Measuring Digital Access in Low- and Middle-Income Countries

A guide for inclusive research and design

2x Digital

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Table of Contents

Acknowledgements 4

Overview **5**

Introduction 5

Toolkit aims 6

Toolkit structure 6

General principles for framing questions on digital access measurement **7**

Recommended self-reported survey questions **11**

1. Access to devices **12**

1.1 Mobile ownership *12*

1.1.1 Individual level mobile ownership 13

1.1.2 Household mobile ownership 14

1.2 Mobile sharing *14*

1.2.1 Access to a shared mobile phone 14

1.2.2 Sharing a mobile phone 15

1.2.3 Primary device user 15

1.3 Mobile device characteristics *16*

1.3.1 Mobile device type 17

1.3.2 Mobile device condition 18

1.4 Characteristics of access *19*

1.4.1 Mobile device movement 20

1.4.2 Timing of access 20

1.4.3 Duration of access 21

1.4.4 Recency of access 22

1.4.5 Frequency of access 23

Table of Contents

2. Connectivity **24**

2.1 Network access *24*

2.1.1 Mobile network type 24

2.1.2 Network strength 25

2.1.3 Household fixed broadband subscription 26

2.2 SIM Cards *26*

2.2.1 SIM availability 26

2.2.2 SIM validity 27

3. Financial access **28**

3.1 Expenditure on mobile devices *28*

3.1.1 Mobile device acquisition 28

3.1.2 Cost of maintenance / repairs 29

3.2 Expenditure on connectivity *30*

3.2.1 Type of SIM pack 30

3.2.2 Mobile credit - prepaid 30

3.2.3 Mobile credit - postpaid 32

3.2.4 Mobile data 32

References **33**

Annex 1. Summary of sources reviewed 34

Annex 2. Mobile ownership: examples 36

Annex 3. Mobile sharing: examples 38

Annex 4. Device characteristics 39

Annex 5. Characteristics of access 41

Annex 6. Network access 42

Annex 7. SIM cards 44

Annex 8. Expenditure on connectivity 45

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Overview



Introduction

Despite near ubiquitous ownership of mobile phones at a household level, the digital gender gap persists between men's and women's ownership and use of mobile phones. The ability to measure digital access and use, including the digital gender gap, is vital for designing effective digital solutions in low- and middle-income countries (LMICs). Measuring and tracking digital access and use is also a prerequisite for understanding the impact of digital interventions on development outcomes. Policymakers, strategists, investors, programme implementers, and digital developers in government, the development sector, and the private sector need reliable data on the role technology plays in catalysing people's access to income generating opportunities, access to information, as well as utilisation of health, education and social services, particularly among women and marginalised populations.

When designing digital development programmes, it is crucial to understand the extent of device access among populations of interest. While questions in existing quantitative surveys serve as a starting point, additional factors — such as access to shared devices, duration and timing of access, availability of and expenditure on internet connectivity, and the condition of devices — are necessary for a comprehensive understanding of how individuals engage with technology. Despite the need for these data, there are a number of challenges with large global surveys which limit the availability and comparability of data. Some of these surveys contain only a limited number of digital questions. Many ask questions with low relevance to 'mobile-first' populations in LMICs, with low literacy, and limited access to devices, digital competence, and control over finance.

This guide outlines methods for measuring different facets of individual and household access to digital technologies. Given the prevalence of mobile-first digital participation in LMICs, the focus is on assessing individuals' and households' access to mobile phones and connectivity. The intended audience includes professionals and organisations involved in designing, evaluating, and implementing digital programmes within these regions. It divides access into three domains, each with their own collection of constructs, considerations, and limitations: access to devices, connectivity, and financial access.

Toolkit aims

This Toolkit aims to support more inclusive and equitable measurement of digital access. Improved measurement will inform the design of digital development solutions and digital programmes that better meet the needs of disadvantaged populations. Furthermore, improved measurement will enhance the evaluation of these efforts and the ability to track changes in digital access over time, including of the digital gender gap. This Toolkit outlines approaches for measuring digital access at the individual level through quantitative surveys.

Toolkit structure

The survey questions in this toolkit are categorised into three categories, as seen in table 1. Each domain includes a set of recommended quantitative survey questions that can be used to measure mobile phone access in low and middle-income countries. Many of these questions were drawn from global surveys identified in the literature and subsequently enhanced through cognitive interviews in India, Kenya and Nigeria.

Table 1. Toolkit structure

Domain	Components
1. Access to devices	1.1 Mobile Ownership
	1.2 Mobile Sharing
	1.3 Mobile Device Characteristics
	1.4 Characteristics of Access
2. Connectivity	2.1 Network Access
	2.2 SIM Cards
3. Financial access	3.1 Expenditure on mobile devices
	3.2 Expenditure on connectivity



General principles for framing questions on digital access measurement

Use simple and easy to understand language including contextually appropriate terms

Prioritise words that are widely used and understood. Well-known local terms for subordinate items, such as brand names, are easier for respondents to understand than global hypernyms (terms for the entire category). For example, asking about the use of 'phones, tablets, computers' is clearer to respondents than asking about the use of 'digital technology'; asking about the use of 'mPesa, Opay, or PayTM' is clearer than asking about the use of 'Mobile Money'.

Measure one construct at a time

Questions that ask about multiple constructs result in inconsistent and unclear measurement. Questions should measure just one construct at a time.

Keep sentences short and avoid unnecessary qualifiers and clauses

Questions with multiple clauses increase the cognitive burden placed on respondents and can lead to confusion. Remove non-essential clauses and qualifiers.

For interviewer-administered surveys, use the 'question-answer' format rather than the 'statement-response' format

Instead of having an interviewer read the statement 'I have [done X]' and inviting the respondent to respond 'agree' or 'disagree', have the interviewer ask 'Have you ever [done X]?' and have the respondent answer yes or no.

Use simple response options and short (three-point) Likert scales

Gradients of feeling or intensity of agreement/disagreement do not resonate in some populations. Thus, in some populations, 'strongly agree' or 'somewhat agree' are not understood as distinct categories. Three-point scales work across populations.

Add examples and explanation boxes as appropriate

When key terms must be used in a survey but are not understood in a standardised manner by all respondents, include explanation boxes that focus on examples. For instance, if the term 'internet' must be used in the survey, include an explanation that focuses on naming key brands and uses of the internet (i.e., 'Using the internet means searching on Google, Yahoo or others, looking at YouTube, TikTok, Twitter, or others, shopping on Amazon, calling on WhatsApp…') rather than explaining the concept of the internet (i.e., 'The internet is a network of networks that consists of private, public, academic, business, and government networks of local to global scope, linked by a broad array of…').

Phrase each question to standalone, and avoid stem and leaf style questions

Each question should be standalone. Stem and leaf style questions, wherein a question stem appears first (i.e., 'Have you ever used a computer or phone') followed by leaves ((a) [to do X]? (b) [to do Y]? (c) [to do Z]?), place a high cognitive burden on respondents to retain the stem throughout question administration. Better quality data is achieved through integrating the stem into each leaf to create separate, standalone questions (i.e., (1) Have you ever used a computer or phone to do X? (2) Have you ever used a computer or phone to do Y? (3) Have you ever used a computer or phone to do Z?).

To assess recency, ask about ever use and then the timing of most recent use rather than use within a certain period

Asking respondents whether they have completed an action in a preset period of time ('In the last three months have you …?') places a high cognitive burden on the respondent. They must consider whether they have done the action, they must calculate when the time period in question occurred, and they must consider whether their action fell within that time period. Some respondents struggled to complete these three mental processes, and instead recalled what they were doing at the reference period time (i.e., three months ago) or recalled completing the action but were unsure if their action fell within the pre-set time period (i.e., 'I did it last week; I don't know about three months ago'). This Toolkit proposes assessing recency by asking the respondent whether they have 'ever [done X]' then asking 'When was the last time you [did X]?' The interviewer can then place the respondent's reply in an appropriate time category, discussed next. Depending on how well enumerators are trained, the response can then appropriately categorise by the enumerator into the response categories provided.

Table 2 below outlines a suggested flow of survey questions and gives two options for response options. This flow is intended to recognize that different activities occur with varying frequencies. Depending on the level of granularity required for your programmatic or analytic data needs, either of the two response options may be appropriate for use: mutually exclusive time categories or overlapping categories which give a more general sense of time. Throughout this Toolkit the mutually exclusive time categories option (the first column in Table 2) is presented, because each response option is unambiguous and discrete. However, this response option requires interviewers to convert the types of natural language responses they will receive ('today,' 'yesterday,' 'this week,' etc.) into the specific predefined categories. Careful training of interviewers will be required to ensure that they can accurately categorise responses provided.

Table 2. Measuring recency

Question: When was the last time you [did X]?	
Response options:	
Mutually exclusive time categories	**Overlapping natural language time categories**
1. Less than 24 hrs ago 2. 2 - 7 days ago 3. 8 - 14 days ago 4. 15 - 31 days ago 5. More than 1 month but less than 3 months ago 6. More than 3 months ago but within the last 1 year 7. More than 1 year ago	1. Today or yesterday 2. Within the last week 3. Within the last two weeks 4. Within the last month 5. Within the last three months 6. Within the last year 7. More than one year ago

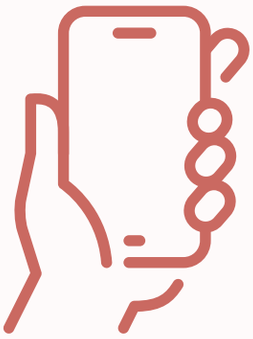
Avoid double negatives

Avoid questions that ask about something negative because if the respondent has not done or disagrees with the negative in the question, identifying the appropriate response option is confusing. For example, the question 'Do you have a Mobile Money account that is in your own name (i.e. not using someone else's, not a joint account)?' could generate a response of 'No' among respondents who mean 'No I do not have my own account' or 'No, I am not using someone else's account.'



Recommended self-reported survey questions

1. Access to devices



Access to devices covers aspects related to physical access to mobile phones. It includes constructs related to the ownership and sharing of mobile phones, the type and functional status of mobile phones, and key aspects of individuals' access, including location, timing, and duration. This Toolkit also suggests ways to adapt questions to measure access to computers and tablets.

1.1 Mobile ownership

Mobile ownership is one of the most commonly measured indicators of access to mobile phones in global surveys. In addition to providing information on the ownership and distribution of assets, it implies a degree of consistency in and control over access to mobile devices. Mobile phone ownership is typically measured at the household and individual levels.

The term 'mobile ownership' is used here only to refer to the ownership status of particular mobile phones. Many stakeholders may differ in their definitions of mobile phone ownership, based on programmatic needs. Additionally, some use the term to refer to a set of conditions related to access to mobile phones.[1]

Ownership of a mobile device, alone, is not a guarantee of digital access. Additional questions need to be asked to establish whether the device is in usable condition and has a functioning SIM card. Additionally, many mobile owners share their devices with multiple users. It is possible for someone to own a mobile phone, but lack consistent access to it due to control exerted by other users.

Additional examples from global surveys are provided in Annex 2.

1 An example of a composite indicator can be seen in the GSMA's definition of a 'mobile owner,' which is 'a person who has sole or main use of a SIM card or mobile phone that does not require a SIM and uses it at least once a month' [1].

1.1.1 Individual level mobile ownership

Code	Question	Response	Source
A	Do you have your own personal mobile phone?	1. Yes 2. No	Developed by UCT Metrics Team for Digital Access and Use Project. Cognitively tested in India, Kenya, and Nigeria.

Key considerations:

- Individual level mobile ownership refers to a mobile device that is owned by the respondent themself. In isolation, this question does not account for the possibility of multiple owners or users of a single device. This is covered in section 1.2.
- While cognitive interviewing in India, Kenya, and Nigeria has demonstrated that this phrasing is easy to understand, it may need to be altered when translating this question into other languages. For example, in Hindi, it is challenging to translate 'own' as a verb, and the question is thus phrased as 'Do you have your own personal mobile phone?'
- This question is deliberately designed to focus on only a single construct. Some surveys include additional conditions and constructs when measuring mobile ownership. For example, the Indian National Family Health Survey (NFHS-5) and World Bank Global Findex Survey introduce conditions related to use when asking about ownership ('Do you have any mobile phone that you yourself use?' and 'Do you have a mobile phone that you use to make and receive personal calls?'). However, cognitive interviewing has highlighted that this approach has the potential to introduce confusion and increase cognitive gaps between question intent and respondent interpretation.
- If computer and tablet ownership is also of interest, a similar question can be asked: 'Do you have your own personal computer, desktop, laptop or tablet?' Cognitive interviews showed us that listing computer, desktop, and laptop improved respondent comprehension, even though desktops and laptops are covered by the term 'computer.' Cognitive interviews also illustrated the value of asking about tablet ownership within the same question as computer ownership to ensure the concept of 'tablet' is understood in relation to digital technology (rather than medicinal tablets).

1.1.2 Household mobile ownership

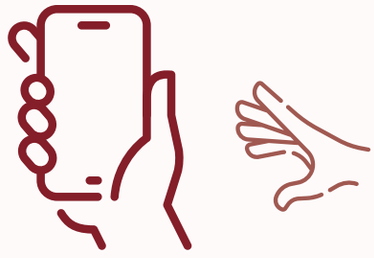
Many large scale quantitative surveys, including the DHS and MICS, include a household survey administered to the head of household. In such instances phone ownership is typically measured as part of household assets and/or via standalone questions.

Code	Question	Response	Source
B	Does any member of this household own: ... b) A mobile phone? ...	1. Yes 2. No	*DHS Phase - 8 Model Questionnaire*

Key considerations:

- Household level phone ownership can be helpful for understanding potential access to shared devices. The simple and easy to understand language will ensure that this construct is measured reliably.
- If household level computer and tablet ownership is also of interest, a similar question can be asked: 'Does any member of this household own... A computer, desktop, laptop or tablet'

1.2 Mobile sharing



While mobile ownership can be a convenient indicator of digital access, many individuals in LMICs have digital access without owning a device. These devices are often borrowed from, or shared with, another member within their households. Among individuals who do own personal mobile phones, it is still important to understand whether these devices are shared with others, and the implications these practices have for their access to mobile devices.

Additional examples from global surveys are provided in Annex 3.

1.2.1 Access to a shared mobile phone

Code	Question	Response	Source
A	**[For respondents who report that they do not own a mobile phone]** You said that you do not own a mobile phone, but is there any mobile phone that you use?	1. Yes 2. No	Developed by UCT Metrics Team for Digital Access and Use Project. Cognitively tested in India, Kenya, and Nigeria.

Key considerations:

- This question is designed to establish whether individuals have access to a mobile phone that they can make use of. It prioritises establishing access over identifying device ownership.
- Due to contextual and cultural differences in how respondents interpret the concepts of ownership and sharing, this question restricts itself to measuring whether they can access a phone to use. Cognitive interviewing found this question to be smooth to administer, resulting in clear responses that aligned strongly with the question's intent.

1.2.2 Sharing a mobile phone

'Sharing' of a mobile device is understood as the use of a particular mobile device by others, in addition to the respondent themself. It does not include conditions related to ownership.

Code	Question	Response	Source
B	The phone that you mostly use, how often do other people also use it?	1. Often 2. Sometimes 3. Rarely / never	Developed by UCT Metrics Team for Digital Access and Use Project. Cognitively tested in India, Kenya, and Nigeria

Key considerations:

- This question deliberately avoids the use of the term 'sharing' due to challenges related to translation and interpretation. However, while it is successful at identifying whether there are multiple users, this question does not establish the duration or frequency with which each user has access to the device. Thus, it is recommended that this question is paired with the question on 'primary use' provided below.
- It is difficult to distinguish between different degrees of sharing, such as between someone who borrows a mobile device occasionally for a couple of minutes, and someone who uses the device for multiple hours each day.

1.2.3 Primary device user

In the event that a mobile device is shared, it is useful to establish whether the respondent is the primary user of the device or not. This allows practitioners to gain additional information on whether the respondent's access is frequent and consistent, which may be required for certain digital programmes to have an impact.

Code	Question	Response	Source
D	And thinking about this mobile phone that you currently use, are you the main user?	1. Yes 2. No	Modified by UCT Metrics Team from *GSMA Consumer Survey 2022* for the Digital Access and Use Project. Cognitively tested in India, Kenya, and Nigeria.

Key considerations:

- While whether the respondent is the primary user or not has implications for their level of digital access, it is important to recognise that being a 'secondary user' is still an important pathway to digital access for many individuals and groups.
- This use of the term 'main user' in place of 'person who uses it the most' was supported by cognitive interviewing. For example, in Nigeria and India, the translation of 'uses it most' was sometimes interpreted to be asking whether the respondent uses their phone often, or excessively.

1.3 Mobile device characteristics



Mobile device characteristics refer to information about the specific mobile phone that the respondent uses. This section includes questions about the type of mobile device (smartphone, feature phone, or basic phone) and its condition. While this document covers some device characteristics, there are additional aspects that programme designers may find relevant. These include:

- Operating system version
- Interface language
- Internet capability
- Installed applications
- Assistive/Accessibility features (such as text-to-speech, voice navigation, and interface scaling)
- Brand and model of the device

Collecting characteristics like the ones listed above should be tailored to the specific needs of the digital program. However it is important to note:

- When inquiring about additional device characteristics, such as the mobile operating system, respondents may be unfamiliar with or unaware of the specific information required. Consequently, the self-reported approach becomes less viable.

- Observation is dependent on the availability of the mobile device at the time of the interview, which may be a challenge for respondents who do not own their own mobile phones.
- Observation may also introduce privacy risks for respondents and may expose interviewers to sensitive or uncomfortable content
- Some types of information, such as battery life, might be too time-consuming and difficult to collect as part of a quantitative interview.

Additional examples from global surveys are provided in Annex 4.

1.3.1 Mobile device type

Mobile device type refers to whether the mobile device is a smartphone, feature phone, basic phone, or other kind of mobile device. Two approaches to measurement are provided below:

Identifying Smartphones

Code	Question	Response	Source
A	**[Ask if respondent is a phone owner]** Is your mobile phone a smartphone {use relevant local term for smartphone}?	1. Yes 2. No	Modified by UCT Metrics Team from *DHS Phase - 8 Model Questionnaire* for the Digital Access and Use Project. Cognitively tested in India, Kenya, and Nigeria.

Key considerations:

- This question deliberately restricts itself to identifying only smartphones. This is due to ambiguity around the categories of 'feature' and 'hybrid' phones, and challenges that respondents and interviewers face with them. In situations where classification across multiple categories (smartphone, feature phone, basic phone) is required, it is recommended that a question similar to question B (below) is used instead.
- Other attempts to determine phone types, such as by asking 'does it go on the internet' or 'can it go on the internet' were beneficial in that they identified feature phone and smartphone users. However, asking about whether a phone was internet enabled is problematic because respondents may focus on whether the phone currently has internet functionality (through an active data pack or access to the network) rather than whether it is the type of phone that can go online (smartphone or feature phone)
- Observation by a well trained interviewer may be the most robust form of assessment of phone type.

Classifying as smartphone, feature phone, and basic phone

Depending on programmatic needs, it may be useful to collect data differentiating between smart-, feature-, and basic phones. In such instances, it is recommended that an 'explainer box' which describes differences in device types, and matches the sequence of response options be included.

Code	Question	Response	Source
READ OUT the below explainer: A smartphone has a big colour screen you can touch. A feature phone has a medium colour screen, but it is a non-touch screen. A basic phone has a small black and white screen.			Developed by UCT Metrics Team for the Digital Access and Use Project. Cognitively tested in India, Kenya, and Nigeria.
B	What type of mobile phone do you have? **[Interviewer: Read out options]**	1. Smartphone 2. Feature phone 3. Basic phone 4. I do not know	

Key considerations:

- This question may create challenges for respondents who are not familiar with each category i.e. smartphone, basic phone, feature phone. It may also create challenges around devices that are difficult to classify, such as the JioPhone (a 'hybrid' phone) in India.
- There are varying definitions around what conditions a device must meet to be a 'feature phone.' Conditions such as 'internet access' still contain ambiguity around the type of internet connection and browser. Similarly, the condition of having a physical keyboard can be met by all three categories: basic, feature, and smartphones.
- Difficulties related to classification by respondents can be addressed through **observed data** recorded by data collectors who are trained on a specific classification scheme.

1.3.2 Mobile device condition

Questions about device condition aim to identify any barriers that might hinder the use of the mobile device due to damage or wear and tear. The condition of the mobile device is a critical factor for understanding its usability. For instance, respondents may claim ownership of a device that is not genuinely usable, potentially inflating ownership statistics if not clarified.

This section does not include questions about whether the respondent was the first owner of a mobile device or not. Questions related to acquisition are covered in section 3.1.

Code	Question	Response	Source
C	We would now like to assess the condition of the phone. [Observe the phone for the following if possible. Otherwise, ask each question.]		*Kilkari Impact Evaluation*
i)	Can the phone remain on / hold charge for 3 minutes or more?	1) Yes — can hold charge for 3+ minutes 2) No — cannot hold charge for 3+ minutes	
ii)	Is the screen cracked so severely that content cannot be read?	1) Yes — screen's content cannot be read 2) No — screen's content can be read	
iii)	Does the touch screen work and/ or all keys work?	1) Yes — touch screen / keys work 2) No — touch screen / keys do not work	

Key considerations:

- It is recommended that this question is prefaced with a short read-out asking for the respondent's permission to observe their mobile device. This question is best implemented through **observed data** recorded by trained data collectors, to prevent inaccuracies related to self-reported data.
- The response options and information collected by this question should be tailored to the specific requirements of the digital programme. For example, programmes that require participants to take pictures may include a response option about the availability of a camera on the mobile device.

1.4 Characteristics of access



This section covers the various characteristics that relate to an individual's access to mobile devices, such as when, where, and for how long they have access to the mobile device they use. It includes questions for measuring device movement and the periodicity of access i.e. timing, duration, recency, and frequency of access.

While these characteristics might also relate to the measurement of agency – defined in this context as an individual's control over mobile devices and connectivity – this document does not cover agency. The measurement of agency is addressed in an in-depth companion document, in the form of another toolkit.

Additional examples from global surveys are provided in Annex 5.

1.4.1 Mobile device movement

In certain situations, a mobile device can serve as a household landline phone, staying at home rather than being carried by individuals when they leave. Questions about device movement help researchers identify such cases, which may limit an individuals' digital access and affect programme design.

Code	Question	Response	Source
A	In the past 7 days, when you have left your home, did you carry the mobile phone with you? Did you carry it with you... [Interviewer note: read options]	1. Every time 2. Most times 3. Some times 4. None of the times	Modified by UCT Metrics Team from *Kilkari Impact Evaluation* for the Digital Access and Use Project.

Key considerations:

- The time horizon of 'in the past 7 days' could be modified to reflect either a longer or narrow window of time, as contextually appropriate. Using hypothetical terms like 'typical day' or 'average day' is not recommended, as they might yield unreliable responses.
- This sentence is constructed using 'In the last [Y time period], have you [done X]' rather than the recommended 'When was the last time you [did X]?'; this format has been retained because it allows the measurement of more nuance around the frequency of carrying the phone (every time, most times, some times); asking 'The last time you left the house did you carry the mobile phone with you?' anchors the respondent to a single event but distils their report of mobile device movement to a single instance.
- While the time horizon presented here can be modified and adapted to the requirements of the program, learning from cognitive interviewing has shown that general terms such as 'usually' or 'normally' do not perform as well as specific time horizons. Moreover, stating a number of days worked better across contexts in India, Nigeria and Kenya compared to using the term 'week'. Finally, a recall of seven days was considered appropriate for frequent activities, which may be required by a digital program.

1.4.2 Timing of access

Many women in LMICs only have access to mobile phones at certain times of day. For example, when they and their husbands are home from work in the mornings and evenings. The following question aims to identify the time(s) of day when respondents have access to mobile phones. This information can be used to identify possible programmatic challenges, for example in contexts where telecommunications regulators restrict pre-recorded outbound calls during 'antisocial' hours.

Code	Question	Response	Source
B	Yesterday, when was the mobile phone within your reach? [Interviewer note: Clarify that this means the respondent could pick it up if it rang] [Select all that apply.]	a) In the morning (6am to 12pm) b) In the afternoon (12pm to 4pm) c) In the evening (4pm to 8pm) d) At night (8pm to 6am) e) The whole day f) Never	Modified by UCT Metrics Team from *Kilkari Impact Evaluation* for the Digital Access and Use Project.

Key considerations:

- This question can additionally be asked using a 'continuous' response option wherein the respondent is asked to provide an estimate of the total time the phone was within reach out of a period of 24 hours.
- The time horizon of 'yesterday' has been intentionally used in place of a more general term such as 'usually.' This decision was made based on learning from cognitive interviewing that shows poor performance when using these general time horizons.
- This question can also be adapted to identify a single part of the day when respondents are most likely to have access to a mobile phone. The provided version, however, is designed with the understanding that many individuals have access at multiple times during the day.
- The phrase 'within your reach' is meant to imply a state in which the mobile phone is accessible by the respondent. However, cognitive interviewing has shown that some respondents interpret it literally; for example, 'in the next room' does not satisfy the condition of 'within your reach.'

1.4.3 Duration of access

The following question adapts question B (above) to collect information about duration in place of timing. The duration of access can have important implications for programmes which require users to have access to devices for sustained periods of time, for example for work or study.

Code	Question	Response	Source
C	Yesterday, was the phone within your reach... [Interviewer note: read response options]	1. All / almost all day 2. Some of the day 3. None of the day	Modified by UCT Metrics Team from *Kilkari Impact Evaluation* for the Digital Access and Use Project. Needs testing.

Key considerations:

- The analytic time horizon of 'yesterday' can also be modified in accordance with what's relevant to a particular program. In some contexts, 'In the last 24 hours' may be better understood. This question may benefit from further cognitive testing in specific contexts.
- The proposed question is suitable for contexts where respondents have difficulty conceptualising time in hours. However, in contexts where respondents are capable of estimating duration in hours, an alternative question of 'Yesterday, how many hours was the phone within your reach?' would elicit a specific number (in hours), allowing for more precise analysis.
- Proximity does not necessarily reflect actual availability - for example, some women report that, when they are at home, their mobile phones are primarily in control of their children.

1.4.4 Recency of access

Given challenges around conceptualising and measuring 'recency of access,' the proposed question uses *recency* of use as a proxy for understanding individuals' access to mobile phones. This information can help digital designers identify whether intended programme participants have the level of access required to meet programmatic needs.

Code	Question	Response	Source
D	When did you last [make a call from] a mobile phone?	1. Less than 24 hrs ago 2. 2 - 7 days ago 3. 8 - 14 days ago 4. 15 - 31 days ago 5. More than 1 month but less than 3 months ago 6. More than 3 months ago but within the last 1 year 7. More than 1 year ago	Modified by UCT Metrics Team from *GSMA Consumer Survey 2022* for the Digital Access and Use Project. Needs testing.

Key considerations:

- This question uses the task of 'making a phone call' as a proxy for understanding when individuals last accessed a mobile phone. However, this information cannot be used to accurately represent access, as there are many other tasks that an individual could have undertaken more recently. Recency of access should thus be assessed by aggregating recency of several actions, given the wide range of phone uses available.

1.4.5 Frequency of access

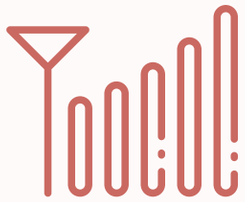
Given challenges around conceptualising and measuring 'frequency of access,' the proposed question uses *frequency* of use as a proxy for understanding individuals' access to the mobile phone.

Code	Question	Response	Source
E	During the last seven days, how often did you [make a call from] a mobile phone? [Interviewer note: read response options]	1. Never made a call 2. Made one call 3. Made multiple calls, but not every day 4. Made calls every day	Modified by UCT Metrics Team from *DHS Phase - 8 Model Questionnaire* for the Digital Access and Use Project. Needs testing.

Key considerations:

- Depending on the need of the programme and most common responses during piloting, the time horizon in this question can be adjusted to 'In the last 24 hours,' and the response options modified accordingly. Shorter time horizons have been found to be easier to administer and recall for respondents.
- This question again proposes the use of 'In the last [Y time period], have you [done X]' construction rather than the recommended 'When was the last time you [did X]?'; this format has been retained because it allows the measurement of frequency rather than recency.

2. Connectivity



Connectivity refers to an individual's ability to access mobile networks and the internet. Examples of constructs include mobile network coverage, SIM card status, and household broadband connection availability. Connectivity can be measured using two approaches: (i) supply-side information collected from mobile network operators and telecommunications regulators, and (ii) population level estimates of connectivity at an individual and household level through surveys.



2.1 Network access

Supply-side indicators such as coverage maps from mobile network operators, internet service providers and utility companies can be useful sources of information about infrastructure availability. The questions in this section, however, are concerned with measuring access to these services at an individual or household level.

Additional examples from global surveys are provided in Annex 6.

2.1.1 Mobile network type

This question aims to capture mobile network types available at the user-level. It is not a direct representation of broader infrastructure availability, as it is restricted to the types of network the respondent's mobile device can receive.

Code	Question	Response	Source
A (Observed)	[Note type of mobile network available on mobile device]	1. 2G Edge (E) H+ 2. 3G 3. 4G LTE 4. 5G 5. No network 98. Don't know	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.
B (Reported)	What type of network is available on your mobile phone right now?	1. 2G Edge (E) H+ 2. 3G 3. 4G LTE 4. 5G 5. No network 98. Don't know	

Key considerations:

- The recommended approach to collecting this data is through observation by a trained data collector. This approach addresses any challenges that respondents may have with reporting the information due to low familiarity with the topic.
- Since this question only collects data about network type available on a specific device, at a specific location, and at a specific point in time; responses cannot be generalised to provide information about the local area or other times of day.
- The response options can be altered based on the requirements of the program. For example, it may be simpler to combine high-bandwidth response options to create a single response option.

2.1.2 Network strength

This question captures the strength of mobile network reception on the respondent's device at a specific location. It is not representative of general mobile network strength or quality in the area.

Code	Question	Response	Source
C (Observed)	[Note how many network bars are visible on the phone]	1. None 2. Less than half 3. Half 4. More than half 5. All / Full	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.
D (Reported)	How many network bars are visible on the phone?	1. None 2. Less than half 3. Half 4. More than half 5. All / Full	

Key considerations:

- The recommended approach to collecting this data is through observation by a trained data collector. This approach addresses any challenges that respondents may have with reporting the information due to low familiarity with the topic.
- Although the question phrasing uses 'how many,' the response options have been changed to reflect proportions instead of discrete numbers. This is to account for differences in how different mobile devices visually represent network strength.
- Since this question only collects data about network strength on a specific device, at a specific location, at a specific point in time, it is important to recognise that it cannot be generalised to provide information about the local area or other times of day.

2.1.3 Household fixed broadband subscription

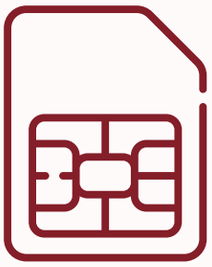
This question aims to identify whether a fixed broadband internet connection is available in the respondent's household.

Code	Question	Response	Source
E	Does your household have a separate fixed, broadband fibre / cable internet connection?	1. Yes 2. No	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.

Key considerations:

- This question is solely focused on identifying if a fixed, broadband internet connection is available, and not the type of connection (fibre-optic versus cable for example). Where additional detail on the type of connection is required, it is recommended that modified questions be used similar to those covered in Annex 6.
- This question only collects information on fixed line internet connection availability within the *household* – individuals may depend on a fixed line internet connection outside their household for connectivity.

2.2 SIM cards



A functional mobile device and a strong mobile network are not sufficient for connectivity – individuals also require a SIM card or alternative method for connecting to, authenticating with, and using mobile networks.

Additional examples from global surveys are provided in Annex 7.

2.2.1 SIM availability

This question captures whether the respondent has access to a SIM card, in combination with the mobile device they have access to. It is restricted to respondents who report using a mobile phone.

Code	Question	Response	Source
A	Is there a working SIM or number in this mobile phone? [Interviewer note: Working SIM means one which has been used to make/ receive a call within the last month]	1. Yes 2. No	Modified by UCT Metrics Team from *GSMA Consumer Survey 2022* for the Digital Access and Use Project. Cognitively Tested in India, Kenya, and Nigeria.

Key considerations:

- This question is intended for respondents who have reported that they use a mobile phone.
- Some respondents may be unfamiliar with the term 'SIM card.' Therefore, it is recommended that this question use local terms and be preceded by a short explanation of what a SIM card is. See Annex 6 for an example.

2.2.2 SIM validity

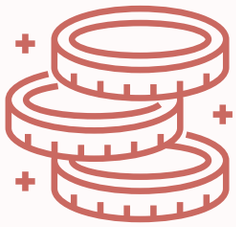
SIM cards need to be valid i.e. able to connect to a mobile network and use the services. Many mobile providers have conditions related to validity e.g. some prepaid SIM cards are only 'valid' up to 3 months from their most recent credit top-up.

Code	Question	Response	Source
B	When was the last time this SIM or number was used to receive or make calls?	1. Less than 24 hrs ago 2. 2 - 7 days ago 3. 8 - 14 days ago 4. 15 - 31 days ago 5. More than 1 month but less than 3 months ago 6. More than 3 months ago but within the last 1 year 7. More than 1 year ago 8. Never	Modified by UCT Metrics Team from *GSMA Consumer Survey 2022* for the Digital Access and Use Project. Cognitively Tested in India, Kenya, and Nigeria.

Key considerations:

- This question uses the condition of making or receiving a phone call to identify whether the SIM card has recently been functional.
- It is technically possible for a SIM to be valid regardless of whether it has been used recently.
- It is difficult to measure SIM validity through self-reported data, as respondents may be unfamiliar with the concept of 'validity' and thus unable to report it themselves.
- The provided questions will need to be adapted for situations where a single respondent uses multiple SIM cards, or has multiple phone numbers.

3. Financial access



Financial access covers financial factors that influence an individual's degree of digital access, as well as additional contextual factors that are financial in nature.

3.1 Expenditure on mobile devices

Mobile device expenditure refers to the amount of money spent on the acquisition or maintenance of a mobile phone and includes the purchase cost of the device, as well as the cost of repairs.

3.1.1 Mobile device acquisition

The following questions are for respondents who report owning a personal mobile phone, and the costs associated with acquiring this mobile device.

Code	Question	Response	Source
A	Your personal mobile phone, how long have you had it?	1. Last 3 months 2. 3 months to 1 year 3. 1 year to 3 years 4. More than 3 years ago	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.
B	Before you, was this mobile phone owned by or used by someone else?	1. I am the first user 2. My husband/wife used it before me 3. Someone else known to me used it before me 4. I got the phone second-hand from a shop 96. Other (specify) _____	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.
C	**[IF (B) == 3]** Who owned or used this mobile phone before you?	[List of relationships]	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.
D	Who paid for you to get this phone? [Select all that apply]	1. Self 2. Spouse 3. Father 4. Mother 5. Son 6. Daughter 5. Other male family member 6. Other female family member 96. Other __ (specify)	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.

Code	Question	Response	Source
E	How much money was spent for you to get this phone?	[Amount] 00. None 98. Don't know	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.

Key considerations:

- This set of questions is designed to capture the cost of acquiring the device. If respondents purchased it from a store, it captures the price paid to the seller. Alternatively, if the phone is passed on from someone else, it aims to capture any expenditure incurred during this process
- The lists of relationships in (C) and (D) should be modified based on the requirements of the programme and/or research activity. The proposed lists intentionally make distinctions between male and female family members to provide additional information that may be related to gender dynamics.
- Some respondents may be unable to provide information on the cost of their mobile devices, as they are often paid for by a family member, received as gifts, or hand-me-down devices from family members.

3.1.2 Cost of maintenance / repairs

This set of questions aims to capture ongoing financial expenditures related to device 'upkeep' — costs that occur after the initial purchase. These insights provide a valuable metric for programmes that distribute devices to users.

Code	Question	Response	Source
F	Since you got this phone, how much have you or others spent on repairs or maintenance?	[Numeric entry (including 0)] 98. Don't know	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.
G	Who paid for these repairs?	1. Self 2. Spouse 3. Father 4. Mother 5. Son 6. Daughter 5. Other male family member 6. Other female family member 96. Other __ (specify)	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.

Key considerations:

- The list of relationships in (G) can be altered based on the requirements of the programme and/or research. It is important to include mechanisms to identify the gender of each person, to enable gender analysis of phone-related finance.
- Some respondents may be unable to provide information on the cost of repairing or maintaining their mobile devices, as these costs may be paid for by other people.



3.2 Expenditure on connectivity

Expenditure on connectivity refers to the cost incurred on mobile talktime, mobile data, mobile messaging, fixed-line internet, and other related connectivity services.

The answers to these questions are crucial for programmes aiming to enhance women's and girls' use of digital technologies. Specifically, the ongoing cost of data may be a greater concern than the upfront expense of purchasing a device for certain segments of the population.

Additional examples from global surveys are provided in Annex 8.

3.2.1 Type of SIM pack

This question identifies whether the respondent is a prepaid or postpaid mobile subscriber. Subsequent questions are filtered based on this criteria.

Code	Question	Response	Source
A	What SIM pack / plan do you currently have? Is it... [Interviewer note: read out options]	1. Prepaid, where you purchase mobile talktime, credit, top-ups or balance to put money on the phone 2. Postpaid, where you pay a monthly bill	Developed by UCT Metrics Team for the Digital Access and Use Project. Needs testing.

Key considerations:

- The terms used to refer to mobile credit vary across geographies and contexts. It is recommended that researchers identify the most relevant terminology prior to questionnaire development.

3.2.2 Mobile credit – prepaid

The following questions are for respondents who are identified as prepaid mobile subscribers in (A). Understanding how much mobile credit is available to the respondent, and when this credit was last added, is important information for assessing the usability of the mobile phone in question. It is possible for respondents to own a mobile phone and SIM card, but for them to be rendered useless due to no mobile credit.

Code	Question	Response	Source
B	How much {local term for mobile credit} is currently on the phone?	[amount] [local currency] 98. Don't know	Modified by UCT Metrics Team from *Kilkari Impact Evaluation* for the Digital Access and Use Project. Needs testing.
C	Is there currently any {local term for mobile credit} on your phone? That is, can you currently make an outbound call from your phone?	1. Yes 2. No 98. Don't know	Modified by UCT Metrics Team from *Kilkari Impact Evaluation* for the Digital Access and Use Project. Needs testing.
D	When was the most recent {local term for top-up/recharge} of your phone?	1. Within 1 week 2. Within 1 month 3. Within 3 months 4. Within 6 months 9998. Don't know	Modified by UCT Metrics Team from *Kilkari Impact Evaluation* for the Digital Access and Use Project. Needs testing.
E	What was the total amount of your last {local term for top-up/recharge}?	[amount] [local currency] 98. Don't know	Modified by UCT Metrics Team from *Kilkari Impact Evaluation* for the Digital Access and Use Project. Needs testing.
F	Who topped up the {local term for mobile credit} on your phone during your most recent top-up?	1. Husband 2. Male child 3. Female child 4. Male household member 5. Female household member 6. Neighbour 7. Self 96. Other (specify) 9898. Don't know	Modified by UCT Metrics Team from *Kilkari Impact Evaluation* for the Digital Access and Use Project. Needs testing.

Key considerations:

- The relationship list in (F) should be modified based on the requirements of the programme and/or research.
- Respondents may have challenges reporting their expenditure if it is incurred by someone else on their behalf.
- Respondents may have difficulty distinguishing expenditure on mobile credit and mobile data, as they are often bundled.

3.2.3 Mobile credit – postpaid

The following question is for respondents who are identified as postpaid subscribers in (A).

Code	Question	Response	Source
G	In terms of mobile phone expenditure, could you tell me how much you spent last month for voice, SMS and data in total (airtime, subscription)	[Amount] 98. Don't know	Modified from by UCT Metrics Team from *After Access 2022* for the Digital Access and Use Project. Needs testing.

Key considerations:

- This question is used in combination with (H) to determine the amount of money spent on talktime and credit.
- Respondents may have challenges reporting their expenditure if it is incurred by someone else on their behalf.
- Respondents may have difficulty distinguishing expenditure on mobile credit and mobile data, as they are often bundled.

3.2.4 Mobile data

The following question is for both, prepaid and postpaid mobile subscribers.

Code	Question	Response	Source
H	In terms of mobile phone expenditure, could you tell me how much you spent last month on data only (dedicated top up or data bundles)	[Amount] 98. Don't know	Modified from by UCT Metrics Team from *After Access 2022* for the Digital Access and Use Project. Needs testing.

Key considerations:

- This question is used in combination with (G) to determine the amount of money spent on talktime and credit.
- Respondents may have challenges reporting their expenditure if it is incurred by someone else on their behalf.
- Respondents may have difficulty distinguishing expenditure on mobile credit and mobile data, as they are often bundled.



Annexes

Annex 1. Summary of sources reviewed



Survey	Organisation	Year
Demographic and Health Surveys - Phase 8	ICF	2020
Multiple Indicator Cluster Surveys - Round 6 (MICS-6)	UNICEF	2016
National Family Health Survey, India 2019-20 (NFHS-5)	International Institute of Population Sciences (IIPS), ICF	2021
Kilkari Impact Evaluation	Kilkari Impact Evaluation Team	2018
Understanding and improving women's work on digital labour platforms - quantitative surveys	International Labour Organisation	2020
The Young Lives Study	University of Oxford	-
GSMA Consumer Survey 2022	GSMA	2022
After Access 2022	Research ICT Africa	2022
After Access Survey 2017	Research ICT Africa	2017
2021 Global Findex Questionnaire	World Bank	2021
Digital Women's Economic Empowerment: Social Network Survey	BBC Media Action	2020
Phone toh Uthao: Dipstick Survey	BBC Media Action	2022
Conduct of Privacy Survey	Philippine Survey and Research Organization	2021
Pew Research Center's American Trends Panel - Wave 49, June 2019.	PEW Research Center	2019
TRUSTe Privacy survey (April, 1998)	TRUSTe	1998
DigCompSAT	European Commission	2020

Survey	Organisation	Year
Living Standards Measurements Study - Plus	Cambodia National Institute of Statistics, World Bank	2019
Global Kids Online 2021	Global Kids Online, London School of Economics, UNICEF, WeProtect, EU Kids Online	2021
EU Survey on the use of ICT in households and by individuals	European Commission	2021
Assessing Digital and Financial Literacy in Fiji	United Nations Capital Development Fund (UNCDF)	2022
MyDigiSkills	All Digital	2021
ICT usage in enterprises	EUROSTAT, European Commission	2023
Worker and Enterprise Household Survey	World Bank, SurveyMETER	2023
Manual for Measuring ICT Access and Use by Households and Individuals, 2020 Edition.	International Telecommunication Union (ITU)	2020

Annex 2. Mobile ownership: examples



Individual level mobile ownership

Source	Question	Response Options
DHS Model Questionnaire - Phase 8	Do you own a mobile phone?	1. Yes 2. No
National Family Health Survey (NFHS-5) India	Do you have any mobile phone that you yourself use?	1. Yes 2. No
GSMA Global Consumer Survey 2022	Do you personally own a mobile phone? Please do not include old handsets that you don't use anymore.	1. Yes 2. No
LSMS+ Sample Household and Individual Questionnaires	Do you own any mobile phones, exclusively or jointly with someone else? INSTRUCTION: THIS REFERS TO MOBILE PHONES IN WORKING CONDITION. ABLE TO BE CHARGED TO INITIATE AT LEAST ONE CALL.	1. Yes 2. No
ITU - Manual for Measuring ICT Access and Use by Households and Individuals, 2020 Edition	Do you own a mobile phone?	1. Yes 2. No
ITU - Manual for Measuring ICT Access and Use by Households and Individuals, 2020 Edition	Do you own a smartphone?	1. Yes 2. No

Household mobile ownership

Source	Question	Response Options
ITU - Manual for Measuring ICT Access and Use by Households and Individuals, 2020 Edition	Does this household have a mobile telephone?	1. Yes 2. No
ITU - Manual for Measuring ICT Access and Use by Households and Individuals, 2020 Edition	Does this household have a smartphone?	1. Yes 2. No

Annex 3. Mobile sharing: examples



Access

Source	Question	Response Options
2021 Global Findex Questionnaire	Do you have a mobile phone that you use to make and receive PERSONAL calls?	1. Yes 2. No 3. (Don't know) 4. (Refused)

Device sharing

Source	Question	Response Options
LSMS+ Sample Household and Individual Questionnaires	Does anyone else jointly own this mobile phone with you?	1. Yes 2. No
GSMA Global Consumer Survey 2022	And thinking about the mobile phone that you use most often, are you …?	1. The sole or main user (i.e. the person who uses it most and carries it most days) 2. A user, but NOT the person using it most

Annex 4.
Device characteristics



Device type

Source	Question	Response Options
DHS Model Questionnaire - Phase 8	Is your mobile phone a smartphone?	1. Yes 2. No
After Access Survey 2022: Household and Individual Questionnaire	What phone is it? [Show phone cards. If not sure ask the respondent to show you the phone]	1. Basic phone 2. Feature phone 3. Smartphone
GSMA Consumer Survey 2022	Please look at the descriptions on the card and indicate which best describes the mobile phone that you have the sole or main use of.	1. [DISPLAY BASIC PHONE IMAGE] A basic mobile phone • No internet access (i.e. unable to visit websites/access social networking websites/send emails/use apps) • Small screen • Basic keypad with several letters per button 2. [DISPLAY FEATURE PHONE IMAGE] A feature mobile phone • Internet access • Tends to have a small screen • Tends to have a basic keypad with several letters per button • Can come with some apps already on the phone • Unable to download apps from an online app store like Google Play or App Store

Source	Question	Response Options
		3. [DISPLAY SMARTPHONE IMAGES] A smartphone • Internet access • Large touchscreen display • Comes with some apps already on the phone • Able to download additional apps from an online app store like Google Play or App Store • Advanced operating systems such as Android or Apple iOS
2021 Global Findex Questionnaire	Can your mobile phone be used to access the Internet?	1. Yes 2. No 3. (Don't Know) 4. (Refused)

Annex 5. Characteristics of access



Source	Question	Response Options
MICS-6 Questionnaire for Individual Men	During the last 3 months, did you use a mobile telephone at least once a week, less than once a week or not at all?	0. Not at all 1. Less than once a week 2. At least once a week 3. Almost every day
GSMA Consumer Survey 2022	When was the last time you used a mobile phone for any reason (e.g. to make or receive calls, send text messages or use the internet on a mobile phone)? Was it …?	1. In the last 3 months 2. Longer ago
GSMA Consumer Survey 2022	Have you ever used a mobile money account to send, pay or receive money, or to deposit or withdraw money?	1. Yes, in the last 7 days 2. Yes, in the last 30 days 3. Yes, in the last 3 months 4. Yes, in the last 12 months 5. Yes, but NOT in the last 12 months 6. No, I have never used a mobile money account
EU Survey on the use of ICT in households and by individuals	When did you last use the internet?	1. Within the last 3 months 2. Between 3 months and a year ago 3. More than 1 year ago 4. Never used it
EU Survey on the use of ICT in households and by individuals	How often on average did you use the internet in the last 3 months?	1. Several times during the day 2. Every day or almost every day 3. At least once a week (but not every day) 4. Less than once a week
After Access Survey 2022: Household and Individual Questionnaire	On average, how much time do you spend daily on social networking sites?	0. Not using it every day 1. Less than a hour 2. 1 to 6 hours daily 3. More than 6 hours a day

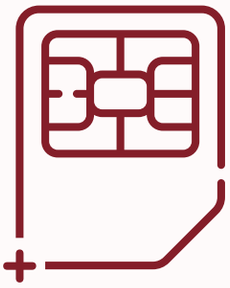
Annex 6. Network access



Source	Question	Response Options
ITU - Manual for Measuring ICT Access and Use by Households and Individuals, 2020 Edition	What type/s of Internet services are used for Internet access at home?	a. Fixed narrowband network, at advertised download speeds below 256 kbit/s: -Analogue modem (dial-up via standard telephone line) -ISDN (Integrated Services Digital Network) -DSL (Digital Subscriber Line) at advertised download speeds below 256 kbit/s -Other fixed narrowband with an advertised download speed of less than 256 kbit/s b. Fixed broadband network, at advertised download speeds of at least 256 kbit/s: -DSL (Digital Subscriber Line) at advertised download speeds of at least 256 kbit/s -Cable modem -High speed leased lines -Fibre-to-the-home/building -Powerline -Other fixed broadband c. Terrestrial fixed broadband network, at advertised download speeds of at least 256 kbit/s: -WiMAX -Fixed CDMA d. Satellite broadband network (via a satellite connection), at advertised download speeds of at least 256 kbit/s e. Mobile broadband network (at least 3G, e.g. UMTS) via a handset f. Mobile broadband network (at least 3G, e.g. UMTS) via a card: -Integrated SIM card in a computer -USB modem

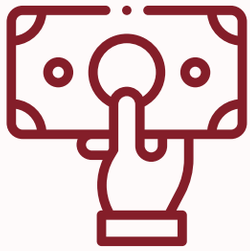
Source	Question	Response Options
After Access Survey 2022: Household and Individual Questionnaire	Is there a way of connecting to the internet in the household (whether this is through a mobile phone, a fixed connection, satellite broadband, etc.)? Please specify:	0. No 1. Yes 1. USB Dongle/Mifi (uses SIM card) 2. Smartphone (that is accessible to all household members all day and night) 3. A router (that uses a sim card) 4. ADSL (uses a fixed-line telephone) 5. Fibre Optic Cables (with or without home Wi-Fi). 6. Wireless (WiMAX, CDMA) 7. Other (Specify)
After Access Survey 2022: Household and Individual Questionnaire	What is the name of your main operator (SIM card you use most often)?	[List]
After Access Survey 2022: Household and Individual Questionnaire	What is your main operator for data?	[List]

Annex 7. SIM cards



Source	Question	Response Options
Living Standards Measurement Study - Plus (LSMS+) Sample Questionnaire Modules on Asset Ownership and Control	Does this [MOBILE PHONE] have a SIM card?	1. Yes 2. No
GSMA Consumer Survey 2022	SIM cards are inserted into a mobile phone or other device to enable customers to access a mobile operator's network. The SIM card may have been installed in the mobile phone by the supplier of the phone and it can come in different sizes, as shown on this card. Do you know what a SIM card is?	1. Yes 2. No
GSMA Consumer Survey 2022	You said that you have [Number of handsets]. Do you have any SIM cards (i.e. mobile phone numbers) that you use in [this/these mobile phone(s)] at least once a month?	1. Yes, I have a SIM card that I use at least once a month 2. No
GSMA Consumer Survey 2022	How many SIM cards (i.e. mobile phone numbers) that you have the sole or main use of do you use at least once a month?	1. One 2. Two 3. Three 4. Four 5. Five or more
After Access Survey 2022: Household and Individual Questionnaire	Is your mobile phone (main SIM Card)?	1. Prepaid 2. Post-paid (contract)
After Access Survey 2022: Household and Individual Questionnaire	How many active SIM cards do you have (SIM cards that you used in the last 90 days (3 months)?	[Number]
After Access Survey 2022: Household and Individual Questionnaire	Do you have a dedicated SIM for data use?	0. No 1. Yes

Annex 8. Expenditure on connectivity



Source	Question	Response Options
LSMS+ Sample Household and Individual Questionnaires	Do you currently have enough airtime to initiate a call with this [MOBILE PHONE]?	1. Yes 2. No 98. Don't Know
GSMA Consumer Survey 2022	How much do you spend on using mobile phone services in a typical [week/month]? Please include all mobile phones / SIM cards, including those paid for by someone else.	[Pre-defined ranges] 8. Don't know 9. Prefer not to answer
GSMA Consumer Survey 2022	You said that you spend [range] on using mobile phone services in a typical [week/month]. Please can you give a more precise estimate of the amount you typically spend. Please enter [weekly/monthly] amount	1. [Type in Amount] 2. Don't know 3. Prefer not to answer

Measuring Digital Access in Low- and Middle-Income Countries

A guide for inclusive research and design

2x Digital

School of Public Health
Departement Openbare Gesondheid
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of PUBLIC HEALTH