

# Communications Access Index

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## Executive Summary

The Communications Access Index (CAI) gives basic insight into a country's communication capabilities. The index, scored from 0 to 100, composes of four subscores – Mobile Connectivity, Internet Connectivity, Landline Connectivity, and Electricity Access. It is based on access to mobile phones, Internet, landlines, and electricity using data collected by the United Nations from 2010 and covers over 200 countries and territories.

Data normalized on a per 100 inhabitants basis and was used to directly relate access metrics (eg: number of mobile cellular subscriptions per 100 inhabitants) to a sub score). Data from the most recent year, 2010, with complete information from the least countries and territories listed on the data sets (207 in total) was used. Each sub score was weighted separately - 30%, 30%, 15%, and 25% - respectively for each of the four connectivity sub scores listed earlier.

Microsoft Excel was used to organize and analyze the data to obtain sub scores. Once the final CAI scores were obtained, CartoDB was used to map the difference between of each country's CAI to the global average CAI. Microsoft Excel was used to generate plots that compare CAI scores and differences on a by-region and a by-country basis.

Europe, specifically Western Europe, had the highest concentration of countries with the highest CAI scores. In addition, developed nations such as the US, Canada, Australia, Japan, and South Korea, also scored near the top of the CAI. Africa had the lowest average CAI score of any continent/region by over 20 points. Finally, most developing nations, such as China and India, scored right around the world average.

In the future, the CAI can be used in conjunction with other measures – such as GDP per capita – to determine the characteristics of countries that have high CAI scores.

## Definition

The Communications Access Index (CAI) is an index that attempts to quantify how well connected a country's population is to other people based on its populations' ability to communicate through electronic and digital means.

The index is scored from 0 to 100. A score of 0 means a country has no means of digital/electronic communications while a score of 100 means all of a country's population has access to electricity and all forms of communication.

## Purpose

The purpose of this index is to quantify a country's communication capabilities, identify the countries that have populations who are best connected to each other and to the rest of the world, and reveal any geographical trends in the communication capabilities.

## Methodology

The Communications Access Index is a score made up of a single number between 0 and 100 and is based on the three ways in which electronic communication takes place: through the internet, over a landline, or through a cellular device. Electrical access is also factored due to the need for power to communicate and as a proxy measurement for communication through other means. The Index has four sub scores for each of the following four categories:

- Mobile Connectivity (30 points)
- Internet Connectivity (30 points)
- Landline Connectivity (15 points)
- Power Accessibility (25 points)

Each sub score is first scored out of 100 points, then brought down to its appropriate weight in the total score calculation. A CAI score of 100 means each person in a country has access to electricity and each means of communications while a score of 0 means no people in a country have access to electricity and communication.

### Mobile Connectivity

The Mobile Connectivity sub score is directly based on a country's mobile subscriptions per 100 people. This sub score has two components:

- Saturation Component (80 points)
  - Up to and including the first 100 subscriptions per 100 inhabitants, each subscriber per 100 inhabitants contributes 0.8 points (1:1 ratio).

- Efficiency Component (20 points)
  - From the 101st subscriber to the 200th subscriber per 100 inhabitants, each subscriber per 100 inhabitants contributes 0.2 points. Any additional subscriber beyond 200 contributes nothing.

A perfect score would mean that each person has 2 subscriptions - one for work, one for personal use. Connectivity wise, there's diminishing returns after each person has one subscription (on average). Therefore, this sub-score is weighted more heavily towards the first 100 subscribers per 100 people. In the context of quantifying connectivity, there is a negligible effect on people having more than two subscriptions.

### Internet Connectivity

The Internet Connectivity sub score is directly based on a country's internet users per 100 inhabitants. Each Internet user per 100 inhabitants contributes 1 point towards the sub score.

### Landline Connectivity

The Landline Connectivity sub score is directly based on a country's number of fixed telephone lines per 100 inhabitants. Similar to the Internet Connectivity sub score, the Landline Connectivity sub score has two components:

- Saturation Component (90 points)
  - 0-20 lines per 100 inhabitants = 37.5 points available
    - Each line per 100 inhabitants contributes 1.875 points
  - 20-25 lines per 100 inhabitants = 27.5 points available
    - Each line per 100 inhabitants contributes 5.5 points
  - 25-33 lines per 100 inhabitants = 17.5 points available
    - Each line per 100 inhabitants contributes 2.1875 points
  - 33-50 lines per 100 inhabitants = 7.5 points available
    - Each line per 100 inhabitants contributes 0.441 points
- Efficiency Component (10 points)
  - 50-100 lines per 100 inhabitants = 10 points available
    - Each line per 100 inhabitants contributes 0.2 points. No points given for lines above 100 lines per 100 inhabitants

Scoring is based on household size. 20 lines per 100 inhabitants means that a household of five people have telephone access, for example. As a country's ability to provide telephone access for households of smaller and smaller sizes, the score will increase. However, this increase is not directly proportional because it is not entirely necessary for each person in a country to have access to a telephone. If one person in the household has access, that is sufficient from a saturation stand point.

## Power Accessibility

The Power Accessibility sub score is directly based on the percentage of a country's population that has access to electricity. Each percentage point of the country's population that has access to electricity contributes 1 point towards the sub score.

## Data Analysis

CartoDB and Microsoft Excel were used to generate maps and bar graphs, respectively. The CartoGB map was used to show the difference between each country's CAI score to the world average CAI. Excel graphs were made to show the top/bottom ten CAI scores and compare the average CAI scores of each continent to each other and of countries within each continent.

## **Results**

CAI Scores ranged from under 10 (several African countries) to just over 90 (Luxembourg). The world average CAI was 54. Average CAI scores of continents ranged from 30 (Africa) to 80 (Europe). From looking at the map, it is evident that the greatest concentration of high-scoring countries is located in Western Europe. In fact, the only countries in the upper quantile (approximately the top 30) located outside of Europe and Greenland are the US, Canada, Australia, New Zealand, Japan, Israel, and South Korea. The trend seems to be that developed countries lead in CAI scores while developing countries – mostly in Central America and Africa – tend to lag. Surprisingly, India and China, two countries known for their emphasis on technical education and in the case of China, massive technology production capabilities, both score in the middle of the pack. It may be interesting to investigate why such is the case.

## **Limitations**

This index is purely a quantitative assessment of communications capabilities; therefore, it cannot take into account the quality or cost of a country's communications and classify countries that way. For example, a country might have a high CAI score, indicating broad access to communications, but Internet speeds might be low and costs to users may be high.

Furthermore, this index cannot show the distribution of access to communications within a country. This is less of an issue for countries with a homogenous population distribution (such as small, densely populated European countries). However, for countries such as the US with a wide range of population densities, the CAI index can tell us nothing about what a country's communication capabilities are in different regions of the country.

## Future Applications

In the future, the CAI can be used in conjunction with other measures – such as GDP per capita – to determine the characteristics of countries that have high CAI scores. The CAI Index can also be used to highlight countries that have low CAI scores and/or countries that show surprising results (e.g. high GDP per capita, low CAI and vice versa) and tag them for further investigation.

## Sources

All data has been obtained from [The Humanitarian Data Exchange \(HDX\)](#) from the following datasets:

- [Mobile Connectivity](#)
- [Internet Connectivity](#)
- [Landline Connectivity](#)
- [Power Accessibility](#)