

**Report of the**  
**Subgroup on measuring fixed broadband penetration**

Expert Group on ICT/telecommunications Indicators (EGTI)

International Telecommunication Union (ITU)

April- June 2023

July 24<sup>nd</sup>, 2023

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## Index

1. Objectives and context
  2. Conceptual considerations
  3. Data collection and availability
  4. Assessment of the advantages and disadvantages of different measurements
  5. Wrap- up and recommendations
- Appendix 1. Definition of Household
- Appendix 2. Example: distinction of residential/business subscriptions
- Appendix 3. Contributions from participants

## 1. Objectives and context

The 13th Meeting of the ITU Expert Group on Telecommunication / ICT Indicators (EGTI) agreed in September 2022 to create a sub-group within EGTI on “Measuring Fixed broadband penetration”. The objective of the subgroup is to examine the strengths and weaknesses of measuring fixed broadband penetration using the number of inhabitants or households as the denominator for fixed broadband penetration in a country and to provide an assessment of the feasibility of alternative measurement approaches.

Four online meetings have been held with 15 participants from different regions in the world: Europe, Americas, Asia, Africa and Arab countries coordinated by the rapporteur Iñigo Herguera (Universidad Complutense de Madrid, Spain). The meetings offered a forum to discuss and several contributions were presented by TRA Bahrain, Brazil, Costa Rica, Qatar, Sri Lanka, the ITU and the rapporteur.

### The broader context

In order to support the digital development and the formulation and implementation of policies, ITU collects annually a rich set of indicators on fixed broadband access. Data comes from two different sources:

- (a) administrative or supply-side data originating from telecom operators are provided by National Regulatory Authorities for Telecommunications (NRAs), and

- (b) demand-side data from household ICT surveys on the use and access to telecom and ICT services which are usually collected by National Statistical Offices (NSOs).

While both data sources provide indicators on fixed broadband access and use, each have different properties in terms of scope and viable disaggregations. The collection of indicators allows for measuring the digital development in countries, or across countries or world regions. Depending on the objective of analysis, some indicators are better suited than others. Tables 1 and 2 below list the indicators related to fixed broadband access and use.

It is relevant to stress that the choice of an indicator to measure a specific reality for a benchmarking exercise is based on three main criteria: (1) that the indicator measures adequately the goal defined, (2) availability of the indicator for a wide set of countries, and (3) the indicator can be collected in a relatively short period of time and due updating are received in a timely manner.

**Table 1: Survey-based indicators on Internet access and use by households**

**Indicator [ITU Code]**

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**Proportion of households with internet [HH6]**

**Proportion of households with internet, by type of service [HH11]**

- with fixed broadband network
- with terrestrial fixed broadband network
- with satellite broadband network

**Table 2: list of supply-side ITU indicators on fixed network broadband: access and use**

**Indicator [ITU Code]**

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**Fixed-broadband subscriptions [i4213tffb]**

*Breakdown by technology:*

*Cable modem Internet subscriptions [i4213cab]; DSL Internet subscriptions [i4213dsl]; Fibre-to-the-home/building Internet subscriptions [i4213ftth/b]; Other fixed (wired)-broadband subscriptions [i4213ob]; Satellite broadband subscriptions [i271s]; Terrestrial fixed wireless broadband subscriptions [i271fw]*

*Breakdown by speed:*

*256 kbit/s to less than 2 Mbit/s subscriptions [i4213\_256to2]; 2 Mbit/s to less than 10 Mbit/s subscriptions [i4213\_2to10]; Equal to or above 10 Mbit/s subscriptions [i4213\_G10]; 10 Mbit/s to less than 30 Mbit/s subscription [i4213\_10to30]; 30 Mbit/s to less than 100 Mbit/s subscriptions [i4213\_30to100]; Equal to or above 100 Mbit/s subscriptions [i4213\_G100]*

**Fixed-broadband subscriptions for organizations [i4213tfb\_o]**

**Leased-line subscriptions [i4213l]**

**Number of households covered by a fixed wired network, by network technology [i4213cv]**

Number of households covered by the traditional public switched telephone network [i4213cv\_pstn]; Number of households covered by digital subscriber lines networks (excluding VDSL/VDSL vectoring) [i4213cv\_dsl]; Number of households covered by digital subscriber lines networks (VDSL/VDSL vectoring) [i4213cv\_vdsl]; Number of households covered by cable TV networks [i4213cv\_cab]; Number of households covered by Fiber-to-the-premises networks [i4213cv\_fttp]; Number of households covered by other fixed-wired networks [i4213cv\_o]

Tables 1 and 2 show that ITU is collecting and publishing multiple indicators that measure the use as well as the availability of fixed broadband networks for households. For example, if penetration or the take-up rate of broadband is to be monitored there is a well-defined survey-based indicator in the Household ICT questionnaires: “Proportion of households with internet”, which can also be broken down by access network type, including “with fixed broadband”, “with fixed wireless networks” or “with satellite”. If, alternatively, availability of fixed broadband to households is to be monitored, the (supply side) indicator best suited is “Number of households covered by a fixed wired network, by network technology” (i4213cv), and its corresponding sub- indicators “covered by DSL networks”, “covered by cable TV networks”, “covered by fiber-to-the-premises networks” and “covered by a wireless fixed network”. This last set of indicators is collected from administrative data, i.e., the source being operators or NRAs that run regular studies on network coverage.

However, there are few countries with recent available survey-based data on the most relevant indicators. This is partly because many countries do not conduct household surveys on access and use of ICT services on a regular basis. In addition, those that do conduct such surveys often exclude questions on type of service due to the difficulty in assuring that respondents fully comprehend these questions and provide reliable responses.

Data from administrative sources provide additional insights into understanding the state and progress in the deployment and use of fixed broadband infrastructure and services. Often such data are used to fill the void when (timely) survey-based statistics on broadband adoption are unavailable. Ratios of administrative figures benchmarked against demographic information from official statistics such as fixed broadband subscriptions over total population is one frequently used measure, combining data from two distinct sources: population census or surveys and administrative (supply side) data.

## Motivation

The given ratio (fixed BB subscriptions/ population) as such is not a directly representative statistic on the use or take-up of fixed broadband among households or population. By its own construction, it is not extracted from a sample with well identified strata and sample design and with specific properties when used for inference. That is, subscriptions are not equivalent to households with fixed broadband subscriptions. The use of this- or in fact any other similar- ratio is made for convenience and availability of data. It may be used to analyze the evolution over time or even across countries, but there are clear limitations that should be spelled out.

A number of countries see the ratio (fixed BB subscriptions/ population) as one that is not a comparable measure of the broadband penetration provided with fixed networks over households<sup>1</sup>. As the representatives from Bahrain, Oman, Egypt, Qatar and Malaysia in the subgroup discussions pointed out, the ratio does not reflect real take up inside a country because a fixed broadband connection is normally demanded by a household (or by an enterprise or institution), not by individuals. A household is a group of people that share some expenses, services and utilities, as for example a fixed broadband connection. By dividing the total fixed BB subscriptions stock by the population figure the magnitude itself does not reflect the effective penetration or take-up of the service over the population. Some suggest using the number of households as the denominator in this ratio.

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<sup>1</sup> Presentation in the subgroup “Proposal to change the definition of the Fixed broadband penetration. Proposal of TRA from Bahrain”, May 2023 and presentation by Qatar “Fixed Broadband Penetration”, May 2023.

The ratio (Fixed BB subscriptions/ population) does not reflect accurately the take-up or adoption of fixed broadband and results in worse relative performance in countries with larger average household size as compared with countries where households are smaller in their average size. Across the world household size varies greatly, from 2.1 in many countries in Europe to 5 or higher sizes in other countries in Africa or the Arab region. Higher household size implies that the same fixed broadband connection may cover more people and hence, effective take-up rates over individuals may be higher than what the value itself of the ratio suggests. Some countries claim that by using the ratio over population for international benchmarking leads to a worse relative performance for some low/ middle income countries and in general, countries with high household size.

ITU has been disseminating the indicator "fixed broadband/population" since the 2003 [World Telecommunication Development Report](#), and is specified in the ITU Handbook for the collection of administrative data on telecommunication/ICT (see indicator 3.5).

A good number of countries in the subgroup suggest using the number of households as the denominator in this ratio. For one, households as scaling factor would take into account in the resulting ratio the household (average) size and to some degree the extent to which fixed broadband is available over the total number of inhabitants in a country. The stock of households as the scaling factor would reduce the distance between high/ medium/ low income countries as a result. The ratio itself, (fixed BB / Households), would represent changes in trends of fixed broadband contracted over time.

Even if the ratio (Fixed BB/ population) is often used by many institutions when comparing countries' performance, it is clear as well that some institutions use the ratio (Fixed BB subscriptions/ households) as the relevant indicator to compare countries or over time. As an example, the World Broadband Association publishes a global index comparing fiber development<sup>2</sup> on a country-by-country basis and uses as scaling factor both the number of households and the number of enterprises/ firms in each country.

Note as well that given the large set of indicators being collected and available from ITU, a country or institution has the option to select different indicators to monitor different digital policies. In addition, they may use a combination of indicators or construct new ones that best fit the national circumstances<sup>3</sup>.

The discussions of the subgroup centered around the conceptual as well as on the feasibility aspects related to different indicators at use. A set of pros and cons and recommendations are provided as a result of the discussions.

## 2. Conceptual considerations

The sources of data for each indicator determine some of their properties and uses. If the objective of a study focuses on the proportion of individuals that consume a specific service the first method that is to be considered is a survey run over the universe of the individuals of interest (e.g., individuals 15 or older) in a specific area (e.g., country) and typically with disaggregations for which later inference can be performed (e.g., gender). Normally a NSO conducting such a survey will identify a sampling frame from which individuals will be randomly selected and shall define strata upon which later inference will be performed. The procedure to define which individuals to select, replacement ratios and the precise questions asked in

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<sup>2</sup> "Global Fiber Development Index: 2020", ([https://worldbroadbandassociation.com/wp-content/uploads/2021/08/FDI-White-Paper-Final\\_151020.pdf](https://worldbroadbandassociation.com/wp-content/uploads/2021/08/FDI-White-Paper-Final_151020.pdf))

<sup>3</sup> as an example see the existing ITU data hub (<https://datahub.itu.int>).

surveys should consist of clearly defined steps, methods and rules. Any proportion obtained thereafter has defined properties, as standard errors from which confidence intervals can be derived based on the distribution of the population of interest and the properties of the sampling method followed. This procedure is the one followed when a survey on households on the use and access to ICTs is conducted.

By contrast, a ratio such as (fixed BB/ population) or (fixed BB/ households) provide averages that may have little to say in terms of effective penetration or take-up of the service. Note that the source of the data now has changed: the numerator is usually drawn from data collected from internet service providers (ISPs), upon which the National Regulatory Authority for telecommunications (NRA) conducts periodic data collection. Usually, any ISP has the obligation to register at the NRA in order to enter the market, i.e., to provide the service, so that the NRA has a census of active agents.

The denominator, in turn, comes from a different source: total population or the stock of households are usually obtained from periodic census or updating run by the NSO. The population census is normally not conducted every year, but once made for one year it is updated by the NSO based on a variety of methods and information on a periodic basis.

When providing a ratio among two magnitudes (i.e., aggregates) extracted from different sources there is no information on the errors attached to them. The aggregates have not been sourced from a sample with known properties and by taking the ratio a gross averaging among the two magnitudes is performed, with no precise population meaning. One household may have two or more fixed broadband connections contracted, or a significant segment of the population may not have access to the service. The ratio (fixed broadband/ population) or the one defined as (fixed broadband/ households) shall not take account of these factors, whereas a statistic- as for example the mean extracted from a sample in a survey- would take these into consideration. One example of the limitations in using a ratio is for example the widely used measure of (number of broadband mobile subscriptions/ population), usually weighted per 100 inhabitants. The figure as published goes well beyond a value of 100 for many countries. This is not a real “penetration” or “take-up” figure over the population, since if measured properly it could never be beyond 100. It is just a ratio of two magnitudes and should be interpreted as such.

In order to shed some light on the different properties of different indicators, an exercise inside the subgroup was made comparing three indicators for which information was available. 19 countries were selected from different world regions and three indicators compared: (1) Fixed broadband subscriptions/ population (Fixed BB/ pop), (2) Fixed broadband subscriptions/ households (Fixed BB/ households) and (3) penetration or take up of fixed broadband by households as obtained from surveys.

**Table 3:** main ratios and indicators for fixed broadband over households for a subset of 19 countries.

	HH with fixed BB (survey)	Fixed BB/ households	Fixed BB/ population	Year of most recent average HH size data
Zimbabwe	1.3	5.3	1.3	2019
Morocco	20.2	(30)	5.7	2014
Iran	22.7	(43.4)	11	2011
Malaysia	41.2	(53.5)	10.1	2000
Egypt	43.8	(48.1)	8.7	2013
Kazakhstan	46.8	(59)	13.8	2015
Brazil	53.7	(66.6)	17	2010
Mexico	61.1	(68.8)	19.1	2015
Costa Rica	61.2	(72)	19.4	2018
Turkey	61.9	(97.1)	19.9	2000
Georgia	72.5	(105.3)	25.7	2018
France	73.6	(109.8)	47.1	2015
Portugal	81.5	(119)	41.9	2011
Spain	83	(102.3)	35.3	2011
Denmark	84.2	99.1	44.5	
Qatar	85	(111)	11	2012
Azerbaijan	86.1	(96.3)	19.4	2009
UK	93.7	(100.5)	41.8	2011
Singapore	94.4	113.6	25.5	2020
average	61.5	79.0	22.0	
stad dev.	26.6	32.4	13.9	

Note: ratios using households as the denominator based on household size data that is older than 2019 are shown in brackets. *Sources:* ITU; UN Population Division.

Selecting those countries with household reported data not older than 2019, the next plot offers the indicators at a glance for the subset of countries.

The population scaled ratio under-represents the effective take-up of the service, while the household based may under- or- over represent the real figure, depending on specific characteristics in each country (one household may own more than one dwelling, differing proportions of fixed broadband contracted by Businesses, among others).

The use in the numerator of the total number of fixed broadband subscriptions biases both ratios as well. Total broadband connections in a country are the sum of those demanded by households (i.e., Residential subscriptions) and those demanded by firms and institutions (the business segment as well as institutions). The numerator in both cases is inflated if the total stock is used.



**Table 4:** proportion of Residential only fixed broadband subscriptions for 99 countries

	<b>N</b>	<b>avg Residential (%)</b>	<b>st dev</b>
Low income countries	47	81,2	21,5
Middle income countries	25	92,7	4,1
High income countries	29	88,7	5,5
<b>all countries</b>	<b>99</b>	<b>86</b>	<b>15,9</b>

In a simple exercise conducted with survey based data as well as supply side (administrative) datasets for two countries (Mexico and Spain) it has been found<sup>5</sup> that for Spain if the ratio (fixed BB/ households) was used an over- representation of 17,5 percentage points over the effective take- up of fixed broadband in households was obtained due to the inclusion of Business broadband connections; for Mexico the upward bias was 11,3 percentage points. Note that these biases are obtained when all fixed broadband subscriptions for enterprises are included in the numerator.

### 3. Data collection and availability

Data availability is a problem in particular for survey- based indicators. As mentioned earlier, if the goal is to monitor the penetration or usage of fixed broadband by households, the survey -based indicator is the first option to consider. But many countries do not run periodic surveys on Households use and access to ICT, or if they do, not on a yearly basis. Next the number of reporting countries to ITU in 2021 is listed for each of the main indicators related to fixed broadband.

**Table 5:** number of reporting countries to the subset of fixed broadband related indicators as of 2021

	<b>Reporting countries (2021)</b>
<b>Administrative indicators (supply side)</b>	
Total Fixed Broadband subscriptions (by technology)	165
Total Fixed BB subscriptions (by speed)	165
Fixed BB subscriptions for organizations	101
Households covered by a Fixed wired network	66
<b>Survey- based indicators (demand side)</b>	
Proportion of households accessing the Internet by fixed broadband, regardless of the type of network used	36
Proportion of household accessing the Internet by mobile broadband network only	40
Proportion of household accessing the Internet by both fixed broadband and mobile broadband network	38
Proportion of households accessing the Internet by a broadband connection	44

Given the recent response rates for survey- based indicators it is clear that no comparisons can be made across the world with only little more than 40 countries providing the relevant data to ITU. By contrast, supply

<sup>5</sup> Relevant data is provided in Appendix 2.



side indicators, and specifically the “Number of fixed broadband subscriptions” is being provided by the large majority of ITU members and for a long time series.

During the second meeting of the subgroup the ITU<sup>6</sup> presented the sources and availability for worldwide homogeneous data on the number and size of households<sup>7</sup>. The UN Population Division, UNPD, is the source for worldwide harmonized data on population. Data on the stock and average size of households is not reported by all the countries with annual periodicity and the use of these numbers is a challenge. As of today, the UN Population Division database registers 35 countries reporting data on household stock and size in 2019 or afterwards. For many countries data has not been updated since 2011.

Members noted that the data available on stock of households and its average size available at the UN Population Division do not match the existing available data on NSO databases in some cases. Some participants suggested the ITU to collect regularly data on number and average size of households.

When the ITU makes use of data from outside sources it follows existing international agreed standards and looks to obtain data from an international organization that collects relevant data from official sources and assures high data quality. This single source is used to avoid inconsistency when using data from many different sources. As the UN Population Division is the only known source of internationally harmonized data on population and households the ITU relies on it to provide these data given the lack of expertise in this area.

The ITU does not directly ask for the number of households in its regular questionnaires, but rather the target number of households for the survey. These data differ from what is available from the UN Population Division. This divergence is explainable as specific surveys conducted by the NSO on ICT use and access base this target number of households on sampling frames that are not always harmonized across countries or not updated regularly. Survey metadata collected by the ITU do not provide sufficient detail to understand for each country whether the target number of household are based on older censuses, recent assessments by the NSO on the stock of households, or an adjusted estimate on the same. ITU members made clear during the discussions that It is important to note that the ITU does not intend for the target number of households requested in its questionnaires to serve as a new or an updated number of households provided by countries. This figure is used as an input coming from population studies and only replicates or adjusts data already produced in the NSO’s population/ housing statistics.

In another presentation on the evolution of the broadband market in Costa Rica<sup>8</sup> the quick increase in broadband subscriptions since 2016 was presented, as measured in absolute values and with respect to the population and the stock of households. The numerator, fixed broadband lines, encompasses Business lines. While the population in Costa Rica has remained constant in the last 5 years, the size of households has decreased (from 3,25 members on average to 3,02) in parallel to the increase in the stock of households. This increment has taken place during the covid-19 pandemic. One aspect to bear in mind when measuring the stock of households is the dwelling- family dichotomy: the NSO in Costa Rica measures the number of dwellings, but it is known that in some dwellings two or more families may coexist or that the same household may own two or more dwellings at the same time.

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<sup>6</sup> Presentation in the subgroup “Measuring household size”, May 2023.

<sup>7</sup> Based on UN Principles and Recommendations for Population and Housing Censuses, Household is a group of persons who make common provision of food, shelter, and other essentials for living, see Appendix for more details.

<sup>8</sup> Presentation in the subgroup “Fixed internet access penetration 2018- 2020” by Superintendencia de Telecomunicaciones de Costa Rica, May 2023.

From the discussion it was apparent that there is a clear need to improve data collection on the stock and the average size of households across all countries.

In a presentation during the third meeting, ITU provided an alternative that is based on using population aged 18 years or older as the scaling factor for all countries. The data on this population segment is available for a very large number of countries and can be used as a scaling factor with respect to the total fixed broadband subscriptions. The exercise presented showed that countries differ much less when this truncated population figure is used across the world. The subgroup discussed this alternative scaling factor (only adult population) and did not reach an agreement to recommend its usage. In any case, it is an alternative possible scaling factor.

#### **4. Assessment of the advantages and disadvantages of different measurements**

In the next tables the different pros and cons discussed in the subgroup for each possible indicator are presented. The list does not pretend to exhaust the different properties of each indicator, but rather to provide an initial comparison and properties to take account of. Two sets of considerations are made: (1) methodological, and (2) regarding data availability, collection and harmonization issues.

Table 6: Strengths and weaknesses of different indicators and concepts to use for measuring fixed broadband penetration for households

		Pros	Challenge
<b>Fixed BB subscriptions</b>	<b>Data collection and availability</b>	Data availability by ITU almost complete for all countries and long time series	Better use “Residential”-only fixed BB (though criteria to assign a fixed BB to Residential or to Business segments depends on operator)
		Data is timely (at least for last year; often quarterly frequency)	
	<b>Methodological</b>	Fixed BB take-up is one important dimension to follow on ICT development (though relevance varies across countries)	Total Fixed BB subscriptions over-represents systematically fixed BB subscriptions pertaining to Households In some countries the same Household may contract two or more fixed BB subscriptions
<b>Residential/ Business distinction</b>		“Fixed BB to organizations” exists as an indicator (though reporting by countries is not universal)	Institutions and large enterprises typically use leased lines, while micro and small enterprises in many cases use residential subscriptions, making distinction difficult
<b>Households covered by a fixed network</b>		“Households covered by a fixed network, by technology” exists as an ITU indicator (but reporting by countries is limited)	Country practices differ in defining the total number of households used for this measure (addresses, dwellings, households, etc.), and since ITU collects the total number, raising the problem of appropriate denominator (ratios resulting above 100)

		Pros	Challenge
<b>Population</b>	<b>Data collection and availability</b>	Harmonized estimates are available from the UN Population Division in its World Population Prospects publication for all countries and are available for various breakdowns	Fixed BB is more household driven (the connection is shared)
	<b>Methodological</b>	Appropriate to identify changes and trends	
<b>Households</b>	<b>Data collection and availability</b>	Harmonized data are available for a limited number of countries from the UN Population Division in its Database on Household Size and Composition	Collection is not universal  Updating is irregular across countries Available for a subset of countries only

	<b>Methodological</b>	<p>Driver of fixed BB connections is Households and Firms/ Institutions</p> <p>Appropriate to identify changes and trends</p>	<p>Not sure common definition is being used across countries</p> <p>In some countries groups of people living in same dwelling may not be counted for as Households, but counted as having a fixed BB subscription</p> <p>Dichotomy "Dwelling" and "Household" not easy to identify</p>
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		<b>Pros</b>	<b>Challenge</b>
<b>Fixed BB subscriptions over Households</b> (survey based)	<b>Data collection and availability</b>		lack of availability for majority of countries (few number of countries conducting annual surveys on ICT use and access by Households)
	<b>Methodological</b>	preferred way to measure penetration (take- up) of the service	survey respondents may not be fully aware of the type of connection technology they have contracted (Fiber based, coaxial, wi- Max...)
		good comparability across countries and over time	

		<b>Pros</b>	<b>Challenge</b>
<b>ratio (Fixed BB subscrpt./ Households)</b>	<b>Data collection and availability</b>		while numerator widely available, the denominator only for a subset of countries
	<b>Methodological</b>	it follows closer the effective penetration of fixed BB on Households (survey based)	when using "total fixed BB subscriptions" the ratio over-represents take- up of fixed BB on Households
			it is not designed to measure effective take- up or adoption of fixed BB by households- group of people-

		Pros	Challenge
ratio (Fixed BB / population age > 18 y-o)	Data collection and availability	Harmonized estimates are available from the UN Population Division in its World Population Prospects	
	Methodological		Not designed to measure effective take up or adoption of fixed BB by households
			It is a ratio, e.g., a simple averaging over numerator and denominator with no clear population meaning
		It reduces heterogeneity across countries due to differences in the average size of households	Fixed BB is more household driven (the connection is shared)

		Pros	Challenge
ratio (Fixed BB/ population)	Data collection and availability	both numerator and denominator widely available and comparable across countries and long time series	
	Methodological		interpretation of ratio not clear
			it is not designed to measure effective take- up or adoption of fixed BB by households- group of people-
			it under-represents effective take-up of the service by households

## 5. Wrap- up and recommendations

- ITU collects a rich set of indicators that help quantifying the development of fixed broadband services both in terms of availability (i.e., network coverage) and in terms of take- up, penetration or use of the service.

- Two main sources of data are used for collecting indicators that measure the availability and use of fixed broadband: (1) administrative data coming from Internet Service Providers (ISPs) that report the stock of fixed broadband subscriptions to its National Regulatory Authority (NRA), and (2) survey-based data, that comes from periodic surveys of households and individuals on access and use of ICT and telecommunications and more specifically, on the use of fixed broadband. These surveys are usually run by the National Statistical Offices (NSOs). The ITU Expert Group on Household ICT Indicators (EGH) develops and revises the recommended methodology for collecting survey-based indicators.

- ITU has a well-defined indicator that measures the effective penetration, take-up or use of, fixed broadband by households: “Proportion of households with internet, by type” and its corresponding sub-component “with fixed broadband network” (HH11). This indicator is obtained from surveys conducted over households.

- The indicators already defined and being collected by ITU from the supply side (“Fixed broadband subscriptions, by technology”, “Fixed broadband subscriptions for organizations”, “Leased lines subscriptions” and “Households covered by a fixed broadband network”) – and the demand side indicator (“Households with fixed broadband”) provide a very good set of tools to measure the developments of fixed broadband networks and given the harmonization in terms of definition, scope and collection methodologies done by ITU, EGH and EGTI, provide a powerful source for benchmarking and research possibilities on the development of fixed broadband networks, an indispensable element of development for ICT in a country. Each indicator, in any case, has its pros and cons.

- Indicators obtained from household surveys provide the most preferred available measure on the proportion of households that contract a specific service, as fixed broadband. This method provides measurements and associated errors that help making an informed judgement when using them.

- Data availability for indicators on fixed broadband varies a lot from indicator to indicator. While data for the supply-side indicator “Number of fixed broadband subscriptions” is practically universal (more than 165 members providing it periodically), the data availability for the deployment (and coverage) of fixed networks is very low. Similarly, data availability for survey-based indicators is also quite low. For example, data on “Proportion of households accessing the Internet by fixed broadband regardless of the type of fixed network used” is available for only 40 member countries.

- This low data availability leads to the use of alternative scaling factors in an attempt to measure fixed broadband development across countries. Any ratio constructed is not specifically designed to represent real take-up or penetration of a service.

- Many countries argue that the ratio (Fixed BB subscriptions/ population) is not a representative measure for the development of fixed broadband in a country and especially when comparing across countries. Using population as the scaling factor does not represent properly the penetration, or extent of usage, over inhabitants of the fixed broadband service because the demand is household driven (or by enterprises). A household, by definition, is a unit where several people share a common expense, resource, or in this case, a fixed broadband service. As a result, the effective number of people that share and use that resource is best approximated by the number of households.

- This is particularly relevant given that across countries the average number of members in a household varies significantly, from 2.1 members in some European countries, to 4.5 or higher in other middle- to low-income countries.

- Many countries propose to use instead number of households, as the scaling factor.

- The ratio (fixed BB subscriptions/ household) follows closer the effective penetration of fixed broadband over households (survey based) than the ratio (fixed broadband/ population) does.

-The ratios (fixed BB subscriptions/ households) of (fixed BB subscriptions/ population) are simple ratios- not a statistic- and as such may over- or under-represent the effective take up of the service depending on country idiosyncratic factors (i.e., size of households, distribution of households by number of members, contracting by the same household of different connections simultaneously, allocation of fixed broadband connections to the Residential or to the Business segments....).

- The primary obstacle to using the stock of households as scaling factor is data availability: unlike for population, there is currently a lack of an up-to-date, globally comparable database on the number of households available over all countries. Much of the available data on average household size provided by the UN are outdated, which is an issue as household size can also change across years or due to shocks, such as the COVID-19 pandemic.

## Recommendations

### On using the indicator fit for the purpose:

- When making analysis across countries and over time, analysts should choose the relevant indicator for their measurement purposes, considering the properties of the indicators, including data availability for a sufficient number of countries, timeliness, or the frequency of updates. The subgroup stresses that any choice of indicators for a specific measurement objective has pros and cons. These should be clearly and transparently spelled out in any analysis or benchmarking conducted.

### Comparison of indicators:

- The survey-based indicator on household with fixed broadband service is the most preferred indicator for monitoring the penetration of the service across households<sup>9</sup>.

- However, data availability for this indicator is low (as not many countries conduct regular household surveys) and it takes time to deliver this figure since surveys have to be conducted, validated and published. As of today, it is not realistic to make any comprehensive international benchmarking based on this survey-based indicator due to the relatively low number of countries reporting it regularly.

- The ratio of (Fixed broadband subscriptions/ households) can be used as a proxy indicator to household penetration. Since households rather than individuals subscribe to fixed broadband, it follows closer the effective take-up (i.e., penetration) of fixed broadband when measured based on surveys over households. However, this is still not a true measure of penetration since fixed broadband subscriptions include business subscriptions and households may have more than one subscription. As the numerator and denominator are not directly related it is not a direct measure of the household penetration rate.

- Instead of using the total stock of fixed broadband subscriptions in the numerator, a better alternative is to use the subscriptions that belong to the Residential level only. The ITU has provided a definition for Residential level and Business level subscriptions.

- There are difficulties in allocating a specific subscription to one or the other segment given the fact that many micro- or small businesses may contract a connection offered for the mass market- to the Residential segment- and may use the connection both for the business environment and for residential use at the same time.

- One important problem with using the number of households as the scaling factor is the fact that data availability is low across countries. As of today, a large majority of countries do not have updated data on the

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<sup>9</sup> A common definition, scope and methodology is provided in the “Manual for measuring ICT access and use by households and individuals” 2020 edition, by ITU.

number of households or average household size in the UN DESA Population Division's internationally harmonized database on household composition.

- The ratio (Fixed broadband/ population) offers a simple way to proxy the intensity of fixed-broadband subscriptions. It has been disseminated for years and data on population and on the stock of fixed broadband subscriptions is widely available and are updated regularly. Using the population as scaling factor, in any case, leads to under-representation of the real take up of the service by households and being a simple ratio its interpretation in terms of effective take-up of the service is not clear.

- The ratio (Fixed broadband subscriptions/ population) widely under-represents the effective take up of the service by its very construction – it is not expected that each individual living in a household would have their own fixed-broadband subscription. The ratio accentuates differences across countries when the average size of households differs significantly across countries or regions, given that fixed broadband demand is typically household- driven (as well as by firms).

- The ratio (Fixed broadband subscriptions/ population aged 18 years or more) is an alternative that can be used in benchmarking exercises as it mitigates some of the afore mentioned issues with comparability across countries when using population as the denominator.

- The use of population 18 years old or higher as scaling factor leads to smaller heterogeneity across countries due to differences in the (average) household size<sup>10</sup>. It is an indicator that is universally available in a timely manner. It still has the limitations of being a simple ratio that measures intensity without serving as an actual proxy for household penetration. It also does not fully account for differences in household size between countries (e.g., the prevalence of single-person households or multi-generational households).

#### **On improving the availability of statistics on the number of households:**

- There is currently a lack of up-to-date and comparable data on the number of households for the large majority of countries. This subgroup recommends that countries ensure the provision of data on total population, number of households and average size of households to the UN Population Division database.

- ITU and Member States shall encourage the UN Population Division to extend and update data regularly from Member Countries on household size and the number of households.

#### **On ITU's data collection:**

- The subgroup stresses the importance of existing indicators as defined by ITU- and the two experts groups: EGH and EGTI- on a wide set of networks and ICT services. The list of demand (or survey-based)- and supply side (administrative) indicators provide a solid set of tools for measuring fixed broadband networks and a whole set of other fundamental services, networks and activities in the digital sphere. This subgroup strongly recommends all countries to engage, measure and provide these indicators as recommended by ITU.

- Specifically, the subgroup recommends all countries to devote enough resources for the measurement of household access to the internet with fixed broadband based on household surveys. Very often NSOs are the ones to run these surveys. In many countries a close cooperation between the NRA and the NSO has resulted

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<sup>10</sup> This is because a considerable share of the variation in household size is due to differences in number of children in households, and that the availability of fixed broadband subscriptions for children is almost fully driven by that for adults.



in more frequent and extensive household surveys. If fixed broadband access by households is to be monitored, this indicator stands as the first option.

- The subgroup also encourages all countries to make the most in devoting resources for the measurement of the deployment of fixed broadband networks, as defined by the indicator “Number of households covered by a fixed wired network” (i4213cv) and its corresponding sub-indicators (based on the underlying technology deployed). This indicator allows to provide a measure on accessibility or availability of fixed broadband networks for the households.

- Benchmarking across countries depends critically on the quality and provision of the relevant indicators to ITU or to UN Population Division by Member States. As of today, a clear deficit exists in this provisioning for some of the ITU defined indicators. The ITU and Member States should make an increased effort in ensuring that the UN collect and provide households data, and the Member States should provide the ITU the relevant data regularly, in order to improve current the situation.

- The indicators that need to be provided by a much larger set of countries regarding fixed broadband are:

**(a) from administrative sources (supply side)<sup>11</sup>:**

“Fixed broadband subscriptions for organizations”

“Household covered by a fixed broadband network” (by network detail)

**(b) from surveys (demand side):**

“Households with a fixed broadband subscription”

**(c) Indicators that are needed to construct benchmarking** (being collected by the UN Population Division):

Number of households and/ or average size of household

- Once internationally harmonized data on the number of households becomes available for a large number of countries, ITU shall provide data on the ratio of fixed-broadband subscriptions /number of households to the international community so that any agent or institution willing to use these figures may do so.

- ITU shall evaluate in two- or three years time the availability of the indicators that need to be improved upon and make available to the public the relevant data so that different indicators or ratios may be used for benchmarking.

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<sup>11</sup> For definitions, scope and methodological issues, see “Handbook for the collection of administrative data on telecommunications/ ICT”, ITU, 2020 edition.

## Appendix 1 – Definition of “Household”

The United Nations Principles and Recommendations for Population and Housing Censuses classifies a household in one of two categories:

- a) a one-person household, in which one person makes provision for his or her own food or other essentials for living without combining with any other person; or
- b) a multi-person household of two or more persons living together who make common provision for food, shelter or other essentials for living.

Persons in a multi-person household may pool their incomes and have a common budget to a greater or lesser extent; they may be related or unrelated persons or a combination of persons both related and unrelated.

Note that an alternative definition is used in many countries: a *“household consists of all persons living together in a housing unit”*. This definition defines household as a dwelling and differentiates from the previous one.

By both definitions, households are distinguishable from families in that:

- a) a household may consist of only one person, but a family must contain at least two members; and
- a) the members of a multi-person household need not be related to each other, while the members of a family must be related. Thus, a household may contain more than one family or no families at all, as in one-person households and households comprised of unrelated members.

## Appendix 2- Example: distinction of residential/business subscriptions

**Example 1:** Bias induced when using the total of Fixed BB lines in approximating the ratio of (Fixed BB/ households).

In Spain the main data is provided in the next two tables. The National Regulatory Authority (NRA) for Telecommunications (CNMC) published quarterly the number of fixed BB subscriptions differentiating between the Residential and the Business segments (14,2 and 2,51 million, respectively as of 2021).

Spain, 2021		
	(million)	
Fixed BB lines	16,71	→
Residential	14,2	
Business	2,51	
Households	16,64	
Population	47,33	

take up of Fixed BB		(%)
FBB/ population		35,3
FBB/ households		100,4
<b>Survey based:</b>		
<b>real Households with Fixed BB</b>		<b>82,9</b>
HH with any BB		95,4
HH with mobile BB		87,5

If the “total of fixed BB subscriptions” is used (16,71 million) and then divided by the number of households (16,64 million) then a 100,4 “penetration” is obtained, higher than 100. Note that if only “Residential Fixed BB subscriptions”, the number would go down to 85,3. The penetration, on the other hand, of fixed BB over households- as measured by the annual survey “Households use and access to ICT” by the NSO- provides the effective take up rate of 82,9% of households declaring to have fixed BB contracted. Hence, 17,5 percentage points of over-approximation bias is being induced by using the total of fixed BB subscriptions.

Note: 82,9% of households in Spain have Fixed broadband, but the ratio (Fixed BB/ HH) provides = 100,4% (an over- representation of 17,5 pp)

**Example 2:** similarly, the exercise is performed for Mexico, where the NRA of telecommunications (IFT) published quarterly data will details on Residential/ Business fixed BB subscriptions and as well runs an annual survey of “Household use of ICTs”, in collaboration with the NSO (INEGI).

México, 2021		(million)
Fixed BB subscriptions		24,57
Residential		21,52
Business		3,05
Households		36,16
population		126,7

take up		(%)
FBB/pop		19,4
FBB/ households		70
<b>survey based</b>		
HH with Fixed BB		58,7
HH with any BB		

In Mexico 58,7% of the households surveyed declared having fixed broadband contracted in 2021. The simple ratio (fixed BB subscriptions/ households) provides a 70% figure; an over- representation of 11,3 pp.

## Appendix 3 – Contributions from participants

In this Appendix the different contributions made by participants in the subgroup discussions are provided.

A3.1. “Contribution for the discussion on fixed broadband penetration by Bahrain”, May, 11, 2023

A3.2. “Proposal to change the definition of the Fixed broadband Internet subscriptions per 100 inhabitants”, Prepared by Telecommunication Regulatory Authority of Kingdom of Bahrain, March 2023

A3.3. “Fixed broadband Indicators”, Presentation by Qatar, May 2023

A3.4. “Measuring household size” Presentation by ITU, May 2023

A3.5. “Fixed Internet access penetration, 2018-2020” Presentation by the Superintendencia de Telecomunicaciones (SUTEL), Costa Rica, May 2023

### A3.1. “Contribution for the discussion on fixed broadband penetration by Bahrain”, May, 11, 2023

With reference to our comments in the 2nd virtual meeting for the sub-group, that countries national broadband policies set target for fixed broadband service and in particular fibre based on households, please find below benchmark of examples on such targets.

As shown in the table below, the countries set their targets for the access to fibre service as a percentage of households or homes and not per 100 inhabitants.

Country	Targets / status of fiber penetration
<b>Qatar</b>	<b>95% of households</b> could access affordable and high-quality broadband service of at least 100Mbps effective download and 50Mbps effective upload speeds by 2016
<b>US</b>	The National Broadband Plan," setting up six key goals to be completed by 2020 including: at least 100 million US homes (approx. <b>one-third of all households</b> )
<b>Germany</b>	To reach 100% of the population with at least 50Mbps broadband download speeds by 2018. By the end of 2018, <b>88% of households</b> had access to the target speeds
<b>UK</b>	In 2016, a new National Broadband Scheme for 2016–20 was announced aiming to extend the superfast (at least 24Mbps) network to <b>95% of homes and businesses</b> by 2017 and as far as possible across the remaining 5% of premises.
<b>Ghana</b>	The National Broadband Strategy adopted in 2012 set out a number of very ambitious objectives to improve broadband connectivity including an aim for <b>40% of households</b> in Ghana, including those in underserved areas, to have access to broadband services by 2015 and ensuring universal penetration of 90% by 2020
<b>Bahrain</b>	The rollout of the high-speed fibre optic National Broadband Network continues with the aim to reach the following targets by 2023: - <b>95% of households</b> ;
<b>Australia</b>	<b>8.4 million premises</b> are now connected to NBNCO
<b>Sweden</b>	<b>92% homes connected</b> (98% homes passed) – Single fiber (October 2022)

Source: Global Fiber Development Index: 2020 ([https://worldbroadbandassociation.com/wp-content/uploads/2021/08/FDI-White-Paper-Final\\_151020.pdf](https://worldbroadbandassociation.com/wp-content/uploads/2021/08/FDI-White-Paper-Final_151020.pdf)), <https://www.nbnco.com>, and TRA Bahrain

Furthermore, the World Broadband Association has published a paper on “Global Fiber Development

Index: 2020”, a global index comparing fiber development on a country-by-country basis.

As you can see in the metrics used in the Fiber Development Index 2020, they have used households and enterprises as a Denominator for measuring the access of fibre and not inhabitants.

**Table 2: Individual metrics used in the Fiber Development Index 2020**

Metric	Definition	Importance
<b>FTTH penetration (%)</b>	FTTH subscription household penetration	FTTH household penetration represents the current take up of FTTH services. The greater the percentage, the higher the number of households that can take advantage of fiber network characteristics.
<b>FTTB penetration (%)</b>	FTTB subscription against total enterprise connections	FTTB business penetration represents the current take up of FTTB services. The greater the take up, the more businesses will be taking advantage of FTTB services, enabling more efficient and more dynamic businesses.
<b>FTTS fiber penetration (%)</b>	Percentage of total mobile cell sites that are fiber connected	Mobile cell sites need high-speed and high-quality backhaul capabilities if they are to optimize the mobile-access performance. A high FTTS penetration will therefore signal a more optimized mobile data network.
<b>FTTH population coverage (%)</b>	Percentage of households that are covered by FTTH	FTTH coverage represents the current potential of FTTH connections. A limited coverage will mean that only a small selection of households and businesses can gain access to the benefits of a fiber network.
<b>Fiber backbone length</b>	Ratio of backbone fiber length to households	Fiber backbone supports the necessary quality of experience and reliability broadband services need. So a higher amount of backbone fiber per household drives greater reliability and performance for broadband networks.
<b>Download speed (MBps)</b>	Average end-user download speed	Fiber networks have the capability to deliver very-high-speed broadband services. Although not the only important network metric, speed is essential for delivering bandwidth-hungry applications such as 8K video in a quality fashion.
<b>Upload speed (Mbps)</b>	Average end-user upload speed	Unlike most other access network technologies, fiber networks can also offer symmetrical services. Although historically deemed more important in business, symmetrical services are now becoming increasingly important even in the residential market
Source: Omdia		© 2020 Omdia

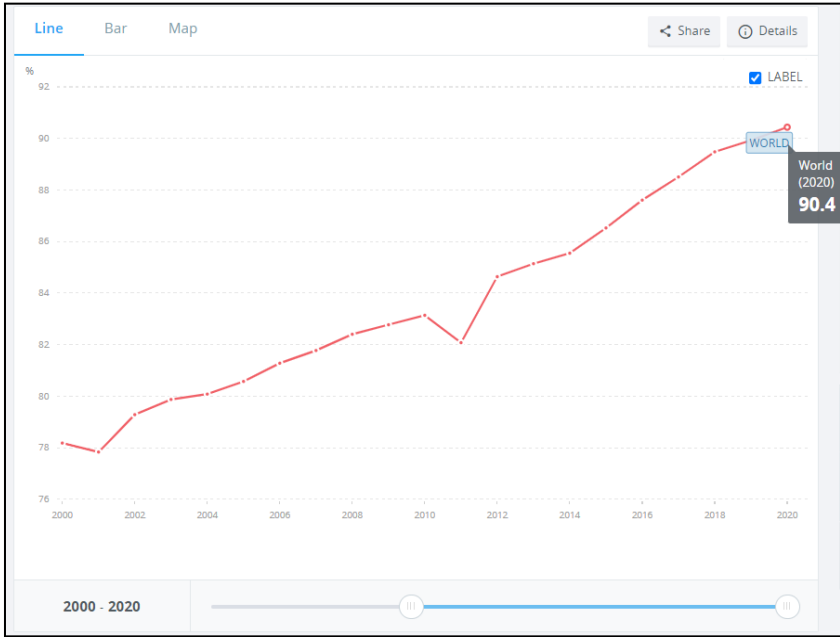
### Access to electricity (% of population)

Having looked at penetration rates for other sectors/services with similar characteristics of fixed broadband (e.g., physical connection to buildings, shared service) I found an interesting indicator for electricity which is Access to electricity (% of population).

See <https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity> And <https://databank.worldbank.org/reports.aspx?source=2&type=metadata&series=EG.ELC.ACCS.ZS>

It could be useful to review such indicator and study if we could apply similar indicator for fixed broadband.

Such indicator may better measure the level of access to fixed broadband services and give a better reflection of countries developments in fixed broadband.



Source: <https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?end=2020&start=2000>

**A3.2. “Proposal to change the definition of the Fixed broadband Internet subscriptions per 100 inhabitants”, Prepared by Telecommunication Regulatory Authority of Kingdom of Bahrain, March 2023**

Contents

Overview ..... 3

Issues with the current definition of the indicator ..... 3

Households as a basis for fixed broadband penetration ..... 6

Proposed change to the indicator..... 7

## Overview

- 1.1 The core list of ICT indicators (March 2022 version) published by the Partnership on Measuring ICT for Development<sup>1</sup> defines “Fixed Internet Broadband subscriptions per 100 inhabitants” (“the indicator”) as subscriptions to high-speed access to the public internet (a TCP/IP connection) at downstream speeds equal to, or greater than, 256 kbit/s<sup>2</sup> (the “Indicator”). This includes cable modem, DSL, fibre-to-the-home/building, other fixed broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband. The number of subscriptions then is divided by the population and multiplied by 100.
- 1.2 The indicator falls under the “infrastructure and Access” set of indicators which main purpose is to ensure access on a universal level to ICT services. Furthermore, the indicators under this set of indicators “correspond to individual use and measure *accessibility in terms of people*”.<sup>3</sup>
- 1.3 The current definition does not consider different size of households by countries.
- 1.4 Developed countries households’ size, on average, is smaller than developing and underdeveloped countries, resulting in inaccurate representation of actual access to the internet by fixed broadband in these countries.
- 1.5 The usage of fixed internet broadband differs in way than mobile internet broadband. As its observed, households usually share a single fixed internet broadband subscription which is used by all members of the household.
- 1.6 Since the goal of indicator is to measure access, dividing by population is not a proper representation of the real level of access to ICT services, and hence does not give decision makers the correct level of broadband access leading to directing resources improperly.
- 1.7 The purpose of this proposal is to explore new methodologies for measuring fixed broadband penetration rate.
- 1.8 The following paragraphs would explain in more details the case for changing the fixed Internet broadband per 100 inhabitants and the proposal to adopt fixed Internet broadband per households as replacement indicator.

### Issues with the current definition of the indicator:

- 2.1 The current definition does not consider the differences characteristics and usage between fixed and mobile broadband. Specifically:

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<sup>1</sup> [https://www.itu.int/en/ITU-D/Statistics/Documents/coreindicators/Core-List-of-Indicators\\_March2022.pdf](https://www.itu.int/en/ITU-D/Statistics/Documents/coreindicators/Core-List-of-Indicators_March2022.pdf)

<sup>2</sup> [https://www.itu.int/en/ITU-D/Statistics/Documents/coreindicators/Core-List-of-Indicators\\_March2022.pdf](https://www.itu.int/en/ITU-D/Statistics/Documents/coreindicators/Core-List-of-Indicators_March2022.pdf)

<sup>3</sup> <https://www.itu.int/en/ITU-D/Statistics/Documents/coreindicators/Core ICT Indicators E.pdf>

2.2 Unlike mobile broadband, a fixed broadband connection is typically used by more than one person.

2.3 Data available from the ITU support this claim. Specifically, ITU data shows:

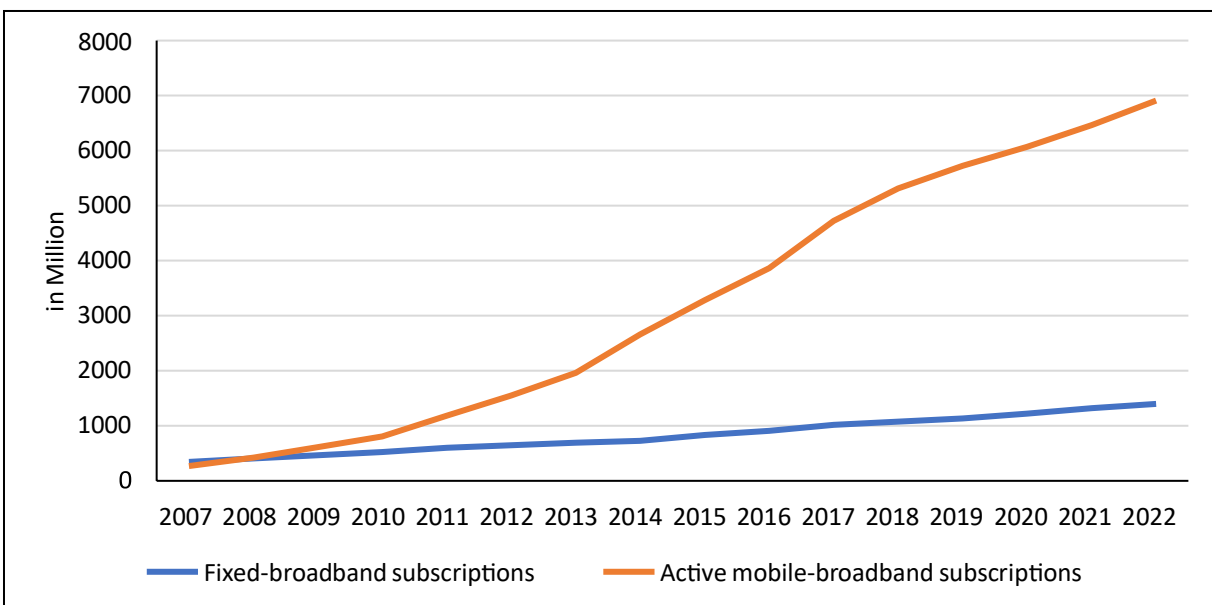
2.3.1 Mobile broadband subscriptions represent 83% of total broadband subscriptions (See figure 1).

2.3.2 As shown in Figure 2, the number of fixed broadband services per 100 inhabitants has increased only slightly over the last decade, in a period of significant broadband growth.

2.3.3 Between 2011 and 2021 the number of fixed broadband connections increased by 715m compared with 5,361m for mobile broadband connections.

2.3.4 Mobile broadband is much higher than fixed broadband penetration (16.7%).

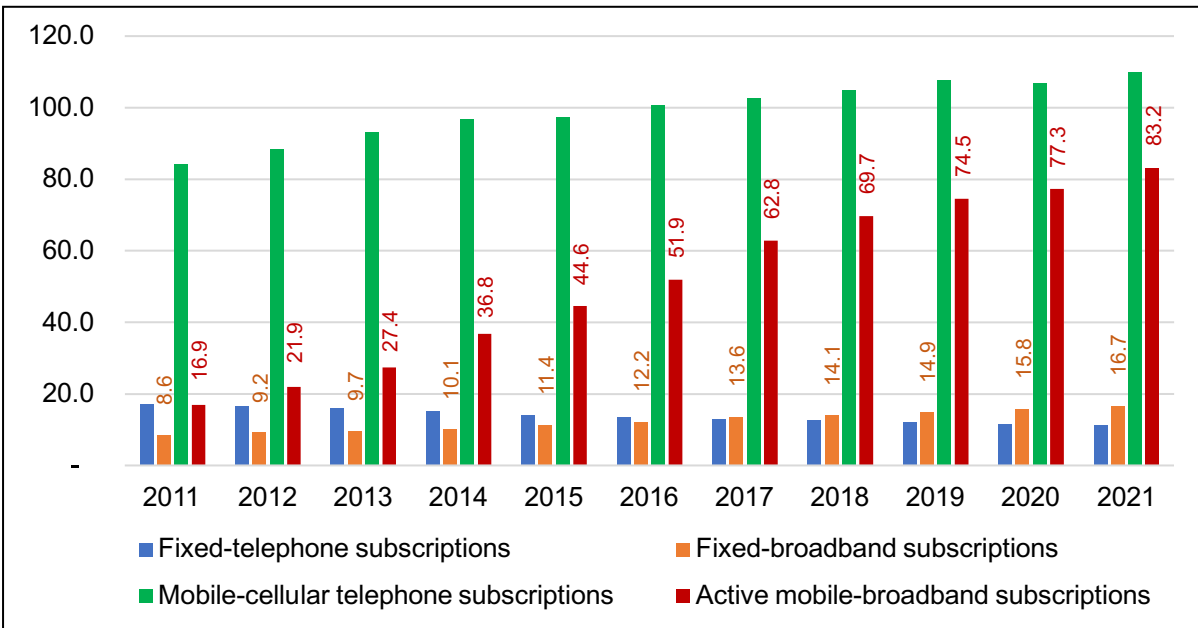
**Figure 1: Evolution of broadband subscriptions and internet users**



Source: ITU



**Figure 2: Evolution of number of subscriptions per 100 inhabitants - World**



Source: ITU

2.3.5 Level of penetration rates for fixed telecommunications services is much lower than mobile penetration rates. On a global level, fixed services penetration rates are below 20 per 100 inhabitants, while penetration rates for mobile services exceed 100 per 100 inhabitants.

2.3.6 Average data usage of fixed broadband is 11 folds higher than mobile fixed broadband. See figure 3.

**Figure 3: Average internet traffic per subscriptions per month (in GB) – 2021 – World**



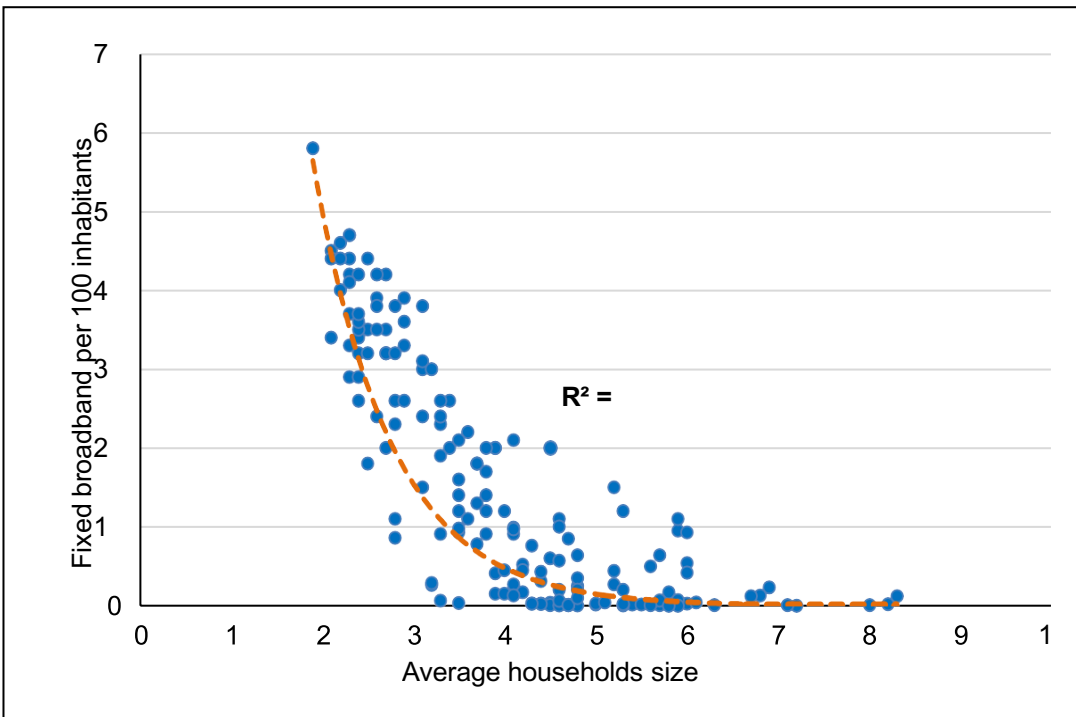
Source: TRA analysis based on ITU data

2.3.7 Although the number of fixed broadband subscriptions in the world is 17% of total broadband subscriptions, its usage per month is 11 folds higher per subscription.

### Households as a basis for fixed broadband penetration:

- 3.1 Using the current definition of fixed broadband penetration per 100 inhabitant does not reflect the true level of broadband access.
- 3.2 Countries with large households are shown to have lower level of access available to their population.
- 3.3 In general, one fixed broadband subscription is used by the entire household.
- 3.4 This is supported by the analysis below (figure 4) in which it shows there is a negative correlation between the number of households of the country and the Indicator.

Figure 4: Correlation between average household size and fixed broadband penetration



Source: TRA analysis based on latest ITU data and Household Size and Composition Around the World 2017

- 3.5 As can be deduced by correlation analysis in figure 4, the current methodology can possibly show a country to have a lower penetration rate than another country, despite more people having access to broadband in the former.
- 3.6 This indicates that fixed broadband penetration rates should not be based on population but on households.

### Proposed change to the indicator:

- 4.1 The previous evidence and analysis show that the current definition of the Indicator is not appropriate.
- 4.2 The current Indicator definition does not reflect real level of access to fixed broadband by people.
- 4.3 We propose to use number of households as the basis for calculating fixed broadband penetration.
- 4.4 As such, we propose to change the definition of the Indicator to “Fixed-broadband subscriptions refers to fixed subscriptions to high-speed access to the public Internet (a TCP/IP connection), at downstream speeds equal to, or greater than, 256 kbit/s. This includes cable modem, DSL, fibre-to-the-home/building, other fixed broadband subscriptions, satellite broadband and terrestrial fixed wireless broadband. This total is measured irrespective of the method of payment. It excludes subscriptions that have access to data communications (including the Internet) via mobile-cellular networks. It should include fixed WiMAX and any other fixed wireless technologies. It includes ~~both only residential subscriptions and subscriptions for organizations~~. The indicator is divided by the ~~population~~ number of households and multiplied by 100.”
  - 4.4.1 The proposal to remove subscriptions for organization from the definition is as households’ subscriptions usually are for residential broadband.
  - 4.4.2 Adding subscriptions for organization would entail adding number of registered businesses to the households total.

4.5. with regards to the availability of the number of households of each country, the UN report used in this proposal suggest that the data is available. However, the ITU needs to confirm the availability of this data and the possibility to obtain it from countries.

### A3.3. “Fixed broadband Indicators”, Presentation by Qatar, May 2023

#### Main issues for indicators

- Must be as objective as possible
- Non-discriminatory, i.e. not underestimate developing versus developed countries
- Fixed broadband may be complemented by mobile and/or satellite, this should also be measured
- Speed,

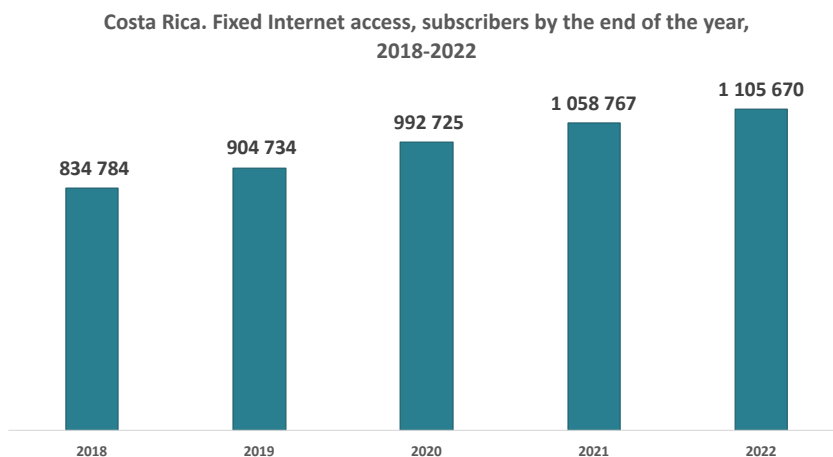
- technology,
- penetration,
- access,
- residential-government-business,
- Content (TV, streaming, http, etc.)

Main issues for the indicator for penetration

- Should it be measured by populations or households?
- The household is the de facto unit that creates demand for the FBB subscription, so it is most logical to use that one.
- If the denominator is population rather than households, the indicator becomes discriminatory, as it underestimates penetration in developing countries and overestimates it in developed countries, simply because the size of households is greater in developing countries
- Household data has the problem that it is often not measured frequently in developing countries, however this can be solved by applying reasonable imputation methodology

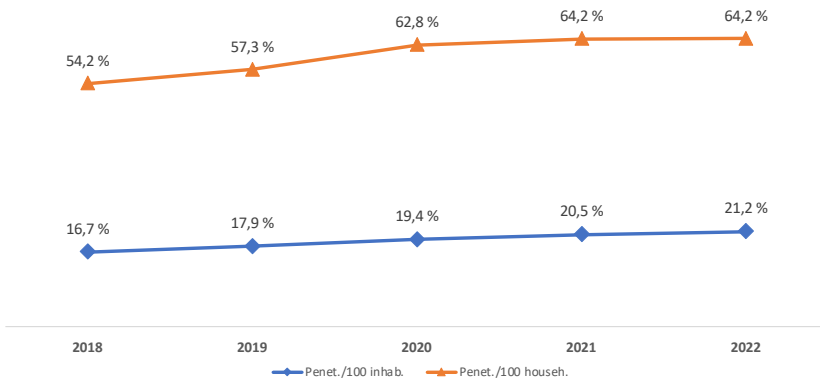
### A3.4. “Fixed Internet access penetration, 2018-2020” Presentation by the Superintendencia de Telecomunicaciones (SUTEL), Costa Rica, May 2023

Costa Rica opened the telecommunication market 15 years ago; since then, the fixed Internet service change its dynamics, new entrants start to compete, and at the end of 2016, the market was declared in effective competition. In this document, we present the situation of the last five years in this market.



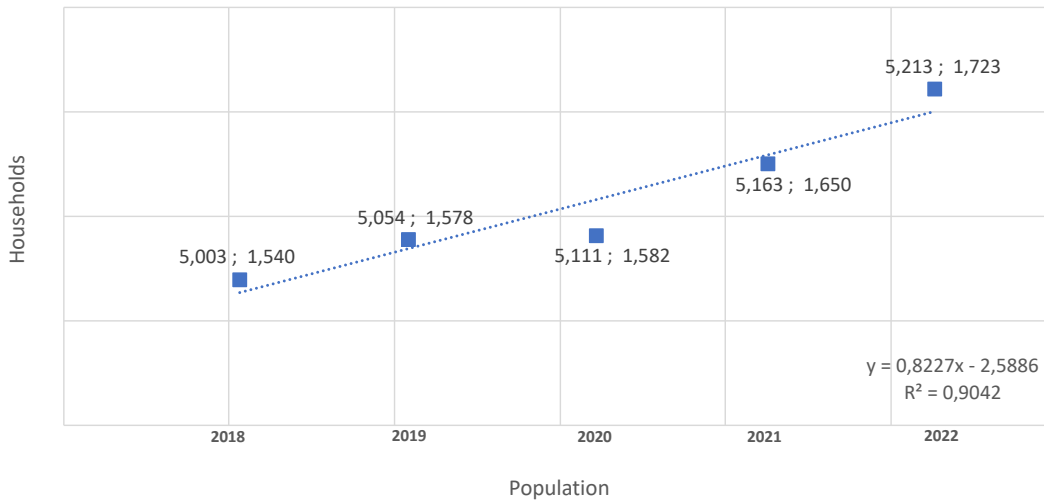
In the last five years, the penetration of the fixed Internet service in Costa Rica is on the rise. The increase by 100 inhabitants is 4,5 percentage points, and by 100 household an increase of 10 percentage points from 2018 to 2022. SUTEL make's public these values every year. 2022 close with 64,2 % of households with access and 21,2 % of persons covered by the services. There's a direct relation between both calculation based on the quantity of persons by household.

**Costa Rica: fixed Internet access, comparison between subscribers per hundred inhabitants and subscribers per hundred households, 2018-2022**



The ratio of population and households in Costa Rica shows a steady behavior; the estimate of persons by dwelling unit is close to three every year, besides the decrease in households in 2020. This ratio is the same between both penetration indicators, and it shows how important it's to analyze demographics in the evolution of the service

**Costa Rica: ratio of population and households, 2018-2022 (number in millions)**



Inhabitantes per household	
2018	3,25
2019	3,20
2020	3,23
2021	3,13
2022	3,03

Although demographic aspects are essential, operators must also compete by platform, seeking to offer better services to the market. For example, in Costa Rica, it is observed that in the last five years, subscribers have contracted more fiber optic services thanks to the expansion of this network in populated zones.

Costa Rica: fixed Internet access, share of subscribers by technology, 2018-2020

