# Measuring the margins:

A global framework for digital inclusion

Digital Future Society

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# About Digital Future Society

Digital Future Society is a non-profit transnational initiative that engages policymakers, civil society organisations, academic experts and entrepreneurs from around the world to explore, experiment and explain how technologies can be designed, used and governed in ways that create the conditions for a more inclusive and equitable society.

Our aim is to help policymakers identify, understand and prioritise key challenges and opportunities now and in the next ten years under key themes including public innovation, digital trust and equitable growth.

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Digital Future Society

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# Executive Summary

**"Efforts to improve digital inclusion would be greatly helped if there were a clear and agreed set of metrics to monitor it."** [1]

**United Nations Secretary General's High-level Panel on Digital Cooperation**

In response to the call put out by the United Nations in The Age of Digital Interdependence,[2] the objective of this report is to present a comprehensive framework underpinned by a clear set of metrics that policymakers can use to measure and monitor digital inclusion more effectively.

While some initial benchmarking work has been done at the global level, existing metrics fall short in several ways that preclude reliable and consistent measures of digital inclusion. Measuring digital inclusion is not as simple as counting how many citizens have access to the internet or a digital device.[3] Yet, with a few exceptions, many of the indexes analysed in this report focus on that singular dimension.

While a handful of intergovernmental and private sector organisations have established a strong foundation for measuring digital inclusion in terms of quality of access and affordability, the data lack granularity, especially at regional and local levels. This deficiency of sub-national data limits the value of current digital inclusion indexes by preventing policymakers from targeting initiatives to digitally excluded communities and groups in specific areas.

Other than affordability, existing benchmarks place a limited focus on assessing the supporting environment as an indicator for digital inclusion. The analysis also detected an absence of metrics tracking legally valid identification, financial inclusion, as well as trust and security in both the digital and physical realms.

Current international assessments collect few indicators on gender equality, and many do not differentiate between different types of users. Without disaggregated data on gender, age, income and educational level, the digital inclusion of marginalised communities cannot be assessed over time and is of limited value for decision-makers to refine initiatives and target resources to specific communities.

If these gaps in measurement are to be filled, international organisations, governments, statistical agencies, and policymakers at all levels of government should validate and adapt the global framework for digital inclusion proposed in this report according to their resources and ability, gathering data for missing indicators where necessary.

Inspired by nine international indexes tracking digital inclusion, this report proposes a new framework based on a combination of existing and new indicators. If policymakers are serious about measuring digital inclusion more effectively, the following data related to **four key dimensions** must be collected regularly and segmented:

[1] UN Secretary-General's High-level Panel on Digital Cooperation 2019

[2] Ibid.

[3] Ragnedda and Muschert 2013

1. **Access** to electricity, the internet, devices and quality of that access
2. Traditional and digital **skills** including critical thinking, literacy and entrepreneurship
3. **Use** of technology, public and private digital services, digital products and content, various types of work, social and civic engagement activities, as well as places of access to measure actual value creation and digital inclusion of marginalised communities
4. A **supportive environment**, particularly in terms of affordability, legally valid identification, financial inclusion, trust and security

Working to eliminate digital divides, the proposed global framework constitutes a highly practical tool to measure the state of digital inclusion, especially within traditionally marginalised and digitally excluded communities worldwide. The framework will help decision-makers to take targeted actions to refine policies and reach digitally excluded groups, thereby helping to achieve the 2030 UN Sustainable Development Goals (SDGs).

# Glossary

## Digital divide

The gap between those individuals with access to digital devices and content and those without.[4]

## Digital inclusion

The elimination of the digital divide by ensuring those who do not have the skills and ability needed to access and use digital devices and content can do so confidently, safely and effectively.

## Digital literacy

The skills and abilities needed to access and use digital devices and content confidently, safely, and effectively.[5]

## Marginalised groups

Individuals within a given context who are subjected to inequalities through a lack of access to digital infrastructure or ICT tools as a result of location, age, gender, skills and/or affordability.[6]

[4] Jaeger et al. 2012; United Nations Department of Economic and Social Affairs 2012; Swan et al. 2011

[5] World Benchmarking Alliance 2019; eLearning Department, Government of Malta 2015

[6] Swan et al. 2011

# Introduction

# It's time to rethink digital inclusion

The transition from an industrial society to a digital one entails new technologies, new concepts and new ways of organising and producing value. Building on past industrial revolutions, current technology developments are changing the way people live but also amplifying existing inequalities. Primarily differentiated by the pace of technological breakthroughs, the digital transformation of society is all-encompassing. Social, public and private sector behaviours, processes and organisational structures are changing before our eyes.

The rapid pace of technological evolution brings with it a greater awareness of interdependencies and the risk of greater fragmentation along socio-economic fault lines. Despite increased opportunities, for instance, access to and use of digital infrastructure and tools is uneven. While the potential positive impacts of the digital transformation of society are substantial, the negative impacts of this transformation may be compounded if current inequalities and potential negative disruptions are not proactively addressed.

Particularly vulnerable are low-income countries, such as small island states in the Caribbean and Pacific, as well as middle-income countries in Africa, the Americas, Asia, and the Middle East.[7] If digital inclusion is not successful, entire communities and even countries will not reap the full benefits of technology. In fact, traditional paths towards economic development are closing not only in emerging economies but around the world as challenges induced by technological change mount. Failing to address the negative impacts of digital transformation through the digital exclusion of entire communities and, disproportionately, people already within marginalised groups are real and present risks for policymakers tasked with technological governance. Digital inclusion is a global concern that must be at the forefront of any government's agenda since digitally excluded communities can be identified in every country.

To address the challenges of digital transformation and inclusion, the UN Secretary-General's High-level Panel on Digital Cooperation has called on the private sector, civil society, national governments, and multilateral organisations to adopt specific policies to support full digital inclusion of traditionally marginalised and digitally excluded groups.[8] That is, the inclusion of individuals within a given context who are subjected to inequalities through a lack of access to digital infrastructure and ICT tools as a result of location, age, gender, skills and/or affordability.[9]

[7] Meyerhoff Nielsen et al. 2018

[8] UN News 2019

[9] Institute of Museum and Library Services 2009

The Secretary-General called for an "...urgent and open debate between governments, the private sector, civil society and others on how we move forward together safely in the age of digital interdependence."[10] Led by Melinda Gates and Jack Ma, the High-level Panel recommends that a set of clear monitoring and measurement indicators be developed to support improved digital equality for traditionally marginalised and digitally excluded communities.

The importance of digital inclusion and the elimination of existing disparities is widely acknowledged by governments and international organisations through the SDGs. Adopted by the 193 UN member states, the SDGs explicitly address marginalisation, including the elimination of challenges emerging from the fourth industrial revolution. While the 2030 Agenda or its 17 goals do not refer to digital inclusion directly, they do advocate for stronger inclusion of traditionally marginalised groups and communities. Similarly, ICTs as enabling tools to advance the SDGs is explicitly acknowledged (see Appendix II for more details).

As a starting point, this report analyses nine past and current international attempts to measure and monitor digital inclusion as the digital transformation gathers pace. Our work seeks to answer the following research questions:

- What indicators of digital inclusion already exist in current international indexes?
- What is the practicality and value of current metrics?
- What might a useful set of primary, secondary, and tertiary indicators look like?

The report finds that policymakers who want to measure digital inclusion more effectively must collect data within **four key dimensions**:

1. **Access** to electricity, the internet, devices and quality of that access
2. A mix of traditional literacy and digital **skills** including critical thinking and entrepreneurship
3. ICT and internet **use** that measures value creation in the context of digital exclusion
4. **Supportive conditions**, including affordability, legally valid identification, financial inclusion, trust and security

The segmentation of data by geographic area and user group is also essential. Without segmented monitoring over time and space, digital inclusion metrics are of limited value to policymakers and decision-makers who cannot prioritise or target initiatives to specific geographical locations or communities.

This report proposes a set of indicators to effectively monitor and guide digital inclusion efforts for both traditionally marginalised and digitally excluded groups. The framework aims to support global, national, regional and local efforts and aid policy and decision-makers at a strategic and operational level by meeting the following key objectives:

[10] UN News 2019

- Create a shareable international framework that provides policymakers with the tools to pinpoint "pockets" of digital exclusion in specific areas, from large cities to rural areas to non-digital hubs.
- Quantify and track how the process of digital exclusion evolves based on age, gender, migration status, economic status, and so on over time.
- Provide evidence to show how digital exclusion is not a phenomenon that only affects traditionally marginalised communities.
- Supplement broad national surveys or censuses that fail to take key indicators into account or do not use sufficiently granular regional and local data.

# Digital inclusion in context

Unequal access to online content and services has been a topic of debate in political, social, economic, and educational discourse since the mid-1990s.[11] Yet while terms like "digital divide" and "digital literacy" have entered common usage, the term "digital inclusion" has received less attention in practice.

"Digital divide" is defined as the gap between those with access to digital infrastructure and devices, and those without. Digital divide is closely associated with age, gender, skills, language, socio-economic status, affordability, geographical location, and other factors.[12]

"Digital literacy" is in turn defined as the skills and ability needed to access and use digital devices and content confidently, safely and effectively.[13] It includes a minimum level of understanding of the hardware and software required to successfully navigate a given technology.[14] It also requires an understanding of the language in which content is available (reading, writing and mathematical skills) as well as critical and analytical skills to navigate digital content (including misinformation, cyber-bullying or online fraud).

While the access to ICT and digital literacy are abstract concepts and preconditions of digital inclusion, this report aims to understand how the latter can be measured. This report therefore defines digital inclusion as the elimination of the digital divide by ensuring access, the skills and ability to use digital devices and content confidently, safely, and effectively.

The importance of digital inclusion is amplified as technologies, especially the internet, become increasingly necessary fixtures of modern life. The presence and use of technologies impact how we as individuals engage in society and heavily influence our access to education, employment, public services, civic participation, and even our social circles.

Given their responsibility to maximise the benefits of technology while mitigating the negative impacts, policymakers have a mandate to measure progress, implement appropriate strategies and initiatives, and allocate the required resources to ensure the inclusion of digitally excluded and traditionally marginalised communities.

[11] Jaeger et al. 2012

[12] Institute of Museum and Library Services 2009; United Nations Department of Economic and Social Affairs 2012

[13] World Benchmarking Alliance 2019; European Commission 2008

[14] UN News 2019

These are individuals within a given context who are subjected to inequalities through a lack of access to digital infrastructure and ICT tools. Their exclusion is often a result of location, age, gender, skills or affordability.[15] For instance, digital technologies are often inaccessible for differently-abled people, the elderly, or indigenous people who are hard-pressed to find content in their native language.[16]

Although digital inclusion has been addressed by policymakers, industry, and research since the late 1990s and early 2000s, the landscape has been dominated by single policies to drive massive technology rollouts, or programmes promoting access to technology or digital literacy.[17]

Digital inclusion and equality for marginalised groups is feasible not just for women, but for low-income groups, communities distinguished by ethnicity, and non-digital hubs.
To meaningfully improve digital inclusion, it is imperative to understand its past and present status at different levels of granularity and across user groups. This requires investment in both short and long-term policies, as well as continuity on the part of policymakers.

[15] Institute of Museum and Library Services 2009

[16] UN Secretary-General's High-level Panel on Digital Cooperation 2019

[17] Rosa 2013; EUR-Lex 2019

# 1

# Measuring digital inclusion

# Current digital inclusion benchmarks

A simple search for digital inclusion in academic databases results in over 2.6 million hits of research papers and reports on the topic. Multiple national and international initiatives have been launched to measure the availability of technologies like the internet and mobile phones, digital public services offerings, and the overall readiness of citizens and businesses to use ICTs.

Optimising policies for the full digital inclusion of traditionally marginalised or digitally excluded groups requires continuous monitoring. Determining the current situation and defining success criteria are necessary first steps before appropriate actions can be implemented. Indicators measuring success, or lack thereof, must be quantifiable, practical, directional, and actionable. Indicators of preconditions, inputs, process, outputs and outcomes will all play a role, serving the needs of different communities at different stages of development.[18]

As we saw in the previous section, digital inclusion reflects the need to develop the capacities of both traditionally marginalised and digitally underrepresented groups to access and use ICTs.[19] Both groups can be characterised by geographical location, population density, age, gender, formal and informal educational attainment levels, occupation type, relative income and location. Digital inclusion indicators must therefore go beyond the measurement of access to the internet and possession of technology devices.

Globally, at least nine initiatives measuring digital inclusion stand out in terms of geographical coverage, as well as number and relevance of indicators (see Appendix I for more details on each index).

1. Formerly known as the Digital Access Index, the **International Telecommunications Union ICT Development Index (ITU-IDI)** evaluates 176 countries on an annual basis from a national perspective across four categories: infrastructure access, affordability and quality of infrastructure, skills, and actual usage of ICTs, specifically telephony and internet.[20]

2. For the last 40 years, The World Economic Forum (WEF) has compared 130 countries in its annual **Global Competitiveness Index (WEF-GCI)**.[21] The pillars on ICT adoption and skills are particularly relevant to digital inclusion. The index is complemented by the Global Information Technology Report on Networked Readiness, where the readiness and usage sub-indexes are especially pertinent for digital inclusion tracking.[22]

[18] Heeks 2006; Huovila et al. 2019

[19] UN News 2019; Hilding-Hamann et al. 2009

[20] ITU 2017

[21] World Economic Forum 2018

[22] World Economic Forum 2016

3 Commissioned by Facebook and carried out by the Economist Intelligence Unit, **The Inclusive Internet Index (EIU-III)** tracks digital inclusion in over 80 countries by assessing the availability, affordability, and relevance of the internet. The index also measures "readiness", defined as citizens' capacity to access the internet, as well as cultural acceptance of the internet and supporting policy.[23]

4 The European Commission's **Digital Economy and Society Index (EC-DESI)** together with the annual ICT Households survey (Eurostat) are major data sources for monitoring digital inclusion efforts within the European digital space.[24] Indicators such as access, skills and usage are broken down based on access points (home vs work), technologies (eg fixed vs mobile internet and telephony), different forms of usage (eg computer vs internet, eCommerce, digital banking, eGovernment services, types of software usage), and frequency of use (daily, quarterly, annually). With respect to digital inclusion, several metrics are disaggregated by country, gender, age, income, educational attainment level, and even type of work.

5 By comparison, UNDESA's **eGovernment Development Index (UNDESA-EGDI)** covers 193 countries and economies but does not focus on marginalised individuals or communities.[25] Instead, EGDI measures general digital inclusion with its sub-indexes tracking access to telecommunication infrastructure, human capacities and skills, and digital public services.

6 Private organisations and trade associations also collect data related to digital inclusion. The GSMA **State of Mobile Internet Connectivity report (GSMA-MIC)** contains data from 165 countries on indicators such as access, quality and affordability of access, technology types, skills, gender equality, eGovernment and cyber-security readiness of the public sector.[26]

7 From the academic world, the **Global Innovation Index (WIPO-GII)** co-published by Cornell University, INSEAD, and the World Intellectual Property Organization (WIPO, a specialised agency of the United Nations) analyses over 120 countries in relation to the human aspects of innovation and policy creation. The two sub-indexes covering infrastructure, and human capital and research are especially relevant when measuring digital inclusion.[27]

8 The Web Foundation's Alliance for Affordable Internet ranks around 60 southern hemisphere countries on the availability and affordability of internet access in its annual **Affordability Drivers Index (A4AI-ADI)**.[28]

[23] The Economist Intelligence Unit 2019

[24] European Commission 2019

[25] United Nations E-Government Knowledge Base 2019

[26] GSMA 2019

[27] The Global Innovation Index 2019

[28] Alliance for Affordable Internet 2019

9

Initiatives measuring digital inclusion at a national level also exist. Although national and supranational statistical agencies are valuable data sources in digital inclusion benchmarks, few track digital inclusion specifically or segment data. The **Australian Digital Inclusion Index (AUS-DII)**,[29] the Eurostat ICT household survey and the associated Digital Economic and Society Index (DESI) all break indicators down by gender, age, income and educational attainment level. By comparison, the Digital Inclusion Index: A Measurement of ICT Advancements in Bahrain & Gulf Cooperation Council is focused solely on access to technology, including fixed and mobile telephony and internet, with no segmentation by user group.[30]

## Where the margins are measured least

The nine indexes tracking various elements of digital inclusion do not cover the world in equal measure. Low- and medium-income countries in north-central Africa, Central Eurasia and the Middle East are tracked the least. Ironically, these are the regions of the world with the proportionally largest digitally excluded communities and with the widest gap separating them from the world's most digitally advanced and inclusive societies.

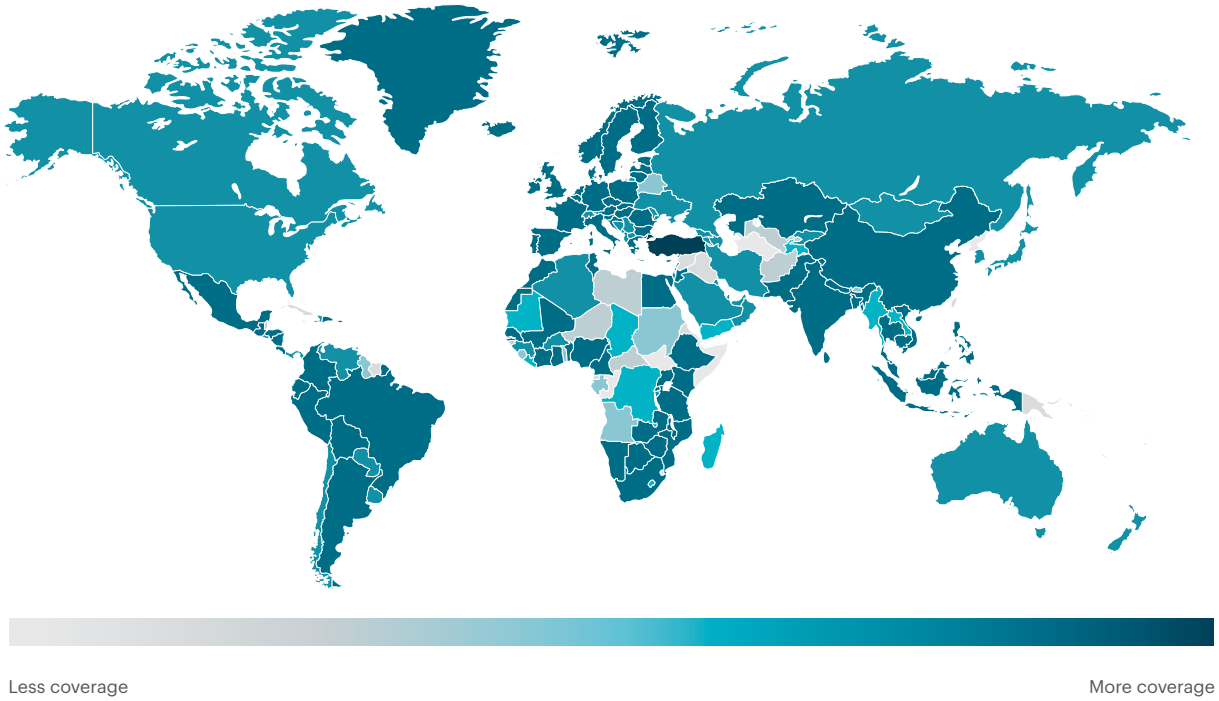



Figure 1: Geographical coverage of the international indexes related to digital inclusion analysed in this report.
The darker the colour, the higher the number of benchmarks covering the country. Image source: Digital Future Society and UNU-EGOV.

[29] Thomas et al. 2019

[30] Sadayan and Rao 2019

# A heavy focus on access

After clustering the key indicators from the nine indexes assessed, access, skills and use emerge as dominant dimensions, with a clear emphasis on access, especially in terms of internet connectivity and content. This is reflected in the weights given to the access dimension, the proportion of indicators, the conceptual framing, and even the benchmarks' rationales and titles (see Appendix I). The focus on connectivity and access can be ascribed to the legacy of digital inclusion, first appearing in public policy discourse in the wake of the roll-out of the internet in the late 1990s.[31]

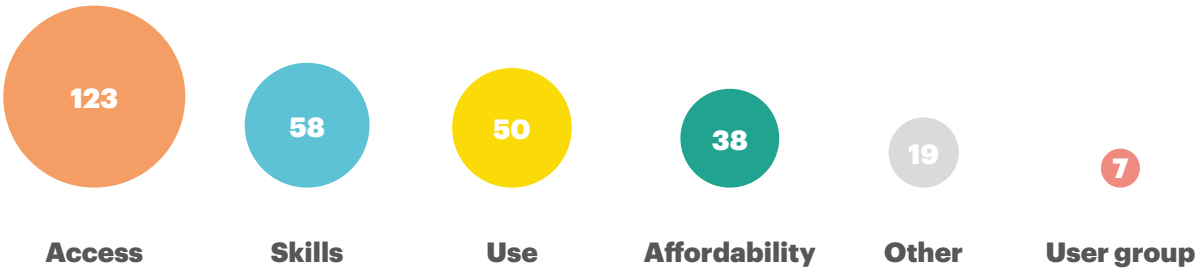



Figure 2: Cumulative number of indicators per dimension. Image source: Digital Future Society and UNU-EGOV.

# Sourcing digital inclusion data

If we were to start measuring digital inclusion tomorrow, where would we find the data? The dominant global source appears to be ITU's ICT Development Index, with Eurostat being key for European countries. For technology types and affordability, the GSMA State of Mobile Internet Connectivity report includes many statistics, while UNESCO is a key source of skills-related indicators. In relation to the availability of digital public services, UNDESA's biannual EGDI survey is a key resource. The European ICT household survey offers a rich dataset, and the statistical agencies of Australia, Brazil and South Africa all collect data relevant for monitoring the digital inclusion of marginalised communities, with each segmenting in similar ways.

[31] United Nations Department of Economic and Social Affairs 2012

# Four key dimensions to measure digital inclusion

Key in most measurements of digital inclusion are four dimensions, which can also be thought of as preconditions for digital inclusion. The first is general access to fixed or mobile internet and telephony. Telephony was the primary means for internet data transfer, later replaced by mobile and fibre-optic infrastructure. Secondary is the quality of access, defined by bandwidth, up- and download speeds. Technology infrastructure such as fibre-optic cable and 3G, 4G and 5G and relative affordability are more often measured in initiatives from the private sector, NGOs and academia.

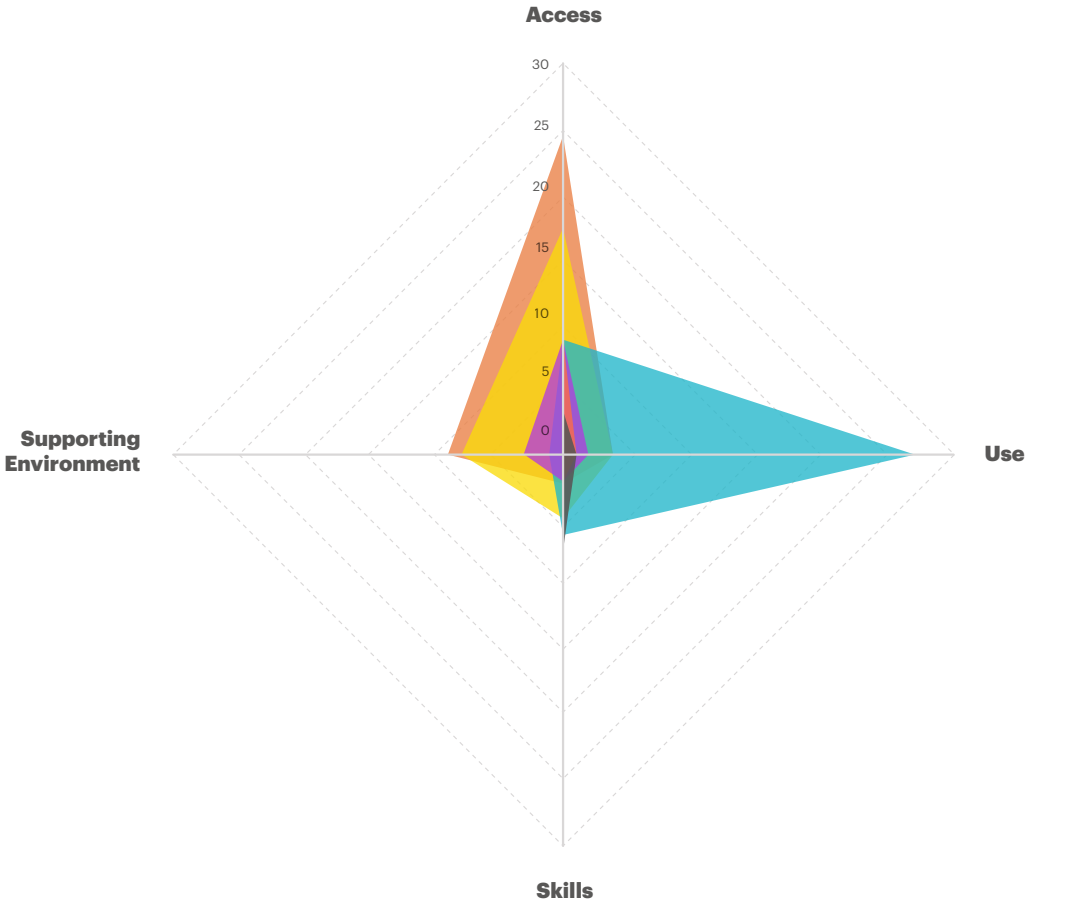



Figure 3: Comparative coverage of analysed indexes by indicator dimension, showing focus and overlaps. See Appendix III for full comparison. Image source: Digital Future Society and UNU-EGOV.

The second dimension, digital skills, refers to a person's ability to increase the benefits gained from using digital technologies and avoid the downsides that can ensue from digital engagement.[32] More traditional literacy skills underpin digital skills, such as reading, writing, and numeracy, but they also involve critical thinking, problem solving, creativity and entrepreneurship.

Basic digital literacy is an essential digital skill. The European Commission's Digital Competencies Framework (DigComp 2.0) emphasises information and digital literacy, as well as general communication and collaboration, digital content creation, safety, and problem-solving, which in the digital realm includes the ability to protect one's personal data and online privacy.[33] While a multitude of frameworks have been proposed to identify, categorise and measure digital skills, they generally agree that technical digital skills are only one component that facilitates digital inclusion.[34] The majority of the 54 different skills-related indicators analysed in this report are associated with traditional literacy skills like reading, writing and math. Nine indicators cover STEM, eight cover basic digital skills and one addresses critical thinking. The focus on traditional literacy may be the result of data availability, with UNESCO and ITU being the two dominant data sources.

Digital skills vary greatly by country, gender, age, geographical location and socio-economic circumstances, and directly impact one's ability to both afford ICT access as well as benefit from it through usage, a third key dimension when it comes to digital inclusion metrics. Most existing digital inclusion indicators focus on cross-country comparisons of access and skills. By contrast, there is a limited focus on the value created from actual use of acquired skills to benefit from ICTs. For this reason, use is the third key dimension of digital inclusion.

As preconditions for digital inclusion, access to the internet and associated technologies and their use are certainly important. But without a supportive environment in which to safely, confidently and effectively use the internet and ICTs, traditionally and digitally marginalised members of society will remain excluded. For example, in Johannesburg, women use free public Wi-Fi less often than men due to a fear of crime.[35] In some cases, girls are physically prevented from accessing Wi-Fi hotspots by boys.[36] A supportive environment is the fourth dimension and precondition for digital inclusion that must be measured if policymakers are to get a full picture in a given region. Other supportive elements influencing digital inclusion that are largely missing from the nine indexes are affordability, legally valid identification, access to financial services, trust in technology, or a supportive environment to safely and confidently access technology such as public Wi-Fi.

[32] Huovila et al. 2019

[33] EU Science Hub 2019

[34] United Nations Department of Economic and Social Affairs 2012; Huovila et al. 2019; EU Science Hub 2019

[35] Backhouse and Chauke, forthcoming

[36] Walton and Backhouse 2010

# Data granularity and segmentation

In addition to indicators covering the four essential preconditions for digital inclusion, two more elements are required for a useful and effective set of digital inclusion metrics.

Geographical segmentation can help channel scarce resources to initiatives and communities where they can have the most impact. As data can be collected live using geo-located internet and data traffic, indicators should be collected in real time or as often as feasible, at least at the national and regional levels. Geographical regions must be predefined along national, regional and local parameters to target the appropriate communities. Regional and local level (e.g. defined by municipalities or postal codes) data segmentation could be collected bi-annually, allowing decision-makers to act and launch targeted initiatives. Where resources are particularly constrained, population census data can be used, as long as indicators are comparable.

Socio-economic circumstances are closely linked to digital inclusion, particularly for lower-income groups. Unfortunately, most international attempts to measure ICT availability and adoption do not segment indicators by different user groups, let alone their physical location in a given country. While some countries do collect user and location segregated data on an annual basis or in connection with regular population censuses, the degree of comparability across national indicators is unclear. Benchmarks that measure digital inclusion in a general sense are of limited value as an evidence base on which policymakers can take digital policy decisions or prioritise resource allocation. Without data segmented by gender, age, income and educational level, digital inclusion of marginalised communities cannot be assessed over time.

Finally, a lack of data at the sub-national level limits the value of current indicators for policy and decision-makers who cannot prioritise or target initiatives to specific geographical communities. The international measurements could be expanded by identifying national sources of location and user-segmented data, from statistical agencies as already in place, such as those in Australia, South Africa,[37] and Europe.

[37] Statistics South Africa 2011

# 2

# Assessing digital inclusion

# A global framework

Based on the prior analysis of the nine indexes, the digital inclusion framework presented in this section is based on four key dimensions:

- Access
- Skills
- Use and
- Supportive environment

Our framework proposes a number of indicators for each of the four dimensions according to the following criteria:

- valid (measuring what they claim to measure)
- relevant to the problem
- easy to measure
- disaggregated by user group (age, gender, employment type) and
- geographically granular (regional and local-level data)

Whatever the metric, it must be quantifiable and measurable over time. Whether aggregated or disaggregated, the indicators compiled in this framework were selected to provide decision-makers at all levels with a snapshot of the current state of affairs on which they can base their decisions.

The framework also includes a comprehensive set of indicators that can be used in local contexts, with enough overlap to enable comparison across geographic communities, user groups and time periods.[38] These indicators are free of descriptors that cannot be quantified, are overly vague or lack relevance for the objective of tracking digital inclusion.

| Dimensions | Indicator clusters | Layer 1 indicators | Layer 2 indicators |
|---|---|---|---|
|  Access | Acccess to electricity | 12 | 14 |
| | Access to telephony | | |
| | Access to device | | |
| | Access to the internet | | |
| | Quality of connectivity | | |
| | Point of access | | |

[38] Huovila et al. 2019

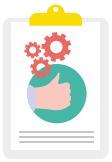
| Dimensions | Indicator clusters | Layer 1 indicators | Layer 2 indicators |
|---|---|---|---|
|  **Skills** | Adult literacy<br>Academic life expectancy<br>Digital skills | **12** | **21** |
|  **Use** | Use internet<br>Basic activities<br>Use eCommerce<br>Use eBanking<br>Use eGovernment<br>eWork / entrepreneurship<br>Social media<br>eParticipation | **8** | **16** |
|  **Suportive environment** | Affordability<br>Legally valid identification<br>Banking and financial inclusion<br>Trust<br>Security | **11** | **29** |

Image source: Digital Future Society and UNU-EGOV.

# Indicator layers: Prioritising what to measure and when

Layer 1 indicators can be thought of as essential and should be collected in real-time (if possible), or on an annual basis.

Layer 2 indicators are a disaggregation of Layer 1 indicators, meaning they are broken down into segments such as technology types, functions, skills and types of usage. Layer 2 indicators should be collected in real-time (if possible), or annually, at the national level as a minimum. If faced with resource constraints, Layer 2 regional and local level data should be collected bi-annually, or as an absolute minimum as part of population censuses every five or ten years.

# Dimension 1: Access

While 4.02 billion people enjoy mobile broadband subscriptions, only 1 billion households have internet access.[39] Access to electricity needed to power devices, internet infrastructure and devices, and access points are indicators most easily found in various benchmarks and statistical sources such as the International Energy Agency or the World Bank. Technology types and quality of access indicators are also well developed, including in the IDI and GSMA benchmarks assessed earlier. Access to internet and ICT devices must therefore be retained in the framework of digital inclusion indicators.

| Indicator clusters | Layer 1 indicators (Index: Original Data Source) | Layer 2 indicators (Index: Original Data Source) |
|---|---|---|
| **Access to electricity** | Access to electricity as % of general/rural/urban population (GSMA-MIC: World Bank) | |
| | Access to electricity (GSMA-MIC: International Energy Agency) | |
| **Access to telephony** | Fixed-telephone subscriptions per 100 inhabitants (GSMA-MIC: ITU) | |
| | Mobile phone subscriptions per 100 inhabitants (GSMA-MIC: ITU) | 2G Coverage - Population covered by a cellular network (%) (GSMA-MIC: ITU) |
| | | 3G Coverage - Population covered by at least a 3G mobile network (%) (GSMA-MIC: ITU) |
| | | 4G Coverage - Population covered by at least an LTE/WiMAX mobile network (%) (GSMA-MIC: ITU) |
| | Internet-enabled (GSMA-MIC: ITU) | |
| **Access to device** | Percentage of households with desktop/laptop computer (GSMA-MIC: ITU) | |
| | Presence of personal computer or tablet computer in household (AUS-DII: Roy Morgan Single Source) | |
| | Mobile/tablet - Percentage of households with mobile phone (GSMA-MIC: ITU) | |
| **Access to the internet** | Access to the internet (%) (ITU-IDI) | Fixed Internet subscriptions per 100 inhabitants (GSMA-MIC:ITU) |
| | | Active mobile-broadband subscriptions per 100 inhabitants (GSMA-MIC:ITU) |

[39] McDonald 2018

| Indicator clusters | Layer 1 indicators (Index: Original Data Source) | Layer 2 indicators (Index: Original Data Source) |
|---|---|---|
| **Quality of connectivity** | Average quality of connectivity (GSMA MIC: GSMA Intelligence) | Average mobile download speeds (GSMA-MIC: Ookla Speedtest Intelligence Data) |
| | | Average mobile upload speeds (GSMA-MIC: Ookla Speedtest Intelligence Data) |
| | | Average mobile latency (GSMA-MIC: Cisco, OpenSignal) |
| | | Secure internet servers per 1 million inhabitants (GSMA-MIC: World Bank) |
| | | International internet bandwidth (bit/s) per user (GSMA-MIC: ITU) |
| | | Internet exchange points (IXPs) per 10 million people (GSMA-MIC: Packet Clearing House) |
| | | Digital dividend spectrum in MHz per operator (GSMA-MIC: GSMA Intelligence) |
| | | Other spectrum below 1GHz per operator (GSMA-MIC: GSMA Intelligence) |
| | | Above 1GHz spectrum per operator (MHz per operator) (GSMA-MIC: GSMA Intelligence) |
| **Point of access** | % of households with internet access (AUS-DII: Roy Morgan Single Source) | |
| | Home (%) | |
| | Work (%) | |
| | Hotspot (%) | Public hotspot (free) - Does the government provide public Wi-Fi access in the largest city in the country and is it free to connect to? (EIU-III) |
| | | Third party hotspot (free) - Does the largest privately owned ISP provide public Wi-Fi access to its customers in the largest city in the country and is it free to connect to? (EIU-III) |
| | Other (%) | |

Image source: Digital Future Society and UNU-EGOV.

# Dimension 2: Skills

The projected impacts of disruptive technologies mean that new skills are required for different job types and employment opportunities, forcing citizens to adapt by increasing their digital competencies. For instance, increased demand for analytical skills are required to realise the potential of open data, estimated to add up to 1.9% of GDP in 2020 for 21 different sectors in 28 EU countries.[40] Similarly, as artificial intelligence and machine learning may add up to 15 billion USD to global GDP, office workers will need to re-skill to adapt.[41] In the long term, jobs traditionally performed by women will be less affected than jobs traditionally performed by men.[42] It is projected that 44% of workers may not have the skills to make the transition into other employment by the mid-2030s.[43]

Current global measurements of digital inclusion largely focus on indicators for traditional skillsets like reading, writing and math, and less on digital literacy, critical content consumption, or entrepreneurship. The skills required for the passive consumption of online content, services and products are different from those required to create new services and products with online content and ICTs.

As traditional literacy skills are both relevant and well-documented internationally, they should be retained in the framework of digital inclusion indicators. However, the skills and competences dimension should be complemented by additional indicators on digital literacy and online safety. The recommended indicators for the skills dimension are outlined below.

| **Indicator clusters** | **Layer 1 indicators** (Index: Original Data Source) | **Layer 2 indicators** (Index: Original Data Source) |
|---|---|---|
| **Adult literacy** | Adult literacy (%) (WEF:UNESCO) | |
| **Academic life expectancy** | Enrolment in primary education (%) (WEF: UNESCO) | Critical thinking in teaching (%) (WEF-GCI) |
| | | STEM (%) (WEF-GCI) |
| | | Coding (%) (WEF-GCI) |
| | Gross graduation ratio from primary education (%) (EIU-III: UNESCO) | |
| | Enrolment in secondary education (%) (EIU-III: UNESCO) | Critical thinking in teaching (%) (WEF-GCI) |
| | | STEM - Share of all students in secondary education enrolled in vocational programmes (UNESCO) |
| | | Coding - Share of all students in secondary education enrolled in vocational programmes (UNESCO) |

[40] Verhulst 2014

[41] Hawksworth et al. 2018

[42] Sorgner et al. 2017

[43] Hawksworth et al. 2018

| Indicator clusters | Layer 1 indicators (Index: Original Data Source) | Layer 2 indicators (Index: Original Data Source) |
|---|---|---|
| **Academic life expectancy** | Gross graduation ratio from upper and lower secondary education (%) (WEF:UNESCO) | Gross graduation ratio from lower education (%) (WIPO-GII: UNESCO) |
| | | Gross graduation ratio from upper education (%) (WIPO-GII: UNESCO) |
| | Enrolment in tertiary education (%) (WIPO-GII: UNESCO) | |
| | Graduates from tertiary education (%) (WIPO-GII: UNESCO) | Graduates from tertiary education in Natural Sciences, Math and Statistics Programmes (%) (WIPO-GII: UNESCO) |
| | | Graduates from tertiary education in Engineering, Manufacturing and Construction (%) (WIPO-GII: UNESCO) |
| | Mean years of schooling (%) (EIU-III: UNDP) | |
| **Digital skills** | Possession of "basic" or "above basic" digital skills (general) (%) (EC-DESI: Eurostat) | Possession of "basic" or "above basic" digital skills: information (%) (EC-DESI: Eurostat) |
| | | Possession of "basic" or "above basic" digital skills: communication (%) (EC-DESI: Eurostat) |
| | | Possession of "basic" or "above basic" digital skills: problem solving (%) (EC-DESI: Eurostat) |
| | | Possession of "basic" or "above basic" digital skills: software for content creation (%) (EC-DESI: Eurostat) |
| | In addition to having used basic software features such as word processing, use of advanced spreadsheet functions, created a presentation or document integrating text, pictures and tables or charts, or written code in a programming language (EC-DESI: Eurostat) | In the private sector (%) |
| | | In the public sector (%) |
| | % of people with a degree in ICT (EC-DESI: Eurostat) | In the private sector (%) |
| | | In the public sector (%) |
| | % employed ICT specialists (EC-DESI: Eurostat) | In the private sector (%) |
| | | In the public sector (%) |

Image source: Digital Future Society and UNU-EGOV.

# Dimension 3: Use

Digital inclusion and the use of digital services and products create value for marginalised individuals, the public and private service providers. As governments, businesses and third sector organisations pivot to proactive and digital service delivery, it must be ascertained if the targeted users are able to access and use the new digital services. These indicators are therefore important components to understand the degree of digital inclusion of marginalised communities and their readiness for digital transformation. Indicators in this dimension go beyond mere internet or technology usage to include the use of public and private sector services offerings, ICT use in the workplace, social activities, and public engagement. The recommended indicators for the use dimension are outlined below.

| **Indicator clusters** | **Layer 1 indicators** (Index: Original Data Source) | **Layer 2 indicators** (Index: Original Data Source) |
|---|---|---|
| **Internet use** | Individuals using the Internet (%) (ITU-IDI) or People who never used the internet (%) (EC-DESI: Eurostat) | Individuals using the Internet once in the last 3 months (%) (ITU-IDI) |
| | | People who use the Internet at least once a week (%) (EC-DESI: Eurostat) |
| **Basic online activities** | Streamed, played, or downloaded content online (%) (EC-DESI: Eurostat) | |
| | AV communication via the internet (%) (EC-DESI: Eurostat) | |
| | Created or managed a site or blog (%) (EC-DESI: Eurostat) | |
| | Searched for advanced information (%) (EC-DESI: Eurostat) | |
| **Used eCommerce** | Searched for eCommerce information in last 12 months (%) (EIU-III: UNCTAD) | Compared products and services online (%) (EIU-III) |
| | Made a transaction in last 12 months (%) (EC-DESI: Eurostat) | Purchased a project or service (EIU-III)<br>Frequency of purchase of goods via the internet (EIU-III)<br>People who ordered goods or services online (EC-DESI: Eurostat)<br>Used the internet to pay bills or buy online in the past year (% age 15+) (World Bank) |

| Indicator clusters | Layer 1 indicators (Index: Original Data Source) | Layer 2 indicators (Index: Original Data Source) |
|---|---|---|
| **Used eCommerce** | Made a transaction in last 12 months (%) (EC-DESI: Eurostat) | Sold a product or service (active)<br>People who sold goods or services online (%) (EC-DESI: Eurostat) |
| | | Developed a commercial site/portal (%) (EC-DESI: Eurostat) |
| | | Developed a digital commerce product or service for 3rd parties (%) (EC-DESI: Eurostat) |
| **Used eBanking** | Searched for online banking information in last 12 months (%) (EIU-III) | |
| | Made a payment or transaction (including mobile money) in last 12 months (%) (World Bank)<br>Made or received digital payments in the past year (% ages 35-59) (World Bank) or<br>Used the internet to pay bills or buy online in the past year (% age 15+) (World Bank) | Made a transfer from website or app (%) |
| | | Made a transfer via SMS or other non-website or app solutions (%) |
| **Used eGovernment** | Searched for digital public service information in last 12 months (%) (EC-DESI: Eurostat) | Number of administrative steps related to major life events (birth of a child, new residence, etc) that can be done online (UNDESA-EGDI) |
| | | Number of administrative steps related to business administration (register/close a company, declare corporate taxes, pay VAT, apply for a licence/permit) that can be done online (UNDESA-EGDI) |
| | Made a digital public service transaction in last 12 months (%) (EC-DESI: Eurostat) | Number of administrative steps related to business administration (register/close a company, declare corporate taxes, pay VAT, apply for a licence/permit) that can be done online (UNDESA-EGDI) |
| | | Number of administrative steps related to business administration (register/close a company, declare corporate taxes, pay VAT, apply for a licence/permit) that can be done online (UNDESA-EGDI) |

| Indicator clusters | Layer 1 indicators (Index: Original Data Source) | Layer 2 indicators (Index: Original Data Source) |
|---|---|---|
| **eWork / entrepreneurship** | Used the internet or a device for work in the last 12 months (%) (EC-DESI: Eurostat) | PC, internet or system based (%) |
| | | Coding (%) |
| | | Designed an application/solution (%) |
| | | Apps developed per person (%) |
| | | Companies per 100 persons (%) |
| | | Startups per 100 persons (%) |
| **Social media** | Used social media in the last 12 months (%) (EC-DESI: Eurostat) | Found information and communicated with people (passive) (%) |
| | | Consumed social media content (passive) (%) |
| | | Commented and shared social media non-social content (e.g. news) (active) (%) |
| | | Produced content for social media content (active) (%) |
| **eParticipation** | Engaged in public discourse online in the last 12 months (%) (UNDESA-EGDI) | Found information (passive) (%) |
| | | Voted for / rated a suggestion (passive) (%) |
| | | Commented on... (active) (%) |
| | | Made a proposal (petition, budget...) (active) (%) |

# Dimension 4: Supportive environment

Despite previous gains in the positive impact of ICT use across the world, the gap between the northern hemisphere and the Global South is growing. Variations in uptake and adjustment are resulting in this widening gap with increased urban-rural divides and disparities in income, opportunities and service access. Inroads made in the 20th century are being eroded by rising income inequality, up 10% globally since the 1980s.[44] As this gap continues to widen, access, and the quality and affordability of such access are universally accepted as essential indicators to assess digital inclusion.

Affordability is an increasingly powerful driver of the digital divide and digital exclusion.[45] While 75% of Africans have mobile phone access, affordability, digital empowerment and gender inclusion require urgent attention. The African Union calls for accelerating the creation of a single African digital market to increase private sector opportunities, improve affordability via increased competition on internet access and digital services and products.[46] Similar patterns are observed in Asian, Latin American and Caribbean contexts in terms of access, skills, affordability and financial inclusion.[47]

Legally valid proof of identity is an essential component of everyday life in both the physical and digital world. The challenges faced globally and by traditionally marginalised communities are even greater when it comes to digital identification. While most emerging economies have some form of digital ID scheme, it is either limited to specific purposes or in limited use. A mere 3% of developing countries have foundational eID schemes that can be used to access an array of online service offers, with 24% of developing countries having no eID system at all.[48] As a result, more than a billion people globally still have trouble proving their identity and therefore lack access to vital services including healthcare, social protection, education, and finance.[49] Of these, 47% are below the national ID age of their country, and 63% of children in low or lower-middle income economies have no formal identities.

Without financial inclusion, one cannot actively engage in the global economy. While the number of adults with an account at a bank or mobile money provider has improved globally and stands at 69%, over 1.7 billion people remain unbanked.[50] Zero-Rupee accounts in India and mobile banking akin to East Africa's mPesa are increasing financial inclusion. Globally, most non-users are in low-income countries, with half of unbanked adults from the poorest 40% of households within their economy, 56% being women.[51] Without access to financial services, marginalised groups have limited access to public and private services, and limited ability to leverage opportunities offered by the digital economy. Financial inclusion must therefore be added to the set of essential digital inclusion indicators.

[44] UN News 2019

[45] UNU-EGOV 2019; ILO News 2015; Meyerhoff Nielsen et al. 2018

[46] Doh 2017

[47] Research ICT Africa 2017; Roseth et al. 2018

[48] Emerson 2017

[49] Desai et al. 2018

[50] The Global Innovation Index 2019; Mesropyan 2018

[51] The Global Innovation Index 2019

Trust in technology, online content and digital public services also influences digital inclusion. Though seemingly difficult to measure, trust can be quantified in relation to national data protection laws or by assessing confidence levels in digital public services. For this reason, the proposed framework includes indicators designed to gauge the general level of trust.

Security influences the use of technology in many ways, two of which are relevant in the context of digital inclusion. One is the fear of falling victim to cyber-crime, such as identity theft. The fear of experiencing online harassment, cyberbullying or violent crime when using public Wi-Fi is another.

Without valid identities, individuals have difficulties accessing essential public and private services, whether in person or online, leading to exclusion. Similarly, any service requiring a financial transaction, or entrepreneurial endeavour will be severely restricted without access to financial services. Trust and safety are additional supportive conditions that can underpin greater inclusion. Therefore, indicators to track affordability, legally valid identification, financial inclusion, trust in technology and safety online and in the physical world should also be included in a holistic digital inclusion framework.

| **Indicator clusters** | **Layer 1 indicators** (Index: Original Data Source) | **Layer 2 indicators** (Index: Original Data Source) |
|---|---|---|
| **Affordability** | Cost of 100 MB of data (GSMA-MIC) | Cost of 100MB of data (% of monthly GDP per capita) (GSMA-MIC: Tarifica) |
| | | Cost of 500MB of data (% of monthly GDP per capita) (GSMA-MIC: Tarifica)<br>Mobile broadband handset + 500MB, postpaid and prepaid, cap, in MB (GSMA-MIC: ITU) |
| | | Cost of 1GB of data (% of monthly GDP per capita) (GSMA-MIC: Tarifica)<br>Mobile broadband USB_1GB, postpaid and prepaid, cap, in GB (GSMA-MIC: ITU) |
| | Device price (cheapest mobile on the market) (GSMA-MIC) | Cost of cheapest internet-enabled mobile device (GSMA-MIC: Tarifica) |
| | | Cost of cheapest internet-enabled PC (GSMA-MIC) |

| Indicator clusters | Layer 1 indicators (Index: Original Data Source) | Layer 2 indicators (Index: Original Data Source) |
|---|---|---|
| **Legally valid identification** | Ability to apply for a personal identity card (UNDESA-EGDI) | |
| | Presence of an eID or national digital identification system to access government services (UNDESA-EGDI: World Bank)<br>Evidence on government websites that the national ID is digitalized (UNDESA-EGDI) | Simple login and password (%)<br>Is there any kind of authentication (a digital ID) required to access online services? |
| | Nationally recognised eSignature (%) | Nationally recognised 2-factor authentication (%) |
| | | Nationally recognised 3-factor authentication (%) |
| **Banking and financial inclusion** | Individuals with access to financial services (%) | Individuals with access to a bank account (%) |
| | | Individuals with access to alternative financial services (e.g. mPesa, mobile money) (%) |
| **Trust and online privacy** | Confidence in privacy of online activities (%) (EIU-III: ITU Cyber Security Index) | Extent of trust in information received from government websites / apps (%) (EIU-III: ITU Cyber Security Index) |
| | | Extent of trust in information received from non-government websites / apps that are based in my country (%) (EIU-III: ITU Cyber Security Index) |
| | | Extent of trust in information received from "other people using social media" (%) (EIU-III: ITU Cyber Security Index) |
| | | Extent of agreement with the statement: "making purchases online is safe and secure" (%) (EIU-III: ITU Cyber Security Index) |
| | Presence of data protection law(s) (EIU-III: ITU Cyber Security Index) | Presence of legal penalties in place for firms that do not follow the law? (EIU-III: ITU Cyber Security Index) |
| | | Privacy Regulations - Are there financial penalties in place for firms that do not follow the law? (EIU-III: ITU Cyber Security Index) |

| Indicator clusters | Layer 1 indicators (Index: Original Data Source) | Layer 2 indicators (Index: Original Data Source) |
|---|---|---|
| Security | Existence of legislation that specifically addresses sexual harassment (World Bank) | Is there legislation that specifically addresses sexual harassment? (World Bank) |
| | | Is there sexual harassment legislation in public places? (World Bank) |
| | | Are there civil remedies for sexual harassment in employment? (World Bank) |
| | Percentage of individuals victims of a crime (%) (UN Women) | Percentage of individuals victims of cyber crime (e.g. ITU Cyber Security Index) |
| | | Percentage of individuals victims of violent crime (%) |
| | | Percentage of individuals victims of domestic violence (%) (UN Women) |

# A call to action

# Key learnings and next steps

**"Without a huge commitment to and investment in digital inclusion, conflicts and mistrust will grow. The longer we wait, the further we will fall behind."[52]**

**Antonio Guterres**
**United Nations Secretary-General**

In order to eliminate digital divides and increase the digital inclusion of marginalised communities, continuous measurement and monitoring is essential to ensure that policymakers can take appropriate targeted action in alignment with the SDGs.

Currently, global digital inclusion indicators and benchmarks tend to focus on cross-country comparisons of access, skills and some basic online activities. This focus should be expanded by adding metrics for access to electricity, the internet and devices as well as quality of access and point of access.

Length of education and traditional literacy skills currently dominate measurements of digital literacy, a precondition for digital inclusion. Given the rapid digital transformation of society and the workplace, indicators tracking literacy must be complemented by metrics for digital skills, critical thinking and entrepreneurship.

Access to ICTs or the ability to use them safely, confidently and effectively does not magically include marginalised communities. Whether in telecommunication infrastructure, skills development, digital content, services or products, benefits of investment come with safe and effective use. The use of digital public services as well as online content, services and products must therefore be monitored and measured to ensure the increased inclusion of marginalised communities together with value creation.

[52] Devdiscourse 2019

Several supporting conditions are required to ensure digital inclusion, particularly within digitally marginalised communities. To eliminate current digital divides, metrics must cover affordability of access to the internet and devices, the ability of individuals to identify themselves legally, financial inclusion, trust in technology and digital public services as well as security in both the physical and digital worlds.

Globally, the assessment of digital inclusion is largely confined to national comparisons and with limited differentiation between different user groups or activities. To facilitate targeted, evidence-based decisions and resource allocations, segmentation by geographic area and user group are essential factors to measure the inclusion of communities at risk of digital exclusion. The ability to aggregate and disaggregate data is also vital for evidence-based decision making, as it will help pinpoint areas and communities in need of investment. Beyond national-level segmentation, digital inclusion metrics should include regional and local levels of assessment where possible. User segments should include gender, age, income, education and even employment type.

## Putting the framework to work

While the goal of this report is to support governments in measuring digital inclusion, creating an updated framework that aggregates relevant metrics and indicators at the global level is just a first step. After all, the word “framework” itself indicates a frame or template for work yet to be accomplished.

By measuring digital inclusion (or lack thereof) on the margins of society, policy decisions and resource allocations can be better targeted not only nationally, but also at regional and local levels. Our analysis has shown how international organisations and national level governments have limited visibility and tools to improve digital inclusion for marginalised groups. Only through targeted policies supported by granular evidence at regional and local levels can tangible improvements be made.

Going forward, tighter collaboration between national, regional and local governments together with non-profit, academic and private sector organisations with deep and detailed knowledge of the targeted collectives will be necessary if the digital inclusion framework proposed in this report is to achieve its full potential.

That means not only gathering data but also using it as a basis to inform policy action, allocate funding and implement digital inclusion projects based on the application of the framework. To further refine, strengthen and apply the framework, the following steps should be taken:

- Add or map in greater detail the contributions of different international and private sector data sources for each of the four dimensions and their two layers
- Implement census-style policies to ensure indicator data are collected consistently
- Test and evaluate the framework at the regional and local level, with a focus on how decision-makers use it for improved policymaking and resource allocation
- Continue to monitor and evaluate whether the most vulnerable and marginalised communities are reached

As the UN recognises, digital inclusion is a crucial component of a more equitable digital future. But it can only be realised through digital cooperation: a joint effort of location-oriented programmes that are specifically designed with and for the collectives that they try to support. The digital inclusion challenge may be global, but it can only be overcome if metrics are translated into actions on the ground.

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# Appendix I

Overview of the main indexes related to digital inclusion analysed in this report.

| Benchmark/Index Name | Description | Additional Data (coverage, frequency, etc.) |
|---|---|---|
| ICT Development Index (ITU-IDI)<br>International Telecommunications Union (ITU)<br>https://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2017/methodology.aspx | A composite index that combines 14 indicators across three sub-indexes: ICT access, ICT use, and ICT skills. Uses official statistics submitted by governments. Uses proxy instead of direct indicators due to lack of official statistics, especially for ICT use and ICT skills (e.g. subscriptions for use and enrolment ratios for skills). Openly published methodology. | 160 countries<br>Annual<br>2009 – onwards<br>Methodology available |
| Global Competitiveness Index (WEF-GCI)<br>World Economic Forum<br>http://weforum.org/ | One of the most cited and influential country-level indexes comparing national competitiveness. The GCI assesses over 100 indicators across 12 pillars. Focus is on a set of institutions, policies and factors that determine the level of productivity. One of its pillars measures technological readiness using seven indicators: availability of latest technologies, firm-level technology absorption, foreign direct investment and technology transfer, internet users, fixed-broadband internet subscriptions per 100, internet bandwidth per capita, and mobile-broadband subscription per 100 inhabitants. | 130 countries<br>Annual<br>2015 – onwards (has been assessed for 40+ years in other forms)<br>Methodology available |
| Inclusive Internet Index (EIU-III)<br>Facebook and Economist Intelligence Unit<br>https://theinclusiveinternet.eiu.com/ | Measures national-level internet inclusion across four categories: availability, affordability, relevance, and readiness. Acknowledges that inclusion goes beyond infrastructure access. Includes cost of access, market competition, availability of relevant and local content, as well as capacity in terms of education and skills. However, certain aspects of the methodology are not clearly explained, and countries are ranked but not scored. | 80+ countries<br>Annual<br>2017 – onwards<br>Methodology not available |
| Digital Economy and Society Index (EC-DESI)<br>European Commission and Eurostat<br>https://ec.europa.eu/ | Tracks internet inclusion in terms of three sub-indexes: access, affordability, and digital ability across the European Union and candidate countries. Some indicators available and regional and local level, but not consistently. Indicators are organised around sub-indexes. Based on the annual ICT household survey data and is consequently able to highlight specific digital skills in more detail. | 30+ countries<br>Annual<br>2000 – onwards<br>Methodology partially available |

| Benchmark/Index Name | Description | Additional Data (coverage, frequency, etc.) |
|---|---|---|
| eGovernment Development Index (UNDESA-EGDI)<br>United Nations Department for Economic and Social Affairs (UNDESA)<br>https://publicadministration.un.org/ | Assesses and compares the level of development of technology infrastructure (five indicators), human capacities (four indicators, eGovernment and eParticipation (200 question assessment) services to promote access and inclusion. Recognises that eGovernment development depends not only on the supply of online services, but also on the country's capacity to participate in the information society. The index is a weighted average of normalised scores for three dimensions of eGovernment development: scope and quality of online services, development status of telecommunications infrastructure, and inherent human capital and is complimented by eParticipation and local government services (c. 80 question assessment of 40 and 100 large cities in 2018 and 2020 respectively). It is regularly revised to reflect changing trends in eGovernment strategies. | 193+ countries<br>Bi-annual<br>2001 – onwards<br>Methodology partially available |
| State of Mobile Internet Connectivity Index (GSMA-MIC)<br>GSMA<br>https://www.mobileconnectivityindex.com/ | Measures performance against the key enablers of mobile internet adoption. Aims to support the efforts of the mobile industry, governments, and the wider international community to deliver on the ambition of universal access to the internet. Countries are scored on a range of 37 indicators on a range from 0 to 100. Most indicators related to infrastructure types, quality and affordability. Four indicators focus on gender gaps and two include raw scores from other indexes e.g. the UN EGDI and Cyber Security Index. | 165 countries<br>Annual<br>2014 – onwards<br>Methodology partially available |
| Global Innovation Index (WIPO-GII)<br>World Intellectual Property Organization (WIPO), INSEAD and Cornell University<br>https://www.globalinnovationindex.org/ | Composite benchmark that aims to track innovation in all its complexity. The GII has two sub-indexes, innovation input and innovation output, built on five and two pillars, respectively. Each pillar has sub-pillars, and the index has about 80 indicators. The ICT sub-pillar is a composite of four other indexes: ICT access, ICT use, online service by governments, and online participation by citizens. | 120 countries<br>Annual<br>2008 – onwards<br>Methodology available |
| Affordability Drivers Index (A4AI-ADI)<br>Web Foundation Alliance for Affordable Internet<br>https://a4ai.org/ | A composite measure of the drivers of internet affordability. The index scores and ranks countries according to two key aspects driving affordability: communications infrastructure and access. The infrastructure sub-index tracks infrastructure deployment, as well as enabling policy and regulation that encourages network expansion. The access sub-index tracks current broadband adoption rates, as well as policy and regulatory frameworks that ensure affordable and equitable access. The 28 indicators are sourced from an expert survey and from statistics published elsewhere, such as in ITU research. | 60+ countries<br>Annual<br>2014 – onwards<br>Methodology available |
| Australian Digital Inclusion Index (AUS-ADI)<br>Supported by Telstra andconducted by Roy Morgan Research, RMIT and Swinburne University<br>https://digitalinclusionindex.org.au/ | Tracks internet inclusion in terms of three sub-indexes: access, affordability, and digital ability across different states and territories in Australia. 30 plus indicators organised around sub-indexes. Uses survey data for the indicators and is consequently able to highlight digital skills in more detail. | Australia only (regional level)<br>Annual<br>2017 – onwards<br>Methodology not identified |

# Appendix II

Overview of how the dimensions of digital inclusion defined in this report are related to each of the 17 Sustainable Development Goals.

**SDG 1: No poverty**

Access and skills are required if all people, especially marginalised groups, are to have equal rights to economic resources, as well as access to basic public and private services (analogue and digital) using new technologies and financial services, including legal identification and microfinance.

**SDG 2: Zero hunger**

Access and skills are required if smallholder and marginalised farmers are to use ICT applications to improve agricultural productivity through access to market data, updated weather forecasts, and financing.

**SDG 3: Good health and well-being**

Access and skills are required if low-income and rural populations in marginalised communities are to have access to eHealth solutions.

**SDG 4: Quality education**

Access is required to equip schools in marginalised communities with digital resources ensure and future generations are taught digital skills. Access is required to equip schools with high-quality digital resources and to level the playing field between rural and urban areas, ensure quality education, and upskilling of all no matter their age, gender or socio-economic circumstances.

**SDG 5: Gender equality**

Access and skills are required to help ensure gender equality across marginalised groups regardless of age, socio-economic status, educational background or geographic location. Ownership and use of ICT devices can enable women and girls to improve their livelihoods and expand their choices by opening access to public and private services such as microfinance and eID solutions.

**SDG 6: Clean water and sanitation**

Access to IoT and mobile solutions, smart grids and smart meters in marginalised communities is required if these technologies are to help improve efficient and effective water management and use.

**SDG 7: Affordable and clean energy**

Access to IoT and mobile solutions, smart grids and smart meters in marginalised communities is required if these technologies are to help improve efficient and effective energy management and use.

**SDG 8: Decent work and economic growth**

Access to cloud services that enable small and medium-sized enterprises to compete in increasingly sophisticated digital markets is required for a level playing field when it comes to economic growth. Investment in digital skills can also improve employment prospects, and higher levels of economic productivity through diversification, attracting digital talent, technological upgrading and innovation.

**SDG 9: Industry, innovation and infrastructure**

Access and skills enable people in marginalised communities to access a broad range of information and services.

**SDG 10: Reduced inequalities**

Access and skills are required for assisted living solutions giving differently abled individuals and the elderly greater independence and the ability to participate fully in the economy.

### SDG 11: Sustainable cities and communities

Access, skills and user data are required to understand how smart, sustainable city and community applications based on IoT, GPS and big data should be deployed, especially in marginalised communities.

### SDG 12: Responsible consumption and production

Access and skills to use IoT and machine-to-machine services that track and reduce waste and energy use are required for sustainable production and consumption in marginalised communities.

### SDG 13: Climate action

Access and skills to use smart and sustainable IoT solutions are needed, for example satellite imaging that tracks deforestation.

### SDG 14: Life below water

Access and skills to use smart and sustainable IoT solutions are needed, for example sensors that track illegal, unregulated or unreported fishing activities.

### SDG 15: Life on land

Access and skills to use smart and sustainable IoT solutions are needed, for example drones that track biodiversity loss.

### SDG 16: Peace and justice

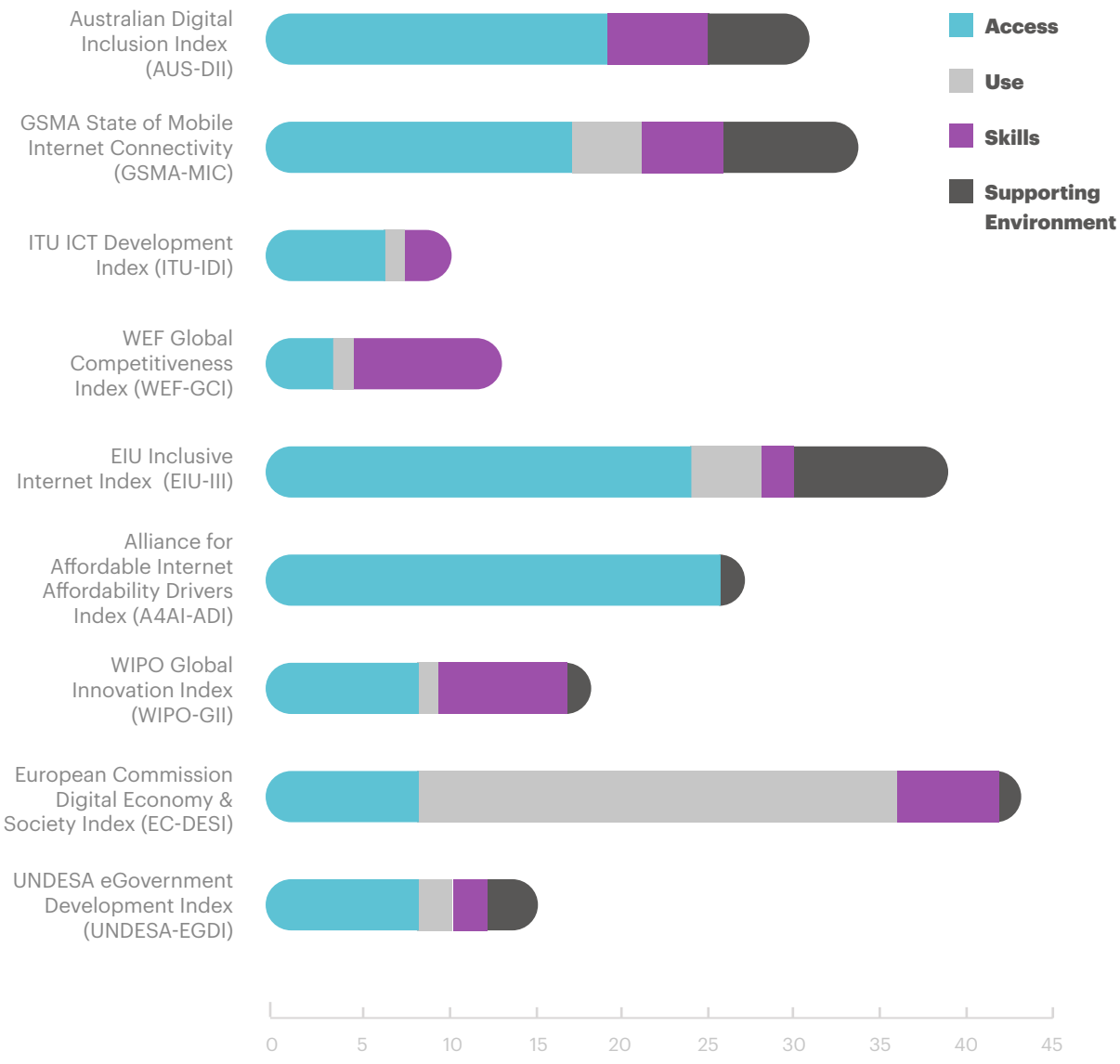
Access and skills to use sentiment analysis tools for social media are required to reveal public opinion on effective governance, as well as new eGovernment solutions that can enhance access to public services. Access and skills are also needed to provide digital tools and channels for greater inclusion of marginalised communities and protection of vulnerable individuals, especially in remote areas or where anonymity might be needed, for example LGBTQ+ communities in some countries.

### SDG 17: Partnership for the goals

Access and skills are required to develop and use ICT applications that enhance the ability of people in marginalised communities to communicate and coordinate action on the SDGs at all levels, and for policymakers to monitor and act on indicator data tracking  digital inclusion of marginalised communities.

# Appendix III

Comparative overview of the indexes analysed in this report by indicator dimension.

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