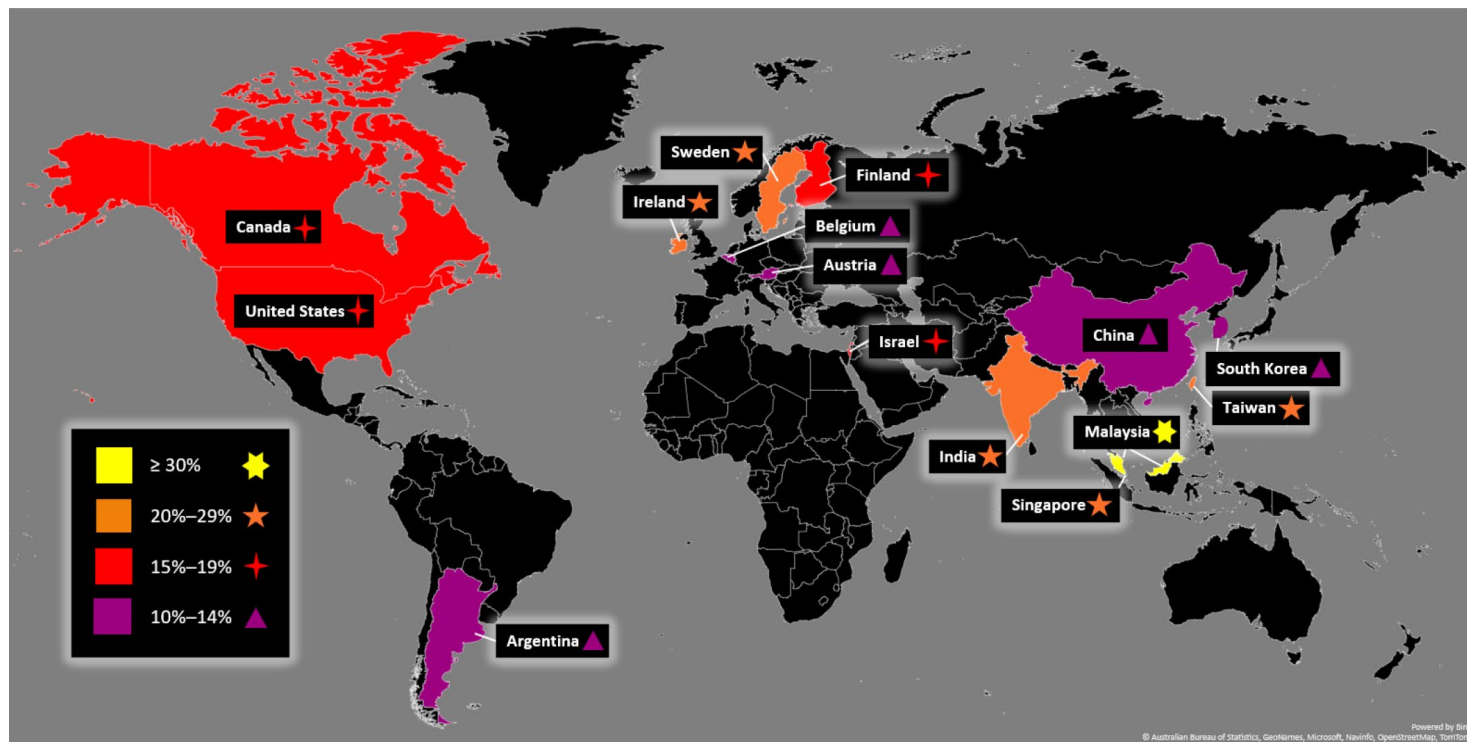


Concentration in International Utility Patenting of Critical and Emerging Technologies Indicates Innovative Capacity

Utility patents granted to residents are one measure of a location's innovative activity. Utility patents are used to provide protection to novel and potentially useful inventions. The number of total utility patents issued to residents in 2020 was greatest in China, Japan, and South Korea. The percentage of these total patents by location that is granted in semiconductors and other communication technologies indicates a location's focus in these key technologies. These key technologies overlap with two technologies identified as “critical and emerging” by the National Science and Technology Council: semiconductors and microelectronics as well as communications and networking technologies (see <https://www.whitehouse.gov/wp-content/uploads/2022/02/02-2022-Critical-and-Emerging-Technologies-List-Update.pdf>).

The map below shows the cumulative percentage of a country's or economy's utility patents in semiconductors, basic communications, digital communications, and telecommunications. Along with multiple countries or economies in Southeast Asia, the countries of India, Sweden, and Ireland also had high concentrations of patents in these four technology areas. Data in this report are from *Science and Engineering Indicators* (<https://nces.nsf.gov/indicators>).



Country's or economy's total utility patents granted to residents in semiconductor and three communications technologies in 2020: Highest 15 by percentage

Note(s): Utility patents are fractionally allocated among countries or economies based on the proportion of residences of all named inventors. Fractional counts of patents were assigned to each technological field on patents to assign the proper weight of a patent to the corresponding technological fields under the classification. The numerator is the sum of international utility patents in semiconductor, basic communications, digital communications, and telecommunications technologies, by region, country, or economy divided by the total international utility patents granted to inventors residing in that jurisdiction.

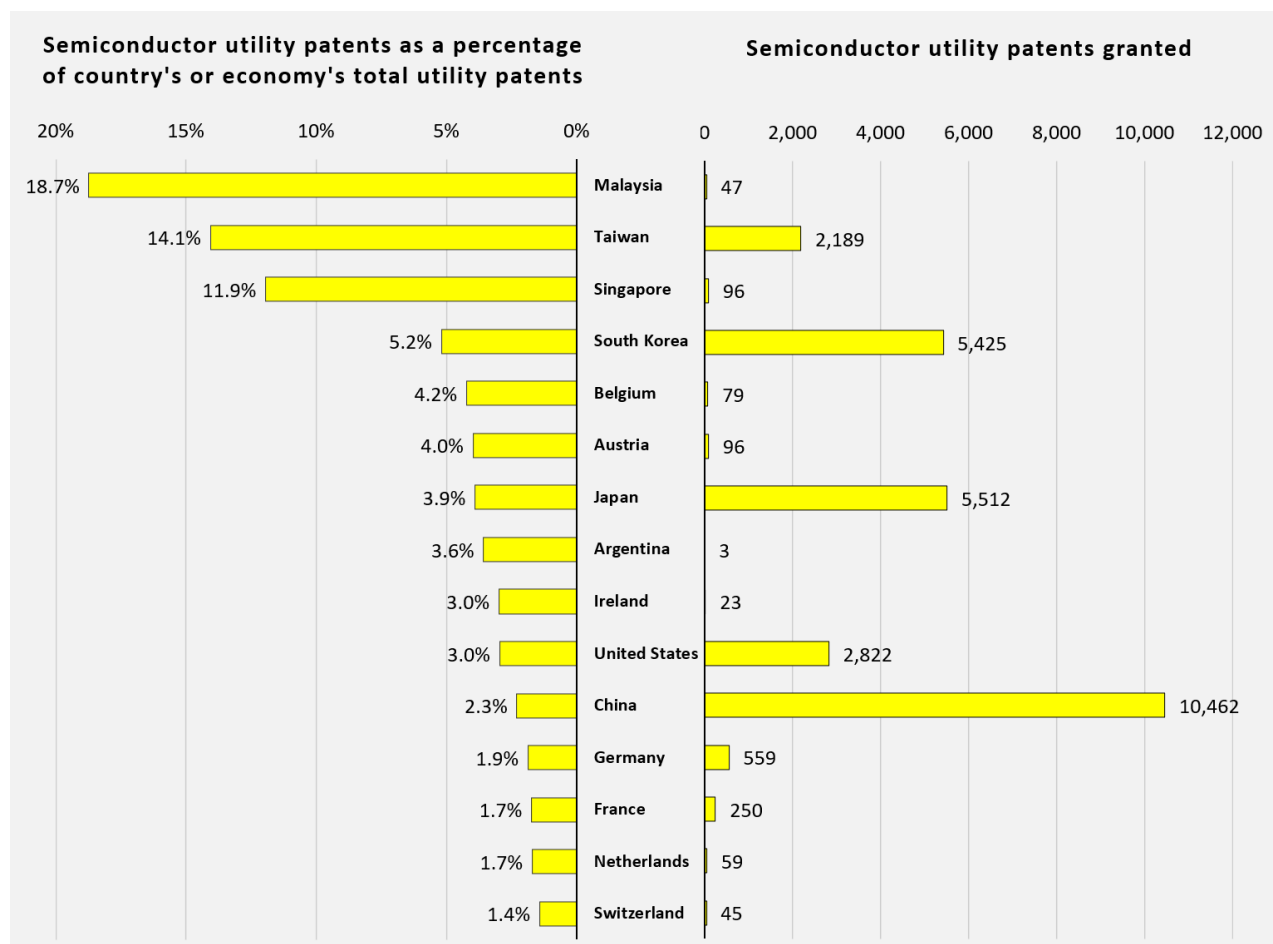
Source(s): National Science Board, National Science Foundation. 2022. Invention, Knowledge Transfer, and Innovation. *Science and Engineering Indicators 2022*. NSB-2022-4. Alexandria, VA. Available at <https://nces.nsf.gov/pubs/nsb20224/>. Tables SINV-5, SINV-8, SINV-9, SINV-10, and SINV-13.

Utility Patenting in Selected Critical and Emerging Technologies Based on International Patents Granted by Country or Economy

Technical notes: Counts of international patents are a broad measure of patents, covering patents issued in all jurisdictions each year to inventors without double-counting inventions. *Science and Engineering Indicators 2022* classifies patent data into 35 comprehensive and non-overlapping technology fields, which are based on the World Intellectual Property Organization’s 2008 [International Patent Classification](https://www.wipo.int/classifications/ipc/en/) (<https://www.wipo.int/classifications/ipc/en/>). This detailed classification system used to verify and grant patents allows these categories to be linked to critical and emerging technologies. Not every patent in each category will be critical or emerging. Patents identify inventions that may later be introduced into use as an innovation. Inventions are also protected by trade secrets and other forms of protection. Differences between technology classes are affected by the propensity to patent a particular type of technology, among other reasons.

International Utility Patent Families Granted in Semiconductor Technology: 2020

Based on the residences of inventors, the country or economy with the greatest percentage of its utility patents granted as semiconductor patents in 2020 was Malaysia (18.7%), followed by Taiwan (14.1%) and Singapore (11.9%). The greatest numbers of semiconductor utility patenting in 2020 came from inventors who are residents in China (10,462), Japan (5,512), and South Korea (5,425). Inventors who are residents in the United States received 2,822 semiconductor utility patents in 2020.



Semiconductor utility patents as a percentage of country’s or economy’s total utility patents and total utility patents granted in semiconductors: 2020

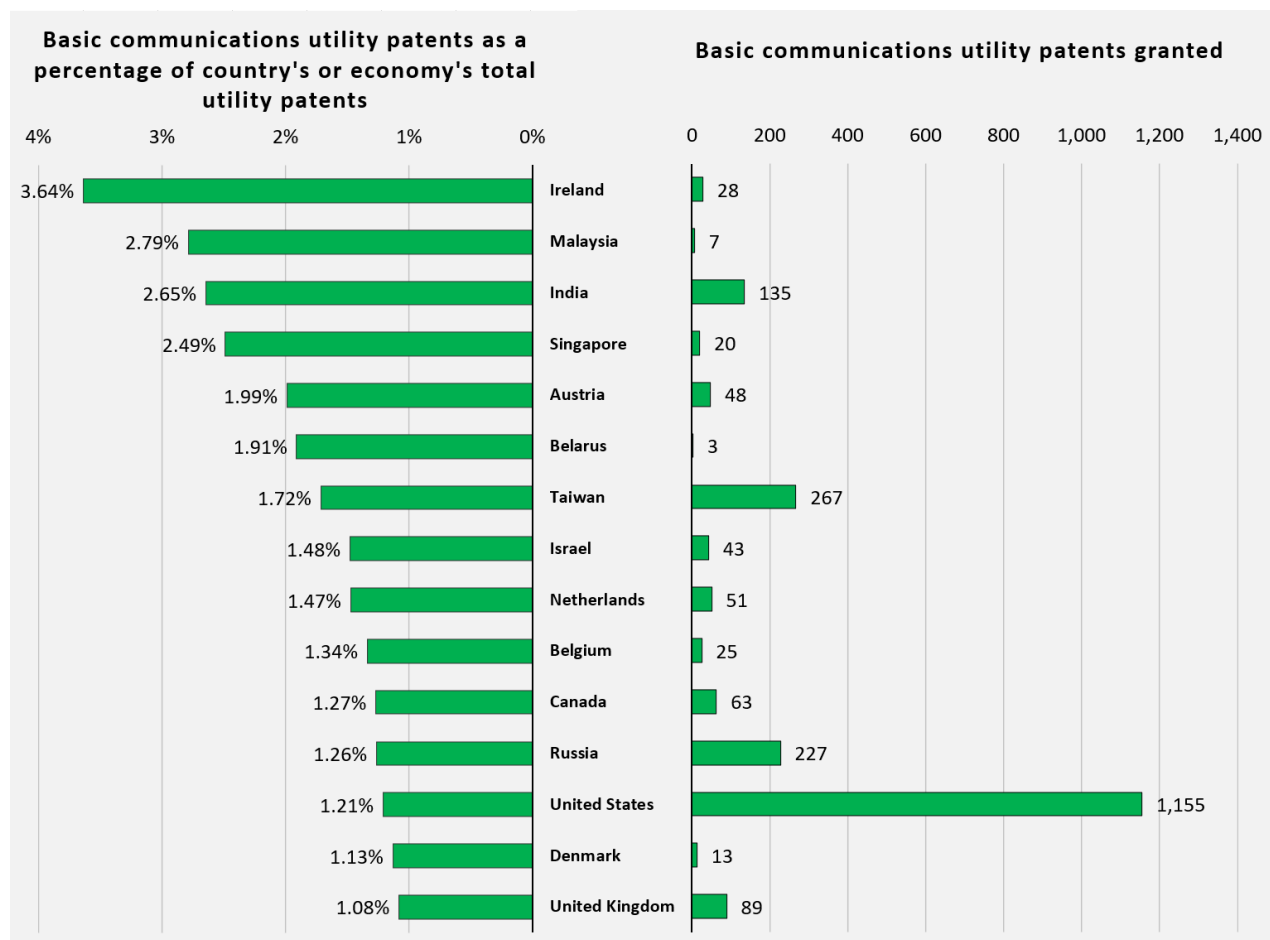
Note(s): Utility patents are fractionally allocated among regions, countries, or economies based on the proportion of residences of all named inventors. Fractional counts of patents were assigned to each technological field on patents to assign the proper weight of a patent to the corresponding technological fields under the classification. Semiconductor technology is a subcategory of basic electric elements that includes electronic solid-state devices.

Source(s): National Science Board, National Science Foundation. 2022. Invention, Knowledge Transfer, and Innovation. *Science and Engineering Indicators 2022*. NSB-2022-4. Alexandria, VA. Available at <https://nces.nsf.gov/pubs/nsb20224/>. Tables SINV-5 and SINV-13.

Utility Patenting in Selected Critical and Emerging Technologies Based on International Patents Granted by Country or Economy

International Utility Patent Families Granted in Basic Communications Technology: 2020

Based on the residences of inventors, the country or economy with the greatest percentage of its utility patents granted as basic communications in 2020 was Ireland (3.6%), followed by Malaysia (2.8%) and India (2.7%). The greatest numbers of these basic communications patents in 2020 came from inventors who are residents in the United States (1,155), Taiwan (267), and Russia (227).



Basic communications utility patents as a percentage of country's or economy's total utility patents and total utility patents granted in basic communications: 2020

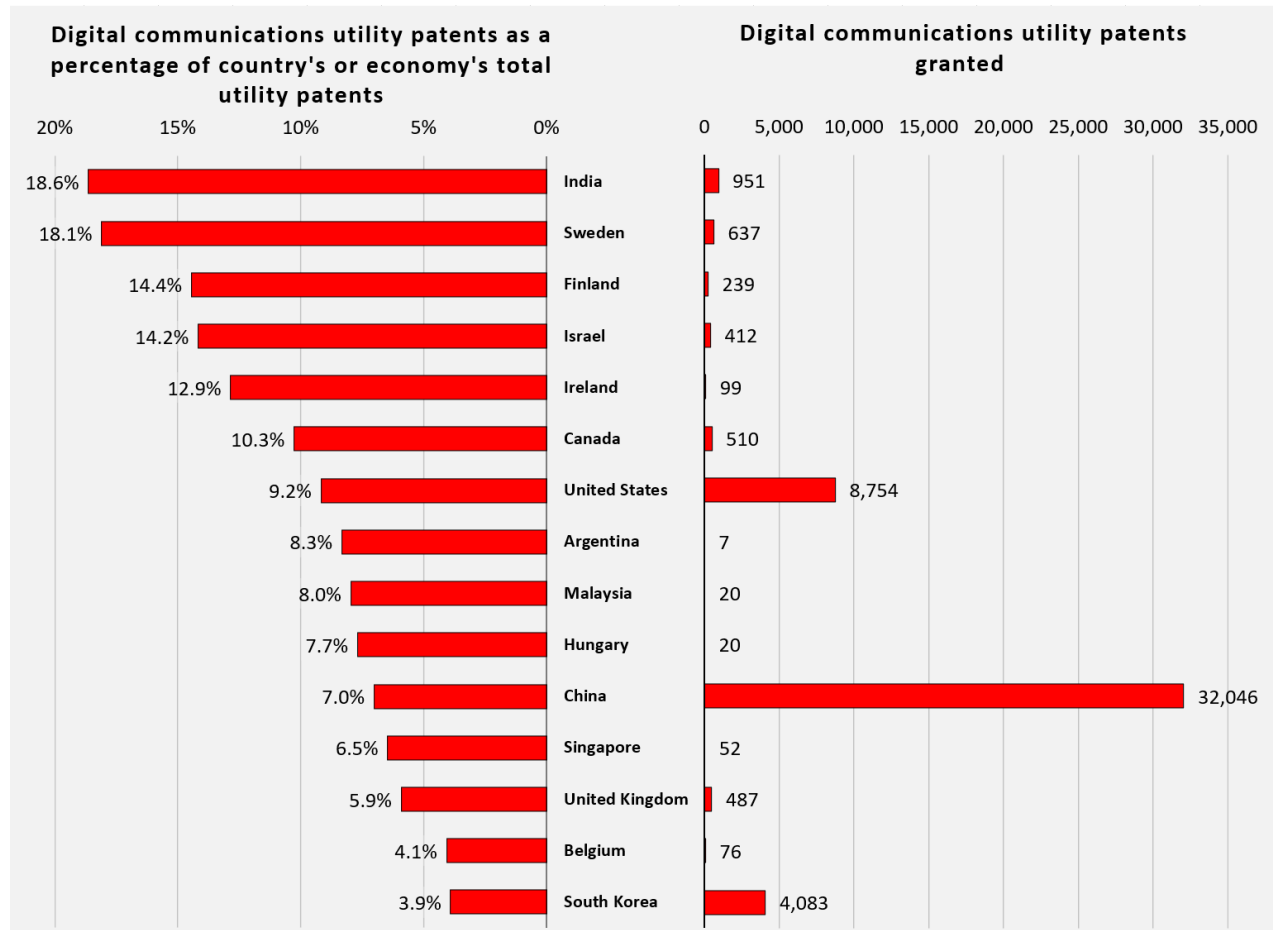
Note(s): Utility patents are fractionally allocated among regions, countries, or economies based on the proportion of residences of all named inventors. Fractional counts of patents were assigned to each technological field on patents to assign the proper weight of a patent to the corresponding technological fields under the classification. Basic communications cover generation, transference, amplification, and switching of oscillating signals.

Source(s): National Science Board, National Science Foundation. 2022. Invention, Knowledge Transfer, and Innovation. *Science and Engineering Indicators 2022*. NSB-2022-4. Alexandria, VA. Available at <https://ncses.nsf.gov/pubs/nsb20224/>. Tables SINV-5 and SINV-10.

Utility Patenting in Selected Critical and Emerging Technologies Based on International Patents Granted by Country or Economy

International Utility Patent Families Granted in Digital Communications Technology: 2020

Based on the residences of inventors, the country or economy with the greatest percentage of its utility patents granted as digital communications in 2020 was India (18.6%), followed by Sweden (18.1%) and Finland (14.4%). The greatest numbers of these digital communications patents in 2020 came from inventors who are residents in China (32,046), followed by the United States (8,754) and South Korea (4,083).



Digital communications utility patents as a percentage of country's or economy's total utility patents and total utility patents granted in digital communications: 2020

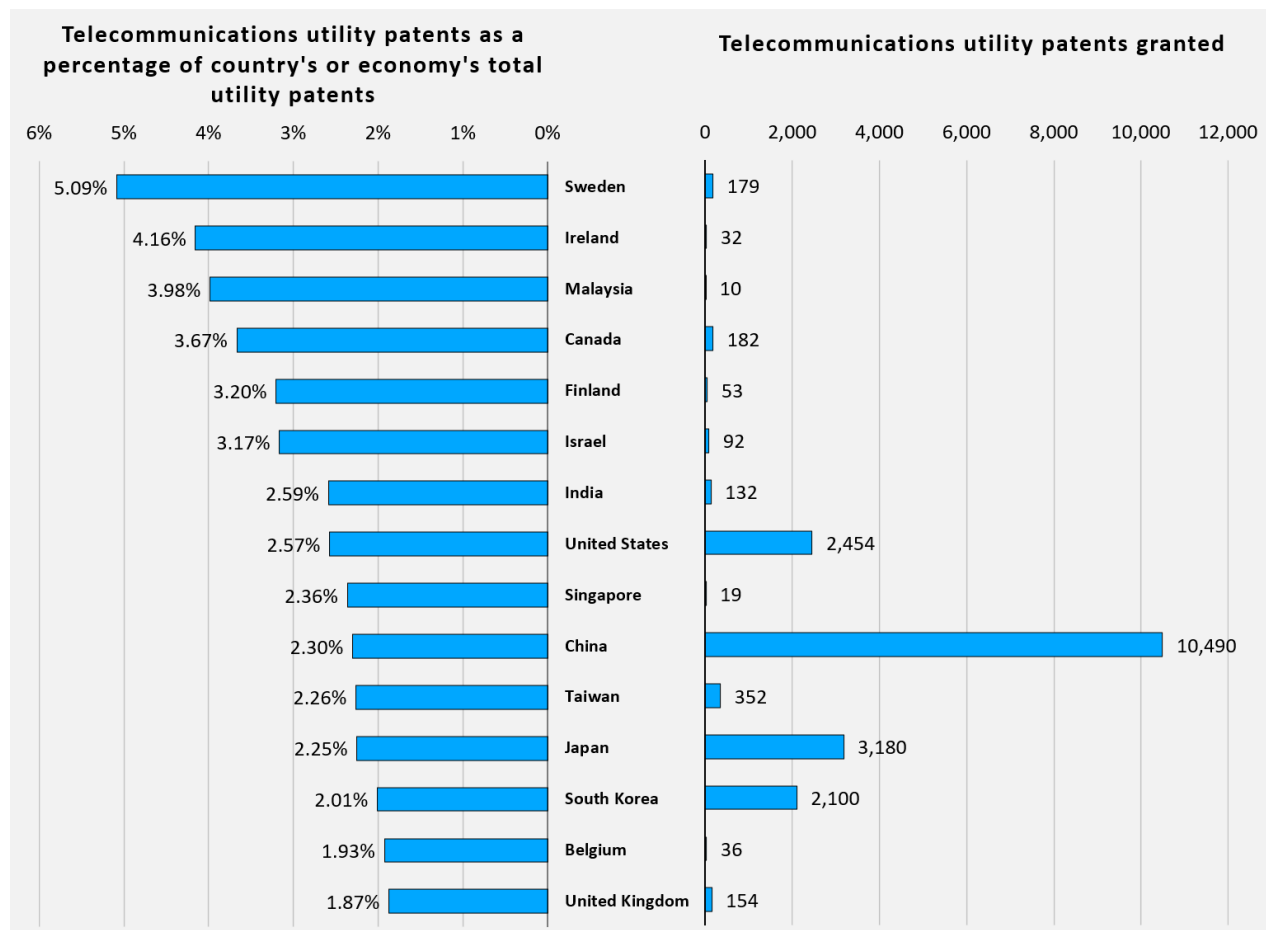
Note(s): Utility patents are fractionally allocated among regions, countries, or economies based on the proportion of residences of all named inventors. Fractional counts of patents were assigned to each technological field on patents to assign the proper weight of a patent to the corresponding technological fields under the classification. Digital communications cover the transmission of digital information.

Source(s): National Science Board, National Science Foundation. 2022. Invention, Knowledge Transfer, and Innovation. *Science and Engineering Indicators 2022*. NSB-2022-4. Alexandria, VA. Available at <https://ncses.nsf.gov/pubs/nsb20224/>. Tables SINV-5 and SINV-9.

Utility Patenting in Selected Critical and Emerging Technologies Based on International Patents Granted by Country or Economy

International Utility Patent Families Granted in Telecommunications Technology: 2020

Based on the residences of inventors, the country or economy with the greatest percentage of its utility patents granted as telecommunications was Sweden (5.1%), followed by Ireland (4.2%) and Malaysia (4.0%). The greatest numbers of these telecommunications patents in 2020 came from inventors who are residents in China (10,490), Japan (3,180), and the United States (2,454).



Telecommunications utility patents as a percentage of country's or economy's total utility patents and total utility patents granted in telecommunications: 2020

Note(s): Utility patents are fractionally allocated among regions, countries, or economies based on the proportion of residences of all named inventors. Fractional counts of patents were assigned to each technological field on patents to assign the proper weight of a patent to the corresponding technological fields under the classification. Telecommunications includes transmission between sensing components, optical, and radio transmission, transmission of information carrying signals, broadcast communications, and wireless communications networks.

Source(s): National Science Board, National Science Foundation. 2022. Invention, Knowledge Transfer, and Innovation. *Science and Engineering Indicators 2022*. NSB-2022-4. Alexandria, VA. Available at <https://nces.nsf.gov/pubs/nsb20224/>. Tables SINV-5 and SINV-8.