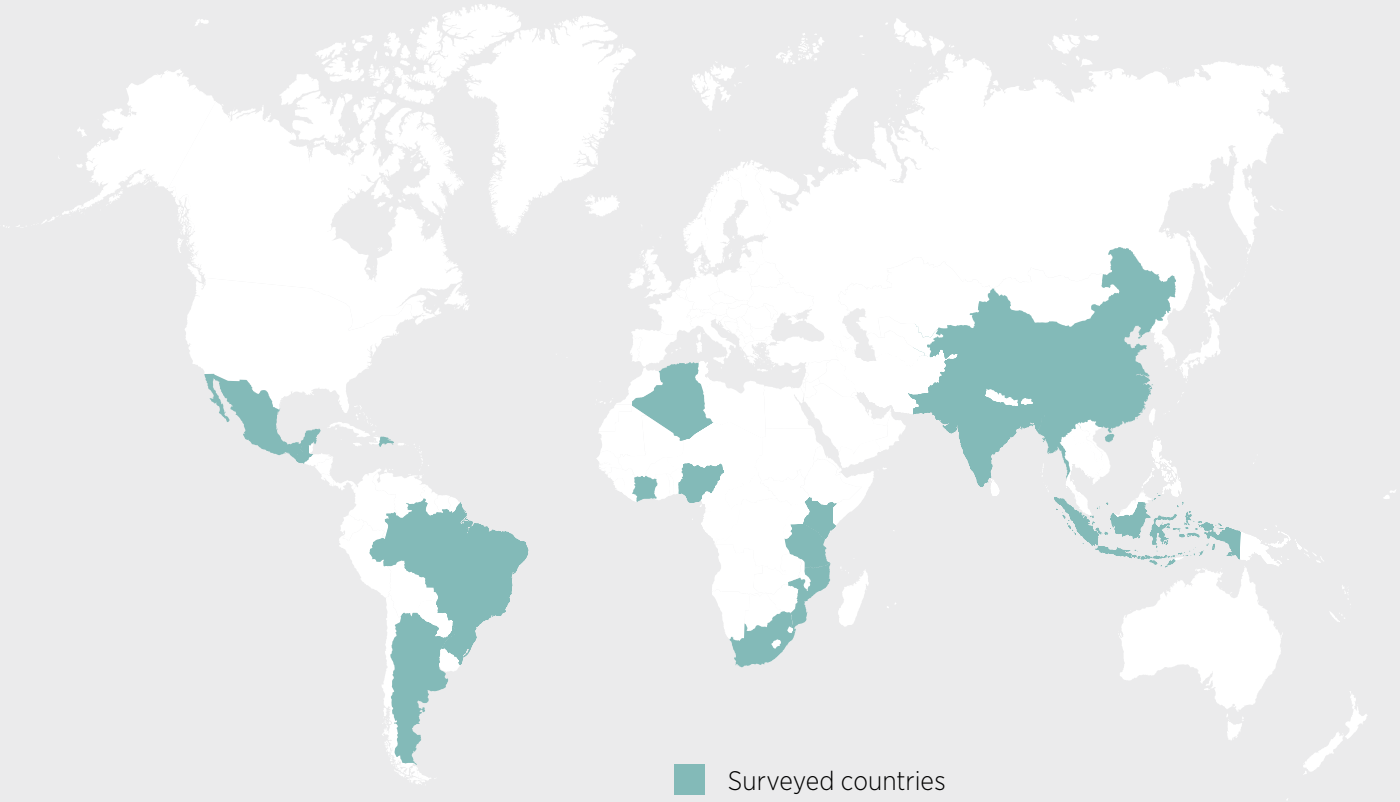

Table 2

Surveyed countries in this report, by region

AFRICA	LATIN AMERICA	ASIA
Algeria	Argentina*	Bangladesh
Côte d'Ivoire	Brazil	China
Kenya	Dominican Republic	India
Mozambique	Guatemala	Indonesia
Nigeria	Mexico	Myanmar
South Africa		Pakistan
Tanzania		

* Although Argentina is now defined as "high income" by the World Bank (2018), it was included in the modelling and analysis for this report as a benchmark for other Latin American countries and for consistency with *The Mobile Gender Gap Report 2018*. When results from LMICs are discussed in the main report, Argentina is included.

Sampling and fieldwork

In all countries, a nationally representative sample of the adult population aged 18 and over 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 by gender;
- Urban and rural distribution by gender;
- Region/state; and
- Quotas were applied for socio-economic class (SEC) to ensure a representative portion of lower income respondents were included, except Mozambique 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 where interviews were conducted 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 in each country.

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). Survey interviews were conducted in the local language by both female and male interviewers. Interviews were conducted in respondents' homes, with the exception of China where in-street interviewing was conducted.[6] Within sampling points, systematic random routes were used for residence selection.

Weights were applied to the data using a random iterative method (RIM weights) whereby several non-interlocking quotas were applied in an iterative sequence and 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; however, 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 use will be different, and likely most limited, in these areas.

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

The gender gap extrapolation model

The Mobile Gender Gap Report 2019 provides figures covering the gender gap in LMICs for three key metrics:

- Mobile ownership;
- Mobile internet use; and
- Spend on mobile services.

In the 18 countries surveyed in the Consumer Survey 2018, these figures were derived directly from the survey results. These 18 countries represent 69 per cent of the total adult population of all LMICs.[7] In order to cover the remaining non-surveyed countries, extrapolation models were created to estimate these three metrics. Data from the 2017 and 2018 Consumer Survey countries served as the primary inputs for the model.[8] In addition, third-party and publicly available survey data was used when it was considered robust, which provided gender gap measures for mobile ownership and internet use in 2017 for an additional 10 countries.[9] All country-level figures cited in the main study were derived directly from GSMA Intelligence face-to-face survey results.

To generate the estimates for non-surveyed countries, three extrapolation models were developed: one to estimate the gender gap in mobile ownership, one to estimate the gender gap in mobile internet use and one to estimate the gender gap in spending on mobile services. There were three stages to the analysis:

1. Testing a range of independent variables to determine the best predictors of the respective gender gaps in mobile ownership, mobile internet use and spending on mobile services in surveyed countries using regression analysis;
2. Generating a best-fit equation for each metric 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 for each metric.

See Table 3 for a summary of the final predictor variables used in the extrapolation models.

7. United Nations Department of Economic and Social Affairs, Population Division, 2017, "World Population Prospects 2017".
8. Where 2017 data was the most recent data available for a country, the year-on-year change between 2017 and 2018 was estimated using the outputs of the extrapolation model.
9. Data was sourced from After Access (Cambodia, Paraguay, Peru, Rwanda), The Financial Inclusion Insights Program (Uganda) and Pew Global Attitudes and Trends (Jordan, Lebanon, Russia, Senegal and Vietnam). To calculate gender gap estimates in these countries for 2018, the growth rate implied from the extrapolation model was applied to the actual 2017 data.

Table 3

Final predictor variables used in extrapolation models

Predictor variables for mobile ownership gender gap model	Predictor variables for mobile internet gender gap model	Predictor variables for mobile spending gender gap model
Composite "income-education" indicator, capturing GNI per capita and mean years of schooling for women (Source: UNDP)	GDP per capita (Source: IMF) Mean years of schooling for women (Source: UNDP)	Composite "income-education" indicator, capturing GNI per capita, mean years of schooling and expected years of schooling for women (Source: UNDP)
Mobile phone ownership among adult women (Source: Gallup World Poll)	Facebook gender gap (Source: Facebook Audience Insights)[10]	Average revenue per user or ARPU (Source: GSMA Intelligence)[11]
South Asia "dummy" variable[12]	South Asia "dummy" variable	South Asia "dummy" variable

The independent variables used in the final extrapolation models are not necessarily those that have the most explanatory power. The regression analysis identified a combination of variables, which together provide the best estimate of the mobile gender gap, even though each individual variable may not have been the one most strongly correlated with the gender gap. The extrapolated models estimated a gender gap that was, on average, within +/– five percentage points of those derived from the survey (see Table 4 for a comparison of modelled and survey results).

10. The gender gap in the penetration of active Facebook accounts in the population. Note that since user gender is self-reported, it may not be fully accurate and individuals may have multiple accounts, Facebook Audience Insights, September 2018.
11. Calculated as recurring revenues divided by total unique subscribers.
12. This dummy variable takes a value of 1 if a country is in South Asia. It is included to capture the disproportionately wide gender gap in South Asian countries.

Table 4

Survey versus modelled results of gender gaps in mobile ownership, mobile internet use and spend on mobile services in a selection of face-to-face surveyed countries

Actual and modelled gender gap: mobile ownership and mobile internet use (2018)	MOBILE OWNERSHIP		MOBILE INTERNET USE		SPEND ON MOBILE SERVICES	
	Surveyed gender gap	Modelled gender gap	Surveyed gender gap	Modelled gender gap	Surveyed gender gap	Modelled gender gap
Bangladesh	33%	29%	63%	58%	51%	36%
Brazil	–2%	0%	–1%	–1%	16%	17%
China	0%	–1%	1%	2%	18%	22%
Côte d'Ivoire	9%	14%	47%	41%	46%	44%
Guatemala	13%	9%	20%	20%	49%	45%
India	26%	29%	56%	59%	19%	30%
Kenya	5%	8%	39%	34%	29%	33%
Mozambique	24%	22%	59%	57%	33%	36%
Nigeria	5%	13%	29%	32%	34%	30%
Pakistan	37%	39%	71%	66%	44%	48%

Once the gender gaps in mobile ownership, mobile internet use and spend on mobile services were estimated for non-surveyed countries using these extrapolations, 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, mobile internet users and the difference in spending, on which we based our estimates of the gender gaps across LMICs. The gender gap in spending on mobile services then informed the modelling of the commercial opportunity to close the mobile gender gap. This is detailed further in the section, *Estimating the commercial opportunity for mobile operators* on page 16.

A small number of LMICs were not included in the extrapolation model due to a lack of available data.[13] For these countries, gender gaps were imputed based on regional averages. However, as they only made up one per cent of the total adult population of LMICs, this approach did not have an impact on the overall results. At the regional level, excluded countries made up no more than two per cent of the adult population of LMICs, so they also had minimal influence on the findings.

13. The countries were: Cuba, Djibouti, Dominica, Eritrea, Grenada, Guinea-Bissau, Kiribati, Kosovo, Marshall Islands, Nauru, North Korea, Saint Vincent and the Grenadines, Samoa, Solomon Islands, Somalia, Turkmenistan, Tuvalu and Vanuatu.

Evaluating the extrapolation models

The extrapolation models for the gender gap in mobile ownership and mobile internet use built on the analysis conducted for *The Mobile Gender Gap Report 2018*,[14] for which over 90 independent variables were tested to determine the best predictors of the gender gap in mobile ownership and mobile internet use. In order to compare different models for *The Mobile Gender Gap Report 2019*, a range of diagnostics were tested including:

- Adjusted R^2 – the proportion of variance of the dependent variable explained by the independent variable. A higher R^2 means that the predicted values better fit the observed data.
- Root Mean Square Error (RMSE) – the standard deviation of model residuals. A lower RMSE indicates better fit.
- Mean Absolute Error (MAE) – similar to RMSE but less sensitive to large residuals. A lower MAE indicates better fit.
- AIC and BIC[15] – assesses fitness of model while also balancing parsimony. Lower values indicate better fit.
- Out-of-sample testing – adopted two variants of the "k-fold" method:
  - One approach split the sample into a "training" set (used to fit the model) and a "test" set (used to evaluate the model results using the RMSE and MAE). Due to the relatively small sample of countries in the analysis, this was run 10 times for each model, varying the training and test sets. Model fitness was then evaluated by considering the average RMSE and MAE across the 10 tests.
  - The second approach was similar to the first, but applied the "leave one out" method whereby the model is fitted using all the data less one observation. The model fit is then evaluated by assessing how accurately it predicts that remaining observation. This approach was run for each observation to generate an average RMSE/MAE for each model.

Tables 5, 6 and 7 correspond with the final extrapolation formulae 1-3 (see section *Final extrapolation model equations* on page 15). The top section of each table outlines the final predictors and their corresponding coefficients used in the final equations. The bottom section of each table outlines the performance of each model against the aforementioned statistical diagnostics.

14. GSMA (2018), *The Mobile Gender Gap Report 2018: Methodology*.
15. Akaike information criterion and Bayesian information criterion.

Table 5

Best-performing models for the gender gap in SIM ownership

	MODEL 1	MODEL 2	MODEL 3 (2018 MODEL)
Female income-education Index	–0.047***	–0.051***	–
Female HDI	–	–	–0.375***
Female mobile adoption	–0.282***	–	–
Mobile adoption	–	–0.318***	–0.363***
South Asia dummy	0.138***	0.162***	0.180***
N	51	51	51
Adjusted R^2	0.84	0.83	0.79
RMSE	0.048	0.049	0.054
MAE	1.889	1.931	2.075
AIC	–161	–158	–149
BIC	–153	–150	–141

*Significance level: *** 1%, ** 5%, * 10%*

Table 5 presents regression outputs for the two best-performing models to determine the gender gap in SIM ownership (models 1 and 2), along with the outputs using the model from the 2018 study (model 3). The first model performed better than all others across the vast majority of diagnostics and was therefore the preferred model. The predictors differ from those used in the 2018 report in that:

1. They now include mobile adoption among women (rather than all adults).

2. Instead of using the female Human Development Index, a composite index incorporating GNI per capita and mean years of schooling for women[16] was developed, essentially a "female income-education" index. This captures two of the components of the female HDI, but excludes health (measured using female life expectancy). The revised model performs better as the gender gap in mobile ownership is more strongly correlated with female income and education than health outcomes. This is also demonstrated by the fact that the correlation coefficient between the gender gap in SIM ownership and the income-education index is –0.77, compared to –0.69 for the female HDI.

16. Data for both indicators is sourced from UNDP.

Table 6

Best-performing models for the gender gap in mobile internet use

	MODEL 1	MODEL 2	MODEL 3 (2018 MODEL)
GDP per capita	–0.112***	–0.150***	–
Female years of schooling	–0.024	–	–
Female HDI	–	–	–1.154***
Facebook gender gap	0.316***	0.422***	0.282*
South Asia dummy	0.201***	0.193***	0.202***
N	52	52	52
Adjusted R2	0.88	0.87	0.85
RMSE	0.085	0.088	0.094
MAE	3.271	3.426	3.702
AIC	–104	–102	–95
BIC	–94	–94	–87

*Significance level: *** 1%, ** 5%, * 10%*

Table 6 presents regression outputs for the two best-performing models to determine the gender gap in mobile internet use (models 1 and 2), along with the outputs using the model from the 2018 study (model 3). Like the gender gap for SIM ownership, health outcomes are not as strongly correlated as education and income (although in this case, the correlation is stronger with overall income than income for women). Model 1 was the preferred specification as it performed better across almost all diagnostics compared to other models.

Table 7

Best-performing models for the gender gap in mobile spending

	MODEL 1	MODEL 2
Female income-education index	–0.100***	–
Female income	–	-0.160***
ARPU	0.153***	0.167***
South Asia dummy	0.164*	0.149*
N	18	18
Adjusted R2	0.63	0.59
RMSE	0.078	0.081
MAE	1.005	1.092
AIC	–37	–36
BIC	–34	–32

*Significance level: *** 1%, ** 5%, * 10%*

Table 7 presents regression outputs for the two best-performing models to determine the gender gap in mobile spending. Model 1 was the preferred specification as it performed better across almost all diagnostics than other models.

It is worth noting that while the models were selected based on how they performed across relevant diagnostics, the estimates of both the 2017 and 2018 gender gaps in mobile ownership and mobile internet across LMICs overall were the same whether the first, second or third best performing models were used. They were also the same for the model used in *The Mobile Gender Gap Report 2018*. The estimates for the global gender gap in LMICs are therefore robust across different models.

Final extrapolation model equations

The three equations for the final extrapolation models are below:

Formula 1: The extrapolation formula for the mobile ownership gender gap in LMICs
$Ownership_{GG}$ = 0.291 + 0.138 x South Asia Dummy – 0.047 x Female Income Education Index – 0.282 x Female mobile adoption

Formula 2: The extrapolation formula for the mobile internet gender gap in LMICs
MI_{GG} = 1.282 + 0.201 x South Asia Dummy – 0.112 x GDP per capita – 0.024 x mean years of schooling for women + 0.316 x FB_{GG}

Formula 3: The extrapolation formula for the mobile spending gender gap in LMICs
S_{GG} = – 0.03 + 0.164 x South Asia Dummy – 0.1 x Female Income Education Index + 0.153 x ARPU

Estimating the commercial opportunity for mobile operators

One of the main objectives of *The Mobile Gender Gap Report 2019* was to size the commercial opportunity of closing the gender gap in mobile ownership and use for mobile operators, expanding the scope of the opportunity identified in the 2018 report beyond just mobile ownership and mobile internet adoption. To inform this analysis, respondents to the GSMA Intelligence Consumer Survey 2018 were asked to indicate how much they typically spend on mobile services.

This spending data was collected through two stages of questioning. First, respondents were asked to categorise their monthly or weekly[17] mobile spending within several broad bands, including all mobile phones/SIM cards paid for by someone else. Of the respondents that stipulated a spending band, an additional question would then ask the respondent to specify an exact spending figure based on their typical usage. The calculation took the average of the exact spend specified per band and weighted the spending according to the number of respondents that had reported spending in that band in the prior question. For the surveyed countries, this allowed the calculation of an average "spending gender gap".[18] An extrapolation model was then developed to estimate the spending gender gap in non-surveyed countries, as outlined in the prior *Extrapolation model* section.

17. Respondents were asked about either monthly or weekly spending depending on the country they were located in. Respondents were asked about monthly spending in countries where monthly, often post-paid top-ups are more prevalent. In countries where more frequent, lower value top-ups are more common, respondents were asked about weekly spend.
18. Calculated as 1– (female spend/male spend).

Breakdown of the commercial opportunity modelling

Male and female ARPU was calculated based on GSMAi country-level ARPU estimates and the gender gap in mobile spending. With this information, it was possible to calculate the estimated revenue opportunity of closing the gender gap in SIM ownership and spend by 2023 as follows:

1. Calculate revenues generated from adult female subscribers from 2019–2023 based on expected growth (multiplying the number of adult female subscribers by female ARPU).[19]

2. Closing the gender gap in SIM ownership – assume that the gender gap in SIM ownership closes in 2023 following a "straight-line glide path". In each year, reducing the gender gap increases the number of adult female subscribers. This total is then multiplied by female ARPU. The difference between this and the calculation in step 1 provides the additional revenue contribution from closing the SIM gender gap.

3. Closing the gender gap in mobile spending – assume that the gender gap in spend closes by 2023 following a straight-line glide path.[20] In each year, reducing the gender gap increases female ARPU. This is then multiplied by the number of adult female subscribers. The difference between this and the calculation in step 1 provides the additional revenue contribution from closing the gender gap in mobile spending.

4. Estimate the adult female revenues when both the gender gaps for SIM ownership and spending on mobile services are assumed to close by 2023. The difference between this and the calculations in steps 1, 2 and 3 provides the incremental revenue from closing both gender gaps.

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 *Extrapolation model* section. Note that this calculation differs from that used in *The Mobile Gender Gap Report 2018* as it includes the revenue from equalising all mobile spending, not just mobile internet uptake, so estimates are commensurately higher.

While this approach draws on actual mobile operator data, and efforts have been made to ensure the resultant commercial opportunity is a realistic and representative reflection of the commercial opportunity for mobile operators, these are all modelled results and the final number should be taken as an indicative figure, not a forecast. The commercial opportunity is based on several assumptions, including that new subscribers have the same ARPU as existing ones. In reality, ARPU will likely be lower for newly acquired customers.

19. For the purposes of forecasting revenues generated by female subscribers, assume that the gender gap in spend remains the same as estimated in 2018.
20. For example, if the gender gap in 2018 is 25% then assume it closes by five percentage point increments until 2023 (i.e. 20% in 2019, 15% in 2020, 10% in 2021, 5% in 2022 and 0% in 2023).

Estimating the economic impact of closing the mobile internet gender gap

The Mobile Gender Gap Report 2019 aimed to quantify the economic impact of closing the mobile internet gender gap, the first such measure of its kind. A best practice approach was concluded through stakeholder consultations and a literature review. The literature review found a broad range of material, covering studies that attempted to measure the impact of ICT on economies and people, and the economic impact of internet technologies, telecommunications and broadband internet. Despite this broad range of literature, few studies have specifically analysed the economic impact for LMICs or disaggregated findings by gender.

The economic impact of closing the gender gap in mobile internet use draws on an ITU study[21] which found that between 2010 and 2017, a one per cent increase in mobile broadband penetration yielded a 0.2 per cent increase in GDP in low-income countries[22] and a 0.18 per cent increase in GDP in middle-income countries.[23] The ITU study used a Structural-Equation Modelling framework to isolate the impact of mobile broadband on economic growth and to address the bi-directional relationship between the two factors. The results of the ITU study were found to be in line with other historic and recent research in this field.[24]

In *The Mobile Gender Gap Report 2019*, the economic impact was calculated using the following steps:

1. Calculate the economic impact driven by increased adult female mobile internet adoption between 2019 and 2023 based on expected growth. This is done by converting the annual increase in adult female mobile internet users into the equivalent percentage increase in mobile broadband penetration[25] and then multiplying this by GDP and the relevant impact co-efficient derived by the ITU (0.2 for low-income countries and 0.18 for middle-income countries).

2. Assume that the gender gap in mobile internet use closes in 2023 following a straight-line glide path. In each year, reducing the gender gap increases the number of adult female mobile internet users. This is again converted into the equivalent percentage increase in mobile internet penetration, which is then multiplied by GDP and the relevant impact co-efficient. The difference between this and calculation (1) provides the additional economic impact of closing the mobile internet gender gap.

The ITU's research indicated that, overall, mobile broadband appears to have a higher economic impact than fixed broadband and that mobile broadband has a higher economic impact in less developed countries.

21. Katz and Callorda (2018), *The economic contribution of broadband, digitization and ICT regulation*, ITU.
22. These were defined as countries with a GDP per capita less than $12,000 (PPP).
23. These were defined as countries with a GDP per capita between $12,000 and $22,000 (PPP).
24. Qiang et al. (2009), Czernich (2011), Scott (2012), Goodridge et al. (2017) and Koutroumpis (2018).
25. This step is required because the ITU study was based on mobile broadband adoption of the total population and not just adults or adult women.

Analysing mobile usage and barriers

Barriers to mobile ownership and mobile internet use

In *The Mobile Gender Gap Report 2019*, the barriers to mobile ownership are identified for respondents who do not own a mobile phone, and barriers to mobile internet are identified for those who own a mobile phone but have not used mobile internet in the last three months, despite being aware of it.[26]

The GSMA Intelligence Consumer Survey 2018 allowed for respondents to identify barriers by their level of importance, ranging from "This is a barrier" to "This is one of the most important barriers" to "This is the single most important barrier". This staggered structuring of the questions allowed for detailed analysis of the key barriers women face to mobile ownership and mobile internet use. Survey respondents were asked to identify barriers from a pre-defined list of thirteen barriers to mobile ownership and eighteen barriers to mobile internet use.[27] In analysing each tier of importance, similarly themed individual barriers were grouped into five broader themes that the GSMA has identified through previous research.

The overarching themes used for grouping were:

- Affordability;
- Literacy and Skills;
- Relevance;
- Safety and Security; and
- Accessibility.

Within each theme, responses to individual barriers were further grouped into a single composite figure, with the exception of the individual barriers under the theme of Accessibility, which are too diverse to be combined as a single composite. The composites were calculated using respondent level feedback, and are not an average of the values of all the individual barriers included in the category. This better illustrated the importance of broad themes that can manifest for consumers in multiple ways. For example, issues related to digital skills or literacy can present a wide range of barriers to people owning or using a mobile phone. Multiple questions need to be asked to fully capture the influence of this issue. By contrast, the importance of cost as a barrier can be more simply captured in two questions. Creating composite barriers therefore allows for the various components of the more complex barriers to be combined, and their full importance accurately represented. Once composite barrier groupings were created, values were averaged across the constituent countries per region to rank the importance of each barrier on a regional level.

26. The proportion of adults that are considered aware of mobile internet is calculated by summing those who report ever having used mobile internet, and those who report not having used it, but being aware of the internet and that it can be used on a mobile phone (i.e. it is assumed that those who have used mobile internet are aware of it).
27. See Appendix 2 in *The Mobile Gender Gap Report 2019* for a comprehensive list of the barriers to mobile ownership and the barriers to mobile internet use.

Analysing usage of mobile services

In the Consumer Survey, mobile owners were asked about their types of mobile usage. This was structured in a pre-defined list of 28 common use cases for a mobile phone,[28] ranging from basic services, such as calling and SMS, to more advanced internet-based services. Respondents were asked to report on the level of frequency with which they used each type of service. The analysis in the main *Mobile Gender Gap 2019* report focused on weekly usage of services to exclude services that were used only sporadically. Usage categories were defined according to the number of unique use cases identified in the Consumer Survey questionnaire. Respondents were divided into groups depending on whether they used 0, 1–5, 6–10 and >10 of the identified use cases on a weekly basis. Looking across the use cases and the corresponding frequency of use, there were noticeable differences in the number of men and women reporting more than 10 use cases on a weekly basis.

The usage questions were not anchored to a respondent's own handset. As such, the usage statistics should be interpreted as being indicative of a respondent's total usage pattern regardless of who owned the handset used.

28. The use cases identified in the survey are as follows: Network calls/IP calls/SMS and MMS/Video calling/Email/Instant messaging apps/Visiting social networking sites/Browsing the internet/Using maps, timetables, traffic information applications/Finding information about goods and services/Ordering and purchasing goods/Reading the news/Booking transport/Playing games/Downloading apps/Watching free-to-access online video/Paying for on-demand TV and movies/Listening to free online music/Paying to download or stream music online/Transferring money via online banking/Using mobile money to send or receive money/Paying for goods using contactless payment/Paying utility bills/Accessing services that improve or monitor health/Access government services/Looking or applying for jobs/Accessing information to support education/Accessing information on farming or fishery services.

Longitudinal analysis of the gender gap in mobile ownership

As part of the analysis for *The Mobile Gender Gap Report 2019*, a comprehensive analysis of third-party gender-disaggregated data was undertaken to investigate trends in the mobile ownership gender gap over time. A similar approach was taken for analysing the mobile internet gender gap; however, ultimately this was not possible due to a lack of longitudinal third party data. Initial comparisons suggested differing results between sources and some level of fluctuation year-on-year per source. This indicated datasets could not be compared directly and emphasised the need for longitudinal data per source to allow for reliable year-on-year analysis.

A variety of third-party surveys with gender-disaggregated data were analysed longitudinally to minimise the effect of individual country-level fluctuations. These datasets included:

- The Financial Inclusion Insights Program (FII) by Intermedia (eight countries, 2013–2017);
- Gallup World Poll (138 countries, 2015–2017);
- LIRNEAsia (seven countries, 2008–2017);
- Pew Global Attitudes and Trends (28 countries, 2010–2017); and
- Research ICT Africa (17 countries, 2008–2017).

The underlying questionnaires and survey methodologies were reviewed for each source and the data points were cross-referenced across datasets to identify anomalous fluctuations in the data points. Results from each dataset were checked and validated against other sources, such as by comparing UNESCO education statistics to the demographics of those surveyed to evaluate the degree of national representativeness. The Gallup and Pew surveys cover the greatest range of countries for the longest consecutive periods and were therefore used as the primary basis of this analysis. The data points from these surveys were weighted by UN World Population Prospects estimates and averaged on a regional basis to further filter out country-level fluctuation. The findings indicated that on a regional level, in terms of statistical significance, gender gaps in mobile ownership have remained largely unchanged, with the average change across all regions for 2015–2017 remaining within two percentage points.

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