# Methodology of the ICT Development Index 2023: Version 2

Prepared by the ITU Secretariat. May 2023.

## Contents



## 1 Introduction

Created to measure the level of development of the information and communication technology sector (ICT), the ICT Development Index (IDI) was a composite indicator published by ITU from 2009 until 2017. It was discontinued in 2018, owing to issues of data availability and quality (see Box 1).

In October 2022, ITU's Plenipotentiary Conference 2022 in Bucharest adopted a revised text of Resolution 131. This new text (Rev. Bucharest, 2022) defines, *inter alia*, the main features of the process for developing and adopting a new IDI methodology and of the IDI itself (see Box 2). Consistent with the urgency imposed by Resolution 131, the objective is to launch the IDI in 2023 (see process and timeline in Annex 1).[1]

In this context, and in line with *instructs 8 to the BDT Director*,[2] the Secretariat prepared a 'Zero draft' document, which described a possible framework and structure for the IDI, to inform, facilitate and expedite the process. This document was posted on a discussion forum dedicated to the new IDI (IDI Forum), where the members of the Expert Group on ICT Household Indicators (EGH) and the Expert Group on Telecommunication/ICT Indicators (EGTI) were invited to share feedback on the draft methodology, comments and suggestions.

[1] Resolution 131 instructs the BDT Director to "urgently perform the tasks set out in *resolves* above".
[2] "to facilitate the work of EGTI/EGH in fulfilling the tasks set out under resolves above, including through correspondence";

More than 200 members signed up for the IDI Forum and almost 100 comments were posted. A document with a compilation of all the comments received on the content and the respective responses from the ITU Secretariat was produced and posted on the IDI Forum. The 'Zero draft' document was revised in light of the comments received to produce a Version 1 document, which also contained additional proposals related to the treatment of outliers, aggregation and weightings. A compilation of all the comments received and the Secretariat's responses to each of them were appended as Annex 4 to the Version 1 document.

In Circular BDT/DKH/IDA/009 of 21 April 2023, Member States were invited to comment on the Version 1 document, as per *instructs the Director of the Telecommunication Development Bureau* 7 of Resolution 131.[3] The period of consultation for Member States ran from 21 April 2023 to 19 May 2023.[4] Fourteen Member States submitted a total of 71 comments.[5]

Based on the comments received, the Secretariat updated the Version 1 document and produced this Version 2 document. Annex 4 features a compilation of the comments submitted by Member States and the Secretariat's responses to each of them.

Following these consultations, the ITU Secretariat identified a number of outstanding issues, which are presented in this document (and summarized in text boxes labelled 'Issues for discussions at the IDI meeting'). These outstanding issues will be discussed at the virtual joint meeting of EGTI and EGH from 13 to 15 June 2023 (Circular BDT/DKH/IDA/007 of 21 March 2023). The agenda of this meeting is available for download here.

The rest of the document is organized as follows: Section 2 presents the conceptual framework (step 1 of the process of developing an index – see Table 1); Section 3 presents a set of selection criteria which combined with the conceptual framework help identify candidate indicators for inclusion (step 2) and the statistical analysis (step 3) used to narrow down and confirm the choice of indicators. Section 4 describes the approach to identify and treat outliers and estimating missing data (step 4). Section 5 describes the approach to normalize indicators and aggregate them (step 5). Section 6 concludes.

**Box 1: A brief history of the IDI**

The IDI was published from 2009 to 2017. In the last published edition in 2017, 11 indicators were combined into a composite score.

In March 2017, an extraordinary meeting of the Expert Group on ICT Household Indicators (EGH) and Expert Group on Telecommunication/ICT Indicators (EGTI) adopted a revised set of 14 indicators to be included in the IDI. However, following the shift from 11 to 14 indicators, countries were facing challenges in collecting and submitting quality data. For the calculation of the 2018 IDI for example, 58 per cent of the data points would have to be estimated. Furthermore, there were issues with the harmonization and quality of the data used, and the methodology applied to derive some of the newly adopted indicators. Because of these flaws it was not possible to compute a methodologically sound index that reflected the true state of ICT development.

Since 2018, attempts either to publish the IDI in line with the Plenipotentiary Conference Resolution 131 "Measuring information and communication technologies to build an integrating and inclusive information society" (Rev. Dubai, 2018) or to develop an entirely new index have been unsuccessful, as no consensus could be reached.

[3] to invite Member States to contribute and comment on the IDI methodology and structure;
[4] The consultation period was initially to end on 19 May but was extended to 22 May to allow for some ITU focal points (or the person to whom they had delegated the task) who experienced technical difficulties to post their comments.
[5] The 14 countries are: Algeria, Bahrain, Brazil, Egypt, India, Kenya, Korea (Rep. of), Oman, Pakistan, Qatar, Russian Federation, Singapore, and the United Arab Emirates. Another country, Japan, posted comments that did not relate to the methodology, but to data availability in Japan of the proposed indicators.

To address these implementation challenges, Resolution 131 was revised at the 2022 Plenipotentiary Conference 2022 in Bucharest. Refer to the ITU website for more on the history of the IDI.

**Box 2: Main implications of Resolution 131 for the development of the IDI**

Resolution 131 (Rev. Bucharest, 2022) describes the main features of the process for developing the IDI methodology and of the IDI itself (relevant paragraphs of the resolution appear in brackets):

- ITU must publish a new IDI "urgently" (*instructs to BDT Director 1*);
- The new IDI will be published without ranking (*resolves 3*);
- ITU should establish a valid structure and methodology for the IDI, working through EGTI/EGH, and through formal consultations (*resolves 3*);
- ITU should establish the criteria on the minimum data availability for Member States to feature in the IDI, working through EGTI/EGH (*resolves 6*);
- The BDT Director should facilitate the work of EGTI/EGH (*instructs to BDT Director 8*);
- Methodology will be submitted to Member States for approval and adopted if 70 percent of respondents approve it (*resolves 3*);
- If adopted, the methodology will be valid for four editions, namely 2023-2026 (*resolves 4*);
- Member States will have with the option to decline to participate in the IDI during the given period of validity, though with the choice to re-join the exercise on an annual basis (*resolves 5*);
- A meeting of EGTI/EGH will be convened following a formal consultation of Member States with a view to resolving any contentious issues and seeking consensus (*instructs to BDT Director 9*);
- Integrity of all ITU's statistical work must be preserved, in strict adherence to UN principles on good statistics (*instructs to BDT Director 12*).

In addition to the IDI, Resolution 131 covers other topics not discussed here.

# 2 Conceptual framework (step 1)

ICT development is an inherently multidimensional concept. An evidence-based assessment of country performance therefore requires multiple indicators. An aggregate measure, or composite indicator, serves the purpose of summarizing a range of metrics into a single number. There are both advantages and disadvantages to using composite indicators, summarised in Table 1.

**Table 1: Pros and cons of a composite indicator**

| Pros | Cons |
|---|---|
| • Can summarise complex, multi-dimensional realities with a view to supporting decision-makers.<br>• Are easier to interpret than a battery of many separate indicators.<br>• Can assess progress of countries over time.<br>• Reduce the visible size of a set of indicators without dropping the underlying information base, making it possible to include more information within the existing size limit.<br>• Uses the power of numbers to advocate an issue of concern and introduce it in the policy arena. | • May send misleading policy messages if poorly constructed or misinterpreted.<br>• May invite simplistic policy conclusions.<br>• May be misused, e.g., to support a desired policy, if the construction process is not transparent and/or lacks sound statistical or conceptual principles.<br>• The selection of indicators and weights could be the subject of political dispute and may be biased by data availability.<br>• May disguise serious failings in some dimensions and increase the difficulty of identifying proper remedial action if the construction process is not transparent. |

- Facilitate communication with the public (i.e., citizens, media, etc.) and promote accountability.
- Help to construct/underpin narratives for lay and literate audiences.
- Enable users to compare complex dimensions effectively.
- Bring public attention to the need to develop and refine statistical data collection.

- May lead to inappropriate policies if dimensions of performance that are difficult to measure are ignored, or if measurement lags are not taken into consideration.
- May hide, inequalities within territorial units and trade-offs between alternatives, by presenting the average of averages.
- May give the false impression that units are independent competitors, while hiding interdependencies and common underlying processes transcending borders.

Source: Based on OECD (2008).

Aggregation necessarily involves simplification. To guarantee a conceptually and statistically sound index, its construction must follow an iterative process, as formalised in the *OECD-JRC Handbook on Constructing Composite Indicators* (2008) and *Your 10-Step Pocket Guide to Composite Indicators & Scoreboards* from the European Commission (2019) and presented in Table 2.

**Table 2: Steps for developing a composite indicator**

| | **Step** |
|---|---|
| 1 | Develop the conceptual framework based on the stated objective. |
| 2 | Identify potential indicators that capture those concepts. |
| 3 | For each considered indicator, assess coverage, methodological soundness, quality of data. |
| | *Based on this assessment, revisit the framework, concepts, and/or indicators (steps 1-3) if necessary.* |
| 4 | Identify and treat any outliers and missing data. |
| 5 | Define the suitable normalization, weighting, and aggregation methods. |
| 6 | Calculate the index. |
| 7 | Assess the statistical and conceptual coherence of the index. |
| 8 | Conduct sensitivity analyses and assess the impact of uncertainties on resulting scores. |
| | *Based on the results of the sensitivity analysis, revisit steps 1-8 if necessary.* |
| 9 | Make sense of the data and validate the results. |
| 10 | Communicate the results and underlying information. |

Source: OECD (2008) and European Commission (2019).

Step 1 consists in developing a conceptual framework based on the objective of the composite indicator. When the IDI was developed in 2009, the objective was to assess the development of the ICT sector. Such development was seen as a simple progression from *access* to *use* to *impacts*, a sequence that provided the framework for the old IDI. However, the framework focused on the quantity of ICTs and less on the qualitative aspect.

This shortcoming is addressed by the concept of *universal and meaningful connectivity* (UMC). UMC is defined as the possibility for everyone to enjoy a safe, satisfying, enriching, productive and affordable online experience. Digital connectivity must be universal *and* meaningful to maximize its impact on society and the economy. UMC reflects the need for a holistic strategy for closing all aspects of the digital divide, across and within countries.

UMC has gained significant traction over the past two years. The concept of UMC was formalised in 2021, in the context of the implementation of the UN Secretary-General's Roadmap for Digital Cooperation. The ITU and the Office of the UN Secretary-General's Envoy on Technology convened a multi-stakeholder sub-working group (SWG) to work on a baseline and aspirational targets for UMC. The baseline and targets were launched in April 2022 along with a background document detailing the concept of UMC.

At the World Telecommunication Development Conference (WTDC) 2022 and ITU's Plenipotentiary Conference (PP) 2022, universal and meaningful connectivity was front and centre. The concept is mentioned multiple times in the Final Report of WTDC 2022: notably in Resolution 2 (Study Groups), Resolution 87 (Connecting every school to the Internet), Resolution 88 (Partner2Connect), Regional initiatives (Europe, Arab States). UMC is also captured in the first Strategic Goal ("Universal Connectivity: Enable and foster universal access to affordable, high-quality and secure telecommunications/ICTs") of the Strategic Plan 2024-2027, adopted at PP 2022.

For these reasons – its relevance and its recognition by ITU constituency – the concept of UMC has been selected to guide the development of a new IDI. Indeed, many comments by EGTI and EGH members on the IDI Forum were to express support for this concept. The comments posted on this topic by Member States confirm the broad support for using the concept of "Universal and meaningful connectivity" as the conceptual framework. The remainder of this section describes the concept of UMC. More details about the concept are available in ITU and OSET (2022).

Figure 1 illustrates the two dimensions of UMC: use – ranging from *none* to *universal*; and quality – ranging from *no connectivity* to *meaningful connectivity*. "Universal connectivity" means connectivity for all. The two dimensions are complementary: neither universal connectivity with poor quality nor meaningful connectivity for the few will yield significant, society-wide benefits. At the same time, the two dimensions reinforce each other: more use can lead to more meaningful connectivity, and vice versa. Based on the definition of universal and meaningful connectivity, the SWG developed a conceptual framework (Figure 2).

Achieving *universal connectivity* (top half of Figure 2) calls for dedicating attention to the connectivity of people, households, communities, and businesses, rather than merely that of the average population.

- Focusing on people helps achieve universality by ensuring that anyone can connect regardless of their urban or rural location, gender, level of education, etc.
- Focusing on households, communities and businesses helps ensure that the main places where people can connect are represented: at home, in schools and community centres, and at work.

**Figure 1: The two dimensions of connectivity**

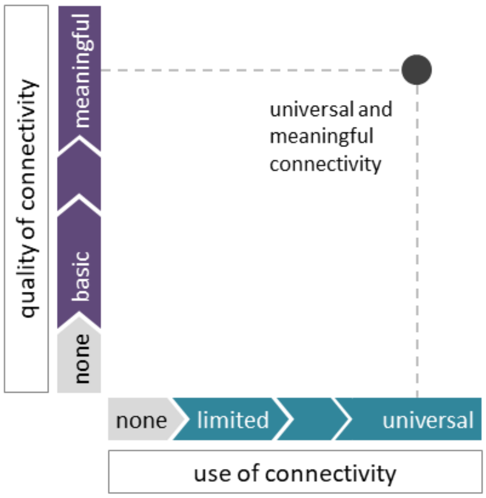
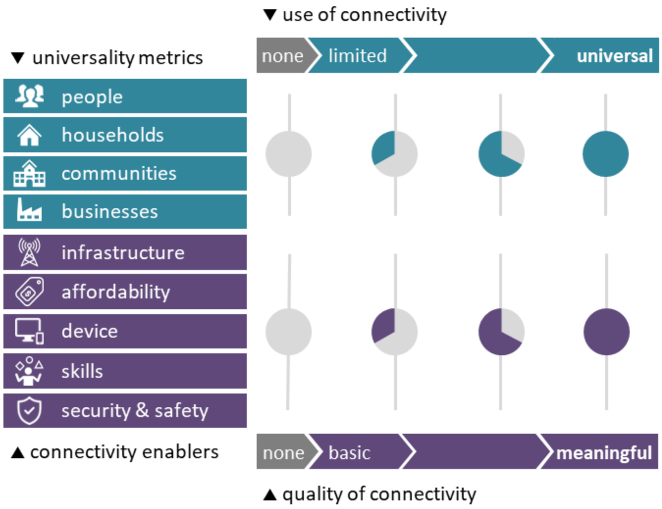



**Figure 2: Conceptual framework of universal and meaningful connectivity**




Source: ITU and UN OSET (2022).

*Meaningful connectivity* depends on several factors, called "connectivity enablers": infrastructure, affordability, device, skills, and safety and security (bottom half of Figure 2).

- Meaningful connectivity requires high-quality infrastructure that is not only in place and functioning but allows for a fast and reliable connection. The framework adopts a technology-neutral approach.

Satellite connectivity, and fixed and mobile terrestrial networks, all can contribute to connecting people to the Internet.

- Affordable devices and ICT services are essential for enabling people to go online. Affordability is a relative concept that depends on people's social and economic conditions.
- Access to an Internet-enabled device is required to go online. These can be either mobile phones or desktop computers, considering that the most basic models of the former are cheaper, while the latter allow for a richer experience. For mobile phones, it is important to distinguish use from ownership, recognizing that mere access without full possession of a device imposes constraints, including when and for how long one can be online.
- An important barrier keeping people from going online or fully benefiting when they are online is a lack of skills. Meaningful use of the Internet requires that people are digitally literate.
- A safe and sec*ure Internet* is important for people to have the trust to go online.

A country with a highly developed digital eco-system is a country where there is a high Internet usage among the population, empowered by high quality enablers. This means that everyone that wants to can connect to high-quality, affordable and safe Internet and benefit fully from its services.

The analytical framework defines the scope, but also sets the boundaries of the exercise. The following aspects of connectivity are out of scope:

- **Levers.** Enablers of connectivity representing areas where policymakers and other stakeholders can intervene using tools such as investment, policies, and regulation. They are not included in the framework as it is deliberately agnostic about the means to improve on the various factors, as there is no single pathway and no one-size-fits-all policy mix that can be prescribed to all countries.
- **Catalysts.** Broader factors and trends, such as economic development and technological innovation, that contribute to improving the quality enablers.
- **Content and services.** These are treated as a lever: the more content and services are available, accessible, and relevant, the more likely people are to connect. Content and services are an enabler of connectivity, but they do not directly influence the quality of connectivity, which is what the frameworks aims to assess.
- **Applications.** The framework is deliberately agnostic about what people do with connectivity. The exercise is about measuring the use and quality of connectivity, rather than assessing what people do online.
- **Impacts.** By extension, the societal, environmental, and economic impacts of connectivity and its applications are well beyond the scope of the exercise.

# 3 Indicator selection and quality assessment (steps 2 and 3)

The next step in the process is to identify potential indicators that capture the concepts of the conceptual framework. Table 3 summarises the criteria for selecting an indicator as candidate for inclusion in the index. These criteria include the instructions from resolution 131.

**Table 3: Indicator selection criteria**

| | Criterion | Rationale |
|---|---|---|
| 1 | Relevance to the concept | An indicator should measure one aspect of the concept retained for the index, in this case universal and meaningful connectivity and have policy relevance. |
| 2 | Clarity/interpretability | Indicators should be easy to interpret and the impact on universal and meaningful connectivity clear. |

| | | |
|---|---|---|
| 3 | Source | Indicators should rely primarily on official data provided by Member States, based on internationally recognized and transparent methodologies (as per *Instructs to BDT Director 4* of Resolution 131). |
| 4 | Reliability | The indicator should be coherently collected and provided by countries according to the harmonized methodology developed by ITU's expert groups EGTI/EGH, or by another international organisation. |
| 5 | Applicability to measure country performance | The indicator should have a sufficiently high variation to allow a meaningful distinction of country performance in any single year and have the capacity to signal progress over time. Quantitative indicators are preferred over qualitative indicators. |
| 6 | Availability and timeliness | Recent data should be available for as many of the 196 considered economies as possible[6], to ensure the broadest coverage possible and reduce the number of estimates, as per *resolves 3* of Resolution 131. |

The first two criteria are self-explanatory steps for any kind of index construction. The third, fourth and sixth criteria stem directly from Resolution 131. The fifth criterion is a best practice in index construction.

The most problematic aspect is data availability. In the context of a composite indicator, maximizing data availability for the countries included is crucial for enabling meaningful comparison. Comparing the performance of a country with 100 per cent data availability against that of a country with only 50 per cent availability is obviously misguided and problematic if the index is meant to help decision making. In addition, limiting the coverage of an index to the sole countries with full or nearly full data coverage would mean excluding most LDCs, and many low- and middle-income economies from the index.

## Data availability and reference period

With these considerations in mind, we follow a two-step approach to indicator selection: 1) indicators that fit the conceptual framework and comply with the criteria 2-6 from Table 3 are considered; 2) data availability is assessed (criterion 6), using the percentage of economies for which official data exists.

To assess data availability, we first must identify a *reference period*, which is the period of the majority of the data points. ITU's data collection cycle plays an important role in determining the reference period.

In the ITU questionnaires, countries usually submit data for the previous year. Furthermore, the results of the long questionnaire (LQ), which is conducted in the third quarter of each year and provides more – and more final – data than the short questionnaire (SQ) conducted in the second quarter of each year, are available at the very end of the year. In addition, all estimates are computed and validated by countries by the end of year, too. The end of the year is therefore a natural cut-off date and defines the reference year. Therefore, to assess data availability in 2023, we use the results of the questionnaires of 2022, which contain mostly 2021 data.

To maximize data availability and reduce the number of estimates, we extend the reference period to the year preceding the reference year, 2020 in the present case. The reason is that not all data are collected annually, especially those derived from household ICT surveys.[7] Therefore, the reference period to assess data availability for candidate indicators is 2020-2021. When computing the percentage of economies for which data exists, only official data for 2020 and 2021 are considered. Estimated values are *not* considered as available data. Annex 2 reports data availability for all indicators for the reference period 2020-2021. Some EGTI/EGH members suggested to extend the reference year to include 2019. In the trade-off between official

[6] For the purpose of the index, 196 economies are considered: the 193 ITU Member States plus Hong Kong (China), Macao (China), and Palestine.

[7] In a handful of cases (typically fewer than 10), countries manage to submit data for household indicators for the current year, if they administered their household survey early in the year and managed to compute and submit the results in the household long questionnaire.

data for older years and estimates for more recent years, we believe this would be going too far back, considering the rapid pace of ICT diffusion.

Beyond assessing data availability to guide the *development of the index*, the same principles will be used to identify the reference period for the *computation of the index* in 2023 and in subsequent years. That is, for an edition of the IDI released in year *t*, the reference period will always be *t-3* and *t-2*.[8] Of course, within this reference period, if data is available for both years t-2 and t-3, the most recent (i.e., *t-2*) will be used. For example, for the 2023 edition, the reference period will be 2020-2021. For the 2024 edition, the reference period will be 2021-2022, and so on. The only difference with the 2023 edition is that subsequent editions will be launched much earlier in the year.[9]

Indicators for which official data for the reference period 2020-2021 are available for less than 50 per cent of economies (i.e., fewer than 98 economies), are in principle excluded, except if there are compelling reasons to keep them. Estimating more than 50 per cent of data points for an indicator would diminish the reliability of the index. This threshold is already very lenient: a threshold of 65 per cent is more in line with good statistical practices (see for example EC (2019)). But in the case of ICT indicators, this would cause too many indicators to be discarded. Additionally, Resolution 131 limits the use of estimates and other data sources to the strict minimum.[10] Finally, estimating many data points is extremely time-consuming and would delay the release.

The exclusion of an indicator based on data availability does not mean that it is irrelevant. Indeed, it may capture an important aspect and must be collected and reported with the hope that coverage can be improved, so that it can be included in a future revision of the index. A few EGTI/EGH members (see Annex 4 of Version 1) and Member States (see Annex 4 below) suggested drawing a list of relevant indicators for potential inclusion in a future iteration of the IDI. When data is available, featuring these indicators on the IDI country scorecard may contribute to draw a more holistic picture and encourage countries to collect data.

For each component of the conceptual framework, several indicators are assessed against these criteria to determine their eligibility for inclusion.

The rest of this section considers the comments by EGTI/EGH members on the 'Zero draft' and comments by Member States on the Version 1 document.

## Indicator selection: Universal connectivity

The notion of universality encompasses four categories: people, households, communities, and businesses (Figure 2). The last three categories represent the main places where people can connect: at home, in schools and community centres, and at work. The following indicators are therefore natural candidates for inclusion: **individuals using the Internet, households with Internet access, business using the Internet** and **schools using the Internet**.[11] In addition, using the Internet requires a subscription to a service, so **mobile broadband subscriptions** and **fixed broadband subscriptions** feature on the list of candidate indicators).

[8] This is different from what was proposed in the 'Zero draft' document, where the proposal was that for subsequent edition of the index, we would use *t-1* as reference year for an edition *t* of the index. Upon further investigation, this option proved not feasible, as explained in the text.

[9] If the methodology is approved, the 2023 edition of the IDI will be launched in later November/early December (see Annex 1). The 2024 edition would then be launched in the first half of 2024 (to allow for six months between two editions). Subsequent editions of the index would be launched at the end of the first quarter of each year.

[10] Resolution 131 (Rev. Kigali, 2022) instructs the BDT Director "to rely primarily on official data provided by Member States based on internationally recognized and transparent methodologies, while also taking into account their level of ICT and statistical database development; only in the absence of such information may other sources be used, after consulting with the focal points of the Member States concerned in advance on other sources used to obtain the information by means of which ITU fulfils the role referred to in considering a) above;"

[11] Internationally comparable data on community centres with Internet access unfortunately do not exist.

Regarding *Internet use by individuals*, some commenters noted that countries submit data for different age ranges, proposing to align all countries based on the same population range (e.g., based on 16 to 74 years). This is a very important and relevant point. Although ITU's *Manual for measuring ICT access and use by households and individuals* (Chapter 7, page 171) recommends collecting data for all individuals aged 5 and above, many countries do not survey children and/or older persons. This creates comparability issues, particularly where older persons are not surveyed. Countries with available data consistently report that they are less likely to use the Internet. One option as suggested is to use only the 16-74 age bracket. Though some differences in survey scope would remain, this option has the clear advantage of increasing the comparability between countries. However, there are costs to this approach. First, many countries that provide overall Internet use data do not provide breakdowns by age. Availability of official data for 2020 or later drops from 96 countries to 64 when requiring data for the 16-74 age range – below the threshold set for inclusion in the index. If this indicator was included despite the lack of data, more estimation would be required. In addition, using Internet use for only the 16-74 age range for the purposes of the index diminishes the importance of children and older persons when assessing ICT development in countries, which would be in contradiction with the concept of universality. Therefore, the costs outweigh the benefits.

For *fixed broadband subscriptions*, the breakdown by speed tier could be considered for inclusion as well. The argument is that subscriptions using a faster connection speed allow for better quality online content, a better experience for customers and more connected devices. Some of the comments on the IDI forum highlighted this as well. While this is certainly true, there are limitations. First, the indicator reflects *advertised* speed, and not *actual* speed.[12] There are other indicators that provide a direct measure of speed or an indicator on fixed broadband traffic. These are discussed below, in the infrastructure section. A second consideration is conceptual: the definition of meaningful connectivity implies that a user should be able to do whatever they want, without prescribing any online behaviour. While a faster connection is preferrable, it is not possible to set a goal post as this would amount to prescribing an ideal speed, which in turn would prescribe a certain type of usage. Finally, using the indicator for total fixed broadband subscriptions instead of the breakdown by speed tiers increases the availability of data from 74 to 87 per cent of economies.

To convert the indicator on active mobile broadband subscriptions into a penetration rate, it is divided by population. Similarly, to convert the indicator on fixed broadband subscriptions to a penetration rate, it must be divided by a scaling factor. Consistent with the definition adopted by EGTI and codified in the *Handbook for the Collection of Administrative Data on Telecommunications/ICT*, the Secretariat used population as the scaling factor in the 'Zero draft' and 'Version 1' of this document. Instead of population, other demographic measures have been suggested, in particular the number of households. Dividing by households has the advantage of taking into account that fixed-broadband subscriptions are often shared within one household and that the average size of households varies across countries. Indeed, several EGTI/EGH members and Member States argue that – conceptually – the number of households is a better denominator than population. An EGTI subgroup is addressing this question. Although any decision on the indicator will be taken at the regular EGTI/EGH meeting in September, which is too late for the purpose of the IDI process, the work of the subgroup feeds into the IDI consultations.

While there are arguments in favour of using households, data availability is ultimately the deciding factor. Data availability on the number of households is very poor. The UN Population Division provides the most complete data on household size (which can then be used to derive number of households). Unfortunately, these data are reported mainly through decennial censuses or other non-regular surveys. *Only 35 countries have reported data on household size to the UN Population Division since 2019.* The size of households for well over 100 economies would need to be estimated. This is outside the expertise and mandate of ITU. In addition to the UN Population Division's database, other data sources on household size and composition exist, such as census microdata and national household surveys. However, these sources are not harmonized. Therefore,

[12] In general, differences between advertised speed and actual speed are due to network overload, user congestion, or more devices being added to the network (connected devices). Other factors that may also affect performance are, for example, interference or environmental factors.

while using households as the denominator has merit, the reality of data availability means that is not possible to compute the indicator fixed-broadband subscriptions per 100 households for enough countries.

An alternative would be to use the population aged 18 and over as denominator. By excluding children in the denominator, this would remove an important part of the difference in household sizes between countries. Table 4 shows the relative difference between using the population aged 18 and over as denominator and total population. For Africa for example, the value for *fixed broadband subscriptions per 100 inhabitants aged 18 and over* is 95 per cent higher than the value for *fixed broadband subscriptions per 100 inhabitants*. For Europe, this difference is only 24 per cent. Since households in Africa on average have more children than in Europe, this result conforms with expectations. As such, in absence of sufficient data on the number of households, using the population aged 18 and over could be a good proxy.

**Table 4: Relative difference between *fixed broadband subscriptions per 100 inhabitants aged 18 and over* and *fixed broadband subscriptions per 100 inhabitants*, by ITU region and income level, 2021**

| | |
|---|---|
| Africa | 95% |
| Americas | 35% |
| Arab States | 63% |
| Asia & Pacific | 38% |
| CIS | 35% |
| Europe | 24% |
| | |
| Low income | 95% |
| Lower middle income | 54% |
| Upper middle income | 31% |
| High income | 24% |

Household surveys offer two possible alternative indicators. The first is *Proportion of households with Internet, by type of service (Fixed broadband network)*. However, data availability is extremely poor for this indicator with only 25 countries having reported data since 2019. The second is *Proportion of households with Internet access at home*. For this indicator, data availability is higher with 94 countries providing data since 2019. This indicator is less precise though as it includes access to the Internet by any service including narrowband or mobile networks. For example, if a member of the household has a mobile phone with connection to the Internet and makes it available for all members, then it is considered that the household has access to the Internet. Moreover, this indicator is already included in the list of indicators.

**Issue for discussion at the IDI meeting**

*Initial proposal*: Fixed broadband subscriptions per 100 population. This is consistent with the definition adopted by EGTI and codified in the *Handbook for the Collection of Administrative Data on Telecommunications/ICT.*

*Summary of comments*: Conceptually, the number of households is considered to be a better denominator than population. Dividing by households has the advantage of taking into account that fixed-broadband subscriptions are often shared within one household and that the average size of households varies across countries. However, up-to-data official data for the number of households is very limited.

*Options:*

- Remain with the original proposal, *Fixed broadband subscription per 100 inhabitants*, despite the conceptual issues;
- Use *Fixed broadband subscription per 100 inhabitants aged 18 and over*;
- Use another indicator to monitor the take up of fixed broadband;

- Drop the indicator.

Because of limited data availability on the number of households, using Fixed broadband subscriptions per 100 households is not an option.

*The potential universal connectivity indicators in detail*

| **Indicator** | **Percentage of individuals using the Internet** |
|---|---|
| Relevance | This is the main indicator for universal connectivity. |
| Availability | 2021: 84 economies<br>2020-2021: 96 economies |
| Reliability | The indicator is an SDG indicator, defined in the ITU Household Manual (ITU, 2020a). It is also one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The source is usually ICT household surveys conducted in countries, often by the national statistical office, but sometimes by other entities as well, such as the regulator. At the international level, data are collected from countries by ITU. Data are also collected by Eurostat for their member countries, as well as by the OECD. |
| Preliminary assessment | Although availability is just below the threshold, the indicator is retained because of its critical relevance in measuring connectivity. |

| **Indicator** | **Percentage of households with Internet access** |
|---|---|
| Relevance | This indicator covers the most common place where people connect to the Internet: at home. |
| Availability | 2021: 81 economies<br>2020-2021: 94 economies |
| Reliability | The indicator is defined in the ITU Household Manual (ITU, 2020a). It is one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The source is usually ICT household surveys conducted in countries, often by the national statistical office, but sometimes by other entities as well, such as the regulator. At the international level, data are collected from countries by ITU. Data are also collected by Eurostat for their member countries, as well as by the OECD. |
| Preliminary assessment | Although availability is just below the threshold, the indicator is retained because of its importance in the conceptual framework. |

| **Indicator** | **Percentage of businesses (10+ employees) using the Internet** |
|---|---|
| Relevance | This indicator covers a common place where people connect to the Internet: at work. |
| Availability | 2021: 3 economies<br>2020-2021: 8 economies |
| Reliability | The indicator is defined in the UNCTAD Manual (UNCTAD, 2021). It is one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The source is usually ICT business surveys conducted in countries, often by the national statistical office, but sometimes by other entities as well. At the international level, data are collected from countries by UNCTAD. Data are also collected by Eurostat for their member countries, as well as by the OECD. |
| Preliminary assessment | While this is a very relevant indicator, as highlighted by some of the commenters on the Forum, the indicator is excluded for data availability reasons. |

| **Indicator** | **Percentage of schools using the Internet** | | |
|---|---|---|---|
| Relevance | This indicator covers a common place where people connect to the Internet: at school. | | |
| Availability | | 2021 | 2020-2021 |
| | Primary education | 47 | 69 |
| | Lower secondary education | 49 | 71 |

| | | | |
|---|---|---|---|
| | Upper secondary education | 50 | 70 |
| Reliability | This is an SDG indicator, defined by the UNESCO Institute for Statistics (UIS) in the SDG 4 Data Digest (UIS, 2019). It is also one of the core indicators of the Partnership on Measuring ICT for Development. | | |
| Source | UIS collects these data from Ministries of Economies from all economies in the world. A secondary source is Giga, the ITU-UNICEF joint initiative to connect all schools to the Internet by 2030. | | |
| Preliminary assessment | While this is a very relevant indicator, as highlighted by some of the commenters on the Forum, the indicator is excluded for data availability reasons. | | |

| **Indicator** | **Active mobile-broadband subscriptions per 100 inhabitants** |
|---|---|
| Relevance | A subscription is necessary to use the Internet, and a mobile phone is the most common way for people to go online. To allow for a meaningful connection, the subscription needs to be to a broadband network, which is a 3G or more advanced technology. |
| Availability | 2021: 160 economies<br>2020-2021: 170 economies |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b). It is one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The data are usually collected by the ICT regulator, which collects the data from the various operators in the country. At the international level, data are collected from countries by ITU. Data are also collected by Eurostat for their member countries, as well as by the OECD. |
| Preliminary assessment | Indicator retained. |

| **Indicator** | **Fixed-broadband subscriptions penetration rate** |
|---|---|
| Relevance | An indicator on fixed-broadband subscriptions is necessary to complement the indicator on mobile broadband subscriptions, to avoid an imbalance with and a bias towards mobile infrastructure. Mobile broadband technology is not yet a perfect substitute for wired connections, particularly fibre optic, which remains critical for businesses. The inclusion of fixed broadband penetration increases the likelihood that the index reflects the infrastructure needed to generate positive economic outcomes. |
| Availability | 2021: 161 economies<br>2020-2021: 170 economies |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b). It is one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The data are usually collected by the ICT regulator, which collects the data from the various operators in the country. At the international level, data are collected from countries by ITU. |
| Preliminary assessment | Indicator to be discussed at the IDI meeting. |

## Indicator selection: Meaningful connectivity

The UMC framework features five connectivity enablers: infrastructure, affordability, device, skills, and safety and security. Ideally, the index would feature indicators capturing each of these areas provided they satisfy the criteria of data availability and data quality.

## Meaningful connectivity: Infrastructure

Access to a signal is a prerequisite for using the Internet. The minimum requirement for meaningful use of the Internet is access to a 3G mobile network. The **population covered by at least a 3G mobile network** should therefore be included. Since **higher quality networks** are preferred, these would be assessed at the same time. If and how these different indicators are aggregated is to be determined later.

In a similar vein, the **number of households passed by a fixed network** could be included in the index, as this is a prerequisite for subscribing to a fixed broadband service.

Another indicator of the quality of the fixed network quality is the percentage of the **population that lives within physical reach of (fiber) nodes on core terrestrial transmission networks**. The indicator was defined by EGTI and approved at the 10th World Telecommunication/ICT Indicators Meeting in 2012 (see the report), where it was decided that the data would initially be collected through an ITU pilot project, with external collaborators obtaining the data from operators to create interactive transmission maps. The data thus collected would be shared with national regulators or ministries for verification, ahead of their publication. This practice has evolved into the ITU Broadband Map initiative, run by the Infrastructure Division of ITU-D. On the definitional side, the nodes are fiber nodes. The indicator is relevant as a proxy for infrastructure density or territorial distribution. Data on the nodes are mostly collected by ITU through desk research, and are subsequently validated by telecom and network operators, with Member States's focal points copied on the correspondence. It is possible that some nodes are missing. The calculation of the percentage of population within a certain distance of the nodes is done by ITU, using a variety of (open) sources. Because of limited resources, the data may not be up to date.

Based on comments received by EGTI/EGH members on the 'Zero draft', and considering that the data for this indicator is not necessarily updated annually, coverage of nodes may be partial, and that various are used sources in addition to official ones, the indicator was dropped from the 'Version 1' document of the proposed IDI methodology (for more information on why this indicator was dropped, see the ITU Secretariat responses in the section *Percentage of population within reach of transmission networks, by distance (10 km, 25 km, 50 km)* of Annex 4 of the 'Version 1' document).

**International bandwidth capacity and bandwidth usage** indicators provide information about the availability and utilisation of infrastructure for international data linkages (including submarine or overland cables, satellite linkages, etc.). These statistics can also signal the presence of barriers to international connectivity. The indicator is normalised by dividing by the number of Internet users in the country. However, international bandwidth usage measures suffer from several limitations. First, end-user experience (which is a key concern for meaningful connectivity) is not only determined by international, but also by middle-mile and last-mile connectivity. However, ITU is not collecting statistics on many of the middle mile elements that influence international bandwidth usage (such as local cache, off-peak load, presence of CDN). Second, while low values of the indicator can signal lack of connectivity for users, high values can often be biased if a country is a connectivity transit hub. Third, many countries do not collect this indicator, and many are estimating it based on domestic traffic data, thus limiting international comparability. The problem is made worse by the fact that a non-negligible share of traffic is not carried over the open Internet and by a lack of transparency of international cable operators about pricing and usage. For these reasons, this indicator is not a suitable candidate for inclusion.

It would be relevant to include measures of **middle-mile and last-mile connectivity**. One example is statistics on Internet exchange points, such as the number in a country, their size measured in terms of traffic or peering partners, or their environmental footprint. The 13th meeting of EGTI in 2022 recognized both the relevance of statistics on middle-mile connectivity, as well as the need to investigate the feasibility to develop internationally comparable measures, given the limitations of information readily available at sources such as Packet Clearing House or IXPDB. This was added to the work programme of EGTI for 2023, but at this stage, given the limitations, it is premature to propose middle-mile connectivity indicators for inclusion.

**Internet traffic** generated over both mobile and fixed networks is another measure of the development of ICT infrastructure. Since Internet traffic is measured at the level of the end-user, it offers a direct comparison across countries of the actual amount of data consumed and is an indication of infrastructure barriers. To account for country size, the indicator is normalised by the number of subscriptions. There are some limitations, though. High shares of traffic generated by institutional and business users limits international comparability. Variation in Internet service providers' traffic monitoring practices and reporting obligations and the application of estimation techniques by countries may limit data reliability.

There was a suggestion to use the number of Internet users as denominator for mobile broadband traffic, to take into account that that a person may own more than one mobile broadband subscription. However, the number of Internet users is a survey-based estimate and may refer to both mobile and fixed broadband service users.

Another issue is that it is very difficult to make high-quality estimates for missing traffic data. Instead, if these two indicators will be included in the index, missing data will not be modelled, but will be imputed using a hot deck imputation method. These estimates will be used to calculate the index, but the underlying estimates will not be published (unlike the estimates for the other indicators that are used for the IDI and for *Facts and Figures*).

**Issues for discussion at the IDI meeting**

*Initial proposal*: Mobile broadband Internet traffic per mobile broadband subscription and Fixed broadband Internet traffic per fixed broadband subscription.

*Summary of comments and issues*:

- Is the number of subscriptions the right denominator to use?
- Do participants agree with the estimation procedure whereby the estimates will not be published?

Meaningful use of the Internet requires a fast connection. High quality data on the **speed of Internet connections** or user experience metrics would be relevant to include in the index, which was highlighted by a few commenters as well. Various data sources exist, such as crowd sourced speed test data from Ookla, OpenSignal, or M-Lab. These are all non-official sources with some limitations (e.g., means of collection, number of observations, country coverage). Consequently, no indicator on the speed of the Internet connection is proposed. Refining existing quality of service (QoS) metrics and developing new ones, notably speed measurement, will be part of EGTI's work agenda.

### *The potential indicators for infrastructure*

| **Indicator** | **Percentage of population covered by a mobile network** | | |
|---|---|---|---|
| Relevance | Access to a signal is a prerequisite for using the Internet. The minimum requirement for meaningful use of the Internet is access to a 3G mobile network. More advanced technologies with increased capacity and faster connection speeds facilitate more meaningful Internet usage. | | |
| Availability | | 2021 | 2020-2021 |
| | At least 3G | 158 | 170 |
| | At least LTE/WiMAX | 156 | 168 |
| | At least 5G | 44 | 55 |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b). The population covered by a 3G mobile network is one of the core indicators of the Partnership on Measuring ICT for Development. | | |
| Source | The data are usually collected by the ICT regulator, which collects the data from the various operators in the country. At the international level, data are collected from countries by ITU. | | |
| Preliminary assessment | Indicator retained. ‘At least 3G’ and ‘at least LTE/WiMAX’ will be included. While ‘at least 5G’ is very relevant, it cannot be included yet, because of poor data availability. A proposal to combine the different technologies is made in the *Weighting and aggregation* section below. | | |

| **Indicator** | **Percentage of households covered by a fixed network** |
|---|---|
| Relevance | Being covered by a fixed network at home is a necessary condition to contract a fixed broadband subscription. |
| Availability | 2021: 66 economies<br>2020-2021: 71 economies |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b). Regarding the denominator, as highlighted above as well when discussing fixed broadband subscriptions, household data are not widely available as they are most often collected in decennial censuses. In countries where these data are available the definition of household often varies – this raises questions about comparability. |
| Source | The data are usually collected by the ICT regulator, which collects the data from the various operators in the country. At the international level, data are collected from countries by ITU. |
| Preliminary assessment | The indicator is excluded for data availability reasons. |

| **Indicator** | **International bandwidth usage (bit/s) per Internet user** |
|---|---|
| Relevance | International bandwidth provides information about the availability and utilisation of infrastructure for international data linkages. |
| Availability | 2021: 86 economies<br>2020-2021: 103 economies |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b). Data for the denominator are defined in the ITU Household Manual (ITU, 2020a). It is one of the core indicators of the Partnership on Measuring ICT for Development, although with a different denominator. Publicly available data sources are limited or missing, and many countries only provide estimates. The indicator is not collected by many of the countries with high volumes of Internet traffic. This creates systematic data gaps and limits the benchmarking capacity of the indicator. Transit hub bias further limits international comparability. |

| | |
|---|---|
| Source | The data are usually collected by the ICT regulator, which collects the data from international connectivity providers in the country. At the international level, data are collected from countries by ITU. |
| Preliminary assessment | The indicator is excluded for data quality reasons. |

| **Indicator** | **Mobile broadband Internet traffic per mobile broadband subscription** |
|---|---|
| Relevance | This indicator measures the intensity of Internet usage by mobile broadband subscribers. A range of specific connectivity needs can only be accommodated through the availability of data-intensive connections at the disposal of users who are able to change their physical location. The indicator reflects the quality of the ICT infrastructure from the end-user's perspective. |
| Availability | 2021: 131 economies<br>2020-2021: 143 economies |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b). Variation in traffic monitoring practices or the treatment of zero-rated services by operators may limit data reliability. |
| Source | The data are usually collected by the ICT regulator, which collects the data from the various operators in the country. At the international level, data are collected from countries by ITU. |
| Preliminary assessment | Indicator for discussion at the IDI meeting. The indicator may require a cap. |

| **Indicator** | **Fixed-broadband Internet traffic per fixed broadband subscription** |
|---|---|
| Relevance | This indicator measures the intensity of Internet usage by fixed Internet subscribers. Given today's most widely available technologies, certain user needs can only be accommodated by data-intensive, fast fixed broadband connections. The indicator reflects the quality of the ICT infrastructure from the end-user's perspective. |
| Availability | 2021: 109 economies<br>2020-2021: 115 economies |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b). High shares of traffic generated by institutional and business users limits international comparability. Variation in Internet service providers' traffic monitoring practices and reporting obligations and the application of estimation techniques by countries may limit data reliability. |
| Source | The data are usually collected by the ICT regulator, which collects the data from the various operators in the country. At the international level, data are collected from countries by ITU. |
| Preliminary assessment | Indicator for discussion at the IDI meeting. The indicator may require a cap. |

## Meaningful connectivity: Affordability

One of the main barriers preventing people from going online is the cost of the device and/or of the service. Affordability is a critical enabler of meaningful connectivity. There is no indicator on the affordability of Internet-enabled devices for which there is enough internationally comparable data. For the affordability of Internet services, two indicators collected by ITU were proposed in the first two versions: the **price of a data-only mobile-broadband basket as a percentage of GNI per capita** and the **price of a fixed broadband basket as a percentage of GNI per capita.**

While no comment challenges the inclusion of affordability in the IDI, some comments by EGTI/EGH members and Member States hinted at possible alternatives:

- *Choice of baskets*. Comments from EGTI/EGH members and focal points from Member States lead to three observations. First concerns the choice of a data-only mobile broadband basket. In addition to the data-only mobile broadband basket (2 GB) proposed, ITU statistics are also available for baskets including voice and SMS services alongside data, such as the mobile broadband data & voice high-consumption basket (2 GB, 140 min, 70 SMS). Preference was given to the data-only basket for several reasons. First, because policy targets on affordability, such as the UN Broadband Commission's 2% GNI per capita target, refer to the data-only mobile broadband basket (as well as the fixed broadband basket). For the sake of coherence, it was decided to use that indicator. Second, according to the rules defined by EGTI, bundled plans may be included in data-only mobile baskets if they are cheaper than mobile data-only plans (which is the case in many countries). Finally, the two indicators (data-only mobile broadband 2GB and mobile data and voice high-consumption baskets) are very highly correlated (0.88); replacing the data-only indicator with a bundle would make little difference, most of the impact would adversely affect 5 LDCs.
- *Choice of units*. Some commenters argue for expressing prices in purchasing power parity (PPP) dollars. However, the Secretariat maintains that expressing the prices of service as a share of gross national income per capita is the most appropriate, because affordability is a *relative* measure. In contrast, prices expressed in PPP dollars account for differences in purchasing power but not in income levels. It is therefore a poor measure of affordability (a service with a low price in PPP dollars can still account for a very large share of an individual's income). Our analysis reveals that the correlation between PPP measures and other indicators in the universal and meaningful groups are significantly weaker, thus reducing the robustness of the framework.
- Finally, questions were raised on the *size of the data allowance of the plans*. Although ITU currently does not collect ICT price baskets with unlimited data allowance, the point raised is captured in the affordability indicator to a fair degree. Two baskets are proposed for inclusion: a data-only mobile broadband basket with 2 GB data and a fixed broadband basket with at least 5 GB monthly allowance. For the fixed broadband basket in the overwhelming majority of cases, the minimum is overshot by far, and the actual plan used for the basket comes with unlimited data allowance in 140 economies, and over 100 GB in an additional 10 economies. The mobile broadband baskets come with a data cap in all economies but one though.

**Issues for discussion at the IDI meeting**

*Initial proposal*: Data-only mobile broadband basket as a percentage of GNI per capita and Fixed broadband basket as a percentage of GNI per capita

*Summary of issues:* Which baskets to select for mobile broadband (alternatives: mobile data and voice high-consumption and low-consumption baskets)

### *The potential indicators for affordability in detail*

| **Indicator** | **Data-only mobile broadband basket as a percentage of GNI per capita** |
|---|---|
| Relevance | Affordability is one of the main barriers to a meaningful use of the Internet. |
| Availability | 2021: 183 economies<br>2020-2021: 186 economies |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b); the methodology can also be retrieved from the price methodology on the ITU website. It is one of the core indicators of the Partnership on Measuring ICT for Development. Data collection for this basket (selecting the representative plan(s) in accordance with the rules) is the least complicated among the mobile baskets, strengthening its reliability. |
| Source | The source of retail price data are the non-promotional advertised prices of selected services for residential customers effective at the time of data collection, from operators with the largest market share in an economy, measured by the number of subscriptions. Data are submitted by countries to ITU, complemented by ITU research. GNI per capita |

| | |
|---|---|
| | levels are from the World Bank World Development Indicators, referring to the preceding year. |
| Preliminary assessment | Indicator retained. |

| **Indicator** | **Mobile data and voice low-consumption basket as a percentage of GNI per capita**<br>**Mobile data and voice high-consumption basket as a percentage of GNI per capita** |
|---|---|
| Relevance | Affordability is one of the main barriers to a meaningful use of the Internet. |
| Availability | 2021: 182 economies<br>2020-2021: 185 economies |
| Reliability | The indicators are defined in the ITU Handbook (ITU, 2020b); the methodology can also be retrieved from the price methodology on the ITU website. It is one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The source of retail price data are the non-promotional advertised prices of selected services for residential customers effective at the time of data collection, from operators with the largest market share in an economy, measured by the number of subscriptions. Data are submitted by countries to ITU, complemented by ITU research. GNI per capita levels are from the World Bank World Development Indicators, referring to the preceding year. |
| Preliminary assessment | Use of the indicators to be discussed at the IDI meeting in June. |

| **Indicator** | **Fixed broadband basket as a percentage of GNI per capita** |
|---|---|
| Relevance | Affordability is one of the main barriers to a meaningful use of the Internet. |
| Availability | 2021: 171 economies<br>2020-2021: 175 economies |
| Reliability | The indicator is defined in the ITU Handbook (ITU, 2020b); the methodology can also be retrieved from the price methodology on the ITU website. It is one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The source of retail price data are the non-promotional advertised prices of selected services for residential customers effective at the time of data collection, from operators with the largest market share in an economy, measured by the number of subscriptions. Data are submitted by countries to ITU, complemented by ITU research. GNI per capita levels are from the World Bank World Development Indicators, referring to the preceding year. |
| Preliminary assessment | Indicator retained. |

## Meaningful connectivity: Device

Access to an Internet-enabled device is required to go online. The index could consider both mobile phones and desktop computers, recognizing that the most basic models of the former are cheaper, while the latter allow for a richer experience. For computers, the indicator considered is **households with access to a computer**.

For **mobile phones**, the indicator considered is **ownership**, recognizing that mere access to a device imposes constraints, including when and for how long one can be online. Some commenters argued for ownership of a smartphone, rather than a mobile phone. In the ITU data collection, smartphone is a subcategory of mobile phone, but unfortunately not enough countries submit data – only 26 countries have reported data on smartphone ownership since 2019. In addition, ownership of any mobile phones including non-smart phones is still relevant to ICT development. An individual who owns a mobile phone is more connected than an individual who does not. For these reasons, overall mobile phone ownership remains the best option for the IDI.

Other comments by Member States concerned the age scope of the indicator, proposing that only the 15+ or 18+ population be considered. It is indeed the case that children are less likely to own mobile phones. However, the definition of ownership covers individuals who are in sole possession of a mobile phone. That is, another person (e.g., a parent) may have paid for the phone and any ongoing subscriptions, but if the individual in question has full access to the mobile phone, she/he is considered its owner. From the ITU's Manual for measuring ICT access and use by households and individuals:

> *An Individual owns a mobile cellular telephone If he/she has a mobile cellular phone device with at least one active SIM card for personal use. It includes mobile cellular phones supplied by employers that can be used for personal reasons (to make personal calls, access the Internet, etc.) and those who have a mobile phone for personal use that is not registered under his/her name. It excludes individuals who have only active SIM card(s) and not a mobile phone device.*

As a result, ages 18 and older may be too high of minimum age for this indicator. In addition, as countries submit data for different age ranges aligning all countries based on the same in-scope population range is not possible at this time. Although ITU's Manual for measuring ICT access and use by households and individuals (Chapter 7, page 171) recommends collecting data for all individuals aged 5 and above, many countries already do not survey children (and/or older persons). An analysis of data availability for this indicator found that the median lower bound for in-scope age was 10 years old. This is broadly in-line with the age that children might reasonably be expected to begin to own mobile phones where families have resources (https://childmind.org/article/when-should-you-get-your-kid-a-phone).

Further alignment of ages would have costs. Notably, many countries that provide overall mobile phone ownership data do not provide breakdowns by age. Given that this indicator already has a low level of data availability it would require an unacceptably high level of estimation.

Initially, the indicator was excluded because of low data availability. Because there was a broad call for inclusion by EGTI and EGH members, the indicator was included in the Version 1 document. However, during the consultation with Member States, some countries objected based on data availability. Therefore, the indicator will be discussed at the IDI meeting.

**Issues for discussion at the IDI meeting**

*Indicator*: Percentage of individuals owning a mobile phone

*Issue to discuss*: Should the indicator be included because of its relevance to the conceptual framework, or excluded because of the low data availability?

### *The potential indicators for device in detail*

| **Indicator** | **Percentage of households with a computer** |
|---|---|
| Relevance | A computer is one of the devices that allows a user to go online. |
| Availability | 2021: 53 economies<br>2020-2021: 67 economies |
| Reliability | The indicator is defined in the ITU Household Manual (ITU, 2020a). It is one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The source is usually ICT household surveys conducted in countries, often by the national statistical office, but sometimes by other entities as well, such as the regulator. At the international level, data are collected from countries by ITU. |
| Preliminary assessment | The indicator is excluded for data availability reasons. |

| **Indicator** | **Percentage of individuals owning a mobile phone** |
|---|---|

| | |
|---|---|
| Relevance | A mobile phone is one of the most common devices used to go online. |
| Availability | 2021: 47 economies<br>2020-2021: 59 economies |
| Reliability | The indicator is an SDG indicator, defined in the ITU Household Manual (ITU, 2020a). It is one of the core indicators of the Partnership on Measuring ICT for Development. |
| Source | The source is usually ICT household surveys conducted in countries, often by the national statistical office, but sometimes by other entities as well, such as the regulator. At the international level, data are collected from countries by ITU. |
| Preliminary assessment | While the indicator falls below the availability threshold, there was a broad call for inclusion by EGTI and EGH members. However, during the consultation with Member States, some countries objected based on data availability. Therefore, the indicator will be discussed at the IDI meeting. |

## Meaningful connectivity: Skills

Digital literacy is a requirement for fully leveraging connectivity. **The percentage of individuals with ICT skills** is a proxy for digital literacy. Because self-reporting of individuals' ICT skills may be subjective, ICT skills are measured based on whether an individual has recently performed certain activities that require different types of skill. The assumption is that performing these activities implies that one has a certain level of the required skills. At first, these activities were grouped in three broad categories: basic, standard and advanced ICT skills. A subgroup of EGH has been at work since 2018 to group the activities in more relevant categories and to propose an overall score based on the reported activities. As a result of the work of the subgroup, activities are now grouped into five categories of digital skills: communication/collaboration; problem solving; safety; content creation; and information/data literacy. Work is still ongoing to aggregate the data into one overall skills score. Until the work of the subgroup is finalised, and data availability is sufficient, this indicator cannot be included in the IDI.

In the old IDI, in the absence of data for ICT skills, three alternate indicators were used: mean years of schooling, gross enrolment ratio for secondary education and gross enrolment ratio for tertiary education. These three indicators were proposed in the 'Zero draft' document and received a fair number of comments on the IDI forum. These comments pointed in two directions regarding the use of education proxies for ICT skills. The first direction is not to use any proxy, as education level is not a good predictor of ICT skills. The second direction is to use education indicators, but not the ones used in the past. Instead, one of the possibilities raised was to use the two indicators that are used as the knowledge pillar in the HDI: **Expected years of schooling** and **Mean years of schooling**. The advantage of this approach is that the data are already available from the HDI, including estimates made by UNDP for the purpose of the HDI. The statistical assessment will show how good the fit will be to the conceptual framework.

There were several comments from focal points of Member States that argued for exclusion of these two indicators, but there was also support these indicators as a proxy for ICT skills. This will be discussed at the IDI meeting in June.

**Issues for discussion at the IDI meeting**

*Indicator*: Expected years of schooling (school life expectancy) and Mean years of schooling (ISCED 1 or higher), population 25+ years

*Issue to discuss*: Should these two indicators be included in the IDI as a proxy for ICT skills or not?

### *The potential indicators for skills in detail*

| **Indicator** | **Percentage of individuals with ICT skills** |
|---|---|
| Relevance | Meaningful use of the Internet requires that people are digitally literate. |
| Availability | 2021: 61 economies |

| | |
|---|---|
| | 2020-2021: 69 economies |
| Reliability | The indicator is an SDG indicator, defined in the ITU Household Manual (ITU, 2020a). It is also one of the core indicators of the Partnership on Measuring ICT for Development.<br>The assumption is that performing certain activities implies that one has a certain level of skills. Furthermore, the aggregation of the various activities into one score, which would be required for the index, is complex and untested. |
| Source | The source is usually ICT household surveys conducted in countries, often by the national statistical office, but sometimes by other entities as well, such as the regulator. At the international level, data are collected from countries by ITU. |
| Preliminary assessment | The indicator is excluded for data availability reasons as well as for the complexity of aggregating the various activities into one score. |

| **Indicator** | **Expected years of schooling (school life expectancy)** |
|---|---|
| Relevance | This indicator is one of the proxies for ICT skills in conjunction with mean years of schooling. |
| Availability | 2021: 192 using the data used for the HDI[13] |
| Reliability | The methodology is defined by the UNESCO Institute for Statistics (UIS). For a child of a certain age, expected years of schooling is calculated as the sum of the age specific enrolment rates for the levels of education specified. The part of the enrolment that is not distributed by age is divided by the school-age population for the level of education they are enrolled in and multiplied by the duration of that level of education. The result is then added to the sum of the age-specific enrolment rates.<br>Estimates are made by UNDP for use in the HDI. |
| Source | UIS and UNDP |
| Preliminary assessment | The indicator is retained for testing against the conceptual framework and will be discussed at the IDI meeting in June. |

| **Indicator** | **Mean years of schooling (ISCED 1 or higher), population 25+ years** |
|---|---|
| Relevance | This indicator is one of the proxies for ICT skills in conjunction with expected years of schooling. |
| Availability | 2021: 190 using the data used for the HDI |
| Reliability | The methodology is defined by the UNESCO Institute for Statistics (UIS). It is defined as the average number of completed years of education of a country's population aged 25 years and older, excluding years spent repeating individual grades.<br>Estimates are made by UNDP for use in the HDI. |
| Source | UIS and UNDP |
| Preliminary assessment | The indicator is retained for testing against the conceptual framework and will be discussed at the IDI meeting in June. |

## Meaningful connectivity: Safety and security

There are no good stand-alone direct measures of safety and security from official sources that can be included in the index. ITU's Global Cybersecurity Index (GCI) assesses countries' *commitments* to cybersecurity. As such, this tool does not fit in this framework (see above), which focuses on outputs rather than inputs. In addition, the GCI's methodology is still evolving and is not 'stable' yet. Introducing it in the index would affect comparability over time, as a change in this indicator may be due to a change in the methodology rather than a change in the performance.

[13] 2021 or last available year, actual year not specified by the source.

## Country coverage

In this step, the preliminary list of indicators is assessed by looking at how many economies can be included in the index. Table 5 lists the indicators retained in the previous step for further consideration and data availability for each. Since some of these indicators will be discussed at the IDI meeting, this table – and the analysis that will follow – is subject to change. The objective is to include as many economies as possible. Resolution Resolution 131 requires that the methodology of the IDI be establish so as "to cover a majority of Member States" (*resolves 3*). As explained in the *Data availability and reference period* section above, the assessment is based on the criterion of having at least one non-estimated data point available within the reference period, which is 2020-2021 in the case of the 2023 edition. Data availability for the 2020-2021 reference period is reported in the right-most column of the table.

**Table 5: Indicators selected for further exploration**

| | Category/Code | Indicator | countries with data available ≥2021 | countries with data available **≥2020** |
|---|---|---|---|---|
| **Universal connectivity** | | | | |
| 1 | yHH7 | Proportion of individuals who used the Internet (from any location) in the last 3 months | 81 | **94** |
| 2 | xHH6 | Proportion of households with Internet access at home | 81 | **94** |
| 3 | i911mw | Active mobile-broadband subscriptions per 100 inhabitants | 160 | **170** |
| 4 | i992b[14] | Fixed broadband subscriptions penetration rate | 161 | **170** |
| **Meaningful connectivity - Infrastructure** | | | | |
| 5 | i271G | Percentage of the population covered by at least a 3G mobile network | 158 | **170** |
| 6 | I271GA | Percentage of the population covered by at least an LTE/WiMAX mobile network. | 156 | **168** |
| 7 | i136mwi_subs | Mobile broadband Internet traffic per mobile broadband subscriptions (GB) | 131 | **143** |
| 8 | i135tfb_subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB) | 109 | **115** |
| **Meaningful connectivity - Affordability** | | | | |
| 9 | i271mb_ts_GNI | Data-only mobile-broadband basket price (as % of GNI per capita) | 183 | **186** |
| 10 | i154_FBB_ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita) | 171 | **175** |
| **Meaningful connectivity – Service** | | | | |
| 11 | xHH18 | Percentage of individuals owning a mobile phone | 47 | **59** |
| **Meaningful connectivity – Skills** | | | | |
| 12 | MYS | Mean years of schooling | 190 | **190** |
| 13 | EYS | Expected years of schooling | 192 | **192** |

Estimating data points adds uncertainty to the calculation of index scores. By setting a higher threshold for data availability, the number of data points to be estimated decreases (implying that the index would be more robust), but so does the number of economies for which the index can be computed. This requires striking a balance. As Table 6 shows, setting the country inclusion threshold at 70 per cent of indicators available would allow 130 economies to be included. In the extreme case where no estimates would be used, the index could be computed for just 42 economies.

[14] The indicator code and data availability are for the indicator *Fixed broadband subscriptions per 100 inhabitants*. The outcome of the discussion at the IDI meeting may change this. See Box 3 in section 4 for further descriptive statistics on alternatives.

**Table 6: Number of economies that can be included in the index with various thresholds**

| Economy inclusion threshold (% of 13 indicators available in the 2020-2021 reference period) | 50% | 60% | 70% | 80% | 90% | 100% |
|---|---|---|---|---|---|---|
| Nr. of economies meeting the threshold requirement: | 168 | 163 | 130 | 89 | 75 | 42 |
| Nr. of missing data points to be estimated | 361 | 331 | 184 | 61 | 33 | 101 |
| % of total data points to be estimated | *17%* | *16* | *11%* | *5%* | *3%* | *0%* |

The inclusion threshold is set to 50 per cent. That is, an economy would be included if official data is available for at least 50 per cent of the indicators of the index. With this threshold, and based on data availability as of January 2023, 168 economies could be included in the index.[15]

## Statistical assessment of the selected indicators

An indicator needs to have certain statistical properties both on its own and vis-à-vis the other indicators of the index in order to add relevant quantitative information to an aggregate index score. A list of indicators was selected in the previous section for the ICT Development Index framework based on conceptual grounds and data availability. This section summarizes the results of several statistical analyses to determine if each selected indicator fits in the index.

Specifically, we aim to:

- identify the presence of outliers and recommend treatment methods;
- identify potential constraints in the explanatory power of indicators; and
- explore the statistical association between a set of indicators and the latent structure of the dataset.

The analyses entail an in-depth look at the data, making use of two statistical tools: first, exploring each variable separately and describing them through their descriptive statistics (such as mean, median, min, max, among others), followed by a correlation analysis to explore the statistical relationships between indicator pairs and groups.

The assessments are conducted along the subsequent steps (outlier detection and treatment, normalization, weighting and aggregation) and provide additional information to help better interpret and understand the strengths and weaknesses of the indicators selected on a conceptual basis. The assessments constitute an integral part of the iterative process of indicator selection and confirmation that ultimately aims at ensuring that the framework is both conceptually and statistically coherent.

# 4 Identifying and treating outliers and missing data (step 4)

The indicators identified based on conceptual grounds contain outlier values and data gaps. The aim of this step is to ensure that IDI scores can be computed based on a statistically solid dataset. This involves identifying and treating outliers and setting goalposts where relevant, and next defining the strategy for treating missing values.

[15] A benefit of an index without ranking is to allow for partial assessment of countries: a country that would normally be excluded for not meeting the overall data availability criterion, could still be assessed on selected components of the index for which sufficient data exists, even though it would not get an overall index score. Without ranking, the inclusion of this country in selected components would be without consequence for other countries. This alternative to outright exclusion would allow to increase the number of countries studied and may incentivise countries to improve data availability.

## Identifying outliers

An indicator is a useful benchmark if it can meaningfully distinguish performance across units (i.e., economies in the present case) and over time. From a statistical perspective, the range of values (the distance between the minimum and maximum) should not be too narrow, and the distribution not too skewed or peaked (a case when the bulk of the values is concentrated within a small range, with some outlying values further apart). The presence of outliers is particularly problematic in the context of composite indicators. Outlying values are not necessarily errors, but if present in component indicators of a composite indicator, they can significantly bias aggregation results. Outliers would not only become unrealistic or unintended targets, but also imply that a significant portion of the data range will remain empty, while small, marginal differences between countries may be inflated or larger differences underestimated. They can also bias diagnostic tools such as statistical coherence analysis. It is therefore essential in the process of developing an index to identify and treat outliers.[16] Statistical methods are available for treating outliers, depending on the nature of the data, e.g., applying a log transformation or trimming the distribution (i.e., applying caps).

Before identifying outliers, some indicators must be scaled by the appropriate size measure (e.g., divided by population, Internet users, GDP, subscriber, etc.) to ensure a valid comparison across economies. This was done in the previous step, the indicator selection.

Key descriptive statistics for each of the indicators identified based on conceptual considerations are presented in Table 7, which reports the number of observations (i.e., economies) for each indicator for the reference period 2020-2021. The other columns present information on range and distribution (minimum and maximum values, mean, standard deviation, median and the 25th and 75th percentile – the range between which half of the observations can be found) as well as skewness and kurtosis (measures of difference from normal distribution).

[16] There is no single definition for outliers (Aguinis et al, 2013), it depends on the nature of the indicators and the measurement purpose. As a rule of thumb, composite indicator development practitioners typically identify outliers when the absolute skewness (a measure of distribution asymmetry) exceeds 2.0 and kurtosis (a measure of the weight of the tails relative to the centre of the distribution) exceeds 3.5, or if kurtosis alone exceeds 10 (see European Commission, 2019).

**Table 7: Descriptive statistics for the list of indicators retained for testing**

| | Code | Indicator | N | N*/ 196 | Min | Max | Mean | St.dev. | 25th pctile | Median | 75th pctile | Skew. | Kurt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Universal connectivity** | | | | | | | | | | | | | |
| 1 | yHH7 | Proportion of individuals who used the Internet (from any location) in the last 3 months | 94 | 48% | 6.1 | 100.0 | 80.3 | 18.6 | 75.6 | 84.8 | 91.9 | -2.1 | 5.0 |
| 2 | xHH6 | Proportion of households with Internet access at home | 94 | 48% | 11.9 | 100.0 | 81.3 | 18.8 | 79.6 | 87.3 | 94.0 | -1.7 | 2.6 |
| 3 | i911mw | Active mobile-broadband subscriptions per 100 inhabitants | 170 | 87% | 2.6 | 285.1 | 84.1 | 43.5 | 54.5 | 84.3 | 107.6 | 1.0 | 3.2 |
| 4 | i992b | Fixed broadband subscriptions penetration rate** | 170 | 87% | 0 | 57.7 | 17.6 | 15.5 | 2.0 | 14.5 | 31.6 | 0.5 | -1.1 |
| **Meaningful connectivity – infrastructure** | | | | | | | | | | | | | |
| 5 | i271G | % of the population covered by at least a 3G mobile network | 170 | 87% | 15 | 100.0 | 92.2 | 14.1 | 92.2 | 98.4 | 99.9 | -2.9 | 9.5 |
| 6 | i271GA | % of the population covered by at least an LTE/WiMAX mobile network. | 168 | 86% | 0 | 100.0 | 83.6 | 24.3 | 80.0 | 96.0 | 99.3 | -1.7 | 1.7 |
| 7 | i136mwi_subs | Mobile broadband Internet traffic per mobile broadband subscriptions (GB) | 143 | 73% | 0 | 1’104.8 | 93.8 | 126.0 | 28.4 | 62.9 | 113.5 | 4.7 | 31.3 |
| 8 | i135tfb_subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB) | 115 | 59% | 0 | 10’484.5 | 2’273.9 | 1’892.0 | 922.3 | 2’029.7 | 3’260.7 | 1.5 | 3.7 |
| **Meaningful connectivity – affordability** | | | | | | | | | | | | | |
| 9 | i271mb_ts_GNI | Data-only mobile-broadband basket price (as % of GNI per capita) | 186 | 95% | 0.1 | 41.0 | 3.9 | 5.5 | 0.7 | 2.1 | 4.8 | 3.2 | 14.3 |
| 10 | i154_FBB_ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita) | 175 | 89% | 0.3 | 164.2 | 10.0 | 18.6 | 1.4 | 3.5 | 11.0 | 4.9 | 32.3 |
| **Meaningful connectivity – device** | | | | | | | | | | | | | |
| 11 | xHH18 | Percentage of individuals owning a mobile phone | 59 | 30% | 41.2 | 100.0 | 85.4 | 15.2 | 75.4 | 91.3 | 97.4 | -1.2 | 0.8 |
| **Meaningful connectivity – skills** | | | | | | | | | | | | | |
| 12 | MYS | Mean years of schooling | 190 | 97% | 2.1 | 14.1 | 9.0 | 3.2 | 6.2 | 9.3 | 11.4 | -0.4 | -1.0 |
| 13 | EYS | Expected years of schooling | 192 | 98% | 5.5 | 21.1 | 13.5 | 2.9 | 11.5 | 13.4 | 15.6 | 0.0 | -0.2 |

Notes: *) N refers to 2021 for all indicators, except those sourced from ICT household surveys (yHH7, xHH6) and the education indicators (MYS and EYS), where it reflects data available in the 2020-2021 range. **) In the absence of an alternative, descriptive statistics for fixed-broadband penetration is still based on fixed-broadband subscriptions per 100 inhabitants. This is without prejudice to the conclusions of the IDI meeting. See Box 3 below for additional details on alternatives.

**Box 3: Descriptive statistics for alternative measurement of fixed broadband penetration**

The table below aims to inform the discussion on the assessment of alternative measures of fixed broadband penetration. It combines ITU data with the average number of households and population by age group statistics from the UN Population Division, for the latest available year in the 2020-2021 timeframe.

| | N | N/196 | Min | Max | Mean | Std.dev. | 25th pctile | Median | 75th pctile | skewness | kurtosis |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fixed broadband subscriptions per 100 inhabitants | 170 | 87% | 0.0 | 57.7 | 17.6 | 15.5 | 2.0 | 14.5 | 31.6 | 0.5 | -1.1 |
| Fixed broadband subscriptions per 100 households | 10 | 5% | 0.0 | 100.8 | 30.9 | 38.6 | 0.8 | 6.0 | 59.3 | 0.8 | -1.1 |
| % households accessing the Internet by fixed broadband network* | 42 | 21% | 22.7 | 99.8 | 68.1 | 20.1 | 61.2 | 69.7 | 83.2 | -0.7 | -0.1 |
| Fixed broadband subscriptions per 100 inhabitants aged 18 or above | 170 | 87% | 0.0 | 67.9 | 22.6 | 18.9 | 3.1 | 20.1 | 39.0 | 0.4 | -1.1 |

*Proportion of households accessing the Internet by both fixed broadband and mobile broadband network or fixed broadband only (regardless of the type of connection)

Data availability is evidently the main binding constraint for using alternative measures of the fixed broadband penetration indicator. While the maximum, mean and medians are always higher when the denominator is either the population aged 18 or above or when household survey-based data are used, the range changes but the overall shape of the distribution remains similar. This is also confirmed by the correlation results (see Annex 3).

The descriptive statistics reveal two issues in the dataset: the presence of outliers and the concentration of variation within a very limited range.

- The values for the indicator *Mobile broadband penetration (i911mw)* range from 2.6 to a maximum of 285 subscriptions per 100 inhabitants. Apart from eight countries, values are less than 150 subscriptions per 100 inhabitants. Setting a cap is justified from a statistical as well as a conceptual standpoint to set a more realistically achievable target and allow for a more meaningful cross-country comparison.
- The indicator *Fixed broadband subscriptions per 100 inhabitants (i992b)* ranges between 0 and 57.7, with a median of 14.5, with 95 per cent of the values not exceeding 43.5 subscriptions per inhabitants. One value may be considered as an outlier (see also additional details on alternative fixed broadband penetration indicators in Box 3).
- Considering the *mobile broadband coverage* indicators, the *percentage of population covered by at least a 3G mobile network* (i271G) has limited discriminatory power (differences between country performance are often in the decimal digits). Apart from a few lower outliers, three-fourth of the observations are found between 92 and 100 per cent. Country performance is somewhat more dispersed for the other indicator, *percentage of population covered by at least an LTE-WiMAX mobile network* (4G, or i271GA). Outlier treatment is not warranted for any of the two, as outliers are only in the lower ranges that do not affect the target.
- Outliers were detected for both Internet traffic indicators. The distribution of *Mobile broadband traffic per subscription* (i136mwi_subs) values is highly skewed, and while the median is 62.9, around 5 per cent of the countries reported values between 265 to 681 GB per subscription. Such a skewed distribution warrants capping the indicator. A goal post, must be forward looking, considering that Internet traffic is growing by 20 per cent annually.

- *Fixed broadband traffic per subscription* (i135tfb_subs) values are more evenly spread compared to mobile broadband traffic per subscription. However, a few outlying values require treatment before including it in the aggregation for a composite indicator. The median value is 2,030 GB/user, and 95 per cent of the observations are below 5,250 GB/user. Like the previous indicator, setting a cap should take into consideration the fact that traffic is expected to increase for the next four years.
- Both affordability indicators have a very skewed distribution, with a median of 2.1 for mobile and 3.5 per cent of GNI per capita, and 95 per cent of the observations less than 14 and 42 per cent of GNI per capita for mobile and fixed broadband, respectively. However, outliers reach up to 41 and 164, respectively. Trimming the distribution is advisable to increase variance across countries, especially because this is an indicator where, contrary to others, the best performer country has the lowest values, thus the direction will have to be reversed at the normalization step.

Table 8 summarizes the key statistical issues identified and the solutions to address those. These solutions will be applied as part of the computation of the index.

**Table 8: Conclusions on statistical issues and proposed solutions**

| Indicator | Statistical issue | Solution |
|---|---|---|
| **Universal connectivity** | | |
| Proportion of individuals who used the Internet (from any location) in the last 3 months (yHH7) | | |
| Proportion of households with Internet access at home (xHH6) | | |
| Active mobile-broadband subscriptions per 100 inhabitants (i911mw) | Outliers in high values | Set a cap |
| Fixed broadband penetration* | | |
| **Meaningful connectivity: infrastructure** | | |
| Percentage of the population covered by at least a 3G mobile network (i271G) | Limited discriminatory power; some outliers in the low values | Combine with LTE/WiMAX |
| Percentage of the population covered by at least an LTE/WiMAX mobile network (i271GA) | Some outliers in the low values | Combine with 3G |
| Mobile broadband Internet traffic per mobile broadband subscriptions (GB) (i136mwi_subs)* | Outliers in high values | Set a cap |
| Fixed broadband Internet traffic per fixed broadband subscriptions (GB) (i135tfb_subs)* | Outliers in high values | Set a cap |
| **Meaningful connectivity: affordability** | | |
| Data-only mobile-broadband basket price (as % of GNI per capita) (i271mb_ts_GNI)* | Outliers in high values | Set a cap |
| Fixed-broadband Internet basket price (as % of GNI per capita) (i154_FBB_ts_GNI) | Outliers in high values | Set a cap |
| **Meaningful connectivity: device** | | |
| Percentage of individuals who own a mobile phone (xHH18)* | | |
| **Meaningful connectivity: skills*** | | |
| Mean years of schooling (MYS) | | |
| Expected years of schooling (EYS) | Outliers in high values | May set a cap |

* To be discussed.

## Treating outliers

Outliers identified for the indicators above will be treated by applying winsorization. This is an adjustment necessary for improving the statistical properties of the indicator within the context of the IDI framework. For each of the concerned indicators, a cut-off threshold is calculated by adding two standard deviations to the mean for each indicator concerned. Values above the threshold are replaced by the cut-off value. Table 9 shows which indicator will be subject to outlier treatment based on the statistical assessment. Since the dataset will change following the inclusion of outliers, specific values are not provided at this point.

## Estimating missing data

As explained in the *Country inclusion* section and shown in Table 6 above, a relatively less stringent data availability threshold allows the inclusion of more economies, however, many of them will have missing values for several indicators. This inevitably affects the accuracy of the assessment of the IDI for those countries. Values for ITU indicators that were not submitted by countries in the reference period 2020-2021 will be estimated, when possible, using a model-based approach tailored to the indicator.

The models used to estimate missing values for indicators typically collected in ICT household surveys are based on a diverse range of widely available national indicators on mobile-broadband subscriptions, ICT affordability, GNI per capita and so on, and accounting for their changes over time. In addition to data submitted by Member States, other sources may be used to obtain data and/or cross-check estimates.

In other cases, univariate time series models (such as autoregressive integrated moving average (ARIMA) models may be applied to historical data to predict missing recent values.

It is very difficult to make high-quality estimates for missing traffic data. Instead, if these two indicators will be included in the index, missing data will not be modelled, but will be imputed using a hot deck imputation method. These estimates will be used to calculate the index, but the underlying estimates will not be published.

Missing data points for any indicators obtained from sources external to ITU will not be estimated by the ITU Secretariat. Instead, the estimates made by UNDP for the HDI would be used. Such will be the case if *Expected years of schooling* or/and *Mean years of schooling* are included in the IDI.Consistent with the iterative nature of the IDI development, the dataset containing estimated values will be subject to outlier detection and treatment as needed. Adding model-based estimates – especially considering that data are not missing at random – will likely change distributions, which will have an impact on thresholds.

# 5 Normalization, weighting, and aggregation (step 5)

## Normalization

The indicators selected are measured on various scales and expressed in different units. Normalization is applied to bring all indicators on a common scale. The most used method is the min-max approach, which rescales indicators onto an identical range of 0 to 100 by subtracting the minimum value for the given indicator across all economies from each value and dividing by the range of the indicator values. It is relatively easy to apply and to interpret. Formally, we have:

$$\text{score}_{i,c} = \frac{\text{value}_{i,c} - \text{threshold}_i}{\text{goalpost}_i - \text{threshold}_i} \times 100$$

where $\text{value}_{i,c}$ is the value of country $c$ on indicator $i$, $\text{threshold}_i$ is the minimum value for indicator $i$ and $\text{goalpost}_i$ corresponds to the target value for indicator $i$. If a value is at or below the threshold value, the corresponding score is 0; if a value is at or above the goalpost, the score is 100.

Depending on the indicator, the goalpost may be a policy target or aspiration, the maximum possible value, or a number derived from statistical analysis of the distribution (e.g., 90th or 95th percentile). Table 99 also shows indicative thresholds and goalposts for the proposed indicators.

A few observations:

- When setting goalposts for the universality indicators, the concept of universality must be interpreted loosely. For individual usage, it is neither expected nor desirable that all children use the Internet. Indeed, approaches to bringing children online varies across geographies. When picking the goalpost, one must also consider that, among the population, some individuals do not want to use the Internet, even if they have access to it and can afford it. For these reasons, the goalpost for Internet users should be set at a value slightly below the 100% mark. We suggest the goalpost to be set at 95%. This means that a country with a share of 95% or more will get a score (i.e., a normalised value) of 100 on this indicator. The same approach would apply to the indicator "Individuals owning a mobile phone", part of the connectivity enabler "Device". While universality is the objective, the goalpost should be set at a lower value, because some people may not want to own a device. The same logics applies to the indicator "Households with internet access", reflecting the reality that some households may not want to have access at home and accounting for possible measurement errors. For the two traffic indicators, goalposts will be projected considering the double-digit annual growth of global median traffic. For the affordability indicators, goalposts will reflect the reverse directionality.

- In the case of the affordability indicators, where a higher cost corresponds to a worse outcome, the same min-max formula applies, but in Table 9, the minimum value is the goalpost, and the maximum value is the threshold.

**Table 9: Outlier treatment, indicative goal posts and indicative thresholds**

| Code | Indicator | Outlier treatment | Indicative threshold | Indicative goalpost |
|---|---|---|---|---|
| yHH7 | Proportion of individuals who used the Internet (from any location) in the last 3 months | Not applicable | 0% | 95% |
| xHH6 | Proportion of households with Internet access at home | Not applicable | 0% | 95% |
| i911mw | Active mobile-broadband subscriptions per 100 inhabitants | Winsorize above Mean+2 x St.Dev | 0% | 95th percentile |
| | Fixed broadband penetration* | Winsorize above Mean+2 x St.Dev | Min. value | 95th percentile |
| i271G | % of the population covered by at least a 3G mobile network | Not applicable | 0% | 100% |
| i271GA | % of the population covered by at least an LTE/WiMAX mobile network. | Not applicable | 0% | 100% |
| i136mwi_subs | Mobile broadband Internet traffic per mobile broadband subscriptions (GB)** | Winsorize above Mean+2 x St.Dev or apply log transformation | Min. value | 95th percentile, projected |
| i135tfb_subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB)** | Winsorize above Mean+2 x St.Dev or apply log transformation | Min. value | 95th percentile, projected |
| i271mb_ts_GNI | Data-only mobile-broadband basket price (as % of GNI per capita)*,** | Winsorize above Mean+2 x St.Dev | 2% | 95th percentile |
| i154_FBB_ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita) | Winsorize above Mean+2 x St.Dev | 2% | 95th percentile |
| xHH18 | Percentage of individuals owning a mobile phone** | Not applicable | 0% | 95% |
| | Mean years of schooling** | Not applicable | | |
| | Expected years of schooling** | Winsorize above Mean+2 x St.Dev | | |

* The directionality of the affordability indicators is reversed, hence score of 100 will be assigned to values *below* the goal post. Scores of 0 will be assigned to values *above* the threshold.
** To be discussed.

## Weighting and aggregation

Conceptually, there are two groups of indicators: universal connectivity indicators and meaningful connectivity (UMC) indicators. The correlation analysis (presented in detail in Annex 3 of the Version 1 document) revealed that all indicators are positively correlated with one another. This suggests that they measure different aspects of the multidimensional concept of UMC. While no significant trade-offs were identified between the indicators, some compensability cannot be ruled out (i.e., weakness in one indicator may be compensated by strength in another).

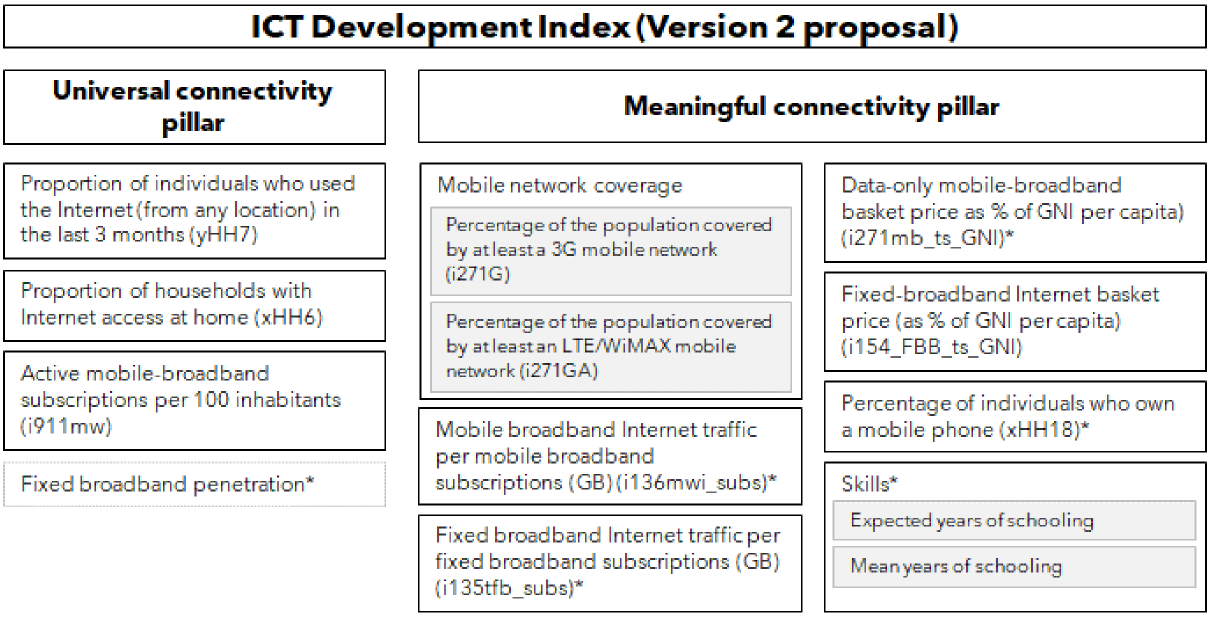
For the weighting scheme, one intuitive and neutral approach is to mirror the two dimensions of the UMC concept, by averaging the scores of the Universal connectivity pillar and of the Meaningful connectivity pillar. The scores of the two pillars would be the average of the individual indicators included in each pillar, so that the pillar score provides a balanced summary of the underlying information. In the absence of a clear conceptual and statistical justification, this neutral approach consisting in applying equal weights at each level of aggregation (i.e., pillar level and overall level) should be preferred. With this approach, the assumption is that the main conceptual components are the two pillars and that the individual indicators within each pillar contribute in a similar extent to the performance of the pillar. The subsequent statistical analysis does not reject this neutral and intuitive approach. For these reasons, we proposed this approach in the Version 1 document and again in the Version 2 document (Figure 3). The statistical analysis does not reject this neutral and intuitive approach.

An alternative approach could be to consider individual indicators as the main conceptual components (instead of the two pillars). In this case, the overall index score would be the average of the scores of the individual indicators. Each indicator would have the same weight in the overall IDI, unlike the other approach where the implicit weight of individual indicator depends on the number of indicators in the pillar. The pillar scores could still be computed and reported (but the average score of the two would not correspond to the overall IDI score).

There should be strong empirical evidence to justify departing from one of the two approaches above for the weighting scheme.

Regarding the weight on skills, a composite indicator made up of the ICT skills collected by ITU would be the first-best solution for the purpose of measuring meaningful connectivity. If data availability was sufficient, there would be no conceptual or statistical justification to treat ICT skills as a 'lesser enabler'. But data availability for ICT skills being too low for now, the first question to address is whether to use proxy measures, such as the ones in the 'Zero draft' (enrolment rates), Version 1 (*Expected years of schooling* and *Mean years of schooling*) and in some of the comments (e.g., *Schools connected to the Internet*). This issue will be discussed at the IDI Meeting. Should a proxy measure be adopted, a statistical analysis will inform the weight to be placed on this proxy measure. Already, in response to some comments from Member States, the two skills indicators are combined to form one indicator (Figure 3).

**Figure 3: Proposed structure of the IDI**




* To be disucssed.
Note: This structure is without prejudice to the conclusions of the IDI meeting.

## The universal connectivity pillar

The pillar consists of four indicators, in accordance with the conceptual framework. Correlation analysis and the preliminary results of a principal component analysis (PCA)[17] confirm that the four indicators capture a single latent dimension strongly associated with the four indicators, each of which contribute in a fairly similar way to the aggregate measure. This suggests that equal weighting can be applied in this pillar.

## The meaningful connectivity pillar

The pillar consists of nine indicators, two of which – % of the population covered by at least a 3G and 4G (LTE/WiMAX) mobile network – are combined to a mobile broadband coverage score, applying 0.4 and 0.6 as the weights, respectively. This is based on feedback from the IDI forum and expert advice and takes into consideration that having at least 4G network technology allows for a more meaningful online experience than having at least 3G technology. It is noted that in practice, the two networks often overlap, in which case often 3G is used for voice and 4G for data communication.

The meaningful connectivity indicators positively correlate with one another, but the structure shows heterogeneity among the indicators. In brief, a moderate compensability was found between the two broadband traffic indicators and the rest of the indicators in the pillar[18] (even after outliers are removed). However, there is no clear statistical justification for departing from the most intuitive approach of applying equal weights to compute the average of the indicator scores in the pillar. One conclusion, in any case, is that it is reasonable to consider the different indicators also by themselves for a comprehensive benchmarking of meaningful connectivity, in addition to using pillar summary scores and the overall aggregate index. This helps understand strengths and weaknesses for each country, delivering more nuanced information for policies.

The IDI scores will be computed by taking the simple average of the meaningful and universal connectivity scores. This *ex-ante* assessment on the structure should, in any case, be revisited in a statistical coherence

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[17] Principal component analysis is applied to explore the underlying multivariate structure of a set of indicators and helps identify latent dimensions. Only the main conclusions from the analyses are reported in this document, as it is based on a restricted set of economies for which all indicators are available.
[18] Preliminary PCA results on a very restricted number of observations indicate the presence of a second component, associated with the traffic indicators.

analysis after the calculation of aggregate scores and after outlier treatment and normalization, as the structure may need some refinements to ensure that the statistical soundness of the IDI. This upcoming step will also take into consideration the results of the statistical audit carried out by the Competence Centre on Composite Indicators of the European Commission's Joint Research Centre.

# 6 Conclusion and next steps

After the 'Zero draft' document and Version 1 document, this document presented a new iteration of the IDI methodology, following the official consultation of Member States, during which 14 Member States submitted comments. A number of outstanding issues have been identified and will be discussed at the joint EGTI/EGH meeting on the IDI on 13-15 June, with the aim of resolving them.

The document first introduced the approach to be followed for developing a composite indicator, which is conceptually relevant and statistically robust. This approach structured the rest of the document. The first step consisted in defining the conceptual framework. The concept of universal and meaningful connectivity (UMC) – the possibility for everyone to enjoy a safe, satisfying, enriching, productive and affordable online experience – appeared as the framework of choice: it is both rooted in earlier editions of the IDI and consistent with the latest ITU resolutions and strategic goals. It captures both the quantitative aspects (universal) and qualitative aspect of connectivity (meaningful). In step 2, the conceptual framework of UMC and a set of selection criteria – such as reliability, availability, quality – guided the identification of indicators for potential inclusion from a large universe of ICT indicators. In step 3, a statistical analysis was carried out to narrow down the choice of indicators, which led to the selection of 13 indicators as a baseline proposal.

Statistical analyses conducted on the selected indicators in isolation as well as the analysis of correlation patterns between indicator pairs (details in Annex 3) in step 4 served to identify and treat outliers and missing data and anticipate the statistical coherence of the selected indicators. In step 5, the methodology was presented for normalization of indicators using thresholds and goalposts to establish a harmonized dataset of indicators measured at comparable scales. This is concluded by the proposal of an intuitive, multi-pillar aggregation framework.

A preliminary statistical analysis reveals that the proposal is statistically sound. Following the aggregation of indicators into a universal connectivity pillar and a meaningful connectivity pillar, together with an overall index will lead to an IDI that will be a fair summary of the information contained in the component indicators part of the baseline proposal. Nevertheless, by its nature, the IDI will simplify the richness of information contained in the individual indicators.

Limited data availability and quality place enormous constraints for the development of the index and impose difficult trade-offs between the depth, completeness, and timeliness of the assessment on the one hand and country coverage on the other. The methodology needs to consider these constraints and trade-offs, while ensuring conceptual relevance and statistical soundness, as per Resolution 131.

The current proposed baseline allows to cover important aspects of universal and meaningful connectivity, but not all.[19] There are many concepts for which no indicator exists or for which indicators exist, but country coverage is either insufficient or sources are not official ones. Therefore, regardless of its final structure, the assessment of the IDI will necessarily be partial. Additional data and information will always be needed to complement the IDI and provide a more accurate picture of a country's state of universal and meaningful connectivity. In this context, the dozens of ICT indicators maintained by ITU that do not meet the eligibility criteria for inclusion in the IDI are as relevant as ever. In fact, some of the most insightful ITU indicators have the lowest data availability, which disqualifies them for the IDI. Even if they are not part of the IDI, Member

[19] The current selection is without prejudice to the conclusions of the IDI meeting.

States must thrive to collect as many of them as possible on a regular basis.[20] The IDI indicators alone – especially when condensed to one single number – will not provide all the necessary information for policymaking.

The current selection of indicators would allow to cover *approximately* 168 economies, which meets the requirement in Resolution 131 “to cover a majority of Member States” (*resolves 3*). In addition, *approximately* 17% of data points would need to be estimated, which is a satisfactory ratio and consistent with the requirement in Resolution 131 to “rely primarily on official data provided by Member States” (*instructs 6 to the BDT Director*).

Finally, the long and complex process of developing an index is also an iterative one. The next steps (6-8) may impose some adjustments to the conclusions drawn at this point for the first steps, this to ensure that the methodology that will be submitted to the approval of Member States is indeed statistically sound.

[20] The technological, policy or market relevance of indicators were recently highlighted in the report of the EGTI subgroup on the review of the indicators collected in the ITU World Telecommunication/ICT Indicators Long Questionnaire, as well as in similar work carried out by the EGH.

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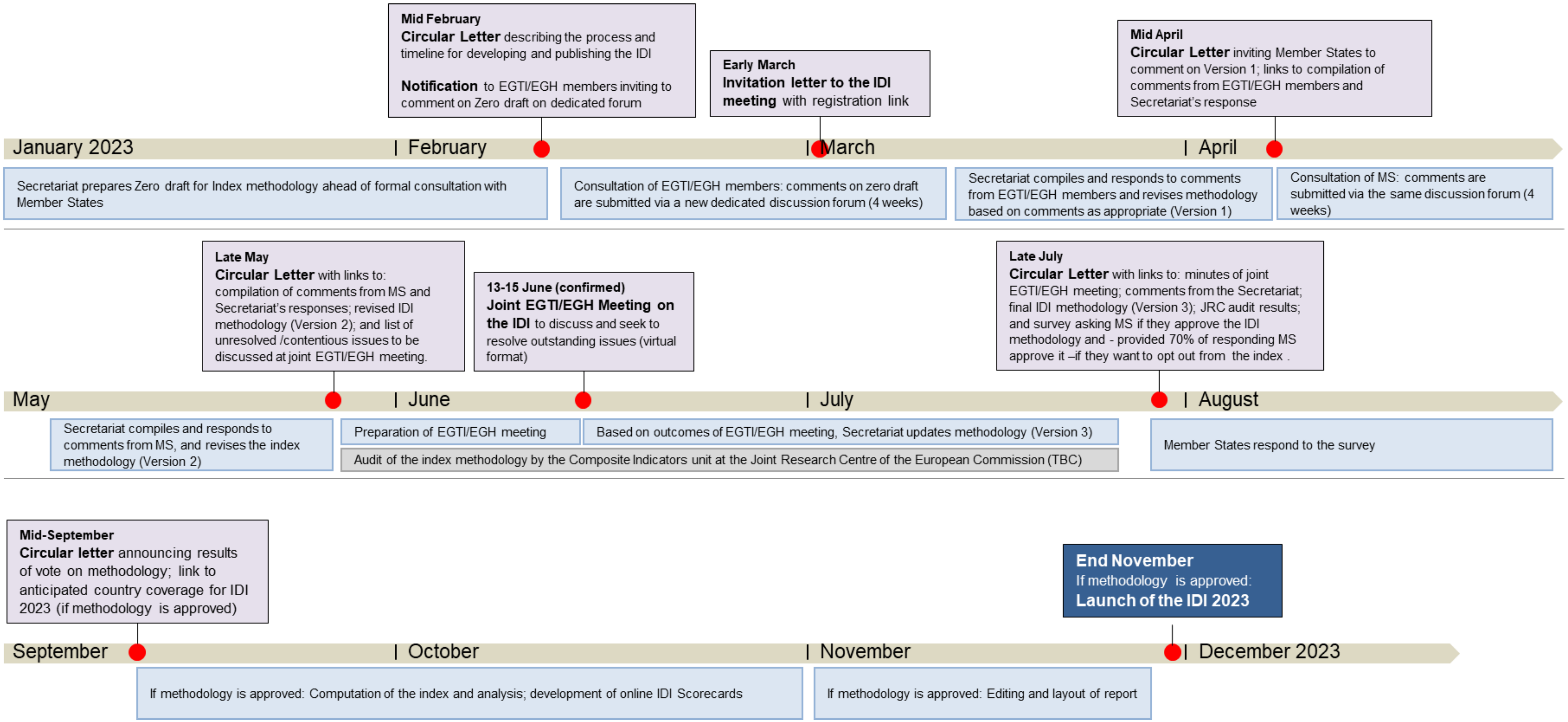
# Annex 1: Indicative timeline for the development of the ICT Development Index (IDI) 2023



# Annex 2: Data availability by economy and indicator

| Economy (ISO code) | Proportion of individuals who used the Internet (from any location) in the last 3 months<br>yHH7 | Proportion of households with Internet access at home<br>xHH6 | Active mobile-broadband subscriptions per 100 inhabitants<br>i911mw | Percentage of the population covered by at least a 3G mobile network<br>i271G | Percentage of the population covered by at least an LTE/WiMAX mobile network.<br>i271GA | Fixed broadband subscriptions per 100 inhabitants**<br>i992b | Mobile broadband Internet traffic per mobile broadband subscriptions (GB)*<br>i136mwi_subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB)*<br>i135tfb_subs | Data-only mobile-broadband basket price (as % of GNI per capita)*<br>i271mb_ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita)<br>i154_FBB_ts_GNI | Percentage of individuals who own a mobile phone*<br>xHH18 | Mean years of schooling (ISCED 1 or higher), population 25+ years*<br>MYS | Expected years of schooling*<br>EYS | Indicators available for the reference period<br>Number | <br>Share | >50%? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Afghanistan (AFG) | | | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Albania (ALB) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Algeria (DZA) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Andorra (AND) | | | 2021 | 2021 | 2021 | 2021 | | | | | | 2021 | 2021 | 6 | 46% | N |
| Angola (AGO) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Antigua and Barbuda (ATG) | | | 2020 | 2020 | 2020 | 2020 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Argentina (ARG) | 2021 | 2021 | 2020 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2021 | 2021 | 2021 | 12 | 92% | Y |
| Armenia (ARM) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Australia (AUS) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Austria (AUT) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| Azerbaijan (AZE) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Bahamas (BHS) | | | 2020 | 2020 | 2020 | 2020 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Bahrain (BHR) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Bangladesh (BGD) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Barbados (BRB) | | | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Belarus (BLR) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Belgium (BEL) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Belize (BLZ) | | 2021 | | | | | | | 2021 | 2021 | | 2021 | 2021 | 5 | 38% | N |
| Benin (BEN) | | | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Bhutan (BTN) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | | 2021 | 2021 | 2021 | 2021 | 2021 | 12 | 92% | Y |
| Bolivia (Plurinational State of) (BOL) | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | | | 2021 | 2021 | 2020 | 2021 | 2021 | 11 | 85% | Y |
| Bosnia and Herzegovina (BIH) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Botswana (BWA) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Brazil (BRA) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Brunei Darussalam (BRN) | | | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Bulgaria (BGR) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Burkina Faso (BFA) | | | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Burundi (BDI) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | 9 | 69% | Y |
| Cabo Verde (CPV) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Cambodia (KHM) | | | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2020 | 2021 | 2021 | 10 | 77% | Y |
| Cameroon (CMR) | | | 2021 | 2021 | 2021 | 2021 | 2020 | 2020 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |

| Economy (ISO code) | Proportion of individuals who used the Internet (from any location) in the last 3 months yHH7 | Proportion of households with Internet access at home xHH6 | Active mobile-broadband subscriptions per 100 inhabitants i911mw | Percentage of the population covered by at least a 3G mobile network i271G | Percentage of the population covered by at least an LTE/WiMAX mobile network. i271GA | Fixed broadband subscriptions per 100 inhabitants** i992b | Mobile broadband Internet traffic per mobile broadband subscriptions (GB)* i136mwi _subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB)* i135tfb _subs | Data-only mobile-broadband basket price (as % of GNI per capita)* i271mb _ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita) i154_FBB _ts_GNI | Percentage of individuals who own a mobile phone* xHH18 | Mean years of schooling (ISCED 1 or higher), population 25+ years* MYS | Expected years of schooling* EYS | Indicators available for the reference period Number | Share | >50%? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Canada (CAN) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Central African Rep. (CAF) | | | | | | | | | 2021 | | | 2021 | 2021 | 3 | 23% | N |
| Chad (TCD) | | | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | | | 2021 | 2021 | 8 | 62% | Y |
| Chile (CHL) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| China (CHN) | 2021 | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 12 | 92% | Y |
| Colombia (COL) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Comoros (COM) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Congo (Rep. of the) (COG) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Costa Rica (CRI) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Côte d'Ivoire (CIV) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Croatia (HRV) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 13 | 100% | Y |
| Cuba (CUB) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2020 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Cyprus (CYP) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Czech Republic (CZE) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Dem. People's Rep. of Korea (PRK) | | | | | | | | | | | | | 2021 | 1 | 8% | N |
| Dem. Rep. of the Congo (COD) | | | 2021 | 2021 | 2021 | 2020 | 2021 | | 2021 | | | 2021 | 2021 | 8 | 62% | Y |
| Denmark (DNK) | 2022 | 2022 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Djibouti (DJI) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Dominica (DMA) | | | 2021 | 2021 | 2021 | 2021 | 2020 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Dominican Rep. (DOM) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Ecuador (ECU) | 2022 | 2022 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2022 | 2021 | 2021 | 13 | 100% | Y |
| Egypt (EGY) | 2022 | 2022 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2022 | 2021 | 2021 | 13 | 100% | Y |
| El Salvador (SLV) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Equatorial Guinea (GNQ) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Eritrea (ERI) | | | | | | | | | | | | 2021 | 2021 | 2 | 15% | N |
| Estonia (EST) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| Eswatini (SWZ) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Ethiopia (ETH) | 2021 | | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Fiji (FJI) | | | 2020 | 2020 | 2020 | 2020 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Finland (FIN) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| France (FRA) | 2021 | 2021 | 2020 | 2020 | 2020 | 2021 | 2020 | | 2021 | 2021 | 2021 | 2021 | 2021 | 12 | 92% | Y |
| Gabon (GAB) | | | 2021 | 2021 | 2021 | 2021 | 2020 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Gambia (GMB) | | | | | | | | | 2021 | | | 2021 | 2021 | 3 | 23% | N |
| Georgia (GEO) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Germany (DEU) | 2022 | 2022 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |

| Economy (ISO code) | Proportion of individuals who used the Internet (from any location) in the last 3 months<br>yHH7 | Proportion of households with Internet access at home<br>xHH6 | Active mobile-broadband subscriptions per 100 inhabitants<br>i911mw | Percentage of the population covered by at least a 3G mobile network<br>i271G | Percentage of the population covered by at least an LTE/WiMAX mobile network.<br>i271GA | Fixed broadband subscriptions per 100 inhabitants**<br>i992b | Mobile broadband Internet traffic per mobile broadband subscriptions (GB)*<br>i136mwi_subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB)*<br>i135tfb_subs | Data-only mobile-broadband basket price (as % of GNI per capita)*<br>i271mb_ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita)<br>i154_FBB_ts_GNI | Percentage of individuals who own a mobile phone*<br>xHH18 | Mean years of schooling (ISCED 1 or higher), population 25+ years*<br>MYS | Expected years of schooling*<br>EYS | Indicators available for the reference period<br>Number | <br>Share | >50%? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ghana (GHA) | 2021 | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 12 | 92% | Y |
| Greece (GRC) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Grenada (GRD) | | | 2021 | 2021 | 2021 | 2021 | 2020 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Guatemala (GTM) | 2021 | 2021 | 2020 | 2021 | 2020 | 2020 | | | 2021 | 2021 | 2021 | 2021 | 2021 | 11 | 85% | Y |
| Guinea (GIN) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Guinea-Bissau (GNB) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Guyana (GUY) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Haiti (HTI) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Honduras (HND) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Hong Kong, China (HKG) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Hungary (HUN) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Iceland (ISL) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| India (IND) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Indonesia (IDN) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Iran (Islamic Republic of) (IRN) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2020 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Iraq (IRQ) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | 9 | 69% | Y |
| Ireland (IRL) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Israel (ISR) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Italy (ITA) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Jamaica (JAM) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Japan (JPN) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Jordan (JOR) | | | 2021 | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Kazakhstan (KAZ) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Kenya (KEN) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Kiribati (KIR) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | 9 | 69% | Y |
| Korea (Rep. of) (KOR) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Kuwait (KWT) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Kyrgyzstan (KGZ) | 2020 | 2020 | | | | | | | 2021 | 2021 | 2020 | 2021 | 2021 | 7 | 54% | Y |
| Lao P.D.R. (LAO) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Latvia (LVA) | 2022 | 2022 | 2021 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Lebanon (LBN) | | | 2020 | 2020 | 2020 | 2020 | 2020 | 2020 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Lesotho (LSO) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Liberia (LBR) | | | | | | | | | 2021 | | | 2021 | 2021 | 3 | 23% | N |
| Libya (LBY) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Liechtenstein (LIE) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |

| Economy (ISO code) | Proportion of individuals who used the Internet (from any location) in the last 3 months yHH7 | Proportion of households with Internet access at home xHH6 | Active mobile-broadband subscriptions per 100 inhabitants i911mw | Percentage of the population covered by at least a 3G mobile network i271G | Percentage of the population covered by at least an LTE/WiMAX mobile network. i271GA | Fixed broadband subscriptions per 100 inhabitants** i992b | Mobile broadband Internet traffic per mobile broadband subscriptions (GB)* i136mwi_subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB)* i135tfb_subs | Data-only mobile-broadband basket price (as % of GNI per capita)* i271mb_ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita) i154_FBB_ts_GNI | Percentage of individuals who own a mobile phone* xHH18 | Mean years of schooling (ISCED 1 or higher), population 25+ years* MYS | Expected years of schooling* EYS | Indicators available for the reference period Number | Share | >50%? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lithuania (LTU) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2020 | 2021 | 2021 | 12 | 92% | Y |
| Luxembourg (LUX) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| Macao, China (MAC) | 2021 | 2021 | | | | | | | 2021 | 2021 | | | | 4 | 31% | N |
| Madagascar (MDG) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Malawi (MWI) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Malaysia (MYS) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Maldives (MDV) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Mali (MLI) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Malta (MLT) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| Marshall Islands (MHL) | | | | | | | | | | 2021 | | 2021 | 2021 | 3 | 23% | N |
| Mauritania (MRT) | | | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Mauritius (MUS) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 13 | 100% | Y |
| Mexico (MEX) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| Micronesia (FSM) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Moldova (MDA) | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Monaco (MCO) | | | 2021 | 2021 | 2021 | 2021 | 2021 | | | | | | | 5 | 38% | N |
| Mongolia (MNG) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Montenegro (MNE) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Morocco (MAR) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Mozambique (MOZ) | | | 2021 | 2020 | 2020 | 2021 | 2020 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Myanmar (MMR) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Namibia (NAM) | | | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Nauru (NRU) | | | | | | | | | 2021 | | | | 2021 | 2 | 15% | N |
| Nepal (Republic of) (NPL) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Netherlands (NLD) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2021 | 2021 | 2021 | 12 | 92% | Y |
| New Zealand (NZL) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Nicaragua (NIC) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Niger (NER) | | | | | | | | | 2021 | 2020 | | 2021 | 2021 | 4 | 31% | N |
| Nigeria (NGA) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| North Macedonia (MKD) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Norway (NOR) | 2021 | 2021 | 2020 | 2020 | 2020 | 2020 | 2020 | | 2021 | 2021 | 2021 | 2021 | 2021 | 12 | 92% | Y |
| Oman (OMN) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 13 | 100% | Y |
| Pakistan (PAK) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 13 | 100% | Y |
| Palestine (WBG) | 2022 | 2022 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Panama (PAN) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |

| Economy (ISO code) | Proportion of individuals who used the Internet (from any location) in the last 3 months yHH7 | Proportion of households with Internet access at home xHH6 | Active mobile-broadband subscriptions per 100 inhabitants i911mw | Percentage of the population covered by at least a 3G mobile network i271G | Percentage of the population covered by at least an LTE/WiMAX mobile network. i271GA | Fixed broadband subscriptions per 100 inhabitants** i992b | Mobile broadband Internet traffic per mobile broadband subscriptions (GB)* i136mwi_subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB)* i135tfb_subs | Data-only mobile-broadband basket price (as % of GNI per capita)* i271mb_ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita) i154_FBB_ts_GNI | Percentage of individuals who own a mobile phone* xHH18 | Mean years of schooling (ISCED 1 or higher), population 25+ years* MYS | Expected years of schooling* EYS | Indicators available for the reference period Number | Share | >50%? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Papua New Guinea (PNG) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Paraguay (PRY) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Peru (PER) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | 2021 | 2021 | 2021 | 11 | 85% | Y |
| Philippines (PHL) | | | 2020 | 2020 | 2020 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Poland (POL) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| Portugal (PRT) | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 12 | 92% | Y |
| Qatar (QAT) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 13 | 100% | Y |
| Romania (ROU) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Russian Federation (RUS) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Rwanda (RWA) | 2020 | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 12 | 92% | Y |
| Saint Kitts and Nevis (KNA) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Saint Lucia (LCA) | | | 2021 | 2021 | 2021 | 2021 | 2020 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Saint Vincent and the Grenadines (VCT) | | | 2021 | 2021 | 2021 | 2021 | 2020 | | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Samoa (WSM) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| San Marino (SMR) | | | 2021 | 2021 | 2021 | 2021 | | | | | | 2021 | 2021 | 6 | 46% | N |
| Sao Tome and Principe (STP) | | | 2021 | 2021 | | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Saudi Arabia (SAU) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Senegal (SEN) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Serbia (SRB) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Seychelles (SYC) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Sierra Leone (SLE) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | | | 2021 | 2021 | 7 | 54% | Y |
| Singapore (SGP) | 2022 | 2022 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2021 | 2021 | 2021 | 12 | 92% | Y |
| Slovakia (SVK) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Slovenia (SVN) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2021 | 2021 | 2021 | 12 | 92% | Y |
| Solomon Islands (SLB) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Somalia (SOM) | | 2020 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | | | 7 | 54% | Y |
| South Africa (ZAF) | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| South Sudan (SSD) | | | 2021 | 2021 | 2021 | 2021 | | 2021 | | | | 2021 | 2021 | 7 | 54% | Y |
| Spain (ESP) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Sri Lanka (LKA) | | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| Sudan (SDN) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | | | 2021 | 2021 | 7 | 54% | Y |
| Suriname (SUR) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Sweden (SWE) | 2022 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| Switzerland (CHE) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Syrian Arab Republic (SYR) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | | | | 2021 | 2021 | 8 | 62% | Y |

| Economy (ISO code) | Proportion of individuals who used the Internet (from any location) in the last 3 months yHH7 | Proportion of households with Internet access at home xHH6 | Active mobile-broadband subscriptions per 100 inhabitants i911mw | Percentage of the population covered by at least a 3G mobile network i271G | Percentage of the population covered by at least an LTE/WiMAX mobile network. i271GA | Fixed broadband subscriptions per 100 inhabitants** i992b | Mobile broadband Internet traffic per mobile broadband subscriptions (GB)* i136mwi_subs | Fixed broadband Internet traffic per fixed broadband subscriptions (GB)* i135tfb_subs | Data-only mobile-broadband basket price (as % of GNI per capita)* i271mb_ts_GNI | Fixed-broadband Internet basket price (as % of GNI per capita) i154_FBB_ts_GNI | Percentage of individuals who own a mobile phone* xHH18 | Mean years of schooling (ISCED 1 or higher), population 25+ years* MYS | Expected years of schooling* EYS | Indicators available for the reference period Number | Share | >50%? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tajikistan (TJK) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Tanzania (TZA) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Thailand (THA) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Timor-Leste (TLS) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Togo (TGO) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Tonga (TON) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Trinidad and Tobago (TTO) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Tunisia (TUN) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Türkiye (TUR) | 2022 | 2022 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2022 | 2021 | 2021 | 13 | 100% | Y |
| Turkmenistan (TKM) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Tuvalu (TUV) | | | | | | | | | 2021 | 2021 | | 2021 | 2021 | 4 | 31% | N |
| Uganda (UGA) | 2020 | | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 2021 | | | 2021 | 2021 | 10 | 77% | Y |
| Ukraine (UKR) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | 2021 | 2021 | 2021 | 11 | 85% | Y |
| United Arab Emirates (ARE) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| United Kingdom (GBR) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2021 | | 2021 | 2021 | 11 | 85% | Y |
| United States (USA) | | | 2021 | 2021 | 2021 | 2021 | | | 2021 | 2021 | | 2021 | 2021 | 8 | 62% | Y |
| Uruguay (URY) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Uzbekistan (UZB) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Vanuatu (VUT) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 10 | 77% | Y |
| Vatican (VAT) | | | | | | | | | | | | | | 0 | 0% | N |
| Venezuela (VEN) | | | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | | | | 2021 | 2021 | 8 | 62% | Y |
| Viet Nam (VNM) | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 13 | 100% | Y |
| Yemen (YEM) | | | | | | | | | 2020 | 2020 | | 2021 | 2021 | 4 | 31% | N |
| Zambia (ZMB) | | | 2021 | 2021 | 2021 | 2021 | | 2021 | 2021 | 2021 | | 2021 | 2021 | 9 | 69% | Y |
| Zimbabwe (ZWE) | 2020 | 2020 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2021 | 2020 | 2021 | 2021 | 13 | 100% | Y |
| Nr. Economies with data available for the reference period (2020-2021) | 94 | 94 | 170 | 170 | 168 | 170 | 143 | 115 | 186 | 175 | 59 | 190 | 192 | | | |

* To be discussed

** In the absence of an alternative, data availability for fixed-broadband penetration is still based on fixed-broadband subscriptions per 100 inhabitants. This is without prejudice to the conclusions of the IDI meeting.

# Annex 3: Correlation analysis

Correlation analysis is an essential statistical tool for composite indicator development. By helping to understand the statistical relationships among the indicators considered for inclusion, it provides an early indication of the strength of an index and of possible internal consistency problems.

Correlation coefficients indicate overlaps, complementarities, and trade-offs across indicators, which are often not evident when indicators are selected purely for their conceptual relevance. For instance, the stronger the correlation between two indicators, the higher the statistical overlap between them. Near collinearity (i.e., a coefficient close to 1) signals that the two indicators contain the same information with regards to establishing country scores. Conversely, if there is no statistical association between two indicators (correlation coefficients close to 0), the two indicators fully complement one another, each providing very different information about the country performance. Negative correlation would indicate unintended trade-offs (i.e., improving one dimension comes at the detriment of another).

While there is no optimal degree of correlation in the context of an index, it is important to ensure that the selected indicators fit in the aggregation framework based on positive correlation with the other indicators in the same index component (e.g., a pillar) and the overall index. A composite indicator that is the average of uncorrelated component indicators is confusing, because how countries perform according to the index will look very different from how countries perform according to the individual indicators. Yet, component indicators should not be perfectly aligned, as this would not only weaken the case for having multiple indicators instead of using just one, but also imply double counting of the same information. Therefore, components should be positively correlated, but not statistically identical (coefficients close to 1), so that the aggregate index is a summary measure, with the added value that it helps reduce dimensionality in a larger underlying dataset.

Correlation analysis can also inform weighting (e.g., to avoid double counting in case of near collinearity), as well as the structuring of indicators (e.g., if multiple dimensions or pillars are used, ensuring that each indicator is assigned to the dimension with which it shares the highest statistical commonality to ensure coherence of the framework.

**Table 10: 11Correlation table for tested variables**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **yHH7 (1)** | 1.00 | 0.81 | 0.55 | 0.59 | 0.59 | 0.46 | 0.58 | 0.39 | 0.32 | -0.55 | -0.70 | -0.69 | -0.74 | 0.87 | 0.71 | 0.71 |
| **xHH6 (2)** | 0.81 | 1.00 | 0.58 | 0.59 | 0.57 | 0.52 | 0.51 | 0.30 | 0.31 | -0.41 | -0.62 | -0.53 | -0.66 | 0.79 | 0.55 | 0.56 |
| **i911mw (3)** | 0.55 | 0.58 | 1.00 | 0.54 | 0.54 | 0.44 | 0.59 | 0.28 | 0.35 | -0.53 | -0.52 | -0.53 | -0.38 | 0.54 | 0.60 | 0.55 |
| **i992b (4)** | 0.59 | 0.59 | 0.54 | 1.00 | 0.99 | 0.50 | 0.60 | 0.20 | 0.31 | -0.53 | -0.55 | -0.55 | -0.47 | 0.51 | 0.78 | 0.76 |
| **i992b_18+ (5)** | 0.59 | 0.57 | 0.54 | 0.99 | 1.00 | 0.52 | 0.62 | 0.21 | 0.29 | -0.54 | -0.56 | -0.56 | -0.48 | 0.50 | 0.79 | 0.76 |
| **i271G (6)** | 0.46 | 0.52 | 0.44 | 0.50 | 0.52 | 1.00 | 0.81 | 0.21 | 0.34 | -0.55 | -0.66 | -0.64 | -0.52 | 0.55 | 0.54 | 0.55 |
| **i271GA (7)** | 0.58 | 0.51 | 0.59 | 0.60 | 0.62 | 0.81 | 1.00 | 0.25 | 0.36 | -0.62 | -0.66 | -0.66 | -0.55 | 0.56 | 0.63 | 0.63 |
| **i136mwi_subs (8)** | 0.39 | 0.30 | 0.28 | 0.20 | 0.21 | 0.21 | 0.25 | 1.00 | 0.22 | -0.25 | -0.23 | -0.22 | -0.21 | 0.32 | 0.28 | 0.26 |
| **i135tfb_subs (9)** | 0.32 | 0.31 | 0.35 | 0.31 | 0.29 | 0.34 | 0.36 | 0.22 | 1.00 | -0.29 | -0.32 | -0.32 | -0.14 | 0.22 | 0.35 | 0.36 |
| **i271mb_ts_GNI (10)** | -0.55 | -0.41 | -0.53 | -0.53 | -0.54 | -0.55 | -0.62 | -0.25 | -0.29 | 1.00 | 0.84 | 0.85 | 0.59 | -0.47 | -0.58 | -0.59 |
| **i271mb_low_ts (11)** | -0.70 | -0.62 | -0.52 | -0.55 | -0.56 | -0.66 | -0.66 | -0.23 | -0.32 | 0.84 | 1.00 | 0.93 | 0.70 | -0.62 | -0.63 | -0.61 |
| **i271mb_high_ts (12)** | -0.69 | -0.53 | -0.53 | -0.55 | -0.56 | -0.64 | -0.66 | -0.22 | -0.32 | 0.85 | 0.93 | 1.00 | 0.68 | -0.54 | -0.65 | -0.60 |
| **i154_FBB_ts_GNI (13)** | -0.74 | -0.66 | -0.38 | -0.47 | -0.48 | -0.52 | -0.55 | -0.21 | -0.14 | 0.59 | 0.70 | 0.68 | 1.00 | -0.64 | -0.54 | -0.49 |
| **xHH18_IDI (14)** | 0.87 | 0.79 | 0.54 | 0.51 | 0.50 | 0.55 | 0.56 | 0.32 | 0.22 | -0.47 | -0.62 | -0.54 | -0.64 | 1.00 | 0.54 | 0.59 |
| **MYS (15)** | 0.71 | 0.55 | 0.60 | 0.78 | 0.79 | 0.54 | 0.63 | 0.28 | 0.35 | -0.58 | -0.63 | -0.65 | -0.54 | 0.54 | 1.00 | 0.78 |
| **EYS (16)** | 0.71 | 0.56 | 0.55 | 0.76 | 0.76 | 0.55 | 0.63 | 0.26 | 0.36 | -0.59 | -0.61 | -0.60 | -0.49 | 0.59 | 0.78 | 1.00 |

Note: This table is without prejudice to the conclusions of the IDI meeting.

Notes: Pairwise Pearson correlation coefficients shaded by strength and significance.
Of note is that this table contains more indicators than the previous tables, because three alternative indicators have been included that could replace current indicators if so, decided at the IDI meeting. Indicators (1) to (5) refer to universal connectivity; (6) to (16) refer to meaningful connectivity, among which (6) to (9) refer to infrastructure, (10) to (13) measure affordability, (14) measures device ownership and (15)-(16) measure skills. See Table 7 for indicator names.

Table 10: 11 shows the correlation coefficients for the selected indicators. This analysis was carried out before any treatment, so some of the patterns are driven by the outliers (see identification in Step 4), and the test should be repeated on the treated dataset. The tests revealed the following information about indicator groups and indicator pairs:

- Overall, the correlation coefficients show the expected signs in the selected indicators set. The negative correlation of the two affordability indicators with the other indicators is also expected, since those indicators are measured in an opposite direction: the lower the prices, the better the situation (this means that the direction should be reversed when normalizing these indicators).
- The indicators in the **universal connectivity group** are positively and moderately to strongly correlated with one another. The two survey-based indicators (share of individuals using the Internet and households accessing the Internet) share the highest degree of similarities, while the somewhat weaker coefficients between the fixed and mobile broadband penetration indicators show that the two technologies are complementary to one another. Similarly, the moderate correlation between the two survey-based measures and the penetration measures based on administrative data shows complementarities between the two approaches. It is possible though that the difference can be explained, to some extent, by the pattern of missing data. Combining indicators of the universal connectivity group into a dimension aggregate appears to make sense from a statistical perspective, as it would not result in a significant loss of information.
    - Considering the testing of alternatives measurement of fixed broadband penetration with sufficiently high coverage, the indicator considering population 18 years or above as the denominator is very highly correlated with the other measure considering the total population. While not reported in the table due to low coverage, we noted that a household survey-based definition of the indicator would show a lower coefficient (0.63), however, given that data availability is driven by income level, this cannot be assumed as representative for the entire dataset.
- Correlation across indicators in the **meaningful connectivity group** shows greater heterogeneity. Not only does the group stand somewhat apart from the universal connectivity indicators group, but there is also considerable heterogeneity across its different subsets.
- In the **meaningful connectivity – infrastructure group**:
    - The strong positive correlation between the pair of indicators for mobile broadband coverage by at least 3G and 4G technologies suggests that the two indicators can be combined into a single indicator.
    - The two Internet traffic indicators – at least prior to outlier treatment stand apart from the other indicators of the infrastructure group and are also complementary to one another.
    - All this indicates that aggregating these indicators to a single component would involve some degree of compensability among the indicators: countries scoring high on the traffic indicators do not necessarily score high on other indicators in the group. When aggregated, this implies that weaker performance in traffic may be compensated by stronger performance in other indicators.
    - The correlation analysis should be revisited after outlier treatment and possible sub-aggregation of the broadband coverage indicators to better understand statistical coherence.
- The **affordability indicators** for the two technologies (mobile and fixed broadband basket price as a percentage of GNI per capita) are complementary to one another. Interestingly, considering the correlation pattern with the other indicators across the table, while one may expect that all indicators relating to the same technology but measuring different aspects of it (e.g., penetration, traffic,

affordability) show greater statistical similarities with one another, correlation patterns show no evidence of that.

    - The alternative affordability indicators (mobile data and voice low- and high-consumption baskets) tested are strongly and positively correlated with the data-only mobile broadband basket (0.84-0.85) as well as with the fixed broadband basket (0.68-0.70), while statistically almost identical considering the collinearity observed (0.99). This clearly suggests that if used, it is sufficient to retain only one of the two data and voice baskets.

- The two **skills proxy indicators** (mean years of schooling and expected years of schooling) are both strongly and positively correlated with one another as well as with many of the other indicators, including those in the universal connectivity group.

# Annex 4: Comments by EGTI/EGH Members on the Version 1 document and responses from the ITU Secretariat

*See next page.*

# Comments by Member States on the Version 1 document and responses from the ITU Secretariat

## Contents



## Introduction

In October 2022, ITU's Plenipotentiary Conference 2022 in Bucharest adopted a revised text of Resolution 131. This new text (Rev. Bucharest, 2022) defines, inter alia, the main features of the process for developing and adopting a new IDI methodology and of the IDI itself. Consistent with the urgency imposed by Resolution 131, the objective is to launch the IDI in 2023.

In this context, and in line with *instructs 8 to the BDT Director*,[1] the Secretariat prepared a 'zero draft' document, which described a possible framework and structure for the IDI, to inform, facilitate and expedite the process. This document was posted on a discussion forum dedicated to the new IDI. Between 21 February 2023 and 22 March 2023, the members of the Expert Group on ICT Household Indicators (EGH) and the Expert Group on Telecommunication/ICT Indicators (EGTI) were invited to share feedback and suggestions. More than 200 members signed up for the IDI Forum and almost 100 comments were posted. Following this first consultation, the Secretariat produced a document with all the comments received from EGTI/EGH members and the respective responses from the ITU Secretariat.[2] The document was appended as Annex 4 to the Version 1 document.

Based on the comments received, the Secretariat updated the 'zero draft' document and produced a new proposal of methodology, called Version 1, which was sent to Members States for comments, as per *instructs the Director of the Telecommunication Development Bureau* 7 of Resolution 131.[3] The

[1] "to facilitate the work of EGTI/EGH in fulfilling the tasks set out under resolves above, including through correspondence"

[2] Comments related to the process were responded by the Secretariat directly on the IDI Forum and were not reproduced.

[3] "to invite Member States to contribute and comment on the IDI methodology and structure;"

consultation period ran from 21 April to 19 May 2023.[4] In total, 14 Member States posted comments.[5]

This document contains the comments received during the consultation period and the respective responses from the ITU Secretariat. Comments related to the process were responded by the Secretariat directly on the IDI Forum and are not reproduced here.

There are ten topics on the IDI Forum:

1. Welcome to the IDI Forum
2. Methodology of the ICT Development Index 2023: Zero draft
3. Feedback on the proposed conceptual framework
4. Feedback on the proposed universal connectivity indicators
5. Feedback on the proposed meaningful connectivity indicators
6. Feedback on the statistical assessment of the proposed indicators
7. Feedback on normalization, aggregation, and weighting
8. Any other feedback on the document
9. Compiled comments on Zero-draft with Secretariat responses (closed)
10. Methodology of the ICT Development Index 2023: Zero draft (closed)

The first and second topics were for information only and no comments could be posted under those. Comments could be posted for topics 3-8. Topics 9 and 10 referred to the consultation with EGTI/EGH members carried out in the previous stage and no comments could be posted under those. All the comments on the 'Zero draft' received during the consultation with EGTI/EGH members document are not reproduced here. They remain accessible under the various topics in the IDI Forum.

The rest of this document follows the structure of the Version 1 document. Under each topic, comments were regrouped by theme (e.g., a discussion on a specific indicator), with the Secretariat's response appearing in blue typeface, below the group of comments. Some comments were moved from the topic under which they were posted to the topic under which they fit best. Some comments were lightly edited for readability and conciseness. The original 'verbatim' text is available on the IDI Forum. Finally, within a group of comments, some comments called for additional elements of response by the Secretariat to complement its general response to the group of comments. In this case, the Secretariat's specific response appear in blue typeface and indented immediately below the comment.

# Feedback on the proposed conceptual framework

**Kenya:** We are in agreement with the approach of the conceptual framework considering that it has taken into account both mobile and fixed broadband to take care of different economies.

**Russian Federation:** Russian Federation generally supports the conceptual approach to the formation of a new version of IDI.

[4] The consultation period was initially to end on 19 May, but was extended to 22 May to allow for some ITU focal points (or the person to whom they had delegated the task) who experienced technical difficulties to post their comments.

[5] The countries are Algeria, Bahrain, Brazil, Egypt, India, Kenya, Korea (Rep. of), Oman, Pakistan, Qatar, Russian Federation, Singapore, and the United Arab Emirates. Another country, Japan, posted comments that did not relate to the methodology, but to the data availability in Japan of the proposed indicators.

**Korea (Rep. of):** The Republic of Korea supports the UN digital goal 2030 for the global ICT development. We express our deep appreciation to the International Telecommunication Union (ITU) for its commendable efforts in developing the IDI 2023 draft. This draft successfully integrates the UN's digital goal while taking into account the ICT status of all member states. We firmly believe that the co-prosperity of all nations in the field of ICT is crucial for sustainable development. As such, the IDI 2023 will serve as a valuable tool, projecting global ICT development factors and providing essential guidance for the direction of future advancements.

**Response from the ITU Secretariat**: We acknowledge and thank you for your comments, which confirm the broad support for using the concept of "Universal and meaningful connectivity".

# Feedback on the proposed universal connectivity indicators

**Percentage of individuals using the Internet and Percentage of households with Internet access**

**Russian Federation**

- Russian Federation does not object to the inclusion of the indicator "Proportion of individuals who used the Internet (from any location) in the last 3 months" (indicator code xHH6) of the sub-index.
- Russian Federation does not object to the inclusion of the indicator "Proportion of households with Internet access at home" (indicator code xHH6) of the sub-index.

**Response from the ITU Secretariat**: We acknowledge and thank you for your comment.

**Singapore:** Percentage of individuals using the Internet: Singapore would like to reiterate our concerns for countries providing data based on different population age range. We note ITU has retained its approach for countries to provide data for all individuals aged 5 and above, we would suggest for ITU to look deeper into this in order to align the data for all countries based on same population range for a fairer apple-to-apple comparison.

**Response from the ITU Secretariat**: This is a valid point, which we acknowledged in the Version 1 document (page 8), in reaction to a few comments noting that countries submit data for different age ranges and proposing to align all countries based on the same population range (e.g., based on 16 to 74 years). Although ITU's *Manual for measuring ICT access and use by households and individuals* (Chapter 7, page 171) recommends collecting data for all individuals *aged 5 and above*, many countries do not survey children and/or older persons. This creates comparability issues, particularly where older persons are not surveyed. Countries with available data consistently report that they are less likely to use the Internet. One option as suggested is to use only the 16-74 age bracket. Though some differences in survey scope would remain, this option has the clear advantage of increasing the comparability between countries. However, there are costs to this approach. First, many countries that provide data on overall Internet use do not provide age breakdowns. Availability of official data for 2020 or later drops from 96 countries to 64 when requiring data for the 16-74 age range – well below the threshold set for inclusion in the index. If this indicator was included despite the lack of data, more estimation would be required. In addition, using Internet use for only the 16-74 age range for the purposes of the index diminishes the importance of children and older persons when assessing ICT development in countries, which would be in contradiction with the concept of universality. This is why, despite the limitations, we recommend keeping the overall indicator for this iteration – too much information would be lost without this indicator –, while hoping that availability of age-disaggregated data will improve in coming years.

**India:** Indicators namely "Proportion of individuals who used the Internet (from any location) in the last 3 months" and "Proportion of households with Internet access at home" to be dropped as Universal connectivity can be measured by Mobile + Fixed broadband subscriptions. Adding up use and access amounts to double entry.

> **Response from the ITU Secretariat:** This approach would provide an inexact approximation of Internet use, as the subscription indicators do not provide information about the number of people using these subscriptions.

**Pakistan:** For universal connectivity, "Proportion of individuals who used the Internet in the last 3 months" and "Proportion of households with Internet access at home" may also be reviewed/ dropped and a composite indicator be developed to reflect universal connectivity using active subscribers of mobile and fixed connections (which is also based on 90 days active definition). Further, as submitted earlier, active mobile-broadband subscriptions per 100 inhabitants and similar indicators be defined using 15+ or 18+ years of age population.

**Algeria:** Regarding the indicators "Percentage of individuals using the Internet" and "Percentage of households with Internet access", taken from household surveys, and retained for the IDI 2023, it is true that they are relevant but given:

- The availability of data that did not reach the threshold for the years 2020 and 2021.
- The last three years, and because of the Covid-19 pandemic and the economic crisis that the world has experienced, surveys in most countries have not taken place.

It is suggested for this IDI version, not to include data from surveys, and to focus on administrative data, which are quite available and richer, on the basis of the various ITU questionnaires which contain around a hundred indicators, from which a dozen indicators can be chosen, the data of which are available for the majority of countries.

Also, it is suggested, during the 4 years of validity of the IDI, and according to resolution 8, that the ITU accompanies the countries which have difficulties in carrying out surveys.

**Response from the ITU Secretariat:** Although there are some objections to using these two indicators and these indicators have limited data availability, they are 'flagship' indicators, in particular *the proportion of Internet users*, which are key to assess the actual state of Internet penetration. While data availability is just below the threshold, we suggest retaining the indicator because of its importance for the conceptual framework. Additionally, the Secretariat has much experience in producing estimates for these specific indicators, which are needed anyway for *Facts and Figures*. Estimates are always submitted to Member States for approval.

**Percentage of businesses (10+ employees) using the Internet and Percentage of schools using the Internet**

**Kenya**: We agree with the selected indicators in general. However, the exclusion of businesses and schools using internet remains as a great concern for us considering that in Kenya, and generally in most African countries most people access and use the internet from these two locations as compared to homes. We appreciate the reasons provided by the ITU on the challenge of data availability by most member countries and hope that this can form part of future improvements on the IDI methodology.

**Response from the ITU Secretariat**: we acknowledge, and thank you for your comment, which highlights the challenge faced by many countries when it comes to data collection. Both the UNESCO

Institute for Statistic and UNCTAD are members of the Partnership on Measuring ICT for Development, which is striving to improve data availability.

**Active mobile-broadband subscriptions per 100 inhabitants**

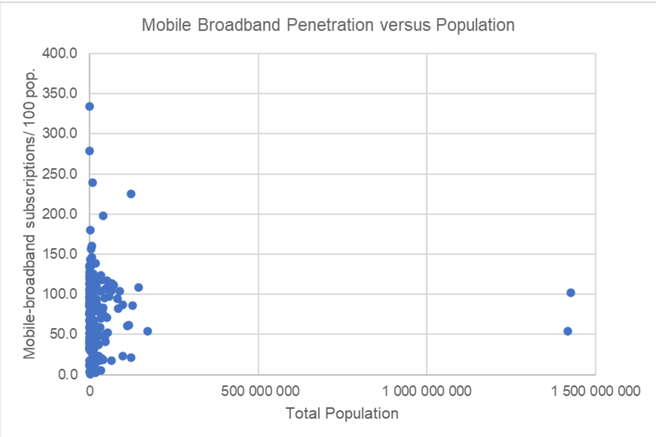
**Russian Federation:** Russian Federation does not object to the inclusion of the indicator "Active mobile-broadband subscriptions per 100 inhabitants" (indicator code i911mw) of the sub-index.

**Response from the ITU Secretariat:** we acknowledge and thank you for your comment.

**India:** Indicator namely "Active mobile-broadband subscriptions per 100 inhabitants" may be replaced with a composite indicator having following three indicators with equal weightage:- (i) Active mobile broadband subscriptions per 100 inhabitants of 18+ years. (ii) "Growth rate of active mobile broadband subscriptions over last 5 years" to capture the efforts made by the country to cover its population. iii) Total active mobile broadband subscriptions. The reason for suggesting composite indicator is that economies having large population should not be at disadvantage.

**Response from the ITU Secretariat:** This proposal is problematic from conceptual and statistical standpoints. First, there is no evidence that larger countries are disadvantaged: the correlation between mobile-broadband subscriptions per 100 inhabitants and total population is 0.00 (Figure 1). In fact, the average penetration for the world's ten most populated countries (86.0 subscriptions per 100 inhabitants) is higher than the average of the ten least populated countries (80.8). Second, including the total number of mobile broadband subscriptions without scaling by a size factor is against good practices. This and any other measure of technology diffusion must be scaled by a size factor to allow for comparison across countries. Without scaling, small countries are heavily penalized (while there is no evidence that large countries are penalized, as demonstrated above).

**Figure 1: Population and mobile penetration (2021)**




Sources: ITU and UN Population Division. N=197 economies with available data on mobile subscriptions.

As for growth, the IDI aims to assess the state (or 'stock') of connectivity. A growth rate, which is a 'flow' measure, does not provide information on the state of connectivity: connectivity can be very poor despite high growth rates, or extensive with very low growth rates. The latter case is typical of mature markets. Using a growth measure would penalize countries that have very high connectivity, are near or at the ideal state, and cannot grow much more.

The proposal allows for a scenario where a country's score for the composite indicator *decreases*, even though penetration has *increased*. Such would be the case if growth decreased significantly but remained positive: the increase in penetration would be proportionally less than the growth reduction, resulting in a *lower* score for the composite indicator, even if the situation on the ground has improved. Assume mobile broadband penetration increases by ten subscriptions over a four-year period, while growth in penetration – the second component of the proposed composite indicator – slows down over that period. If the relative reduction in growth is larger than the relative increase in the number of subscriptions, the score of the composite indicator would be *lower* after four years, which is not acceptable. Efforts to increase penetration, if successful, will automatically be reflected in an increased mobile penetration rate and in a higher score.

Finally, there is no data on subscriptions by age. The indicator is typically collected by the regulator from telecommunication operators, which don't attach socio-demographic information to the subscriptions data.

**Fixed-broadband subscriptions per 100 inhabitants**

**Russian Federation:** Russian Federation does not object to the inclusion of the indicator "Fixed broadband subscriptions per 100 inhabitants" (indicator code i992b) of the sub-index.

**Response from the ITU Secretariat:** We acknowledge and thank you for your comment.

**India:** Indicator namely "Fixed broadband subscriptions per 100 inhabitants" may be replaced with a composite indicator having following three indicators with equal weightage: - (i) Total Fixed broadband subscriptions (ii) Growth rate of Fixed broadband subscriptions over last 5 years. (iii) Fixed broadband subscriptions per 100 inhabitants of 18+ population. The reason for suggesting composite indicator is that economies having large population should not be at disadvantage.

**Response from the ITU Secretariat:** Please refer to the Secretariat's response to India's comment on *Mobile-broadband subscriptions per 100 inhabitants* for more information.

**Bahrain**: We have a comment regarding the indicator "Fixed broadband subscriptions per 100 inhabitants". Noting that there are comments from many member states on the current methodology for calculating fixed broadband penetration rate (i.e., using households as a denominator instead of population). Considering the ongoing discussion in the sub-group for fixed broadband to explore options for the Fixed broadband penetration rate. We propose not to refer to Fixed broadband subscriptions per 100 inhabitants but to use a general terminology "e.g., Fixed Broadband penetrations rate" (Based on the latest agreed methodology). The purpose of this proposal is to reflect any change in the methodology of calculating the fixed broadband penetration rate in the future IDI, especially that the new IDI, if it is approved, will maintain for four years.

**Response from the ITU Secretariat:** We have adopted the suggested terminology in the Version 2 document.

**Oman**

- Referring to the previous meetings on the IDI and discussions on the inclusion of "Fixed Broadband Subscriptions per 100 inhabitants", many countries including the Sultanate of Oman clearly objected on the inclusion of this indicator, and again the Sultanate of Oman is not changing its position on this regard. We believe that the ITU should consider the outcomes of the previous discussions and either remove indicator or propose new suggestion.
- Fixed Broadband as a service is taken by households (families) or housing units rather than individuals, and considering the large family size in many Asian & African countries, the results of calculation by population will create discrepancy between the figures and the actual penetration (not giving a correct indication on the penetration of fixed broadband).

- We argue that the use of population rather than households results in a systematic bias favoring developed nations to developing nations. We believe that this is not ITU's intention, but the results will create the bias and will not be sufficient for measuring ICT development.
- The ITU Zero Draft provided justifications on calculating the indictor by population and not household. We understand the first justification regarding data availability and the definition issue.
- However in the second justification, the ITU mentioned that "dividing by the number of households assumes that only households subscribe to fixed broadband. This is not the case, as a large share of fixed-broadband connections are subscribed to by businesses and the number of businesses per population varies greatly across countries." In this case using population is also insufficient.
- The ITU has jumped into conclusions to recommend using the population as a denominator, describing it as a superior alternative to households, despite the fact that there is an EGTI sub-group still studying the issue and concerns from developing countries are still unresolved. However, and despite the unfinished work of the sub-group, the indicator is retained.

Therefore, the indicator must be removed or replaced with another indicator.

**Egypt**

- We have previously raised concerns on the mentioned indicator, and the ITU established a discussion to explore changing the methodology of calculating fixed broadband subscriptions penetration. Therefore, the new IDI should consider the outcome of the discussion.
- Indeed, there is generally only one fixed internet subscription per household, unlike mobile internet subscriptions where you can find several subscriptions in a single household. As a fixed connection is inevitably linked to a physical address, the household is in our opinion the most correct denominator.
- We stand on different sides with the ITU regarding whether advantages outweigh disadvantages or vice versa. We agree that the use of households also has limitations, such as poor data availability of number of households, and the fact that fixed connections are also used by organizations. However, it is our belief that the advantages outweigh the drawbacks, and that households are preferable to population, while the ITU Secretariat states that they are unsure if advantages offset the disadvantages. It is therefore becoming a must to resort to the detailed study that is being prepared by the EGTI sub-group and to carefully and methodologically study the advantages vs the disadvantages.
- Consequently, we believe that the current analysis is not sufficiently based on scientific evidence. We therefore advise the ITU to produce a comparison of the value of the indicator when using households versus population as denominator. We furthermore recommend performing this analysis on a representative sample of members, provided that these members do not object to being used as sample countries. The results could finally be cross referenced to the calculated score in the draft IDI Index.
- It is a matter of fact that fixed broadband subscription per 100 inhabitant indicator and its method of calculation was ONE OF THE subjects of debate and non-consensus in the IDI 2020 methodology, and proposing and retaining it as is despite everything is problematic.

- On another note we suggest that the indicator could specify the technology type (Fiber, FWA, copper, etc)

  **Response from the ITU Secretariat**: Unfortunately data availability is too limited.

**Qatar**

- The definition of this indicator has been discussed by a forum of Arab regulators among who there is general consensus that it is recommended to measure the indicators per 100 households instead of per 100 population. We have previously raised concerns on the mentioned indicator, and the ITU established a discussion to explore changing the methodology of calculating fixed broadband subscriptions penetration. Therefore, the new IDI should consider the outcome of the discussion.
- Indeed, there is generally only one fixed internet subscription per household, unlike mobile internet subscriptions where you can find several subscriptions in a single household. As a fixed connection is inevitably linked to a physical address, the household is in our opinion the most correct denominator.
- We argue that the use of population rather than households results in a systematic bias favoring developed nations to developing nations. We do not believe this is ITU's intention, but it is nevertheless the result.
- Fixed broadband subscriptions include residential subscriptions as well as business subscriptions and calculating business subscriptions in relation to the number of population is also considered insignificant.
- We stand on different sides with the ITU regarding whether advantages outweigh disadvantages or vice versa. We agree that the use of households also has limitations, such as poor data availability of number of households, and the fact that fixed connections are also used by organizations. However, it is our belief that the advantages outweigh the drawbacks, and that households are preferable to population, while the ITU Secretariat states that they are unsure if advantages offset the disadvantages. It is therefore becoming a must to resort to the detailed study that is being prepared by the EGTI sub-group and to carefully and methodologically study the advantages vs the disadvantages.
- The ITU has jumped into conclusions to recommend using the population as a denominator, describing it as a superior alternative to households, despite the fact that there is an EGTI sub-group still studying the issue and concerns from developing countries are still unresolved. However, and despite the unfinished work of the sub-group, the indicator is retained.
- We disagree with the ITU also that there is ONE decisive factor; which is the data availability; because the percentage of individuals owning mobile phone was accepted as best option despite data availability limitations.
- Despite the fact that data availability is important and may lead to problems as you've kindly stated regarding the IDI 2017, it is also a matter of fact that it may be an urge for countries to fill data gaps. Also other options stated from your respectable side about national sources should not be excluded without a scientific study about its expected results.
- It is a matter of fact that fixed broadband subscription per 100 inhabitant indicator and its method of calculation was ONE OF THE subjects of debate and non-consensus in the IDI 2020 methodology, and proposing and retaining it as is despite everything is problematic.

- Consequently, we believe that the current analysis is not sufficiently based on scientific evidence. We therefore advise the ITU to produce a comparison of the value of the indicator when using households versus population as denominator. We furthermore recommend performing this analysis on a representative sample of nations which could include China, India, USA, Brazil, Nigeria, Australia, Switzerland, Singapore, Qatar and Rwanda in the sample, provided that these nations do not object to being used as sample countries. The results could finally be cross referenced to the calculated score in the draft IDI Index.

- We also recommend carefully studying other options results and, in all cases, wait for the results of the EGTI study group and not retaining the indicator without sufficient evidence and study.

Some further comments.

- ITU writes that there are arguments in favor of and against using HHs instead of population. In the sub-group that is currently discussing this indicator there is increasing agreement that HHs is the better indicator, as the HH is the unit that generates the demand for FBB. Also, different HH sizes, especially between developed and developing nations creates a bias towards developed nations.
- ITU writes that there is very little data availability of HHs from UN PD. The current investigations in the sub-group have highlighted that a lot of nations have recent data available on the number of HHs in the country, but this data has not been collected by UN DP. The reasons for this are unclear. Still, countries like Iceland, Denmark, KSA, UAE, Bahrain have data available on the number of HHs but there are no data on HHs for these countries in the UN DP database. For Qatar, data is available for number of HHs for 2015 and 2020, but in the UN DP database, only data for 2012 is available. Therefore, before any conclusions are made on this indicator, it is absolutely necessary to investigate why the data collection from UN DP is so poor, and solve these issues. This will benefit both the calculation of the FBB indicator and the UN DP's work in general.
- ITU writes that the results of the subgroup will not be ready for this cycle of the IDI Index. As the calculation of this indicator is very important for Arabic countries and developing countries in general, CRA Qatar urges ITU to explore avenues to ensure that the results of the FBB subgroup are considered when deciding on the definition of the FBB indicator.

**Algeria**

- We have previously raised concerns on the mentioned indicator, and the ITU established a discussion to explore changing the methodology of calculating fixed broadband subscriptions penetration. Therefore, the new IDI should consider the outcome of the discussion.

- Indeed, there is generally only one fixed internet subscription per household, unlike mobile internet subscriptions where you can find several subscriptions in a single household. As a fixed connection is inevitably linked to a physical address, the household is in our opinion the most correct denominator.

- We argue that the use of population rather than households results in a systematic bias favoring developed nations to developing nations. We do not believe this is ITU's intention, but it is nevertheless the result.

- Fixed broadband subscriptions include residential subscriptions as well as business subscriptions, and calculating business subscriptions in relation to the number of population is also considered insignificant.

- We stand on different sides with the ITU regarding whether advantages outweigh disadvantages or vice versa. We agree that the use of households also has limitations, such as poor data availability of number of households, and the fact that fixed connections are also used by organizations. However, it is our belief that the advantages outweigh the drawbacks, and that households are preferable to population, while the ITU Secretariat states that they are unsure if advantages offset the disadvantages. It is therefore becoming a must to resort to the detailed study that is being prepared by the EGTI sub-group and to carefully and methodologically study the advantages vs the disadvantages.
- The ITU has jumped into conclusions to recommend using the population as a denominator, describing it as a superior alternative to households, despite the fact that there is an EGTI sub-group still studying the issue and concerns from developing countries are still unresolved. However, and despite the unfinished work of the sub-group, the indicator is retained.
- We disagree with the ITU also that there is ONE decisive factor; which is the data availability; because the percentage of individuals owning mobile phone was accepted as best option despite data availability limitations.
- Despite the fact that data availability is important and may lead to problems as you've kindly stated regarding the IDI 2017, it is also a matter of fact that it may be an urge for countries to fill data gaps. Also other options stated from your respectable side about national sources should not be excluded without a scientific study about its expected results.
- It is a matter of fact that fixed broadband subscription per 100 inhabitant indicator and its method of calculation was ONE OF THE subjects of debate and non-consensus in the IDI 2020 methodology, and proposing and retaining it as is despite everything is problematic.
- Consequently, we believe that the current analysis is not sufficiently based on scientific evidence. We therefore advise the ITU to produce a comparison of the value of the indicator when using households versus population as denominator. We furthermore recommend performing this analysis on a representative sample of nations and include China, India, USA, Brazil, Nigeria, Australia, Switzerland, Singapore, Qatar and Rwanda in the sample, provided that these nations do not object to being used as sample countries. The results could finally be cross referenced to the calculated score in the draft IDI Index.
- We also recommend carefully studying other options results and in all cases wait for the results of the EGTI study group and not retaining the indicator without sufficient evidence and study.

**Singapore**

Fixed-broadband subscriptions per 100 inhabitants: Singapore would like to reiterate our concerns about reflecting fixed broadband subscription on a per capita basis. We note that several countries (Qatar, Saudi Arabia etc) have raised similarly strong objections & instead proposed measuring on a per household basis in the IDI Forum during the 'Zero draft' phase. We request that ITU takes these objections & feedback into deeper consideration.

To recap: By reflecting fixed broadband subscription as such, the penetration rate will not account for the fact that fixed broadband is subscribed to on a household basis and that each subscription is in fact accessed by several (if not all) members of the household. The indicator 'Fixed-broadband subscriptions per 100 inhabitants' therefore underrepresents the proportion of inhabitants with access to fixed broadband. The varying results across countries will therefore be due to different household size instead of real access differences, making it more difficult to compare the data across countries.

We note ITU's explanation that the proxy indicator "Proportion of households with internet access" is less precise as it includes access to the Internet by any service including narrowband or mobile networks. However, such access is still within the scope of universal connectivity which this indicator is trying to measure. ITU should therefore re-consider using this as an alternative indicator.

**Pakistan**: Fixed Broadband Subscriptions per 100 inhabitants: Using overall population is not appropriate and may create bias against developing countries where a housing unit has a larger number of persons. It may also be noted that fixed broadband connections are used by multiple families in a developing country context. Further, with large availability of mobile connectivity, many low income households in a developing country prefer to subscribe to mobile connections for the overall household use rather than a fixed network which is relatively costly. Therefore, we propose to drop this indicator or if deemed necessary be replaced with Fixed Broadband Subscriptions per 100 Households.

**Response from the ITU Secretariat:** We acknowledge the objections raised to using population as denominator, as well as the limitations associated with using population as denominator. Many countries are proposing to use households as a more conceptually sound denominator. However, as explained in the Version 1 document, data availability on the number of households is extremely poor. The UN Population Division provides the most complete internationally-comparable data on household size (which can then be used to derive number of households). Unfortunately, these data are reported mainly through decennial censuses or other non-regular surveys. Only 35 countries have reported data on household size to the UN Population Division since 2019. The size of households for well over 100 economies would need to be estimated. This is outside the expertise and mandate of ITU.

In addition to the UN Population Division's database, other data sources on household size and composition exist, with potentially more updated data for some countries, such as census microdata and national household surveys. However, these sources are not harmonized.

There are proposals that ITU should work with countries or with the UN Population Division to improve data availability. While we can certainly discuss with the UN Population Division, we do not have the mandate to interfere with their work and the legitimacy, expertise and resources to discuss demographic statistics with all Member States, let alone resolve the issues of availability and comparability.

There have been suggestions that we could use the number of households as collected through ICT household surveys. However, these sources are not harmonized, and are not useable for this purpose.

Household surveys offer two possible alternative indicators. The first is *Proportion of households with Internet, by type of service (Fixed broadband network)*. However, data availability is extremely poor for this indicator with only 25 countries having reported data since 2019. The second is *Proportion of households with Internet access at home*, which is already included in the list of indicators. For this indicator, data availability is higher with 94 countries providing data since 2019. This indicator is less precise though as it includes access to the Internet by any service including narrowband or mobile networks. For example, if a member of the household has a mobile phone with connection to the Internet and makes it available for all members, then it is considered that the household has access to the Internet.

There is currently an EGTI subgroup looking at the denominator for the fixed broadband subscriptions indicator, where all these issues are discussed. Some comments suggest that the conclusions of the subgroup be considered. However, the subgroup will only report to EGTI in September, which is too late if the IDI is to be published in 2023– consistent with the urgency dictated by Resolution 131. That said, the interim conclusions from the subgroup can be considered and discussed at the IDI meeting. The subgroup aims to produce a comparison of the value of the indicator when using households versus population as denominator, as was also suggested by some Member States in the comments. Of note is that the mandate of the subgroup is to study the various denominators for the number of fixed broadband subscriptions. It is not tasked with deciding the best indicator to be included in the IDI.

>>> Considering the comments received so far, the fixed-broadband penetration rate has been added to the agenda of the IDI meeting.

# Feedback on the proposed meaningful connectivity indicators

**Percentage of population covered by a mobile network**

**Russian Federation**: Russian Federation does not object to the inclusion of the indicator “Percentage of the population covered by at least a 3G mobile network” (indicator codes i271G & i271GA) of the sub-index “Meaningful connectivity – Infrastructure”.

**Kenya**: We are in agreement that the indicator on the percentage of population covered by a mobile network, 3G and above is critical considering that 99% our Internet users are on mobile broadband.

**Brazil:** Considering the requirements for meaningful connectivity, we acknowledge that 3G technology does not adequately support crucial aspects of internet usage. While we understand the challenges in deploying 4G or superior infrastructure in many countries and regions, we do not oppose including 3G as an indicator. However, future iterations of the index should raise the threshold to at least 4G to align with the evolving demands of internet usage. Brazil suggests that this recommendation be considered and implemented in subsequent revisions or updates of the IDI Index.

**India:** Composite indicator namely “Mobile broadband coverage” that includes two indicators “Percentage of the population covered by at least a 3G mobile network” and “Percentage of the population covered by at least a LTE/WiMAX mobile network” should be modified as due weightage should also be given to “percentage of population covered by at least 5G mobile network”. Hence, the weightage for the indicators for calculating mobile broadband coverage scope should be – 3G and above: 20%, 4G and above: 60% and 5G :20%.

**Korea (Rep. of):** The inclusion of a 5G indicator- percentage of population covered by a mobile network 5G-in the IDI 2023 is of utmost important, considering its significance in the mobile broadband sector. Since the introduction of 5G services in 2019, number of countries have been deploying the services while many other nations that have not yet deployed 5G are actively preparing for its implementation.

**Response from the ITU Secretariat:** We acknowledge all these comments and agree with the need to progressively raise the bar and that 5G coverage has become the new benchmark. Unfortunately, data availability on 5G coverage is not sufficient to include this indicator in this iteration of index. Only 44 countries have submitted data on 5G coverage for 2021. This indicator is a prime candidate indicator for the next iteration of the index. In the meantime, it could certainly be reported alongside the indicators of the IDI, as several EGTI/EGH members suggested (see Annex 4 of the Version 1 document). This supplemental list could include candidate indicators for future iterations of the IDI. For those countries that have data, those indicators would contribute to paint a more complete picture. Additionally, featuring those additional indicators on the IDI country profiles may encourage countries to collect the data.

**Mobile broadband Internet traffic per mobile broadband subscription and Fixed-broadband Internet traffic per fixed broadband subscription**

**India:** Indicators namely "Mobile broadband Internet traffic per mobile broadband subscription" and "Fixed broadband Internet traffic per Fixed broadband subscription" should be retained.

**Russian Federation:**

- Russian Federation does not object to the inclusion of the indicator "Mobile broadband Internet traffic per mobile broadband subscriptions (GB)" (indicator code i136mwi_subs) of the sub-index "Meaningful connectivity – Infrastructure".
- Russian Federation does not object to the inclusion of the indicator "Fixed broadband Internet traffic per fixed broadband subscriptions (GB)" (indicator code i135tfb_subs) of the sub-index "Meaningful connectivity – Infrastructure".

**Response from the ITU Secretariat:** we acknowledge, and thank you for these comments.

**Korea (Rep. of):** We suggest dividing the mobile broadband Internet traffic per mobile broadband subscription into two categories: LTE and 5G. Network download speed is a crucial metric that directly influences user experience and determines the network's capacity to support various applications and services. Each technology generates a distinct volume of traffic, which allows us to project the actual tendencies of mobile broadband users and identify national trends. In actual traffic usage, it has been observed that the 5G service accounts for a significant percentage of the total mobile broadband traffic compared to the traffic generated from the LTE service.

**Response from the ITU Secretariat:** Unfortunately, we currently don't have data about the share of traffic represented by a specific technology to make this distinction (data is for '3G and above').

**Singapore:**

- Mobile broadband Internet traffic per mobile broadband subscription (GB)

Singapore's view is that this is the wrong indicator as the methodology penalises countries that have high mobile penetration rate. The current approach of calculating Internet traffic based on per subscription basis does not take into consideration that a person may own more than 1 mobile phone, and correspondingly more than 1 mobile broadband subscription. If ITU really sees the need to measure Internet traffic volume and since the purpose of this indicator is to measure the intensity of Internet usage by mobile broadband subscribers & to reflect the quality of the ICT infrastructure from the end-user's perspective, it would instead be more logical for ITU to look at this indicator from a user standby and measure Internet traffic based on a per user instead of per subscription.

**Response from the ITU Secretariat:** ITU collects administrative data on *subscriptions* rather than *subscribers*. Additionally, the number of Internet users is a survey-based estimate and capture both mobile- and fixed-broadband service users. The choice of using subscriptions as the denominator is motivated by the fact that additional subscriptions generate additional traffic, thus making subscriptions a direct scaling factor that allows a comparison of countries of different size. Internet users, by contrast, would be an indirect scaling factor biased by the combination of fixed and mobile service usage. Using other denominators, such as population, may be similarly biased by differences in penetration rates.

- Fixed-broadband Internet traffic per fixed broadband subscription (GB)

Singapore does not collect this data currently. Singapore also notes that only 115 out of 196 countries (59%) provide data for this indicator. Given the low data availability, we request ITU to share more details on how it intends to collect the data as well as estimate the data for countries that do not provide this data.

**Response from the ITU Secretariat**: Due to a lack of established, reliable methodologies for estimating traffic volume, the ITU cannot commit to producing traffic estimates in a similar manner as for other indicators such as Internet users, subscriptions or network coverage. For the purpose of the IDI, a simple method (such as a hot deck imputation method) will be used to estimate the traffic data for the countries that do not submit data. These estimates will be used to calculate the IDI score but will not be published separately (unlike the estimates for the other indicators).

**United Arab Emirates:** The internet Traffic (MBB and Fixed broadband) may not be very relevant, as they are not connected to the number of subscriptions a country has, whether it is a few thousands or tens of millions. If this approach is used, a country with a very low Mobile broadband penetration rate may perform better than a country with a high penetration rate; this also applies to the traffic of Fixed Broadband indicator.

**Algeria:** The internet Traffic (MBB and Fixed broadband) may not be very relevant due to two reasons: first, it is not connected to the number of subscriptions a country has, whether it is a few thousand or tens of millions; second, there may not be much variation in usage between countries.

**Response from the ITU Secretariat:** Both mobile and fixed broadband traffic are measured at the end-user point, so the indicators are directly related to subscriptions and reflects usage. It is arguably a better measure of usage than international bandwidth, which is prone to be affected by transit hub bias. Variation in the data of this indicator is relatively large, as indicated in Table 7 of the Version 2 document.

>>> Considering the comments received so far, mobile-broadband traffic has been added to the agenda of the IDI meeting, to discuss if the number of subscriptions the right denominator to use and whether participants agree with the estimation procedure whereby the estimates will not be published.

**International bandwidth usage (bit/s) per Internet user**

**Algeria:** It is suggested to consider the international bandwidth capacity indicator.

**Response from the ITU Secretariat:** As explained in the Version 1 document, measures of international bandwidth usage suffer from several limitations. First, end-user experience (which is a key concern for meaningful connectivity) is not only determined by international, but also by middle-mile and last-mile connectivity. However, ITU is not collecting statistics on many of the middle mile elements that influence international bandwidth usage (such as local cache, off-peak load, presence of CDN). Second, while low values of the indicator can signal lack of connectivity for users, high values can often be biased if a country is a connectivity transit hub. Third, many countries do not collect this indicator, and many are estimating it based on domestic traffic data, thus limiting international comparability. The problem is amplified by the fact that a non-negligible share of traffic is not carried over the open Internet and by a lack of transparency of international cable operators about pricing and usage. For these reasons, this indicator is not a suitable candidate for inclusion.

**Speed of Internet connection**

**Algeria**: Speed of Internet connections: As you write there is currently no agreed methodology for measuring actual speeds and the results from Ookla, OpenSignal, etc., may follow different procedures. I would recommend that ITU establishes common international standards/guidelines for speed measurement. Then independent audit firms could audit whether these speed measurements comply with the standards. If they do, then the results can be used as valid and reliable measurements. Actual speeds are becoming increasingly important and the area would benefit greatly from standardization of measurement methodologies.

**Response from the ITU Secretariat:** We agree with this comment that calls for more and better international standards for measuring quality of service (QoS), including actual connection speed. The refinement of the QoS indicators (e.g., specifying a globally harmonized methodology for sampling speed tests) was indeed added to the future work agenda of EGTI in September2022. Work can commence once there is sufficient expression of interest, but so far, the topic has not gathered enough volunteers to form a subgroup.

**Affordability**

**Russian Federation**

- Russian Federation does not object to the inclusion of the indicator "Data-only mobile-broadband basket price (as % of GNI per capita)" (indicator code i271mb_ts_GNI) of the sub-index "Meaningful connectivity – Affordability".
- Russian Federation does not object to the inclusion of the indicator "Fixed-broadband Internet basket price (as % of GNI per capita)" (indicator code i154_FBB_ts_GNI) of the sub-index "Meaningful connectivity – Affordability".
- It should be noted, that other price baskets included in the ICT Price Baskets toolkit (ICT Price Baskets – IPB) may also be considered for inclusion in the IDI.

**United Arab Emirates:** For a better measurement of affordability, cheapest plan that include voice, data and SMSs is suggested to be used, including Data and voice low-usage basket (70 min, 20 SMS, 500 MB).

**Algeria:** Plans that include voice and SMSs to be used to measure affordability, data only plans may not be a perfect measure. The price baskets are good to be used, but these baskets need further review and updates.

**Kenya**: Affordability: "Data-only mobile broadband basket as a percentage of GNI p.c." This means that the data will reflect data-only tariffs. This is quite limiting considering that most tariffs in our country are bundled and we believe it's the case for most developing countries.

**India:** For indicators – "Data-only mobile-broadband basket price (as % of GNI per capita)" and "Fixed-broadband Internet basket price (as % of GNI per capita)", value of affordability indicators should be taken in Purchasing Power Parity (PPP) $. Also in addition to data only basket price, voice and data basket price such as (i) Mobile (voice and data) high consumption basket (PPP$) (ii) Mobile (voice and data) low consumption basket (PPP$) may also be added.

**Pakistan:**

- Earlier comments are reiterated: "While measuring affordability in terms of GNI p.c.; Purchasing power parity may also be considered to make it comparable across countries." Affordability indicators should be in terms of PPP.
- "Data-only mobile broadband basket as a percentage of GNI p.c." may be reviewed as most of the subscriptions are in terms of bundles wherein voice and data are available. The same may be addressed appropriately.

**Response from the ITU Secretariat:**

- **On bundled plans**: In addition to the *Data-only mobile broadband basket*, ITU statistics are also available for a *Mobile data and voice high-consumption basket* (2 GB, 140 min, 70 SMS). Bundled plans may be included in data-only mobile baskets if they are cheaper than mobile data-only plans (which is the case in many countries). Policy targets on affordability, such as the UN Broadband Commission's 2% GNI p.c., refer to the *Data-only mobile broadband basket*. For the sake of consistency, it is proposed to use this basket. The two baskets – *Data-only mobile broadband* and *Mobile data and voice high-consumption* – are very highly correlated (0.88). Replacing the former with the latter would therefore make very little difference.

>>> Considering the comments received so far, the choice of the mobile basket to include (*data-only* or *voice-data-sms basket*) has been added to the agenda of the IDI meeting.

- **On the use of PPP:** Affordability is a *relative* measure. Expressing the price of a monthly service ('basket') as a share of gross national income per capita per month is therefore the most appropriate approach. In contrast, prices expressed in purchasing power parity allows to compare prices across countries. This approach accounts for differences in *purchasing power*, without regard for difference in *income levels*. Our analysis reveals that the correlation between PPP measures and other indicators in the universal and meaningful groups are significantly weaker, thus reducing the robustness of the framework.

**<u>Percentage of individuals owning a mobile phone (and Households with a computer)</u>**

**India:** Indicator -"Percentage of individuals owning a mobile phone" is to be modified as 18+ population to be used as base to this indicator. However data is not available in ITU data base for 2021 but for subsequent years data will be provided by India.

**Russian Federation:** Russian Federation objects to the inclusion of the indicator "Percentage of individuals owning a mobile phone" (indicator code xHH18) of the sub-index "Meaningful connectivity – Device" due to the very low collection rate of the indicator (only 58 out of 193 Member States provided information on this indicator in 2020-2021), as well as difficulties in identifying owners of mobile phones, which work in 3G/LTE networks, since the second generation of mobile communications (GSM) cannot be considered as broadband communication devices, which is the central concept of IDI – meaningful and universal connectivity to broadband networks.

**Pakistan:** "Percentage of individuals owning a mobile phone" may not be used as limited number of operators are reporting this indicator and collection of information / ownership is also not well defined. Further, any modified indicator should be in terms of 15+ or 18+ years of population rather than the whole population.

**Response from the ITU Secretariat**: Please note that this indicator is derived from household surveys – not from operators.

**Algeria:** The Percentage of individuals owning a mobile phone is not very relevant because we have to ensure that this phone is smartphone.

Regarding the indicators "Percentage of individuals owning a mobile phone", taken from household surveys, and retained for the IDI 2023, it is true that they are relevant but given:

- The availability of data that did not reach the threshold for the years 2020 and 2021.
- The last three years, and because of the Covid-19 pandemic and the economic crisis that the world has experienced, surveys in most countries have not taken place.

**Response from the ITU Secretariat:** Developing and calculating the new index involves trade-offs between relevance and data availability. We established a threshold for data availability, which is why this indicator was initially excluded. However, considering the relevance to the concept, the strong support from EGTI/EGH members for its inclusion, and experience in computing estimates for this indicator, this indicator was included in Version 1 of the proposal.

Concerning the issue of smart phone *versus* mobile phone, smart phone is a subcategory of mobile phone, but data availability is very poor: only 26 countries have reported data on smartphone ownership since 2019. In addition, ownership of any mobile phones including non-smart phones is still relevant to ICT development. An individual who owns a mobile phone is more connected than an individual who doesn't. For these reasons, overall mobile phone ownership remains the best option for the IDI.

Concerning a possible age cut-off, it is indeed the case that children are less likely to own mobile phones. However, the definition of ownership covers individuals who are in sole possession of a mobile phone. That is, another person (e.g., a parent) may have paid for the phone and any ongoing subscriptions, but if the individual in question has full access to the device s/he is considered its owner. From the ITU's *Manual for measuring ICT access and use by households and individuals*:

> *An Individual owns a mobile cellular telephone If he/she has a mobile cellular phone device with at least one active SIM card for personal use. It includes mobile cellular phones supplied by employers that can be used for personal reasons (to make personal calls, access the Internet, etc.) and those who have a mobile phone for personal use that is not registered under his/her name. It excludes individuals who have only active SIM card(s) and not a mobile phone device.*

As a result, ages 18 and older may be too high of minimum age for this indicator. In addition, as countries submit data for different age ranges aligning all countries based on the same in-scope population range is not possible at this time. Although ITU's *Manual for measuring ICT access and use by households and individuals* (Chapter 7, page 171) recommends collecting data for all individuals aged 5 and above, many countries already do not survey children (and/or older persons). An analysis of data availability for this indicator found that the median lower bound for in-scope age was 10 years old. This is broadly in-line with the age that children might reasonably be expected to begin to own mobile phones where families have resources (https://childmind.org/article/when-should-you-get-your-kid-a-phone). Further alignment of ages would have costs. Notably, many countries that provide overall mobile phone ownership data do not provide breakdowns by age. Given that this indicator already has a low level of data availability it would require an unacceptably high level of estimation.

>>> Considering that several EGTI/EGH members called for including this indicator, whereas several comments by Member States called for excluding it, the question of whether to keep or exclude *Percentage of individuals owning a mobile phone* has been added to the agenda of the IDI meeting.

**United Arab Emirates:** Since there is no ranking for the new IDI2023, it would be useful to include indicators that are relevant regardless of the percentage of their availability as to encourage countries to collect these important indicators; a good example is the percentage of Households with computer.

**Response from the ITU Secretariat**: We agree that inclusion of this indicator and other with limited coverage may encourage countries to collect data for those. However, it would mean that the aggregate scores would be based on a set of indicators that is different across countries which would undermine the comparability of overall scores among countries and the ability to produce regional averages. One solution, suggested by several EGTI/EGH members, would be to report this and other relevant indicators next to the IDI indicators. This 'supplemental list' would provide a more holistic picture. It would also be immediately clear when data is missing.

**<u>Skills</u>**

**India:** Indicators – "Mean years of schooling" and "Expected years of schooling" should be dropped, reason being that just schooling should not be taken as base for ICT skill and this proxy may not be a good practice. Many people are well conversed with ICT skills who have not gone to schools.

**Russian Federation:**

- Russian Federation objects to the inclusion of the indicator "Mean years of schooling" (indicator code MYS) of the sub-index "Meaningful connectivity – Skills" due to the fact that the indicator does not reflect the acquisition of digital skills in the learning process.
- Russian Federation objects to the inclusion of the indicator "Expected years of schooling" (indicator code EYS) of the sub-index "Meaningful connectivity – Skills" due to the fact that the indicator does not reflect the acquisition of digital skills in the learning process.
- Instead of mentioned 2 indicators on digital skills, Russian Federation proposes to use the indicator "Proportion of Schools Connected to the Internet" as a proxy indicator for digital skills using data from the UNESCO/ITU GIGA Initiative and data from Member States.

**Korea (Rep. of):** The proposed indicators for assessing skills may not adequately capture the complexity of digital literacy, considering the variations in education policies, legislation, and curriculum composition across different countries. In this regard, the existing ITU ICT SDG Indicator, percentage of individuals with ICT skills, can provide a more suitable framework for evaluating ICT skills.

**Singapore:** Mean years of schooling (ISCED 1 or higher), population 25+ years & Expected years of schooling (school life expectancy). Singapore has concerns on using these 2 indicators as proxy indicators of ICT skills. There are several reasons:

- Singapore's opinion is that measuring the mean years of school or expected years of schooling does not translate into ICT skills (i.e. there is no direct & clear relationship between the 2),

- Each country has different schooling system (including the number of years at each level), therefore using these as a proxy would also not produce meaningful insights for countries to learn from others.

- Using 25+ years as the population range to measure will exclude the young (i.e. below 25 years) who represents a key age group that is increasingly exposed to ICT skills from young age, this would hence render the insights from this indicator incomplete and inaccurate since a key segment is excluded

Instead, ITU collects data on ICT skills (which SG submits currently) and this segregated into basic, standard and advanced skills. We propose that ITU considers using this indicator instead.

**Algeria:** The current indicators for ICT skills and the suggested indicators in this document are both unrelated and irrelevant to ICT skills and need to be updated. We believe that these indicators should be directly related to ICT skills, considering data already collected annually by the ITU, such as data for the Digital Development Dashboard. We believe that we can use the three sub-indicators of the Digital Development Dashboard to indicate ICT skills in a given country, including (i) individuals with basic skills, (ii) individuals with standard skills, and (iii) individuals with advanced skills.

**Pakistan**

Earlier comments are reiterated: "It has been observed that people in developing countries are users of internet and other digital services with good knowledge base despite their low educational background. Therefore, indicators of secondary and tertiary education to proxy for the digital literacy / knowledge may be reviewed in a developing country context and in pursuit of a better measure." HH survey based info may be considered. Further, proposed indicators such as "Mean years of schooling" and "Expected years of schooling" do not reflect digital skills as submitted earlier: schooling should not be a base for digital skills. Many individuals who did not attend schools are well converse with basic ICT skills. Therefore, inclusion of schooling indicators for digital skills in IDI is not supported and should be dropped.

**Brazil**

The Brazilian Regulatory Agency (ANATEL), along with the Ministry of Communications (MCom) and the Brazilian Network Information Center (NIC.br/Cetic.br), recognizes the crucial importance of refining the elements that comprise the IDI to establish a solid index. As a committed Member State in fostering inclusive and robust digital ecosystems, Brazil would like to present two important points for ITU's consideration in the current version.

In addition to the feedback provided in the "Draft Zero version", Brazil highly appreciates the opportunity to provide further comments on the document regarding the revision of the ICT Development Index (IDI). First, we emphasize the importance of including the indicator on Percentage of individuals with ICT skills in the IDI, as it plays a pivotal role in shaping future ICT policies. Brazil acknowledges and commends ITU's efforts in this regard and urges continued collaboration to ensure the inclusion of this indicator. Secondly, we recommend that in future iterations of the IDI Index the threshold for infrastructure connectivity should be least 4G to align with the evolving demands of internet. These two comments are outlined in detail below.

ANATEL, MCom and NIC.br/Cetic.br recognize the crucial importance of this pillar for the robustness of the IDI index. The concept of Meaningful Connectivity is gaining significant prominence in shaping future ICT policies in Brazil and globally. Therefore, we believe it is essential to include an indicator on ICT skills or at least a proxy for it (e.g. education level) in the IDI Index.

Regarding indicators to this pillar, we see two possibilities. The first is to reinstate the ICT Skills indicator derived from household surveys, which was previously removed despite being present in 69 member states. We acknowledge that including this indicator is complex, as discussions are still ongoing at the EGH subgroup regarding a methodology to consolidate the multiple categories into smaller composite indicators. The second option is to accept the proposed proxies as an alternative. Working with proxies has limitations, but it offers a feasible solution to reduce the burden of estimating data for Member States lacking this information.

Regardless of the chosen option, Brazil advocates for keeping this dimension in the IDI Index, and we urge ITU and other international organizations to encourage, support, and assist member states in producing and reporting this indicator.

**Response from the ITU Secretariat**: The survey-based ICT skills indicator was excluded for data availability reasons (69 economies) as well as for the complexity of aggregating the various activities into one score. At first, these activities were grouped in three broad categories: basic, standard and advanced ICT skills. A subgroup of EGH has been at work since 2018 to group the activities in more relevant categories and to propose an overall score based on the reported activities. As a result of the work of the subgroup, activities are now grouped into five categories of digital skills: communication/collaboration; problem solving; safety; content creation; and information/data literacy. Work is still ongoing to aggregate the data into one overall skills score. Until the work of the subgroup is finalised, and data availability is sufficient, this indicator cannot be included in the IDI.

The alternative is therefore to look for indicators that could serve as proxy measures for ICT skills. The 'Zero draft' proposed two enrolment rates and Mean years of schooling (consistent with the old IDI), but several EGTI/EGH members considered these proxies as too remote, while other proposed alternatives. Based on these comments, we proposed *Mean years of schooling* and *Expected years of schooling* as replacement. These two indicators are strongly and positively correlated with one another, as well as with many of the other indicators, including those in the universal connectivity group. But the comments above reveal that a few Member States have concerns about these measures, too.

>>> Considering the comments received so far, the identification and inclusion of proxy measures for ICT skills has been added to the agenda of the IDI meeting.

**Security and safety**

**India:** A new indicator "Global Cyber Security Index" may be added as it is an important component of meaningful connectivity.

**Response from the ITU Secretariat**: Safety and security is indeed an enabler of meaningful connectivity. ITU's Global Cybersecurity Index was considered as a candidate indicator for measuring this important aspect. However, as explained in the first two version of the documents, the GCI assesses countries' *commitments* to cybersecurity. As such, it does not fit the framework, which focuses on outputs rather than inputs. In addition, the GCI's methodology is still evolving and is not stable yet. Introducing it in the IDI would affect comparability over time, as a change in this indicator may be due to a change in the methodology rather than a change in the performance. But we encourage stakeholders to consider all the available information when making decisions. This means going beyond the IDI and beyond ITU; using additional data points, such as the GCI will produce a more holistic picture.

## Feedback on the statistical assessment of the proposed indicators

No comments received.

## Feedback on normalization, aggregation, and weighting

**Korea (Rep. of):** In order to ensure precise and comprehensive statistical analysis, we highly recommend adjusting the statistics cap from 95% to 100% for indicators number 1 to 4 and 7 to 11. By raising the cap to 100%, we will be able to achieve a more accurate assessment of the data and capture a complete representation of the indicators' measurements.

**Russian Federation**: In case of the decision to restrict the upper limit of the values of indicators included in the new version of the IDI, it is reasonable to proceed from reaching the threshold of 90-95% of the values of each of these indicators. At the same time, one of the possible solutions that could improve the importance of IDI is the introduction of a cluster system for countries based on the different levels of development with a separate calculation of IDI for each of the clusters."

**Response from the ITU Secretariat**: When setting goalposts for the universality indicators, the concept of universality must be interpreted loosely. For individual usage, it is neither expected nor desirable that all children use the Internet. Indeed, approaches to bringing children online varies across geographies. When picking the goalpost, one must also consider that, among the population, some individuals do not want to use the Internet, even if they have access to it and can afford it. For these reasons, the goalpost for Internet users should be set at a value slightly below the 100% mark. We suggest the goalpost to be set at 95%. This means that a country with a share of 95% or more will get a score (i.e., a normalised value) of 100 on this indicator. The same approach would apply to the indicator "Individuals owning a mobile phone", part of the connectivity enabler "Device". While universality is the objective, the goalpost should be set at a lower value, because some people may not want to own a device. The same logic applies to the indicator "Households with internet access", reflecting the reality that some households may not want to have access at home and accounting for possible measurement errors.

**Russian Federation:** Indicators that do not have statistical significance, such as indicators of the sub-index "Meaningful connectivity – Skills", and indicators for which there is insufficient data collection, which may lead to a situation similar to 2018. In this regard, it is reasonable to consider this sub-index only if there is sufficient data collection for the indicator "The percentage of individuals with ICT skills".

**Qatar:** We need to have a visibility on the weight for each indicator and sub-indices which will be used for calculating the IDI and based on what.

The first 3 pillars are clearly related to telecom and the internet, while the 4th pillar regarding skills is more broadly related to skill levels in general and as such is not collected by NRAs. We would therefore propose that the 3 first pillars are weighted equally with e.g. 2/7 each, while the 4th pillar on skills is weighted with half the weighting equal to 1/7.

**Algeria:** We need to have a visibility on the weight for each indicator and sub-indices which will be used for calculating the IDI and based on what.

The first 3 pillars are clearly related to telecom and the internet, while the 4th pillar regarding skills is more broadly related to skill levels in general and as such is not collected by NRAs. I would therefore propose that the 3 first pillars are weighted equally with 2/7 each, while the 4th pillar on skills is weighted with half the weighting equal to 1/7.

In this version 01 of the IDI 2023, an equal weighting has been proposed for all indicators, and also for each of the pillars, whereas as already discussed in the forum on version "0" the competence indicators, which measures the education level of individuals and not ICT skills should not have the same weighting as other ICT indicators.

Thus, and being the weighting, a very important step in the methodology of the index, it is suggested to review this weighting, once there is consensus on the choice of indicators.

**Response from the ITU Secretariat**: Conceptually, there are two groups of indicators: universal connectivity indicators and meaningful connectivity (UMC) indicators. The correlation analysis (presented in detail in Annex 3 of the Version 1 document) revealed that all indicators are positively correlated with one another. This suggests that they measure different aspects of the multidimensional concept of UMC. While no significant trade-offs were identified between the indicators, some compensability cannot be ruled out (i.e., weakness in one indicator may be compensated by strength in another).

For the weighting scheme, one intuitive and neutral approach is to mirror the two dimensions of the UMC concept, by averaging the scores of the *Universal connectivity* pillar and of the *Meaningful connectivity* pillar. The scores of the two pillars would be the average of the individual indicators included in each pillar, so that the pillar score provides a balanced summary of the underlying information. In the absence of a clear conceptual and statistical justification, this neutral approach consisting in applying equal weights at each level of aggregation (i.e., pillar level and overall level) should be preferred. With this approach, the assumption is that the main conceptual components are the two pillars and that the individual indicators within each pillar contribute in a similar extent to the performance of the pillar. The subsequent statistical analysis does not reject this neutral and intuitive approach. For these reasons, we proposed this approach in the Version 1 document and again in the Version 2 document (Figure 3). The statistical analysis does not reject this neutral and intuitive approach.

An alternative approach would be to consider individual indicators as the main conceptual components (instead of the two pillars). In this case, the overall index score would be the average of the scores of the individual indicators. Each indicator would have the same weight in the overall IDI, unlike the other approach where the implicit weight of individual indicator depends on the number of indicators in the pillar. The pillar scores could still be computed and reported (but the average score of the two would not correspond to the overall IDI score).

There should be strong empirical evidence to justify departing from one of the two approaches above for the weighting scheme.

Regarding the weight on skills, a composite indicator made up of the ICT skills collected by ITU would be the first-best solution for the purpose of measuring meaningful connectivity. If data availability was sufficient, there would be no conceptual or statistical justification to treat ICT skills as a 'lesser enabler'. But data availability for ICT skills being too low for now, the first question to address is whether to use proxy measures, such as the ones in the 'Zero draft' (enrolment rates), Version 1 (*Expected years of schooling* and *Mean years of schooling*) and in some of the comments (e.g.

*Schools connected to the Internet*). This issue will be discussed at the IDI Meeting. Should a proxy measure be adopted, a statistical analysis will inform the weight to be placed on this proxy measure.

>>> Considering the comments received so far, notably regarding the inclusion of one or more proxy measures for ICT skills and their weight in the index, weighting has been added to the agenda of the IDI meeting.

# Any other feedback on the document

**Suggestions for new or additional indicators**

**India**

India proposes that following indicators may be added in the IDI under universal connectivity:

- "Fixed broadband with speed equal to or above 10 Mbits/subscriptions per total fixed broadband subscriptions" reason being that it is extremely important to ensure that 10Mbit/s to be included as low speed cannot be a good measure of universal connectivity.
- "Fibre to the home/building Internet subscriptions per total fixed broadband subscriptions" as apart from fixed broadband connections it is important to ensure that fibre connections which are most reliable should be included in universal connectivity.
- "M2M mobile network subscriptions" as Machine to Machine connections should also be taken as a measure of universal connectivity

**Response from the ITU Secretariat**:

- Regarding speed, as mentioned in Version 1, the breakdown by speed tier for fixed broadband subscriptions could be considered for inclusion as well. The argument is that subscriptions using a faster connection speed allow for better quality online content, a better experience for customers and more connected devices. Some of the comments on the IDI forum highlighted this as well. While this is certainly true, there are some limitations. First, the indicator reflects *advertised* speed, and not *actual* speed.[6] There are other indicators that provide a direct measure of speed or an indicator on fixed broadband traffic. These are discussed in the infrastructure section. A second consideration is conceptual. The definition of meaningful connectivity implies that a user should be able to do whatever they want, without prescribing any specific online behaviour. While a faster connection is preferrable, it is not possible to set a goal post as this would amount to prescribing an ideal speed, which in turn would prescribe a certain type of usage. Finally, using the indicator for total fixed broadband subscriptions instead of the breakdown by speed tiers increases the availability of data Finally, if retained, the denominator should not be total fixed broadband subscriptions, as a country with only a few of those subscriptions which are all fast would get a higher score than a country with many subscriptions, but which may not all be fast.
- A similar problem occurs with the indicator "Fibre to the home/building Internet subscriptions per total fixed broadband subscriptions", for which data availability is also insufficient (available for 74 countries in 2021 and 83 countries in the 2020-2021 window).

[6] In general, differences between advertised speed and actual speed are due to network overload, user congestion, or more devices being added to the network (connected devices). Other factors that may also affect performance are, for example, interference or environmental factors.

- M2M subscriptions were not considered as part of the framework for two reasons. First, because of conceptual grounds, M2M subscriptions cover a wide range of use cases (from smart meters to livestock tracing, to industry 4.0 technologies, etc.) that limit international comparability and cannot be fully aligned to the scope of universal connectivity in a coherent manner. Second, because the EGTI subgroup that closely investigated the ITU M2M subscriptions indicator scope highlighted an important limitation of the existing definition: it captures part of the activity regarding devices being connected (subscriptions sold for the specific purpose of M2M usage), but it is unable to capture connections among devices that use other networks, i.e., non- licensed spectrum, private networks or some local area networks, among others.[7]

India recommends that the following indicators may also be added in the IDI:

- "Government online services" (Source: UNDESA) may be added under universal connectivity to measure Government efforts to deploy ICT for the benefit of the general population.
- "Regulation of emerging technologies" (Source: WEF) under meaningful connectivity- security may be added as Government participation through regulations should also be made part of the framework.
- "AI scientific publication" (Source- OECD) may be added under meaningful connectivity-skills as a proxy for skills.

**Response from the ITU Secretariat:**

- The Online Services Index, which is part of the UN E-Government Development Index looks at specific applications of connectivity, namely online services. This is outside the scope of the conceptual framework for universal and meaningful connectivity, which looks at the state of connectivity and excludes applications of connectivity. Similarly, regarding the suggestion to include regulation of emerging technologies, regulation is a "lever", a tool to improve connectivity (like policy, investment, tax policies, innovation, etc.). As such, it is outside the scope of the conceptual framework, which focuses on the state of connectivity. The specific indicator proposed is also from a non-official source. For more information on the conceptual framework and its scope, refer to pages 5-6 of the Version 2 document.
- On scientific publications in AI: publications in general do not refer to the digital skills of the population, rather, to the generation of specialized new knowledge by researchers. Furthermore, the field of AI is merely a subset of the scientific domain that could be associated with digital technologies. The indicator would have to be normalized by e.g., total publications or the number of scientific researchers in order to ensure international comparability, which would result in a specialization or performance measure, and suffer from the limitations of bibliometric-based indicators.

**Pakistan:** Earlier comments are reiterated: "The conceptual framework at page 3 describes meaningful connectivity in terms of "productive" online experience; however, does not include productive usage of internet in the society. For example, use of internet for business and other economic activities to enhance productivity and efficiency come under "productive" usage, whereas, many other uses of internet are not considered as productive rather become counter-productive for the society. It is proposed that meaningful connectivity may also include some indictors on the

[7] See Report of the 5G/M2M subgroup to EGTI, 2022 [https://www.itu.int/itu-d/meetings/statistics/wp-content/uploads/sites/8/2022/09/EGTI2022_5G-m2m_Report.pdf]

productive usage of internet." ITU is again requested to work on the issue through its expert group e.g. EGTI. ITU may also review its methodology towards such indicators and should consider other reliable international sources where official sources are not available.

**Response from the ITU Secretariat:** Business use of the Internet was considered, but ultimately dismissed owing to lack of data (see page 10 of the Version 1 document for more information). We welcome proposals for alternative indicators, which would need to come from official sources and offer good coverage and comparability.

**Algeria:** We would suggest that three indicators that were dropped from the original IDI 2017 structure for unavailability to be included again as to avoid any kind of backwards step and also to encourage countries to collect these important indicators; namely Bandwidth per internet user, Households with computer (access) and Mean years of schooling (*already retained for testing against the conceptual framework*). This is in addition to Fibre-to-the-home/building Internet subscriptions (infrastructure).

We would like to note that the indicators selected in this section are measuring the take-up of service by individuals households and entities. but that does not reflect the universality of service itself, so it deserves to think about adding coverage indicators.

**Response from the ITU Secretariat:** the first three indicators are discussed in the Version 1 document. Concerning 'Fibre-to-the-home/building Internet subscriptions', data availability is below the 50% threshold since there are 85 economies with data (43%) in the 2020-2021 window.

**Korea (Rep. of):** Initiatives to study and prepare indicators for new technologies: The Republic of Korea recommends initiating studies on cutting-edge technologies such as IoT, AI, cloud computing, and Metaverse for future revision of the IDI. Conducting studies on these cutting-edge technologies and incorporating them into the IDI framework will enable us to prepare for the future and stay ahead of emerging trends.

**Russian Federation**: Russian Federation proposes an approach by which a number of indicators with sufficient collectability can be included in the IDI 2023 version, and those indicators that are relevant to the telecommunication/ICT development, but currently do not have sufficient collectability, could be included as a list of candidates for inclusion in the IDI (2027 version), which will ensure continuity of work in measuring telecommunication/ICT development.

**Response from the ITU Secretariat:** These are good suggestions, and it is indeed our intention to maintain such a 'supplemental list' of candidate indicators to be considered for the next version of the Index.

**<u>Comments on the reference period</u>**

**Russian Federation:** Calculations for approbation the methodology of the new version of the IDI can be carried out according to data from 2020-2021, but in the future the IDI should be calculated according to data no older than two years. For instance, in 2024 the Index should be calculated based on data of 2022-2023.

**Response from the ITU Secretariat**: This issue was indeed addressed in the 'Version 1' document (pages 7-8). In particular, beyond assessing data availability to guide the *development of the index*, the same reference period will be used for the *computation of the index* in 2023 and in subsequent years. That is, for an edition of the IDI released in year *t*, the reference period will always be *t-3* and *t-2*. Of course, within this reference period, if data is available for both years t-2 and t-3, the most recent (i.e., *t-2*) will be used. For example, for the 2023 edition, the reference period will be 2020-2021. For the 2024 edition, the reference period will be 2021-2022, and so on. The only difference with the 2023 edition is that subsequent editions will be launched much earlier in the year.

**Algeria:** The reference period: We think that we can delay this version one or two months but we should take the last data, that will add more data (2020, 2021 and 2022) and results will reflect the last state in countries.

**Response from the ITU Secretariat:** The resolution insists on the urgency of resuming the publication of the index. If we wait for the results of the 2023 questionnaires to be available, the publication of the IDI will be delayed by at least six months, as we would need to process the data, compute the estimates, and compute the index. This means that the IDI would be launched in 2024 with some 2022 data. The time lag between the index edition (2024) and the reference year (2022) would still be two years. Instead, we propose to publish the IDI still in 2023 and use 2021 as reference year. The lag will be two years, but the index will be released still in 2023.

**Comments on data availability**

**Pakistan:** Indicators where there is insufficient data availability may not be included in the current IDI, while pending these indicators for future IDI, while keeping them for discussion and improvement of data collection.

**Response from the ITU Secretariat:** We acknowledge this comment and agree with this suggestion, made by many other commenters: a supplemental list of indicators, including potential indicators for future iteration of the IDI, could be included in the IDI country profiles.

**Algeria:** "Regarding the issue of data availability, we should not exclude important and relevant indicators for availability reasons. As mentioned in RESOLUTION 131 (REV. BUCHAREST, 2022) Resolve 6, that ITU should establish the criteria on the minimum data availability for Member States to feature in the IDI, working through EGTI/EGH; and Resolve 7 that ITU should consult and seek agreement from Member States not meeting these criteria about proposed methods for supplementing data, including from other sources or from estimations, to enable their inclusion in the IDI."

**Response from the ITU Secretariat:** One of the reasons for which the revised IDI of 2017 could not be computed was that data availability was not duly considered, leading to the selection of indicators that were relevant, but did not have sufficient coverage. It is not sound to have a too large proportion of estimated data points for a specific indicator, and more generally in an index. Additionally, computing estimates is an extremely complex and time-consuming exercise which can be conducted only for a limited number of data points. The Secretariat always submits estimates to the concerned countries, which have the right to reject them, as per PP Resolution 131. The Secretariat also stands ready to help countries improve data availability through capacity building, as per WTDC Resolution 8. It must be noted, however, that that it is often a lack of financial resources – rather than a lack of capacity – that prevents countries from administering household surveys, from which all individual use and household access indicators are derived. This comment seems to contradict a comment made by Algeria that *Percentage of individuals using the Internet* and *Percentage of households with Internet access* may be dropped despite their relevance, due to the lack of data availability (see above).

**Other comments**

**Kenya:** We are in agreement that given the gaps in the proposed IDI methodology, ITU should proceed with measuring the same but hold on the ranking of countries until these gaps are addressed. Draft one is a great improvement from draft zero. We propose that ITU could consider introduction of a cluster system for countries based on the different levels of development with a separate calculation of IDI for each of the clusters. This will address most of the challenges being experienced with the proposed methodology.

**Response from the ITU Secretariat**: It is a possible approach. However, clustering means assigning countries to tiers (Tier 1, Tier 2, Tier 3, etc.) based on their scores, which amounts to a form of ranking. Resolution 131 explicitly dictates that the IDI should be published without ranking. Additionally, the clustering approach is not without limitations: clustering requires setting an arbitrary number of tiers and a threshold for each. Two countries with a very similar performance may end up in two different tiers (say Tier 1 and Tier 2) if they are just below and above, respectively, the threshold. This may lead to misguided conclusions, for example that the performances of the two countries are very different, even though their score is almost the same, or that the country in Tier 1 country is at a similar level as the best country in that tier, even though their performances are very different. Another serious problem with clustering is if it is based on a percentile ranking, for example, countries in the first quartile belong to Tier 1, those in the second quartile to Tier 2, and so on. This goes against the idea that every country can achieve universal and meaningful connectivity. Indeed, if all countries were to achieve an index score of at least 90 out of 100 (and therefore be close or at the ideal state), the percentile ranking would still force the countries into four tiers.

**Pakistan:** Earlier comments are reiterated: "It may be noted that availability of many important ICT indicators (e.g. household survey based internet usage) proposed for IDI do not have regular availability from developing countries; however, these indicators have been included in IDI due to their utmost importance. It is proposed that methodology to estimate such indicators in case of their non-availability may also be proposed, deliberated and adopted in a transparent manner. The estimation methodology should be developed in a manner that countries not collecting such indicators should not be at dis-advantage." In response, ITU has suggested following link: Facts and Figures 2022 (itu.int). The referred estimation methodology seems not address the concern raised above and does not provide sufficient information / disclosure to understand the methodology, therefore, the concern still requires ITU's response. Further, as many countries are not reporting usage data based on household surveys, it is suggested that the usage indicators based on household surveys may please be dropped as submitted in other posts as well.

**Response from the ITU Secretariat**: We use different estimation techniques to estimate missing data points, depending on the indicator, the number and distribution of missing data points across regions and income levels, the availability of historical data, the availability of proxies, etc. As noted in *Facts and Figures,* we are aware of the lower data availability for developing countries. For this reason, we use weighting techniques in our models to attempt to correct for this imbalance and avoid bias toward higher income countries. If the explanations provided in *Facts and Figures* are not deemed sufficient, the Secretariat remains available to provide more explanation to interested parties, while noting that it must retain the necessary freedom and independence to identify and apply the most appropriate techniques depending on the circumstances to produce the most accurate estimate possible in a timely manner. By nature, estimates are not official data. Estimates therefore suffer from a degree of uncertainty that we try to minimize by adopting the best techniques. Estimates are necessarily less precise than real data. However, in the absence of such data, a good estimate is better than no data. Finally, it is noted that Secretariat provides its estimates to the countries for review prior to publication or use in indices. During this review period countries have the possibility of rejecting the estimate.

Comments by Algeria and Pakistan seem to propose two opposite approaches for dealing with missing data: the former recommends including all the important and relevant indicators, regardless of data availability, whereas the latter recommends dropping the indicators with low data availability. The ITU Secretariat's approach aims is to strike a balance: to establish a threshold of 50% data availability (with sone exceptions) and to estimate the missing values. This way, those relevant indicators for which the proportion of missing data is not too large can be included.