Connected Women | 2015

METHODOLOGY

Bridging the gender gap: Mobile access and usage in low- and middle-income countries

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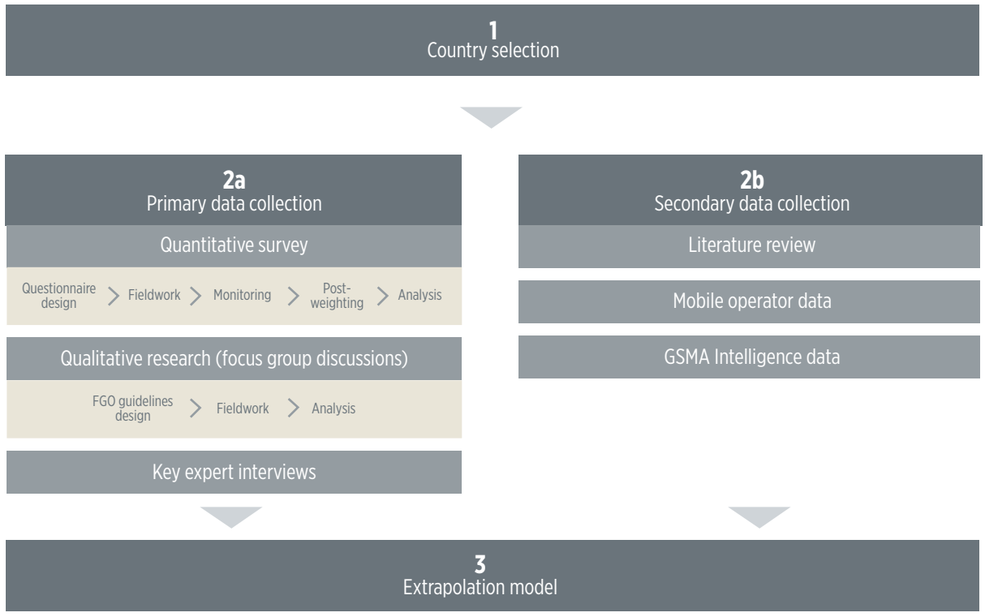
Introduction

This study aims to understand how many women in low- and middle-income countries own mobile phones, how intensively they use them, and the barriers to mobile phone adoption and use compared to men. Primary field research in 11 countries combined with secondary sources has been used to estimate the gender gap in mobile phone ownership in 139 low- and middle-income countries, and to identify trends and recommendations that will help stakeholders ensure women have access to mobile technology and benefit from using it.

This study was conducted over a 6-month period and structured around three main steps: 1) country selection, 2) data collection and analysis, and 3) designing the extrapolation model to estimate the gender gaps in mobile ownership and usage and the revenue opportunity *(Fig. 1)*. Data was collected from six main sources of primary (quantitative survey, qualitative survey, and key expert interviews) and secondary information (literature review, mobile network operator data, and GSMA Intelligence data). This document provides some definitions and highlights the main differences with the GSMA 2010 study[1] before describing the methodology used to complete each of these three main steps.

Fig. 1



1. *GSMA Mobile for Development, 2010, "Women and Mobile: A Global Opportunity", http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/01/GSMA_Women_and_Mobile-A_Global_Opportunity.pdf*
2. *GSMA Intelligence, 2014, "Measuring Mobile Penetration", https://gsmaintelligence.com/analysis/2014/05/measuring-mobile-penetration/430/*
3. *GSMA Intelligence, 2014, "Evaluating Consumer Spending: The Need for a Revised ARPU Metric", https://gsmaintelligence.com/analysis/2014/10/evaluating-consumer-spending-the-need-for-a-revised-arpu-metric/448/*
4. *Ibid.*
5. *GSMA Personal Data Programme, "Glossary", http://www.gsma.com/personaldata/glossary*

Definitions

Unique subscriber: Single individual who has subscribed to a mobile service and may hold multiple mobile connections (i.e., SIM cards) as calculated by GSMA Intelligence.[2]

Unique subscriber penetration: Unique subscribers divided by the total population using GSMA Intelligence data.

ARPU: Average revenue per user. This is calculated based on mobile revenue received by a mobile operator(s) divided by the average number of SIM connections over a certain period of time (often one month).[3]

ARPS: Average revenue per unique subscriber. This is calculated based on mobile revenue received by a mobile operator(s) divided by the average number of subscribers over a certain period of time (often one month).[4]

Gender gap in ownership: Refers to how less likely a female is to own a mobile phone than a male:

$$\text{GENDER GAP IN OWNERSHIP (\%)} = \frac{\text{MALE PHONE OWNERS (\% OF MALE POPULATION)} - \text{FEMALE PHONE OWNERS (\% OF FEMALE POPULATION)}}{\text{MALE PHONE OWNERS (\% OF MALE POPULATION)}}$$

Low- and middle-income countries: Includes all countries classified as low-income (GNI per capita of US$ 1,045 or less in 2013), lower-middle income (GNI per capita between US$ 1,046 and US$ 4,125) or upper-middle income (GNI per capita between US$ 4,126 and US$ 12,745) by the World Bank.

MSISDN: Mobile subscriber ISDN number: a structured identifier for a subscriber that indicates the A-Number, which is the phone number of a caller.[5]

Higher education: Higher education respondents are those who attended (but not necessarily completed) the following: college, university, or non-standard curriculum (e.g. Madrassa).

Lower education: Lower education respondents are those who attended (but not necessarily completed) primary or secondary school, or who answered "other" or "do not know".

Wealthier household: Respondents from wealthier households are those who reported that their household had either a TV, motorbike, or car. The specific asset chosen as a criteria for this definition varied depending on the country context:

- TV (DRC, Niger, and Kenya)
- Motorbike (India, Indonesia, and Colombia)
- Car (China, Egypt, Jordan, Turkey, and Mexico)

Poorer household: Respondents from poorer households are those who reported their household did not have either a TV, motorbike, or car. The specific asset chosen as a criteria for this definition varied depending on the country context (see definition of 'Wealthier household').

Survey respondents in the 11 countries where primary research was conducted are divided into either mobile 'users' or 'non-users':

Users	Non-users
• Has used a mobile (in the last 3 months)	• Has not used a mobile (in the last 3 months)[1]

Mobile 'users' have been divided into either mobile 'owners' or mobile 'borrowers', based on whether or not they own a SIM:

Users	
Owners	**Borrowers**
• Own a SIM (that they carry with them most of the day)[2]	• Does not own a SIM (that they carry with them most of the day)
• Vast majority[3] also own a handset,[4] so 'owners' are referred to as 'mobile phone owners' in this report	• Majority[5] of 'borrowers' borrow (or share) a handset and a SIM together, but some borrow a SIM only

1. *Non-users may have used a mobile phone in the past;*
2. *Owners may own more than one SIM;*
3. *Over 96% in all countries except in DRC, where 91% of SIM owners also own a handset;*
4. *That they carry with them most of the day. Owners may own more than one handset;*
5. *79–100% per country.*

This report focuses on the differences in self-reported data on mobile phone access and usage between women and men in low- and middle-income countries. For global market data, GSMA Intelligence[6] provides a comprehensive range of subscriber, operational, and financial statistics available at https://gsmaintelligence.com.

Main differences with the 2010 study

Direct comparisons should not be made between the estimates of the gender gap in mobile ownership in the GSMA 2010 research[7] and this study, as data and analysis have substantially expanded since then.

Category	2015 study	2010 study
Geographical scope	12 countries (Niger, India, DRC, Mexico, Indonesia, China, Turkey, Kenya, Colombia, Egypt, Jordan)	4 countries (India, Kenya, Egypt, Bolivia)
Methodology	1,000 individuals surveyed in each country (80% women and 20% men)	500 individuals surveyed in each country (only women)
	84 focus group discussions conducted across 12 countries	No focus group discussions
	Over 120 key expert interviews	40 in-depth interviews
Low- and middle-income country classification	Based on a 2013 gross national income (GNI) per capita of US$ 12,746 or less (139 countries)	Based on a 2008 gross national income (GNI) per capita of US$ 11,905 or less (149 countries)

This study also benefited from the availability of new data, especially unique subscriber data estimates based on total population from GSMA Intelligence.

Image Courtesy of Qualcomm® Wireless Reach™

Country selection

The 12 countries[8] surveyed were chosen in consultation with external stakeholders across the mobile ecosystem to represent a high proportion of the population in low- and middle-income countries, mix of geographic regions, mix of income levels, and the presence of large mobile network operators. Nigeria was initially one of these 12 countries, but results of the quantitative survey and focus group discussions in this country were eventually discarded as data could not be cross-validated with secondary sources of information. However, findings from expert interviews in Nigeria are included.

The 4 criteria used to select the 12 countries were:

- **Percentage of studied population**: Maximise the share of the population in the 12 surveyed countries as a proportion of the total population in the 139 low- and middle-income countries.
- **Income level**: Ensure each of the income level categories defined by the World Bank (low-income, lower-middle income, and upper-middle income) is suitably represented.
- **Geographic spread**: Ensure each of the six regions where low-, lower-middle, and upper-middle income countries are located (as defined by the World Bank) are suitably represented (i.e., South Asia, East Asia & Pacific, Sub-Saharan Africa, Latin America & Caribbean, Europe & Central Asia, and Middle East & North Africa).
- **Industry relevance**: Presence of top 15 mobile network operators (defined by total number of connections) that work across low-, lower-middle, and upper-middle income countries.[9]

The 12[10] countries selected cover 61% of the studied population and 13 of the top 15 mobile operators, with a good balance in terms of income level and geographic spread.

Country	% population of low- and middle-income countries	Income level	Geographic spread	Industry relevance
China	24.0%	Lower-middle income	East Asia & Pacific	3
India	21.9%	Lower-middle income	South Asia	4
Indonesia	4.3%	Lower-middle income	East Asia & Pacific	1
Nigeria	2.9%	Lower-middle income	Sub-Saharan Africa	3
Mexico	2.0%	Upper-middle income	Latin America & Caribbean	2
Egypt	1.5%	Lower-middle income	Middle-East & North Africa	3
Turkey	1.3%	Upper-middle income	Europe & Central Asia	1
Colombia	1.0%	Upper-middle income	Latin America & Caribbean	2
DRC	1.0%	Low income	Sub-Saharan Africa	3
Kenya	0.7%	Low income	Sub-Saharan Africa	3
Niger	0.3%	Low income	Sub-Saharan Africa	2
Jordan	0.1%	Upper-middle income	Middle-East & North Africa	1
Total	60.6%	n/a	n/a	13

6. GSMA Intelligence is a unit within the GSMA that houses an extensive database of mobile operator statistics, forecasts, and industry reports.

7. GSMA Mobile for Development, 2010, "Women and Mobile: A Global Opportunity", http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/01/GSMA_Women_and_Mobile-A_Global_Opportunity.pdf

8. Of the 12 countries surveyed, 3 (Kenya, India, and Egypt) were also surveyed in the original 2010 report: "Women and Mobile: A Global Opportunity".

9. China Mobile, Vodafone Group, China Unicom, Bharti Airtel Group, America Movil Group, Telefonica Group, VimpelCom Group, Orange Group, China Telecom, Telenor Group, MTN Group, Deutsche Telekom Group, Idea Cellular, Telkomsel, Etisalat Group (Source: GSMA Intelligence, majority-owned groups in Q2 2014).

10. Nigeria was one of the original 12 countries selected and is shown in the table, but was later excluded. The remaining 11 countries represent 57% of the population of low- and middle-income countries, and 12 of the top 15 mobile operators.

Primary data collection

Quantitative survey

The objective of this survey was to measure self-reported mobile ownership and usage among men and women, including barriers and opportunities associated with the use of mobile services.

Questionnaire design

Quantitative questionnaire structure[11]

Part 1: Administration

• Introducing and explaining the questionnaire • Selection of survey respondents • Formal informed consent of respondents to participate in the survey	All interviewees

Part 2: Filter question and basic socio-demographics

• Filter question – age • Socio-demographic information, including gender, household breakdown, and marital status	All interviewees

Part 3: Access

• Q6–9: categorising interviewees into: » Non-users » Users including: - SIM owners - Borrowers	All interviewees
• Q10–17: Assessment of borrowers' habits, including who they borrow from, whether they paid a fee to borrow, and how often they borrow	Borrowers of SIM and/or handset

Part 4: Handset ownership

• Ascertaining information about their handset, including: » Technical capabilities » Role and influence when purchasing » How they acquired it and who paid for it » Important criteria when selecting it	Handset owners

Part 5: SIM ownership and credit refill

• Gathering information about their SIM(s), including: » Their operator » Influences when choosing their SIM » Methods of refilling credit	SIM owners

Part 6: Non-users: barriers

• Assessing barriers preventing non-users from owning and using a mobile phone • Asking whether and how they might use a phone if given one • Understanding the possible benefits and disadvantages they may derive from using a mobile	Non-users

Part 7: Awareness and barriers

• Gauging their opinion of men and women using mobile phones • Assessing the barriers that might be preventing them from using a mobile phone or using it more often	All interviewees

Part 8: Usage (users)

• Examining their usage patterns and behaviours, including: » The last time they used specific services on a mobile » Their ability to perform certain operations on a mobile » Who they may ask for help to use a mobile	SIM owners Borrowers

Part 9: Socio-demographics

• Assessing literacy, education levels, household expenses, and occupation • Asking permission to record their mobile phone number	All interviewees

Fieldwork

In each of the 11 selected countries, 1,000 individual face-to-face surveys were conducted.[12] The following quotas were applied in each country:

Gender: 80% of interviews were conducted with women to provide a large sample of women, and 20% were conducted with men to draw gender comparisons between mobile ownership and usage.

Location: Regions where the survey was conducted were selected to reflect the country's diversity (e.g., cultural, geographical, economic) in consultation with local research firms, taking into account logistical constraints such as time, budget, accessibility, and security. Within those regions, the survey has been conducted in both urban and rural areas, using the latest data on urban/rural population split at the national level. It should be noted there is no common global definition of 'rural' and 'urban', and national definitions were used for each country. A binary definition of urban and rural was used, which excluded consideration of the peri-urban interface.

COUNTRY QUANTITATIVE SURVEY SAMPLING

- **N= 1,000 interviews**
- **80% women/20% men**
- **Urban/rural quota, based on national urban/rural split**
- **Regions selected to reflect some of the country's economic, cultural, and geographical diversity**

11. Full version of the survey questionnaire available on the Connected Women website.

12. Local research partners were: GFK (China), Dichter & Neira (Colombia and Mexico), MRA (DRC), TNS (India and Turkey), Sagaci Research (Kenya and Egypt), IPSOS (Indonesia), MRO (Jordan), and REM (Niger).

The selection process was based on the following rules:

	Methodology guidelines	Country exceptions
1. Survey location	In each country, survey locations were selected in consultation with local research firms to ensure the country's population and cultural diversity were reflected, taking into account logistical constraints (time, budget, accessibility, and security).	N/A
2. PSU[13]	Within those locations, primary sampling units (PSUs) were randomly selected by Altai Consulting using a sampling proportionate to size method: the larger the population of a PSU, the higher its chances of being randomly selected.	**China**: Each city (PSU) was split into 4 distinct geographical areas. In each of those 4 areas, street intercept interviews were conducted in one specific location per area. **Colombia**: The number of interviews conducted was proportional to the share of each socio-economic stratum in each city (PSU).[14]
3. Household	Within each PSU, households were randomly selected following a door-to-door methodology using the left-hand approach,[15] with a variable number of households skipped after each survey.	**Niger**: Random selection within sub-areas of the PSU. **India**: Right-hand approach. **China**: Street intercept as household surveys are not the norm in China.
4. Survey respondents	Within each household, the interviewee was selected randomly using the Kish grid method. Interviews were conducted on tablets in most countries. Interviewees did not receive any compensation for their participation in this quantitative survey.	**China**: Used an age quota to avoid bias in the sample due to the street intercept approach and the use of pen and paper (as tablets are not the norm in China). **Turkey**: Next birthday selection method.

Quantitative survey sampling limitations

Although significant effort was made in each of the countries at every stage to obtain a sample that was representative of the population, as is often the case in face-to-face surveys, some segments of the population showed more reluctance to participate in this survey. In addition, very remote or conflict-ridden areas were not always accessible. As such, in some countries, the most marginalised may be underrepresented, such as those with very low formal education, and/or the very old or those living in very rural areas. To avoid strong bias in the survey samples, secondary data has been used to validate country samples and highlight potential data skewed towards specific demographic groups in some countries (see following table). It is important to remember this when interpreting the findings; for example, in extremely remote areas where research was not possible, the gender gap in mobile phone ownership is likely to be even higher.

Country	Sample Demographics
Niger	N/A
India	Sample may be slightly skewed towards higher educated populations, which include those who have a non-standard curriculum (home schooling, religious studies, vocational training).
DRC	Sample may be slightly skewed towards the younger population, especially women.
Mexico	N/A
Indonesia	Sample may slightly underrepresent the young and elderly.
China	N/A
Turkey	Sample may be slightly skewed towards the younger population.
Kenya	N/A
Colombia	N/A
Egypt	In the absence of a reliable definition of urban and rural areas, analysis by location could not be conducted in this country. It should also be noted that the sample may be slightly skewed towards higher educated and younger populations.
Jordan	The database has been post-weighted by age to correct for a slight bias witnessed in the sample age split.

Image Courtesy of Qualcomm® Wireless Reach™

Monitoring

Altai Consulting applied a three-step monitoring process to maximise the quality of the data collected in the field:

- **Field supervision by Altai Consulting**: Altai Consulting deployed a large team of 13 consultants in the field, who spent more than 200 days overseeing training of the researchers and the launch of the fieldwork. This direct supervision of the fieldwork ensured the methodology was strictly followed and was as consistent as possible across countries, the surveys were conducted properly, and the right processes were in place to ensure the quality of the data collected.

- **Field supervision by local research partners**: One full-time supervisor at the research partner was in charge of a limited number of survey researchers so they could be individually and closely monitored. Wherever possible, the risk of data fabrication was minimised by the use of tablets, which allowed the researchers to regularly check the consistency of answers, as well as the duration and location of interviews. GPS coordinates of surveys were checked to monitor their exact location, and interviews that were deemed too short (based on the number of questions to be covered depending on the respondent's profile, such as users versus non-users) were discarded.

- **Call-back of survey respondents**: 15% of each researcher's surveys were systematically monitored by independent researchers recruited by Altai Consulting (interviewees' phone numbers have been collected with their agreement) through a call-back with the survey respondent to verify whether they had been interviewed correctly.

Post-weighting and analysis

Survey data has been analysed using SPSS software. Weighting has been used to correct disproportional sample sizes and adjust the collected data to better represent the population from which the sample was drawn. For example, due to resource limitations, survey samples included an 80/20 female-male split, while the proportion of women versus men in the total population is closer to 50/50. Similarly, the number of interviews conducted in each surveyed region is not necessarily proportional to the share of the population in that region compared with the total country population. Urban/rural splits were also used to design the survey sample, but need to be aligned with the actual urban/rural split in each surveyed region.

To adjust such distortion within a sample, every case (interviewee) has been assigned a weighting factor by which the corresponding data is multiplied. The factor is determined by the number of cases in the respective group in the population divided by the number of cases in that group in the sample.

$$\text{Weighting factor} = \frac{\text{Number of cases in population}}{\text{Number of cases in sample}}$$

13. Primary Sampling Unit: smallest administrative division for which population data is available.
14. Based on national definition of "estratificación socioeconómica".
15. Door-to-door/left-hand approach is a survey technique in which researchers walk from the door of one house to the door of another, each time selecting houses on their left-hand side, to select the household in which the survey will be conducted.

Qualitative research: Focus group discussions

The objective of the focus group discussions (FGDs) was to capture each country's context in a more nuanced and qualitative way, to better understand the profile of mobile users and non-users, and the specific barriers and opportunities associated with owning and using mobile phones that women and men may face in each country.

Focus group discussion guide structure[16]

Section A: Introduction — 10 MIN

- Putting the participants at ease
- Explaining the FGD process

Section B: Understanding the current situation — 20 MIN

- Understanding their personal priorities and community challenges
- Issues/difficulties they and their community face
- Access to information

Section C: Mobile access and usage — 45 MIN

- Use of mobile
- Access to mobile
- Barriers and opportunities to access/use, including listening for:
  - » Cost
  - » Ease of use
  - » Cultural norms
  - » Value and relevance
  - » Agents
  - » Mobile operators
  - » Availability of electricity
  - » Network coverage/quality
  - » Other barriers and opportunities
- Handsets: aspirations, likes and dislikes, smartphone awareness, role in selecting their handset
- Mobile internet: who uses mobile internet in their community, for what purposes, aspirations regarding mobile internet

Section D: Perceptions and aspirations — 30 MIN

- Perceptions: benefits and disadvantages of mobile phones
- How mobile phone use and access will change in the future
- Ideas for improved mobile access and use by women

Section E: General discussion on men and women in the community and overall gender relations, thanks, and wrap-up — 15 MIN

Fieldwork

Seven FGDs were conducted in each country. To gather a diversity of perspectives from different segments of the country's population, each of the seven FGDs gathered participants with a specific profile. Gathering participants with the same socio-economic background in one FGD also helped ensure they could share information relatively freely, limiting the impact of social and power dynamics.

Participants were recruited using three main criteria:[17]

- **Gender**: In each country, 4 FGDs were conducted with women exclusively, and 3 with men exclusively to draw gender comparisons.
- **Location**: In each country, 4 FGDs were conducted in urban areas and 3 in rural areas to reflect each country's diversity to some degree. Urban and rural areas were defined in the quantitative survey, as explained previously.
- **Level of formal education**: Groups were also organised based on formal education levels, which were used as a proxy for the socio-economic status of respondents—both of which are believed to be a key influence on mobile phone ownership.[18] In each country, 4 FGDs were organised with participants who had a lower level of formal education (completed primary school or less) and 3 FGDs with participants who had a higher level of formal education (completed secondary school or more).[19]

Two secondary criteria were used to ensure greater diversity of each FGD and better reflect their respective population groups/stratum:

- **Age**: Each FGD was composed of respondents from different age groups.
- **Occupation**: Participants had various occupations, to reflect the variety of typical occupations in each of the 7 FGD categories.

All participants gave formal informed consent to take part in the focus group discussions and were compensated for their participation based on local research partner common practices (including time and transportation costs).

Given the short timeline of this study, the quantitative survey and FGDs were conducted in parallel rather than sequentially. However, a large amount of previous research conducted by the Connected Women team and other sources was reviewed prior to designing both the qualitative and quantitative research tools. Academics with extensive experience in gender and ICT research also provided input into the research tools.

Analysis of focus group discussions

The focus group discussions were synthesised to identify topics and trends emerging by country, and a search was conducted to look for potential explanations and illustrations of the quantitative data. Analysis was conducted both top-down through keyword searches based on pre-identified themes, as well as a bottom-up analysis in which the research team read and synthesised findings for each focus group transcript.

FOCUS GROUP DISCUSSION PROFILES IN EACH COUNTRY

		WOMEN	MEN
Urban	Low Education	1	1
	High Education	1	1
Rural	Low Education	1	1
	High Education	1	

16. Full version of the Focus Group Discussion Guidelines are available on the Connected Women website.

17. Due to resource constraints, 7 focus group discussions were organised in each country.

18. Research ICT Africa found that income and education have a significant effect on mobile phone ownership in 11 countries in Africa: Mariama Deen-Swarray, Alison Gillwald, and Ashleigh Morrell, 2012, "Lifting the Veil on ICT Gender Indicators in Africa," Policy Paper 13, Research ICT Africa & University of Cape Town, http://www.researchictafrica.net/publications/Evidence_for_ICT_Policy_Action/Policy_Paper_13_-_Lifting_the_veil_on_ICT_gender_indicators_in_Africa.pdf

19. Participants who had not completed secondary school were classified as 'low education', as they had finished primary school.

Key expert interviews

Formal interviews with 123 different experts were conducted at both country and global levels. Different categories of experts were interviewed to gather various points of view and experiences in understanding and targeting the market for women: mobile operators, other mobile industry stakeholders (handset manufacturers, VAS developers, etc.), other industries, NGOs, international organisations, government and public sector entities, academics, donor agencies, and general thought leaders.[20]

These interviews had several objectives:

- To help formulate research hypotheses and interpret the data collected;
- To better understand the gender dynamics, mobile market specificities, social norms, etc. at country level;
- To draw lessons from initiatives undertaken by mobile industry stakeholders and other industries to close gender gaps and assess what worked, what did not work, and to better understand why; and
- To identify the implications of these findings for industry and non-industry stakeholders.

Insights from the key expert interviews were used to identify opportunities and inform recommendations for different stakeholder groups.

Secondary data collection

Literature review

A literature review of existing reports and secondary data sets on gender and ICT from the mobile industry, international development organisations, academics, and other sources was conducted to formulate research hypotheses and inform the design of research tools, and then interpret the data that was collected. This review has enriched this study by allowing our findings to be complemented and compared with the information and evidence gathered in prior research.

Mobile operator data

Finally, mobile network operators in more than 35 countries contributed to this study by voluntarily providing anonymous market research and/or usage data, including complementary usage data on MSISDNs collected during the quantitative field survey.

GSMA Intelligence data

GSMA Intelligence data on average revenue per unique subscriber (ARPS), unique subscriber penetration rates, and forecasts of ARPS and unique subscriber penetration rates from 2015-2020 for the 139 low- and middle-income countries was used to build the extrapolation model (see the next section).

Extrapolation model

Overview

An extrapolation model was developed to estimate the gender gap in mobile ownership across the 139 low- and middle-income countries. The model was based on recent mobile ownership data from 22 countries, of which 11 were the primary research countries in this study, 9 were countries where selected mobile operators had agreed to disclose data, and 2 were publicly available data sets. Three independent variables out of 72 were selected based on their ability to predict the mobile ownership gender gap when compared to the actual measured ownership gender gaps in the 22 countries. However, it should be noted that extrapolating global figures from a limited data set provides indicative global figures, but are not a substitute for in-country field research. This extrapolation model, along with GSMA Intelligence forecast data on unique subscriber penetration growth rates and average revenue per unique subscriber, were used to forecast the revenue opportunity for the next 5 years.

Selecting the extrapolation model

Extrapolation is a technique that extends a range of values by inferring unknown values from patterns observed in the known data. Such techniques are used in a broad array of sectors/topics to predict a given outcome. In the context of this project, the objective of the extrapolation model is to estimate the gender gap in mobile phone ownership for each of the 139 low- and middle-income countries.

The first step was to choose the extrapolation model family. Because of various factors (size of the sample, gender gap being a continuous variable, etc.), we decided to use a multiple linear regression model (with an ordinary least square estimation).

Dependent variable selection

In the extrapolation model, the dependent variable is the gender gap in mobile phone ownership. The quantitative surveys provide data for the gender gap in mobile ownership from 11 countries. This was a limited base from which to extrapolate to 139 countries. To enrich and build a more robust extrapolation model, therefore, additional data was sourced on the gender gap in mobile ownership. In order to be eligible to be included in the extrapolation model, the data had to meet the following criteria:

- **Common definition**: Eligible datasets had to have a comparable definition of SIM ownership as the one used in the research study ("personally own an active SIM that you carry with you most of the day").
- **Reliable sample**: The sampling approach had to be available and deemed to be largely representative of the country.
- **Recent data**: Data had to be less than 2 years old.

20. The following number of interviews were conducted per expert category: 28 mobile operators, 9 other mobile industry stakeholders, 21 non-mobile industry stakeholders, 22 NGOs, 7 international organisations, 13 government/public sector entities, 16 academics, 2 donor agencies, and 5 general thought leaders.

In addition to the mobile ownership figures from the primary field surveys in 11 countries, data from another 11 countries was found to meet these 3 criteria. This data was sourced from mobile operators and the InterMedia Financial Inclusion Insights programme, funded by the Bill & Melinda Gates Foundation:

- Bangladesh: Financial Inclusion Insights Survey – 2013
- Burundi: Mobile operator market research data collected by Altai Consulting – 2012
- Chad: Mobile operator market research data collected by Altai Consulting – 2014
- Ghana: Mobile operator market research data collected by Altai Consulting – 2014
- Iraq: Mobile operator market research data collected by Altai Consulting – 2014
- Nigeria: Financial Inclusion Insights Survey – 2013
- Pakistan: Financial Inclusion Insights Survey – 2014
- Rwanda: Mobile operator market research data collected by Altai Consulting – 2014
- Senegal: Mobile operator market research data collected by Altai Consulting – 2014
- Tanzania: Mobile operator market research data collected by Altai Consulting – 2014
- Uganda: Mobile operator market research data collected by Altai Consulting – 2014

Independent variable selection

Independent variables that could potentially explain the gender gap in mobile ownership among the 22 countries were short-listed to be tested in our extrapolation model. These independent variables (59 continuous variables and 13 discrete variables) belong to various categories:

Category	# of variables tested (continuous/discrete)	Example
Global indicators	5/10	Human Development Index
Health	5	Maternal mortality ratio
Education	13	Ratio female/male in tertiary enrollment
Economics	8	Asset ownership
Infrastructure	7	Electric power consumption per capita
Employment	4	Gender gap in labour force participation
Women's empowerment	4	Women in parliament
Culture	4	Domestic violence
Demography	2	Fertility rate
Rurality	1	Rural population
Country opening	1	International inbound tourists
Mobile market	5/3	SIM penetration

However, some of these variables were not eligible to be tested for the extrapolation model for various reasons, including inconsistent collection method from one country to another, lack of recent data, and unavailable data for a large number of countries, among others. After this eligibility check, 54 remaining variables were tested.

Building the extrapolation model

We ultimately chose a multiple linear regression model (with ordinary least square estimation), which was arrived at using stepwise procedures.

The final extrapolation model equation is:

Gender gap = 0.047 + 0.26 x OMPI + 0.305 x South Asia + 0.184 x Low Unique subscriber penetration

Definitions and sources of independent variables:

- 'OMPI': Oxford Multidimensional Poverty Index[21] (continuous variable)
- 'South Asia': Refers to whether or not the country is located in the South Asia region as defined by the World Bank (binary variable)
- 'Low unique subscriber penetration': Refers to whether or not the country belongs to the group of countries where mobile unique subscriber penetration (unique subscribers/total population) is lower than 25% (binary variable).

This model has an adjusted R-square of 0.81, and can be computed for 98 of the 139 countries, representing 93% of the adult population of low- and middle-income countries. Proxy values were used for the remaining countries (see next section).

Estimating the gender gap in ownership

A gender gap in mobile phone ownership has been estimated for the 139 low- and middle-income countries:

- For the 22 countries included in the initial model, the gender gap in mobile phone ownership values were the original figures derived from fieldwork by Altai Consulting or the InterMedia Financial Inclusion Insights programme (i.e., the values used to calculate the gender gap in mobile ownership are not derived from the extrapolation model).
- For the 76 countries for which OMPI data was available, the gender gap has been calculated using the extrapolation formula.
- For the remaining 41 countries, which represent 7% of the total population in low- and middle-income countries, a different method was used to obtain proxy values. In the absence of country-level data, the gender gap in mobile phone ownership for each of these countries was the weighted average (by population) of the gender gaps in mobile ownership of countries with similar characteristics (in terms of geographic region, income bracket, whether they belong to the Least Developed Countries group, and mobile penetration bracket).

To estimate one gender gap figure across all 139 low- and middle-income countries, we used the following formula to estimate female (and male) SIM ownership levels for each of the 139 countries:

$$\text{GENDER GAP IN OWNERSHIP (\%)} = \frac{\text{MALE PHONE OWNERS (\% OF MALE POPULATION)} - \text{FEMALE PHONE OWNERS (\% OF FEMALE POPULATION)}}{\text{MALE PHONE OWNERS (\% OF MALE POPULATION)}}$$

21. http://www.ophi.org.uk/multidimensional-poverty-index/

Once the gender gap in mobile ownership was calculated as a percentage for each of the 139 countries, the number of unique subscribers (from GSMA Intelligence data) could be split into male versus female unique subscribers by applying these ratios. It is worthwhile to note that in the surveyed countries, the GSMA Intelligence data for unique subscriber penetration rates differed from our field research in mobile phone ownership penetration due to substantially different research methodologies. However, GSMA Intelligence data allows for a comprehensive data set through which we could estimate the gender gap in ownership for low- and middle-income countries, which was essential to this extrapolation model. The following table shows the gender gap in ownership measured through field research versus the gender gap in ownership extrapolated from the model. In many countries, the gender gap in mobile ownership is very similar:

Country	Gender gap in mobile ownership from field research	Gender gap in mobile ownership predicted from the extrapolation model
Bangladesh	38%	42%
Burundi	42%	35%
Chad	19%	32%
China	1%	6%
Colombia	3%	5%
DRC	33%	15%
Egypt	2%	5%
Ghana	4%	8%
India	36%	43%
Indonesia	10%	6%
Iraq	11%	6%
Jordan	21%	5%
Kenya	7%	11%
Mexico	6%	5%
Niger	45%	39%
Nigeria	5%	11%
Pakistan	51%	41%
Rwanda	18%	14%
Senegal	15%	16%
Tanzania	13%	13%
Turkey	2%	5%
Uganda	14%	14%

Estimating the revenue opportunity

One of the objectives of this study is to size the revenue opportunity of bridging the gender gaps in mobile ownership and usage. Given the complexity of forecasting future revenues in the mobile space, particularly for over 139 countries, these estimates are indicative.

Several assumptions/limitations need to be considered when looking at the result:

- The revenue opportunity is an estimate of potential increased revenue for mobile network operators. Revenues for other industry players (e.g., handset manufacturers, internet players) are not included, but are likely to be significant.
- The forecast is for 5 years from 2015–2020.
- Three scenarios have been considered *(Fig. 2)*:
  - » 'Status quo': Based on GSMA Intelligence forecasts for overall market penetration growth rate by 2020, and assuming that the gender mix in the customer base by country will remain identical to the one observed today, the average revenue per subscriber (ARPS) is expected to grow over the next 5 years according to GSMA Intelligence forecasts (as of December 2014).
  - » 'Bridging the ownership gap': Same growth rate estimates by 2020 as in the 'Status quo' scenario, but assuming the gender mix will change at country level so that the percentage of female phone owners reaches the percentage of male phone owners. In this scenario, it is assumed new female owners will contribute a revenue equal to 50% of existing female users' ARPS (see later).
  - » 'Bridging the ownership and usage gaps': Same estimates for growth rate and gender mix evolution as in the 'Bridging the ownership gap' scenario. In this scenario, it is assumed that existing female owners will contribute a revenue equal to male users by 2020, while new female owners will contribute a revenue equal to 50% of existing female users' ARPS.

Fig. 2

Revenue opportunity estimates are based on three scenarios

Description of scenarios

Scenario	Mobile ownership assumptions	Revenue assumptions
1 Status quo	Mobile phone ownership will increase from 44% to 55% by 2020 (GSMA Intelligence figures) Male-to-female ratio identical to existing ratio (by country)	Country ARPS* based on GSMA Intelligence forecasts as of December 2014 Female ARPS = 90% of market ARPS
2 Bridging the ownership gap	Gradually increase the % of female phone owners to match the number of male phone owners by 2020	New female phone owners contribute 50% of existing female users' ARPS
3 Bridging the ownership and usage gaps	Gradually increase the % of female phone owners to match the number of male phone owners by 2020	Existing female ARPS gradually increases to align with overall ARPS by 2020 New female phone owners contribute 50% of existing female users' ARPS

Note: **ARPS stands for average revenue per unique subscriber.*

To estimate the current ARPS of female owners—and of future female owners—the following methodology has been used:

- For each of the 11 countries where primary research was undertaken in this study, the ratio of 'female owners' ARPS'/'average owners' ARPS' has been calculated based on the self-reported spend of survey respondents. Excluding the top and bottom 5% results, the range by country was 77%–97% and the simple average of this range was 89%, which was rounded to 90%.
- This ratio of 90% was applied to ARPS forecast (in USD) provided by GSMA Intelligence for all 139 countries. This allowed 'women mobile revenue' to be calculated for each of the 139 countries.
- Conversely, knowing the share of females among mobile owners in each country, their ARPS in USD, and the average ARPS of the country, the male ARPS in USD could then be calculated.
- A similar approach was used to calculate the ARPS of new female owners: for each of the 11 countries, the expected spend by female non-owners in the survey (should they buy a mobile) was divided by the female owners' ARPS reported in the survey. Observing the range (51%–119%), with a simple average of 75%, a decision was made to use a very conservative ratio of 50% given that current non-owners are likely to spend far less than current owners.