The multidimensional nature of economic development

Figure 1. Measure what you treasure.

Credit: Getty Images Skobrik

What should we measure?

Measuring development requires that we examine many different areas of human experience. We need to look at how healthy people are, their levels of education, their freedom, and their capabilities and opportunities. But we also need to examine the state of the political systems, institutions, and infrastructure that support people in their daily lives. No one indicator can give us all that information; therefore, development is a multidimensional, emergent concept that requires careful examination of data across the human experience. The 17 Sustainable Development Goals (SDGs) explored in subtopic 4.7 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-30430/) capture some of this complexity.

To classify and compare countries at different stages of development, economists use individual attributes and characteristics measured by the use of indicators.

An indicator is a variable that measures certain characteristics of a country or its people. For example, GDP per capita is an indicator of the level of income per person. Life expectancy at birth is an indicator of the health of the population. The adult literacy rate, the proportion of the population that can read and write, is an indicator of the level of education.

Single indicators measure only one specific characteristic of development. Since development is multidimensional, you would have to use many single indicators to get a picture of a country's development. Composite indicators measure multiple characteristics of development and are usually presented as an index number. Sections 4.8.2–4.8.7 will explain in more detail a number of single and composite indicators used by economists to measure development.

Exam tip

Although there are many possible single indicators for measuring development, it is a good idea to be familiar with two indicators in each category (health, education, etc.) of indicators presented in the sections below.

Overview
(/study/ap
186-
cid-
754025/

Strengths of indicators to measure development

If we want to know how the world is changing over time, we need to have a sense of what it looked like in the past, so we have a point of comparison for the present. Indicators are measurable and when data is collected over time, it provides us with an idea of how change is occurring. This should prevent the analysis and evaluation of development from being merely anecdotal.

Data can help identify specific areas where human well-being is poor, giving some direction to policy-making. For example, one of the indicators for SDG 5: Gender Equality is the percentage of women holding seats in the national parliament. Brazil has a very low percentage of women holding seats in parliament at 10.7% (2017). This data would indicate to Brazil's government that this is an area for attention with policy-making.

Additionally, data may be able to provide information on whether certain interventions are improving well-being for people. Therefore, collecting data from development indicators is important both to direct and to evaluate policy.

Limitations of indicators to measure development

One weakness of using indicators to measure development is that they are often averages. Averages can hide very large discrepancies inside countries, within regions, and between groups of people. For example, deaths from a drug overdose in the US differ significantly among US states, as shown in **Figure 2**. If we only look at the average for the entire country, we would not see the differences that exist regionally.

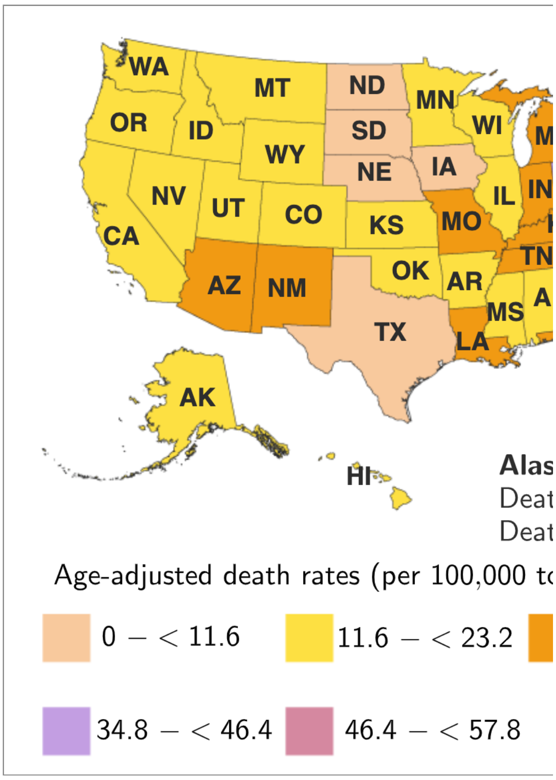


Figure 2. Drug overdose mortality by US state.

Source: National Center for Health Statistics (https://www.cdc.gov/nchs/pressroom/sosmap/drug_poisoning_mortality/drug_poisoning.htm)

More information for figure 2

The interactive map illustrates the wide regional disparity in age-adjusted death rates from drug overdoses across the United States. The death rates are age-adjusted and given per 100,000 people in each state. The colors on the map represent six different levels of overdose death rates, ranging from very low (0 to less than 11.6 deaths, shown in light peach) to very high (46.4 to less than 57.8 deaths, shown in dark purple).

The data indicates that the eastern United States, especially states like West Virginia and Pennsylvania, has some of the highest drug overdose death rates.

Student
view

Overview (/study/app/pp/sid-186-cid-754025/

These states are shaded in purple, meaning they fall in the highest categories. On the other hand, many western and central states such as Texas, California, and Colorado have lower overdose death rates, shown in lighter colors. For example, Colorado has a death rate of 18 per 100,000 people, which places it in the yellow category (11.6 to less than 23.2). This suggests that drug overdose deaths in Colorado are relatively lower compared to states in the eastern region. A few states such as Arizona and New Mexico fall into the orange range (23.2 to less than 34.8), showing a moderate problem, while southern states like Louisiana, Mississippi, and Kentucky also show relatively higher rates than their neighboring states.

This map is a good example of how national averages can hide regional differences. If we only look at the average drug overdose death rate for the entire U.S., we would miss the fact that some areas are facing a much more serious crisis than others. It shows that some regions, especially in the Northeast and Appalachia, need more focused attention and resources to deal with the overdose problem, while other areas may need different kinds of prevention or intervention strategies. The map highlights that drug overdose deaths are not evenly spread across the country. While some states are heavily affected, others are doing comparatively better.

A death rate and deaths for each state is provided in the following table:

Student view

State	Death rate in %	Deaths
Alabama	16.3	768
Alaska	17.8	132
Arizona	26.8	1907
Arkansas	13.5	388
California	15	6198
Colorado	18	1079
Connecticut	34.7	1214
Delaware	48	435
Florida	25.5	5268
Georgia	13.1	1408
Hawaii	15.9	242
Idaho	15.1	265
Illinois	21.9	2790
Indiana	26.6	1699
Iowa	11.5	352
Kansas	14.3	403
Kentucky	32.5	1380
Louisiana	28.3	1267
Maine	29.9	371
Maryland	38.2	2369
Massachusetts	32.1	2210

Overview
(/study/ap
186-
cid-
754025/

State	Death rate in %	Deaths
Michigan	24.4	2385
Minnesota	14.2	792
Mississippi	13.6	394
Missouri	26.9	1583
Montana	14.1	143
Nebraska	8.7	161
Nevada	20.1	647
New Hampshire	32	407
New Jersey	31.7	2805
New Mexico	30.2	599
New York	18.2	3617
North Carolina	22.3	2266
North Dakota	11.4	82
Ohio	38.3	4251
Oklahoma	16.7	645
Oregon	14	615
Pennsylvania	35.6	4377
Rhode Island	29.5	307
South Carolina	22.7	1127
South Dakota	10.5	86
Tennessee	31.2	2089
Texas	10.8	3136
Utah	18.9	571
Vermont	23.8	133
Virginia	18.3	1547
Washington	15.8	1259
West Virginia	52.8	870
Wisconsin	21.1	1201

Student view

Overview
(/study/ap
186-
cid-
754025/

State	Death rate in %	Deaths
Wyoming	-	-

It is very important to look carefully at how development data differs among groups to ensure that the causes of poor development data are accurately pinpointed and that policy measures are targeted at the groups who can most benefit.

A second problem with development indicators is that accurate data cannot always be gathered. In low-income countries, in particular, governments may not always have the financial, institutional or logistical means to gather the data needed to assess development and develop good policies. As David Pilling points out in his book *The Growth Delusion* , a country like the Democratic Republic of the Congo (DRC) has enormous problems gathering data because so much of the country is inaccessible by road, with many places only reachable by riverboat or canoe. Gathering accurate data on development is practically impossible.

The third problem with development indicators is that, even where data is possible to gather, much of the data is hidden because so much of a country's economic activity is in the informal sector. The informal sector comprises all economic activity that is not officially monitored by the government or taxed. A very large percentage, up to one-third (https://blogs.imf.org/2019/10/30/the-global-informal-economy-large-but-on-the-decline/), of economic activity in the world's poorest countries fits this description. Therefore, governments often have to use estimates that can be wildly inaccurate. You will learn more about the informal sector in subtopic 4.9 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-30278/).

A final problem with development indicators is that they simply cannot capture the complexity of development. As was discussed earlier in this subtopic, development is a multidimensional concept encompassing material, relational, subjective, and emergent properties that one indicator or even composite indicators are not designed to represent. Whenever we examine single or composite indicators we risk reductionism, making judgments about development that are far too simplistic and may lead us to conclusions about causes of problems and policies to remedy them that are not justified.

Student
view

It is also worth pointing out that quantitative data is not the only way to capture the diversity of development across countries. Qualitative data can be equally enlightening, though is often not as accepted by economists as quantitative data.

In the video below, Anna Rosling Rönnlund describes an ongoing project where photographers have taken pictures of living conditions across the world and organized that information by household and income. The result is Dollar Street (https://www.gapminder.org/dollar-street/matrix), an interactive platform for visually exploring the quality of life of families across the world. It shows development in a truly multidimensional context.

Overview
(/study/ap
186-
cid-
754025/

Video 1. The Quality of Life of Families Across the World.

More information for video 1

Activity

Use the Dollar Street (https://www.gapminder.org/dollar-street/matrix) tool to identify three families from different parts of the world on similar income levels. Examine how they live, choosing sets of pictures that interest you.

1. What similarities do you see in their living conditions or aspirations?
2. What differences do you see in their living conditions or aspirations?
3. What do those similarities and differences indicate about the role of income in quality of life?

Economic growth and development

The relationship between economic growth and development is complex, but there are a number of key points we can make.

Student view

Exam tip

Understanding the points below is extremely important for your longer exam responses that ask you to discuss how policies may affect growth and development, which will be a common question.

1) Growth and development can be mutually reinforcing

Economic growth can lead to improved development. Improving quality of life often means that individuals and governments need to spend money on services and policies that promote community cohesion, mental and physical health, education, and sustainability. Economic growth can result in higher incomes for individuals that can, for example, be spent on school tuition or improved health care. Economic growth can also result in higher tax revenues for governments that can be spent on merit goods like schools and hospitals that improve development.

Development can also lead to growth. When people's health, education, relationships and networks, freedom, choices, and general capabilities improve, this can result in higher productivity, more risk-taking and entrepreneurship, and increased incomes. Improvement in human, as well as physical capital, can cause increases in the productive capacity of the economy and economic growth.

Overview (/study/ap 186- cid- 754025/

So there seems to be a positive correlation between growth and development. When positive feedback loops are present, growth and development can be mutually reinforcing over time, as shown in **Figure 3**.

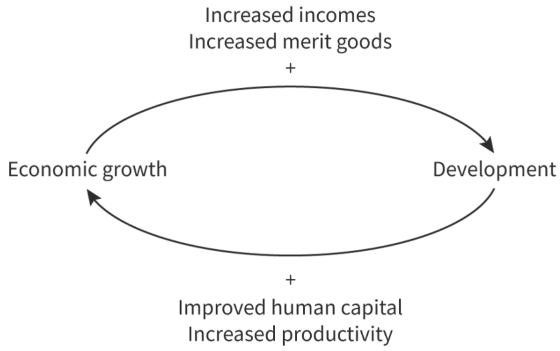


Figure 3. Growth and development positive feedback loops.

More information for figure 3

The diagram illustrates a positive feedback loop between economic growth and development. It is structured with two main nodes labeled 'Economic growth' and 'Development,' connected by arrows indicating a cyclical relationship. An arrow from 'Economic growth' points towards 'Development,' and another arrow returns from 'Development' to 'Economic growth.' Text near these nodes explains the implications of this relationship: 'Increased incomes' and 'Increased merit goods' are associated with economic growth, while 'Improved human capital' and 'Increased productivity' relate to development. The cycle suggests that as economic growth occurs, it leads to development, which in turn further fosters growth, creating a self-reinforcing loop.

[Generated by AI]

2) Growth does not always lead to development

Economic growth does not always result in improved development. High levels of economic inequality and skewed income distribution can prevent the benefits of economic growth from being experienced by the majority. These high levels of inequality can be present in any size of the economy and with any economic growth rate.

Student view

Furthermore, economic growth can undermine development. Environmental damage from over-exploitation of resources and unmanaged waste can lower the quality of life for the world's poorest. Two examples of this are the environmental damage and exploitation of child labour in cobalt mining (https://www.theguardian.com/global-development/2019/dec/16/apple-and-google-named-in-us-lawsuit-over-congolese-child-cobalt-mining-deaths) in the Democratic Republic of the Congo (DRC), and the significant unmanaged plastic waste in many low-income countries discussed in subtopic 4.7 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-30430/). Additionally, relentless pursuit of economic growth and higher incomes can reduce subjective well-being, especially if people sacrifice essential elements of their well-being – such as health and social relationships – for higher incomes.

Finally, it is not a given that governments spend their increased tax revenues on things that truly help well-being. For that to happen, political and economic leaders need to deliberately prioritise policy to focus on the factors that we know contribute significantly to human well-being, such as social networks and social capital, health, education and the natural environment. New Zealand has been a leader in shifting priorities in this way.

Case study

New Zealand's Wellbeing Budget

Figure 4. New Zealand's Wellbeing Budget (2019).
Credit: Getty Images Hagen Hopkins / Stringer

In 2019, New Zealand became the first high-income country to declare well-being a priority over economic growth. It did this by announcing a new Wellbeing Budget (https://www.google.com/url?q=https://treasury.govt.nz/sites/default/files/2019-05/b19-wellbeing-budget.pdf&sa=D&ust=1593766795514000&usg=AFQjCNHQUA3AK2qJUN8fY2Hmh_wKjzoPZA).

New Zealand's Prime Minister Jacinda Ardern explained her government's change in focus by first acknowledging the importance of economic growth. But she also noted that economic growth does not account for the quality of growth in the economy, or take into account who benefits from growth and who is left behind.

So her government has decided to focus on the health of New Zealand's natural resources, people and communities, in addition to financial health. New Zealand, and many other countries, is starting to pay more attention to the multidimensional nature of economic development. These priorities will continue in future budgets.

The following podcast from the BBC programme *The Inquiry* discusses different perspectives on the question of whether, or to what extent, government policies can

promote happiness or general well-being. New Zealand's Wellbeing Budget is discussed.

BBC The Inquiry: Can governments make us happy? (https://www.bbc.co.uk/programmes/w3csytg4)

- How should governments weigh GDP against other indicators when assessing the health of the economy and creation of policies?

3) Development without growth?

There is a growing debate about whether development can occur without economic growth. Once a fringe position, an increasing number of economists are proposing that countries attempt to improve well-being without growing their economies. Given that there has been a close correlation between growth and development, in part due to the role of incomes in enabling purchases of goods and services that improve life, it can be hard to imagine how development may improve without higher incomes.

Overview (/study/ap 186-cid-754025/

Figure 5. Could development still happen with slower growth, or even degrowth?

One perspective on this debate centres on whether the slowing growth rates experienced by many high-income countries in the last decade are a problem or something to be embraced. Some advocate for degrowth, which is the deliberate downscaling of production and consumption and increased focus on other factors we know contribute to well-being, including personal relationships, health, culture, community and the environment. In high-income countries, in particular, economic growth has been accompanied by overconsumption and resource depletion, often without significant increases (and in fact sometimes decreases) in well-being indicators. Economists favouring a degrowth strategy argue that high-income countries can reduce output without sacrificing well-being. Many economists have also pointed out that significant gains in well-being can be achieved without growing economies to the size of high-income countries. In fact, the majority of gains in health, education, and subjective well-being occur when countries reach middle incomes.

The debate about the possible benefits of degrowth, and whether and how development can continue in the absence of growth, is a very exciting area of research in the economics discipline.

Student view

Section

Feedback

4) Development is more than growth

Economists do agree, however, that development is not the same as economic growth and encompasses much more than growth. The multiple dimensions of development – material, relational, subjective and emergent – have been already discussed in section 4.7.1 (/study/app/pp/sid-186-cid-754025/book/what-is-development-id-30431/). You may find it helpful to review those characteristics at this point.

It is extremely important to remember that development does not automatically come from economic growth. Development is the result of the interaction of complex social and economic systems that operate in non-linear, emergent ways.

Complete section with 3 questions

Start questions

Previous section(/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-30432/)

Next section (/study/app/pp/sid-186-cid-754025/book/sing

Single indicators: income

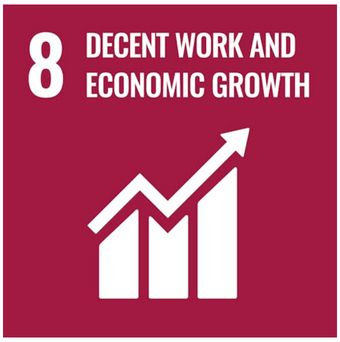


Figure 1. Income is an important component of development.

Source: 'Sustainable Development Goals (https://www.un.org/sustainabledevelopment/)' by UN and UNESCO

Measuring changes in average income levels is very important for assessing development. Higher incomes mean that individuals and families can purchase more goods and services to improve their quality of life. This might include spending on more or better food, clothing or shelter, or improved healthcare or education. Increased income can give people more choice in life and more opportunities.

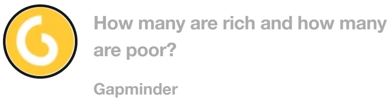
For governments, too, higher incomes can result in higher tax revenues. This money can be spent on services and infrastructure that improve quality of life. So even though higher incomes do not guarantee that development improves, income can be an important factor for standards of living.

GDP/GNI per person (per capita) at PPP

The most commonly used income indicators to make comparisons between countries are GDP per capita and GNI per capita in terms of purchasing power parity (PPP). You learned about these measures in subtopic 3.1 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-29927/).

Important

Many people believe that the world is divided into two groups: the rich and the poor. You will often see books (including this one!) refer to high-income countries and low-income countries. However, it is important to understand that most of the world now experiences incomes in the middle. Knowing this will help you understand recent changes in development data. Hans Rosling explains in the short video below.



Higher income levels are correlated with other improved development indicators. For example, GNI per capita at PPP is positively correlated to life expectancy at birth , a health indicator, as shown in **Figure 2** below. If you drew a trendline, it would slope upwards from left to right.

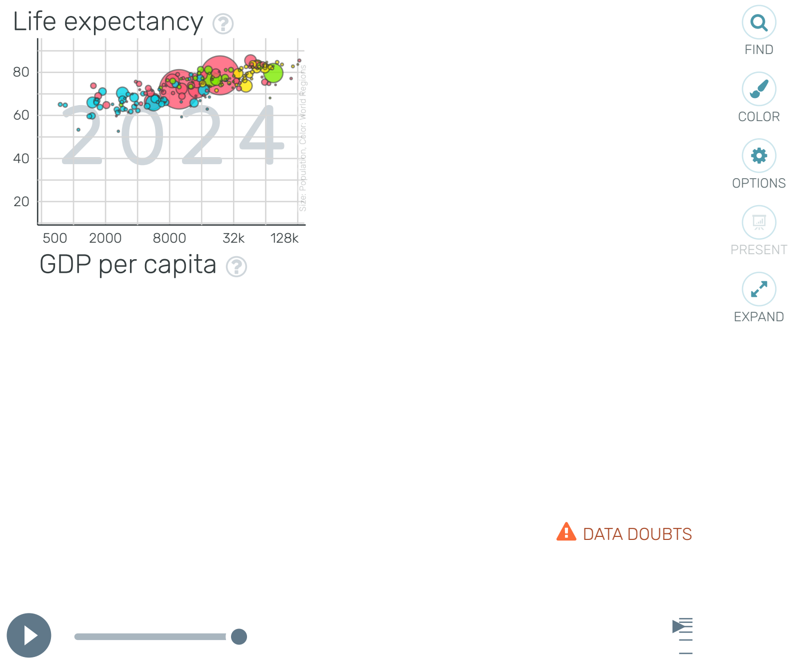


Figure 2. Correlation between income (logarithmic scale) and life expectancy.

More information for figure 2

An interactive bubble chart represents the relationship between GDP per capita and life expectancy for different countries in 2023. Each bubble corresponds to a country, with its position on the x-axis indicating GDP per capita (adjusted for price and inflation in PPP$2017) and its position on the y-axis indicating life expectancy. The size of each bubble represents the population of the respective country. The colors of the bubbles correspond to different world regions, as indicated by the small color-coded map in the top right corner.

The chart is divided into income levels, which provide a contextual background for understanding economic classification. The chart highlights the strong correlation between GDP per capita and life expectancy, where wealthier nations tend to have longer life expectancies. Countries with low GDP per capita, mainly in sub-Saharan Africa and parts of South Asia, cluster at the lower-left side of the chart with lower life expectancy. In contrast, high-income nations in Europe, North America, and parts of East Asia appear toward the upper-right, signifying longer life spans and greater economic prosperity. The size variation of bubbles emphasizes population differences, with countries like China and India appearing prominently. China's transition from a low-income country with modest health outcomes to a global economic powerhouse with a higher standard of living.

Over time, as seen using the animation feature, most nations show an upward trend, indicating economic growth and improvements in healthcare, though disparities remain. Outliers exist, such as oil-rich nations with high GDP but moderate life expectancy and conflict-affected countries where economic instability correlates with stagnating or declining health outcomes.

On the right side, there is a search and selection panel allowing users to filter and highlight specific countries. Users can explore individual nations by

Overview
(/study/ap
186-
cid-
754025/c

checking their names in the list. Additional options allow changing the bubble size representation based on different factors, such as population. At the bottom, an interactive time slider allows users to observe trends over time, making it possible to view historical progressions in economic development and life expectancy. A play button can be used to animate the data to see how countries have evolved over the years. Zoom controls at the bottom right provide options to adjust the view, making it easier to examine data points in more detail.

It is even more interesting to see how both incomes and life expectancy have changed over time. Take a minute to 'play' the graph above. Notice how the country bubbles are moving from the bottom left corner of the graph, with low income and low life expectancy, to the top right corner of the graph, with high incomes and high life expectancy. So we can see the positive correlation between income and life expectancy not only by looking at a snapshot of the countries of the world in 2019, but also by looking at changes and trends over time.

Activity

Choose China from **Figure 2** by clicking on it.

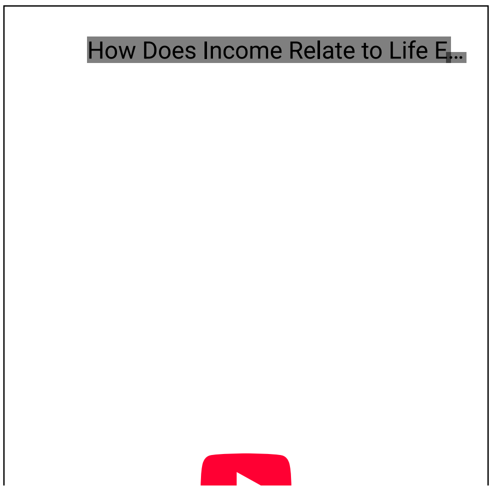
1. Press the ‘play’ button to see how China’s income and life expectancy have changed over time.
2. For much of the period highlighted by the data, China does not follow the income and life expectancy trends we outlined above. Sometimes China’s average income declines and sometimes life expectancy declines. At what point do both of those indicators make a sustained improvement? Do a quick internet search to find out what happened in China to bring about a sustained improvement in these indicators.
3. Change the variable on the y-axis to a different development indicator of your choice.
4. Using the data to support your response, state the relationship between the two variables.
5. Explain the relationship between the two variables. In other words, how could increased incomes result in the trend you see in the other variable?

Exam tip

When an exam question asks you to use information from a table or graph, make sure you include a reference to specific data in your response. You may lose marks on a question if you do not link your response to numbers, showing a full understanding of the data you have been asked to interpret.

Student
view

Hans Rosling explains the correlation between income and life expectancy in the very short video below, but he also makes a key point about the variance we see in life expectancy even among countries with a similar income level. Income isn’t everything: how that income is spent in a country can matter just as much.



Overview
(/study/ap
186-
cid-
754025/

Be aware

GDP/GNI data does **not** include the value of economic activity in the informal sector . In low-income countries, this can be very significant. So it is important to understand that GDP/GNI statistics may underestimate the amount of economic activity taking place. If they are being used as a proxy for development, they may underestimate the level of development too. On the other hand, large informal sectors are correlated with low productivity and lack of secure work and social safety nets, all of which may undermine development.

The role of the informal sector will be explored in subtopic 4.9 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-30278/).

Poverty headcount ratio

Figure 3. Reducing poverty improves development.

Source: 'Sustainable Development Goals (https://www.un.org/sustainabledevelopment/)' by UN and UNESCO

The first Sustainable Development Goal (SDGs) is No Poverty. You learned about poverty previously in subtopic 3.4 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-30471/). Poverty is usually defined in two forms: absolute (extreme) and relative poverty.

Student
view

Absolute (extreme) poverty is a level of income so low that an individual cannot meet basic needs for food, clothing and shelter. The World Bank defines extreme poverty as less than a global threshold of 1.90 international dollars (PPP int.-$) per day. National governments often identify their own, sometimes higher, thresholds for absolute poverty. The indicator for extreme poverty calculates the percentage of the population that falls under this income level.

Figure 4 below demonstrates that levels of extreme poverty have fallen dramatically over time.

Overview
(/study/ap
186-
cid-
754025/

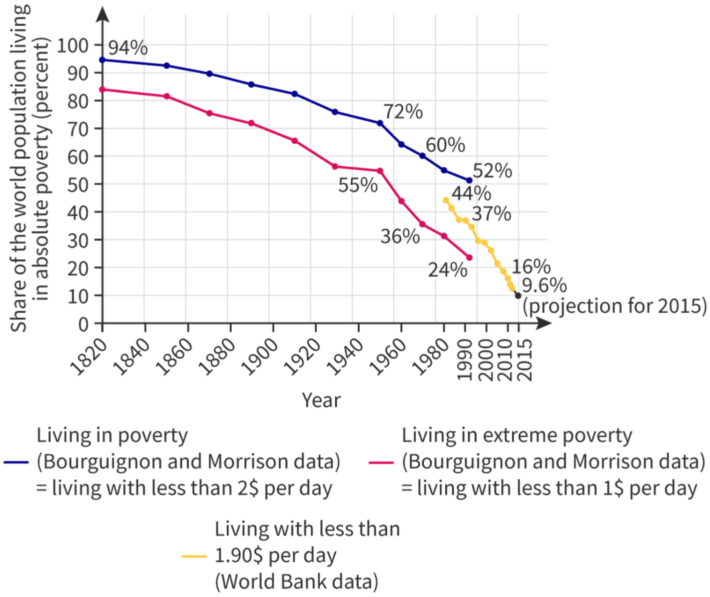


Figure 4. Proportion of the world population living in absolute poverty, 1820—2015.

Source: Our World in Data (https://ourworldindata.org/extreme-poverty)

More information for figure 4

The image is a graph depicting the proportion of the world population living in absolute poverty from 1820 to 2015. The X-axis represents the year, ranging from 1820 to 2015, and the Y-axis denotes the share of the world population living in absolute poverty, measured in percentages from 0% to 100%.

The graph contains three lines:

1. **Blue Line**: Represents the population living in poverty with less than $2 per day according to Bourguignon and Morrison data. It shows a decline from about 94% in 1820 to 60% in 2000 and continues to decline.

2. **Pink Line**: Indicates the population living in extreme poverty, with less than $1 per day as per Bourguignon and Morrison data. This line shows a significant decrease from around 75% in 1820 to about 20% in 2000.

3. **Yellow Line**: Illustrates those living with less than $1.90 per day according to World Bank data, starting around 1980 and declining sharply to 9.6% by 2015.

Overall, the graph highlights the substantial reduction in poverty levels over nearly two centuries, with a drastic drop in recent decades. The final projections for 2015 show a significant decrease in populations living below these poverty thresholds.

[Generated by AI]

Student
view

You can see in **Figure 4** that in 1820, by some measures, more than 90 percent of the world's population lived in highly vulnerable circumstances, with incomes that did not meet their basic needs. Today, about 90 percent of people in the world are **not** living in extreme poverty.

It is also useful to look at how the geographic distribution of poverty has changed over time. **Figure 5** shows that certain regions of the world have made faster progress in reducing their populations in poverty than others.

Overview
(/study/ap
186-
cid-
754025/

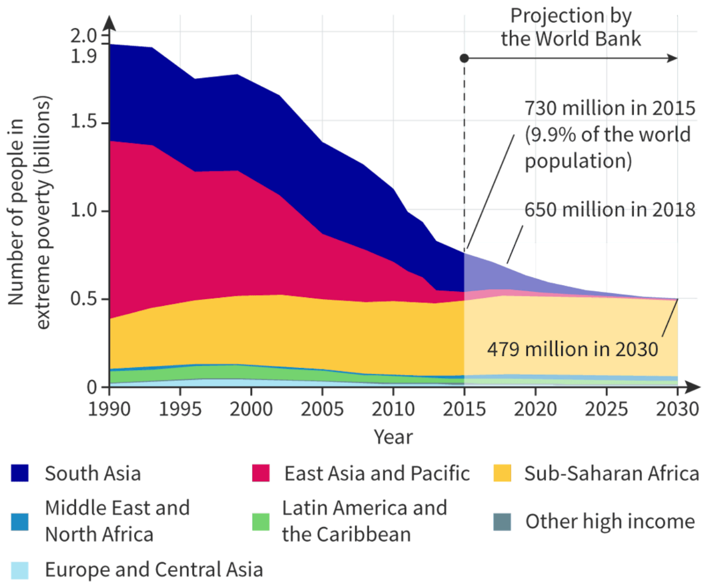


Figure 5. Number of people in extreme poverty 1990—2030 by region (projected).

Source: Our World in Data (https://ourworldindata.org/extreme-poverty)

More information for figure 5

The image depicts a stacked area chart illustrating the number of people living in extreme poverty, measured in billions, from 1990 to 2030. The X-axis represents the years from 1990 to 2030, while the Y-axis shows the number of people in extreme poverty in billions, ranging from 0 to 2.0 billion. The chart categorizes the data into regions, each represented by a different color: South Asia (dark blue), East Asia and Pacific (red), Sub-Saharan Africa (yellow), Middle East and North Africa (light blue), Latin America and the Caribbean (green), Europe and Central Asia (cyan), and Other high income (light gray).

From 1990 to 2015, the data indicates a general decline in extreme poverty across most regions. Notably, South Asia and East Asia and Pacific regions see a significant reduction. By 2015, there are 730 million people in extreme poverty. Projection trends suggest further decline, reaching approximately 479 million in 2030, indicating varying progress rates in reducing poverty among different regions.

[Generated by AI]

Student
view

Worked example 1

Using data from **Figure 5**:

1. Identify the geographic region of the world that has experienced the largest decline in the number of people living in extreme poverty since 1990.
2. Which country in this region likely accounted for much of this decline? Take a quick look through this section (https://ourworldindata.org/extreme-poverty#the-evolution-of-extreme-poverty-country-by-country) of Our World in Data to find the answer.
3. The reductions in poverty levels are projected to slow in the future. How can you see this in the graph?
4. Which geographic region is likely to continue to see a large number of people in extreme poverty in the future?

1. East Asia and Pacific. In 1990, there were just under 1 billion people in those regions living in extreme poverty. By 2015, it was less than 100 million.
2. China.

Overview (/study/app/pp/sid-186-cid-754025/o

3. The slope of the boundary marking the number of people in extreme poverty becomes shallower, almost levelling out at just under 500 million people. If the trend continues, it would indicate that we may not see further significant reductions in the number of people in poverty.
4. Sub-Saharan Africa, the region indicated by the yellow area, will still see large numbers of people living in extreme poverty. This is mainly due to large population growth in the region.

Extreme poverty is not only unevenly distributed by geography, but also by demography. According to the United Nations, globally, for every 100 men between the ages of 25 and 34 living in extreme poverty, there are 122 women. Children are also disproportionately affected; one out of five children live in extreme poverty.

The reduction in extreme poverty is one of the greatest achievements in human history, but it is one that not many people are aware of. Gapminder conducted surveys across the world, across education levels, and found that most people believe that poverty is increasing. It is important to understand that many global efforts to reduce poverty are working, even if progress is now projected to slow moving forward.

Relative poverty is when income falls below a defined percentage of a country's median income. For example, in Germany the poverty line is defined at 60% of the country's median income. Poverty by this measure is relative, because whether or not someone is considered in poverty depends on a country's median income, which will differ from country to country. According to the World Bank (https://blogs.worldbank.org/opendata/relative-versus-absolute-poverty-headcount-ratios-full-breakdown), this way of measuring poverty is often used in European countries, but most countries in the world do not measure poverty this way. This is because this relative measure does not provide a good picture of need in the way that absolute measures do.

Theory of Knowledge

In early 2019 Bill Gates tweeted about the positive trends in global poverty numbers, using this graph.

Student view

Figure 6. World population living in extreme poverty.

More information for figure 6

Overview
(/study/ap
186-
cid-
754025/c

He got a heated response from some critics of the data (https://www.vox.com/future-perfect/2019/2/12/18215534/bill-gates-global-poverty-chart). Although there was consensus that poverty in the world had declined, one critic, Hickel argued that the $1.90-per-day poverty line is simply too low. He also argued that we should look at absolute numbers; we should not only consider the share of people in absolute poverty, but also the total number of people living in poverty. As our population has increased, so has the number of people who live below the poverty line.

Knowledge question: How do we know what level of income should define the poverty line?

Complete section with 3 questions

Start questions

Previous section(/study/app/pp/sid-186-cid-754025/book/the-multidimensional-nature-id-30572/)

Next section (/study/app/pp/sid-186-cid-7540

Student
view

Single indicators: health and education

Health indicators

Health is one of the main factors contributing to human well-being and life satisfaction. Healthy populations are more productive and good health reduces stress and builds resilience in individuals, families and communities. Schooling Years

Figure 1. Health is a fundamental part of human development.

Source: 'Sustainable Development Goals (https://www.un.org/sustainabledevelopment/)' by UN and UNESCO

Life expectancy at birth

Life expectancy at birth is a measure of the average number of years that a person may expect to live from the time they are born. It is one of the components of the Human Development Index (HDI), which we will discuss in the next section. As mentioned in the previous section on income, there is a positive correlation between income and life expectancy. **Figure 3** shows the life expectancy by country.

Overview
(/study/ap
186-
cid-
754025/

Figure 2. Population growth since the year 1800 .

More information for figure 2

This interactive bar chart from Gapminder offers a dynamic, engaging view of global population trends. It enables users to explore how country populations have evolved from 1800 to 2023, providing clear insights into demographic shifts. The chart includes an animated timeline slider, allowing users to track population changes over time. The play button at the bottom of the chart makes it easy to watch transitions smoothly, while the manual slider allows users to focus on specific years for detailed comparisons. Additionally, a search function helps users find and highlight individual countries for side-by-side analysis.

In the 2023 visualization, India has surpassed China as the most populous country, with 1.44 billion people compared to China's 1.42 billion. This marks a major demographic milestone, as China had held the top spot for decades. The chart highlights this shift, driven by India's high birth rates and youthful demographic, contrasting with China's aging population and the long-term effects of its population control policies. These changes underscore significant global trends impacting economic, social, and educational landscapes.

The chart categorizes countries into color-coded regions, making it easy to identify global and regional population distributions. With each country represented by a bar, the chart ranks countries by population size, with the length of each bar directly corresponding to the population number. Numerical data is provided next to each country name, offering a precise comparison of populations.

This visualization also features a world map on the right, serving as a color-coded legend to further illustrate the geographical distribution of population growth. Countries from South Asia, Sub-Saharan Africa, and Southeast Asia are prominent in the top rankings, emphasizing the demographic importance of these regions. Observing these shifts is vital for understanding the implications of population growth on resource allocation, infrastructure development, and international policy.

As users explore the chart, they gain valuable insights into global population dynamics, helping to track the ongoing evolution of human demographics and their effects on global systems. The tool aids in understanding patterns of urbanization, migration, and regional economic development, offering a comprehensive look at how global population trends shape societies worldwide.

Infant mortality rate

The infant mortality rate is a measure of the number of children younger than one year that die annually for every 1000 born alive. The higher the number, the lower the development.

Figure 3 shows the relationship between income and Life expectancy. There is a positive correlation between the two variables. You can draw a trendline that goes from the bottom left of the graph to the top right.

Student
view

Overview
(/study/ap
186-
cid-
754025/

Figure 3. Correlation between income and infant mortality.

More information for figure 3

A Gapminder interactive chart allowing to explore the relationship between life expectancy and GDP per capita over time for different countries. We can interact with the graph by selecting specific countries, adjusting the size of bubbles to represent population, and filtering data based on regions.

The horizontal axis represents GDP per capita (inflation-adjusted, PPP$2017), which indicates economic prosperity. The vertical axis represents life expectancy at birth, a measure of health and quality of life. Each country is represented as a bubble, with the size of the bubble corresponding to population size.

The right-side panel allows us to categorize countries by region (e.g., Asia, Americas). A search bar enables selection of specific countries. With the help of zoom and Playback Controls we can zoom in/out and play an animated timeline to observe historical trends.

China is represented as a large red bubble, indicating its significant population (1.42 billion). China falls under Level 3 income, meaning it has a moderately high GDP per capita compared to many other nations but has yet to reach the highest income levels. Key Observations about China in the chart is that it has a relatively high life expectancy, surpassing 78 years. This reflects improvements in healthcare, economic growth, and social policies. China's GDP per capita, adjusted for purchasing power parity (PPP$2017), is around 19.2k, indicating a strong but still developing economy. When compared with other countries, China outperforms many developing nations in both life expectancy and income but lags behind wealthier countries in terms of per capita GDP. We can observe China's progress over the years, shows rapid economic and social development.

We can analyze how GDP per capita influences life expectancy and compare different regions or income levels. By using the timelapse option, we can examine historical economic and health progress for different countries. The size of bubbles visually represents demographic weight, helping us comprehend the significance of large-population countries.

Income is an important factor in improved health. However, access to vital medical care and sanitation infrastructure is also a key factor for both life expectancy and infant mortality. Where vaccines are widely given, maternal care is available and reliable, medical facilities and doctors are accessible, and there is clean water and sanitation, life expectancy will be higher and infant mortality lower. Therefore, improving health is not just about raising income levels, but also about improving distribution of care and infrastructure.

Education indicators

Student
view

Figure 4. Education, another fundamental part of human development.

Source: 'Sustainable Development Goals (https://www.un.org/sustainabledevelopment/)' by UN and UNESCO

The fourth Sustainable Development Goal (SDG) is Quality Education. The goal according to the United Nations is to 'ensure inclusive and quality education for all and promote lifelong learning'.

Education is not only a development goal in itself, but it plays an important role in achieving other SDGs. Education can help people earn higher incomes and break out of the poverty cycle. It reduces income and gender inequalities. According to the UN, one extra year of education correlates with a lower Gini coefficient by 1.4 percentage points.

Overview (/study/app/pp/sid-186-cid-754025/

Education also improves health and well-being for individuals, increases choices and opportunities and strengthens communities. Educated communities find innovative solutions to the world's problems.

Mean years of schooling

Mean years of schooling is one component of the Human Development Index (section 4.8.7 (undefined)) (/study/app/pp/sid-186-cid-754025/book/composite-indicators-id-30578/). The mean years of schooling is the average number of years of education received by people aged 25 and older in their lifetime. As **Figure 5** shows below, the mean years of schooling has increased over time across the world. Especially after World War II, countries made great progress in increasing education levels.

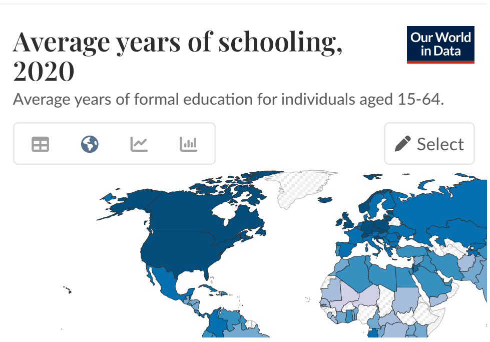


Figure 5. Mean years of schooling, 1870—2017.

More information for figure 5

Student view

The interactive map provides a comprehensive visualization of the average years of schooling for individuals aged 15-64 across the globe, based on data from 2020. This map serves as a valuable tool for understanding global educational attainment and the disparities in access to education between different countries and regions. The color gradient on the map represents the average years of schooling, with darker shades indicating higher educational levels, while lighter shades correspond to lower averages. Countries for which data is unavailable are marked with hatched lines.

Users can hover over any country to view its exact average years of schooling, allowing for quick comparisons between nations. The map also includes an interactive timeline slider at the bottom, enabling users to track how education levels have changed over time, starting from 1870. By adjusting the slider or using the play button, users can watch an animated time-lapse that illustrates the progress in global education over the past century and a half.

The map highlights the stark differences in education levels across the globe. Highly developed nations, such as the United States, Canada, Australia, and most of Europe, show high average years of schooling, typically exceeding 12 years. In contrast, many countries in Africa and South Asia have significantly lower averages, often below 6 years, reflecting challenges in providing widespread access to education.

In addition to the map, users can switch between Table, Map, and Chart views to explore the data in different formats. This flexibility allows for a deeper understanding of global education trends, educational disparities, and historical advancements in schooling over time.

On the right-hand panel, users can add or remove countries for comparison, sort data alphabetically, and dive deeper into specific trends. This dynamic feature enhances the user experience by allowing for customized exploration of the data.

Overall, this interactive map offers a clear, engaging way to visualize the disparities in educational attainment across the world, providing valuable insights into how education levels have evolved over time and highlighting areas where further progress is needed.

Overview
(/study/app/pp/sid-186-cid-754025/

Expected years of schooling

Expected years of schooling is another component of the Human Development Index (section 4.8.7 (undefined)) (/study/app/pp/sid-186-cid-754025/book/composite-indicators-id-30578/). Expected years of schooling is the number of years of schooling that a child of school entrance age can expect to receive in his or her lifetime if current age-specific enrolment rates persist. Like mean years of schooling, expected years of schooling in most countries has been increasing over time.

Adult literacy rate

The adult literacy rate is a measure of the percentage of the population older than 15 years that is literate at a specific moment in time. A person is considered literate if they can write and read, with basic understanding, a short statement on everyday life. Therefore, literacy depends on the education opportunities in each country.

There have been significant gains in literacy across the world; all countries outside Africa (except Afghanistan) have literacy rates above 50%, as can be seen in **Figure 6** below. You can see the changes in literacy over time by clicking the 'play' button.

Student view

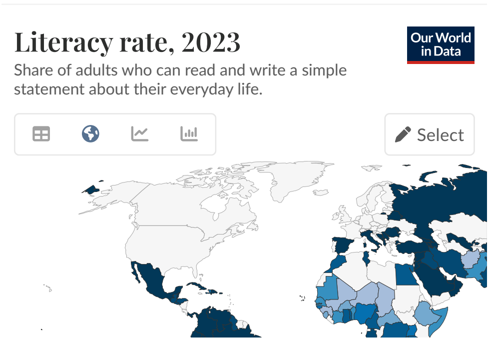


Figure 6. Literacy rate, 1475—2015.

More information for figure 6

This interactive map presents global literacy rates for 2023, showing the percentage of adults aged 15 and older who can read and write. The data is providing insights into literacy levels across different countries and regions, helping users understand global education progress and disparities. The map visually represents literacy rates using a color gradient—darker shades indicate higher literacy rates (closer to 100%), while lighter shades represent lower literacy rates. Developed nations, including the United States, Canada, most of Europe, Russia, China, Japan, South Korea, and Australia, boast near-universal literacy rates (95-100%), reflecting strong educational infrastructure. India, Brazil, Mexico, and South Africa fall in the moderate literacy range (60-95%), showing steady progress but facing rural and socio-economic challenges. In contrast, Sub-Saharan Africa (Chad, Niger, South Sudan) and Afghanistan report the lowest literacy rates (below 60%), where poverty, and lack of access to education hinder progress. Users can hover over a country to view its specific literacy percentage. A dropdown menu allows filtering by country or region for detailed comparisons. A timeline slider enables users to track literacy trends over time.

A time slider at the bottom enables exploration of historical literacy trends. Users can also access the data in a table tab.

With this interactive, users gain insights into global education trends, learning which regions have achieved high literacy rates and which still face challenges. The data highlights educational progress in developed nations while showing persistent literacy gaps in some developing regions, emphasizing the importance of educational policies and investment.

Be aware

Note that in many countries with lower incomes per capita, the difference between the adult literacy rate by gender can be significant. The male population tends to have a higher literacy rate than the female population in many countries. However, in countries with higher incomes, this difference generally disappears.

Complete section with 3 questions

Start questions

Previous section(/study/app/pp/sid-186-cid-754025/book/single-indicators-income-id-30573/)
Next section (/study/app/pp/sid-186-cid-754025/l

Overview (/study/ap 186- cid- 754025/ Table of contents Notebook Glossary Reading assistance
0 (https://intercom.help/kognity)
4. The global economy / 4.8 Measuring development

Single indicators: economic/social inequality

Figure 1. Ensuring that the gains from development are inclusive.

Source: 'Sustainable Development Goals (https://www.un.org/sustainabledevelopment/)' by UN and UNESCO

Inequality indicators help economists understand to what extent all groups in society can access the income, resources, services and institutions necessary to improve development. For example, if the GDP per capita increases in a country, we would like to understand whether incomes have increased for all groups, or whether income gains have gone mainly to higher-income groups. If income gains go mainly to a small group of higher-income people, this would limit the development impact across the population. Therefore, economic and social inequality indicators can help us understand how evenly any gains in income or development are distributed in society.

Student view

Economic inequality indicators

You have already learned about the causes, consequences and policies related to reducing economic inequality in subtopic 3.4, so the section will only provide a brief reminder of the measures.

Economic inequality is most commonly assessed through income inequality, measured by the Gini coefficient. You may recall from section 3.4 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-30471/) that the Gini coefficient is the ratio of the area above the Lorenz curve to the entire area under the line of perfect equality, shown in **Figure 2** below. The Lorenz curve plots the cumulative share of income held by cumulative quintiles of the population.

Overview
(/study/ap
186-
cid-
754025/

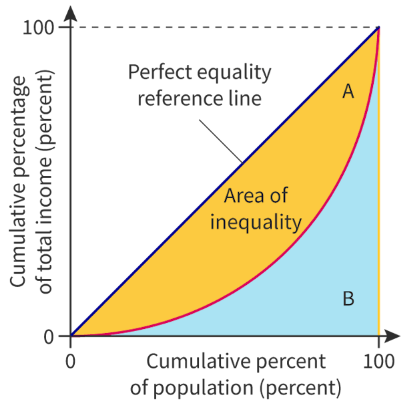


Figure 2. A simple Lorenz curve.

More information for figure 2

The image is a graph depicting a Lorenz curve, which illustrates economic inequality. The X-axis represents the cumulative percent of the population, labeled from 0 to 100, while the Y-axis shows the cumulative percentage of total income, also from 0 to 100 percent. There are three main elements in the graph:

1. The straight line labeled 'Perfect equality reference line' represents a scenario where income is evenly distributed across the population. It is a 45-degree line from the bottom left (0,0) to the top right (100,100) of the graph.
2. The curved line is the Lorenz curve itself, deviating below the line of perfect equality, indicating actual income distribution that is unequal. The space between this curve and the line of perfect equality represents inequality.
3. The area between the perfectly equal line and the Lorenz curve is labeled 'Area of inequality' (shaded in yellow), and the area under the Lorenz curve is labeled 'B' (shaded in blue). These labeled areas help visualize the degree of inequality, with area 'A' above the Lorenz curve representing inequality and area 'B' below the curve representing the share of total income distributed.

The graph effectively shows how income distribution deviates from perfect equality, providing a visual tool for understanding economic inequality.

[Generated by AI]

Student
view

To calculate the Gini coefficient, we use the following formula:

$$\text{Gini coefficient} = \frac{A}{A+B}$$

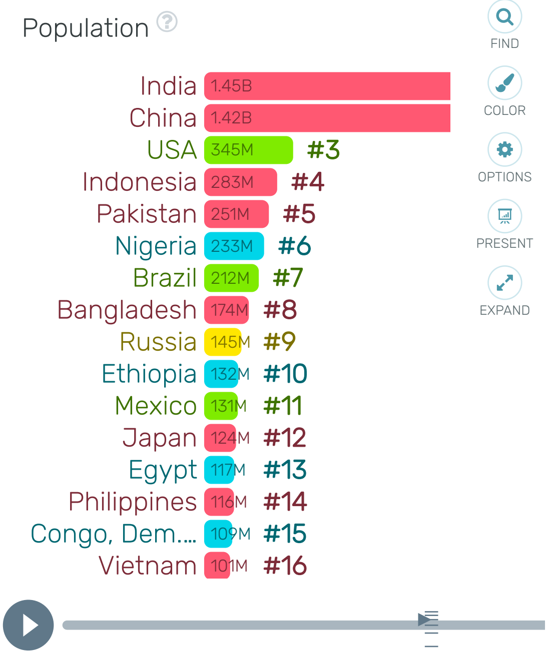


Figure 3. Gini coefficient by country. [You must click on the title to change it to "Gini coefficient"]

More information for figure 3

An interactive bar graph is a detailed representation of the population of various countries from 1800 to 2023. The horizontal bars on the left reflect the population sizes, listed in descending order, starting with the most populous country. The population data is presented in billions or millions for easier interpretation.

Each country is color-coded according to its Gini coefficient, a measure of income inequality ranging from 0 (indicating low inequality) to 100 (indicating high inequality). The graph uses a gradient scale: countries with low Gini coefficients are marked in purple, signifying less income disparity, while those with high Gini coefficients are shaded red, indicating significant inequality.

The graph includes interactive elements such as a search bar, allowing users to filter and focus on specific countries. It also provides a customizable view, where countries can be selected or deselected. This functionality enhances the user experience, making it tailored to individual preferences.

The Gini coefficient color scale is displayed in the upper-right corner, ensuring clarity and ease of understanding. This visualization effectively combines demographic and economic data, offering insights into global trends in population and income distribution.

When we compare India and Azerbaijan, we find India's Gini coefficient being 40.2. This highlights a higher level of income inequality compared to Azerbaijan's 26.6. There is a notable disparity in income distribution within India. Factors such as regional disparities, urban-rural divide, and unequal access to resources and opportunities likely play a role in driving this figure.

Worked example 1

Using data from **Figure 3**:

1. State a geographic pattern to the Gini coefficient data. Where in the world do we see higher Gini coefficients (more income inequality) and where in the world do we see lower Gini coefficients (less income inequality)? The colours on the bar graph indicate region.
2. State an income pattern to the Gini coefficient data. Hint: if you go to the main Gapminder Tools (https://www.gapminder.org/tools/#$chart-type=bubbles)page, you can change the y-axis to Gini coefficient to produce a scatter plot.

1. The bar graph is dominated by blue and green colours at the higher Gini coefficient values. This indicates that Africa and the Americas generally have greater income inequality. The bar graph is dominated by yellow at the lower Gini coefficient values. This indicates that European countries generally have lower income inequality.

Overview
(/study/ap
186-
cid-
754025/

2. According to Our World in Data (https://ourworldindata.org/income-inequality#economic-growth), high-income countries tend to have lower inequality. However, this is difficult to discern in the Gapminder graph without a trendline. It is interesting to note that a wide range of inequality can be found at all income levels, again reinforcing the point that policies, not just income, have a large effect on equity and development.

The data above provides a snapshot of income inequality right now, looking at geographic and income patterns. However, to fully understand income inequality data, you need to look at trends over time. Latin American countries have some of the highest Gini coefficients in the world, but when the data is presented over time, in **Figure 4,** you can see that income inequality in those countries is declining, particularly since 2000. This is important, because identifying a decline in income inequality could indicate a change in the economy or government policy that is worth further study.

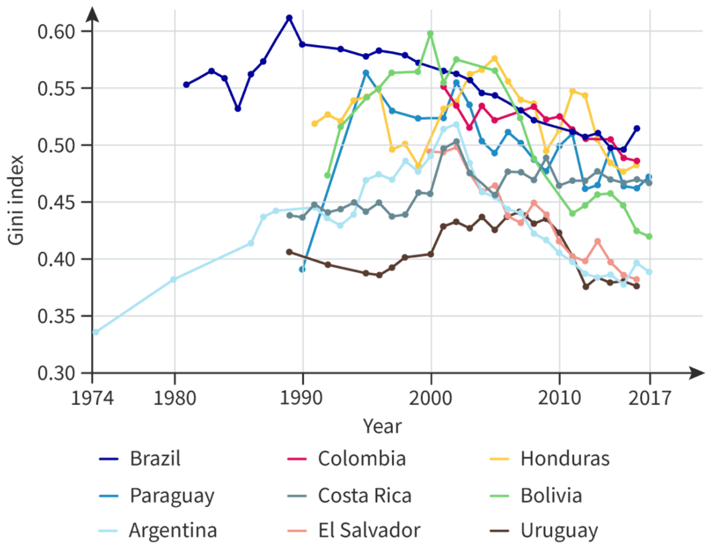


Figure 4. Income inequality in Latin America, 1974—2017.

Source: Our World in Data (https://ourworldindata.org/income-inequality)

More information for figure 4

Student
view

The graph displays the Gini index trends for multiple Latin American countries from 1974 to 2017. The x-axis represents the years, ranging from 1974 to 2017, while the y-axis shows the Gini index, ranging from 0.30 to 0.60. Each colored line represents a different country: Brazil, Colombia, Honduras, Paraguay, Costa Rica, Bolivia, Argentina, El Salvador, and Uruguay.

The data shows varying trends with most countries experiencing a decline in the Gini index from the early 2000s onwards, indicating a reduction in income inequality over time. Brazil's Gini index peaked around the year 2000 and then showed a downward trend. Colombia and Honduras represented in pink and yellow, show fluctuations but generally a downward trend from the early 2000s. Paraguay, Costa Rica, Bolivia, and Uruguay demonstrate a decrease in Gini index, especially notable after 2005. Argentina and El Salvador show a more stable trend with minor fluctuations. This visualization suggests that Latin American countries have seen a general decline in income inequality since 2000, potentially due to changes in economic policies or governmental actions.

[Generated by AI]

Overview (/study/ap 186- cid- 754025/

One area where there are significant differences in populations is in pay for men and women, a difference called the gender pay gap. Women generally earn less than men in most countries. There are many causes for this: experience, gender differences in choice (or opportunities) in occupation, education levels, family care burdens, among others.

Figure 5 below shows the 'unadjusted' pay gap; in other words, it does not take into account differences in the factors listed above. The data shows the difference between the average hourly earnings of men and women, expressed as a percentage of average hourly earnings of men. The data does not account for whether the work is full- or part-time. You can add more countries to the graph, by clicking on 'add country'.

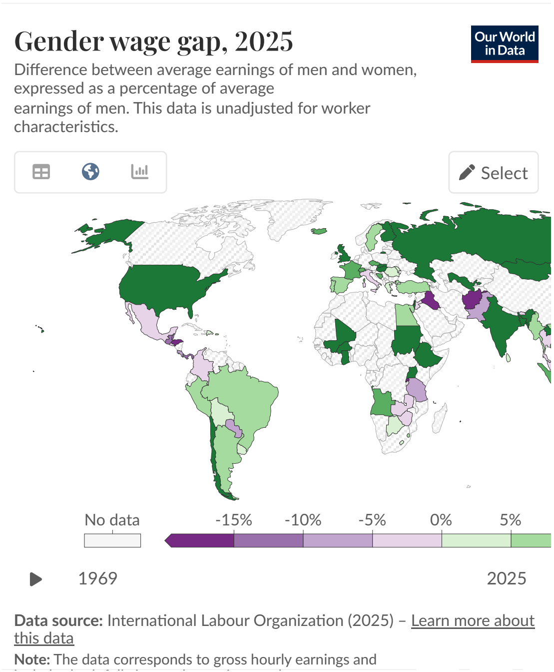


Figure 5. Unadjusted gender pay gap (average hourly wages %) in 2016.

More information for figure 5

A horizontal bar graph presents data on the unadjusted gender gap in average hourly wages across various countries in 2016, showcasing disparities in earnings between men and women. The x-axis represents the unadjusted gender wage gap as a percentage of men's average earnings, while the y-axis lists countries.

Countries with longer horizontal bars highlight larger wage gaps, emphasizing the extent of income inequality globally. South Korea (33.59% gap) faces persistent gender inequality, likely influenced by traditional roles and underrepresentation in high-paying sectors. Russia (24.42% in 2015) reflects historical labor divisions and weak wage equity measures. Switzerland (17.38% in 2014), Brazil (15.97% in 2014), and Denmark (15.96% in 2014) show moderate disparities, indicating barriers in accessing high-paying roles. Belgium (6.54% in 2014) demonstrates strong progress, supported by legal frameworks and workplace equality initiatives. Colombia (0.34% in 2015) reports a minimal gap. Malaysia (negative 2.25% in 2015) is the only country with a negative percentage.

Users can search and filter countries through a panel on the right. A slider at the bottom enables users to adjust the year, observing historical trends in gender wage gaps over time. Additional options allow users to download the dataset, share the visualization, and customize the view for a tailored analysis.

There are other options that a user can switch to analyse the data, in a map and table format. The map visually displays wage disparities by shading countries based on the percentage difference in average hourly wages between men and women. Darker shades signify a higher percentage gap, indicating greater inequality, while lighter shades represent smaller gaps. A timeline slider enables users to track trends in wage gaps over time, highlighting historical changes and progress in gender equity.

Users gain valuable insights into global gender wage disparities, it provides an overview of income inequality, highlighting countries with significant gaps.

Student view

As **Figure 5** shows, in most countries (except Malaysia: you can check this by adding it at the bottom of the graph) the gender pay gap is positive. Men earn more than women. We can also see that there are very large differences in the gender pay gap among countries.

However, as with the previous development data we have examined, it is not enough to simply look at one point in time. We need to look at how data has changed over time to get a better picture of development. **Figure 6** shows that the gender pay gap has been declining in most countries since 1970. This decline indicates that some of the factors that cause pay differences between men and women are having less of an impact over time.

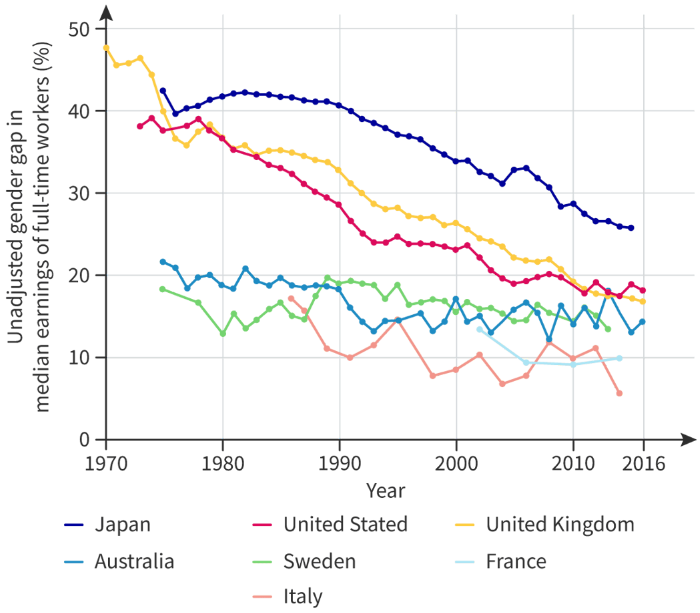


Figure 6. Unadjusted gender gap in median earnings of full-time workers (%), 1970—2016.

Source: Our World in Data (http://ourworldindata.org/economic-inequality-by-gender)

More information for figure 6

The image is a line graph illustrating the unadjusted gender gap in median earnings of full-time workers from 1970 to 2016. The Y-axis represents the percentage of the gender gap, ranging from 0% to 50%. The X-axis represents the years from 1970 to 2016.

Several lines represent different countries: - **Japan (blue line):** Shows a consistent decrease from around 48% in 1970 to about 25% in 2016. - **United States (red line):** Starts at around 35% in 1970 and steadily decreases to approximately 18% by 2016. - **United Kingdom (yellow line):** Begins at about 44% and declines to just above 20%. - **Australia (navy line):** Fluctuates slightly but shows an overall decrease from around 25% to about 15%. - **Sweden (green line):** Starts low at around 10%, remaining relatively stable throughout. - **France (light blue line):** Shows minor fluctuations around the 10% mark. - **Italy (pink line):** Starts at about 30%, following a decreasing trend to stabilize at around 10%.

Overall, the graph illustrates a general decline in the gender pay gap across most countries featured, indicating improved gender wage equity over the shown period.

[Generated by AI]

(Note: the data in **Figure 6** is slightly different from in **Figure 5**, showing only full-time workers and looking at **median** pay, rather than average (mean) pay).

Distribution of income and pay gaps are not the only way to assess economic inequality. Differences in access to physical and financial resources, like land and bank loans, and differences in the power to make economic decisions in the household, are other ways to assess economic inequality. These differences can significantly impact overall distribution of income and development.

Overview
(/study/ap
186-
cid-
754025/

Social inequality indicators

Differences across demographic categories, such as gender, also matter in many non-economic areas of society. Social inequality indicators measure the differences in access to resources, services and institutions by demographic groups. Discrimination based on age, gender, caste, religion, race, disability and sexual orientation reduces the access of certain groups to the tools they need to improve their quality of life. Social inequality indicators help economists and policy makers identify areas where unequal access to resources, services and institutions exist so that policies can be made to improve equity.

One area where there has been a lot of success is in improving equal access to education for girls. To track this progress, we can look at the gender ratio for mean years of schooling, which measures female-to-male educational attainment. A lower ratio means that girls have less equal access to education. A higher ratio means that girls have more equal access to education.

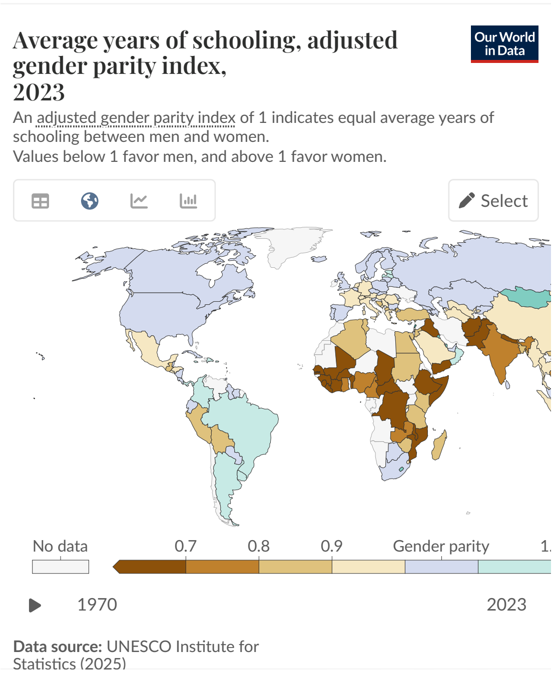


Figure 7. Gender ratios for mean years of schooling, 1870—2010.

Student view

More information for figure 7

This interactive world map visualizes the adjusted gender parity index for average years of schooling in 2010, highlighting progress in girls' access to education across different countries. The map uses a colour scale, where an index of 1.0 indicates equal average years of schooling between men and women. Values below 1.0 signify that men receive more years of schooling, while values above 1.0 indicate that women receive more. The timelapse slider represents time, ranging from 1970 to 2023, allowing us to track historical trends.

The map provides country-specific data by hovering over each region, enabling us to compare gender parity in education worldwide. Regions such as the Middle East and North Africa have shown substantial improvements, with the gender ratio for average schooling increasing from 36.1% in 1960 to 87.5% in 2010. The colour coding highlights disparities, showing where gender parity has been achieved and where gaps remain. An interactive time-lapse slider allows us to adjust the year to explore how the gender parity index has evolved over time. By moving the slider, we can observe how education accessibility for girls has improved across different countries, offering insights into global progress toward gender equality in schooling.

There are various formats, allowing users to analyze data in multiple ways. The interactive features of the table, such as a country selection panel, enables users to add or remove specific nations for comparison, and a time-lapse function that animates the data over time to visualize historical changes dynamically.

This will help in understanding the difference in schooling years between men and women across countries. They will learn to read and interpret data on gender equality in education and realize the progress made and challenges still faced by some countries.

Overview (/study/ap 186- cid- 754025/

As you can see in **Figure 7**, there have been significant gains in improving girls' access to education. For example, in 1960 the gender ratio for mean years of schooling for girls in the Middle East and North Africa was only 36.1%. By 2010, that ratio had increased to 87.5%.

Be aware

Be careful not to read too much into data. The data in **Figure 7** does not tell you anything about the number of mean years of education for girls or boys, or quality of education, or how the access to education might differ among groups such as castes. It also combines information from many countries into groups. It simply shows the changes in gender ratio of mean years of schooling. It is an average for a large group of economies, among which and within which there can be significant differences.

Activity

Social inequality also exists among age groups in countries. One area of inequality is in the percentage of young people who are unemployed. Remember that the unemployment rate refers to the percentage of the labour force without work, and that the labour force is made up of those who are willing and able to work.

1. Use data in **Table 1** below to create a bar graph comparing the values for each country. Use spreadsheet software that you are familiar with.
2. Suggest two policies that could narrow the gap between youth and general unemployment in a country. Explain why your suggestions could work.

Table 1. Comparison of youth and general unemployment rates in five countries (Source: World Banl

Country	Youth unemployment rate (% of total labour force 15—24) (https://data.worldbank.org/indicator/SL.UEM.1524.NE.ZS?end=2018&start=1960&type=shaded&view=chart)	Unemployment rate (% of total (https://data.worldbank.org/indicato type=shaded)
Canada (2018)	11.1	5.9
Greece (2017)	43.6	21.5
Argentina (2017)	22.6	8.3
Zambia (2017)	24	7.2
Philippines (2017)	7.5	2.6

Student view

The 2019 UN Human Development Report noted that while development improvements have been made among socially disadvantaged groups in basic capabilities, inequality is growing in enhanced capabilities. The difference in progress in basic versus enhanced capabilities can be seen in the data on access to mobile phone (basic) technology and computer (enhanced) technologies in India. In the two left-hand graphs in **Figure 8** below, we see the percentage of households with access to mobile phone technology, and the change in access between 2005 and 2015 for different social castes.

Overview (/study/ap 186- cid- 754025/

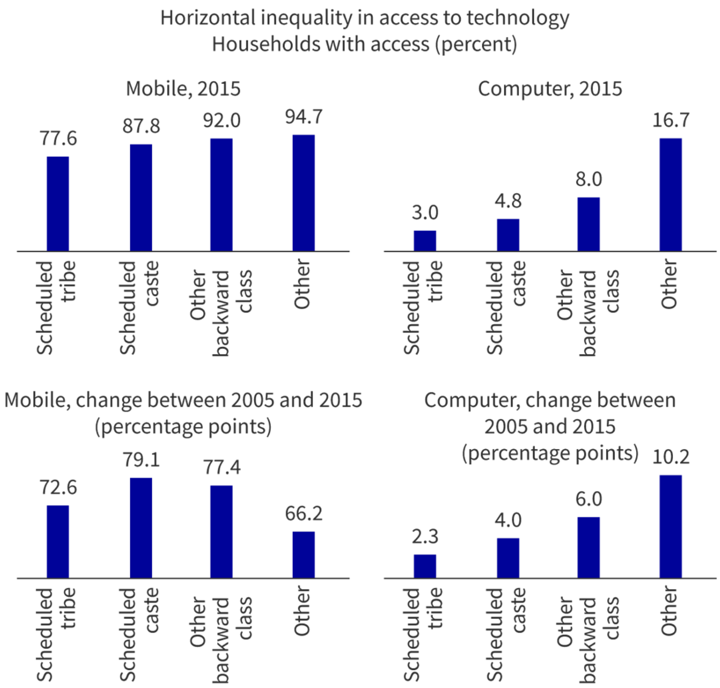


Figure 8. Reduced inequalities in access to mobile phone (basic) technologies, but increasing inequalities in access to computer (enhanced) technologies in India.

More information for figure 8

The image displays four bar charts illustrating household access to technology in India, categorized by social groups.

1. **Top Left Chart: Mobile Access in 2015**
    - The X-axis represents different social groups: Scheduled Tribe, Scheduled Caste, Other Backward Class, and Other.
    - The Y-axis shows the percentage of households with access, ranging from 0 to 100.
    - Bars for each group show access percentages: Scheduled Tribe (77.6%), Scheduled Caste (87.8%), Other Backward Class (92.0%), and Other (94.7%).
2. **Top Right Chart: Computer Access in 2015**
    - The X-axis represents the same social groups.
    - The Y-axis indicates the percentage of households with access, with lower values ranging from 0 to 20.
    - Access percentages are much lower: Scheduled Tribe (3.0%), Scheduled Caste (4.8%), Other Backward Class (8.0%), and Other (16.7%).
3. **Bottom Left Chart: Mobile Access Change from 2005 to 2015**
    - The X-axis represents the same social groups.
    - The Y-axis shows percentage-point change, from 0 to 100.
    - Increases are: Scheduled Tribe (72.6 points), Scheduled Caste (79.1 points), Other Backward Class (77.4 points), and Other (66.2 points).
4. **Bottom Right Chart: Computer Access Change from 2005 to 2015**
    - The X-axis represents the same social groups with similar axis scale as in mobile change.
    - The Y-axis shows percentage-point change, ranging from 0 to 12.
    - Changes: Scheduled Tribe (2.3 points), Scheduled Caste (4.0 points), Other Backward Class (6.0 points), and Other (10.2 points).

Student view

The charts highlight pronounced disparities in terms of both current access and progress made over a decade, with more significant growth observed in mobile phone access compared to computer technology.

Overview (/study/app/pp/sid-186-cid-754025/

[Generated by AI]

We can see that there are still discrepancies in access to mobile (basic) technologies between scheduled tribes and castes (constitutionally-recognised groups determined by birth and occupation who experience discrimination in Indian society) and other less socially disadvantaged groups. On average, 87.8% of those in scheduled castes had access to mobile (basic) technologies in 2015, while 94.7% of those less socially disadvantaged groups had access. However, the change in access to mobile (basic) technologies over the decade was greater for scheduled castes at 79.1%. This indicates that the social inequalities in access to basic technologies were declining in India.

However, the two graphs to the right in **Figure 8** indicate a different story. Access to computer (enhanced) technology is still at a low level across social groups in India, with only 4.8% of scheduled castes having access to computer technologies and only 16.7% of other less socially disadvantaged groups. However, the change in access between 2005 and 2015 was much more significant for less socially disadvantaged groups. They have made the most gains and marginalised groups are lagging further behind, despite progress. These trends in rapid improvement in basic capabilities versus widening inequality in enhanced capabilities among India's social castes applies to education and health as well. Both trends are important. It is encouraging to see more of the world's poor having access to education, health care and technologies to improve their lives. But, according to the United Nations Human Development Report, the increasing inequalities in enhanced capabilities may result in concentrations of power that further polarise societies.

Complete section with 3 questions

Start questions

Section

Feedback

Previous section(/study/app/pp/sid-186-cid-754025/book/single-indicators-health-and-education-id-30574/)

Next section (/study/app/pp/sid-186

Student view

Single indicators: energy

Figure 1. Energy is an important factor for development.

Source: 'Sustainable Development Goals (https://www.un.org/sustainabledevelopment/)' by UN and UNESCO

Energy is a very important part of development. Access to energy sources improves quality of life through increased productivity, improved health care and education, expanding digital communication, networks and access to knowledge, as well as freeing time from basic chores.

The link between energy and development reveals the same positive feedback loops that we have seen elsewhere in this subtopic. Access to energy improves people's ability to produce goods and services, increasing incomes, which can lead to higher quality of life. It also directly influences quality of life by improving human freedoms and capabilities. Increased economic growth and improved development can then lead to further increases in energy consumption. Therefore, the relationship between energy and development is multidimensional and complex, and mutually reinforcing.

In **Figure 2** below, we can see the positive correlation between per capita energy use (kg of oil equivalent) and incomes (GDP per capita at PPP).

Overview (/study/ap 186- cid- 754025/

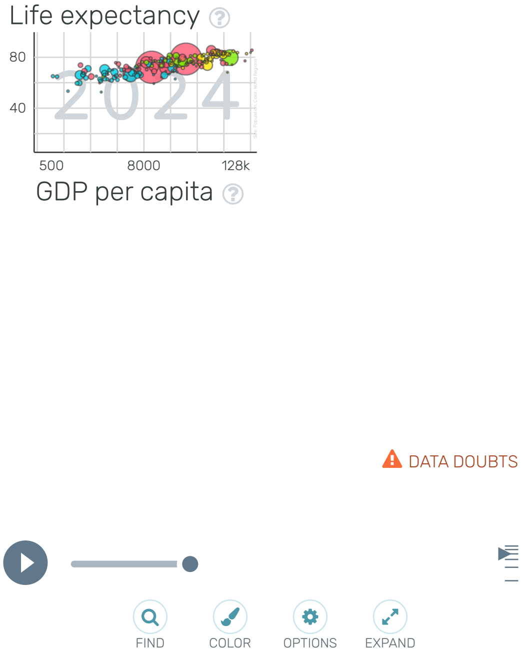


Figure 2. Energy use is positively correlated with income.

More information for figure 2

This interactive bubble chart explores the relationship between GDP per capita (PPP) and life expectancy at birth. The horizontal axis represents GDP per capita, reflecting economic prosperity, while the vertical axis represents life expectancy, indicating health and quality of life. Each country is represented by a bubble, with a size corresponding to a population.

Countries can be categorized by region using the right-side panel, and a search bar enables the selection of specific countries. Users can zoom in, zoom out, and play an animated timeline to observe historical trends. The timeline helps visualize how the relationship between economic status and life expectancy evolves over the years.

The chart generally shows that countries with higher GDP per capita tend to have higher life expectancy, with developed nations appearing in the upper right and lower-income countries in the lower left. Some exceptions exist where countries achieve higher life expectancy with relatively lower income, indicating effective healthcare systems or social policies. This interactive tool provides insights into global disparities and long-term trends in economic and health development.

Student view

From a sustainable development perspective, it is worth examining sources of energy in terms of human and environmental harm. One way of doing that is to plot different sources of energy according to the number of deaths per unit of energy (due to accidents and air pollution) and greenhouse gas emissions, as can be seen in **Figure 3** below:

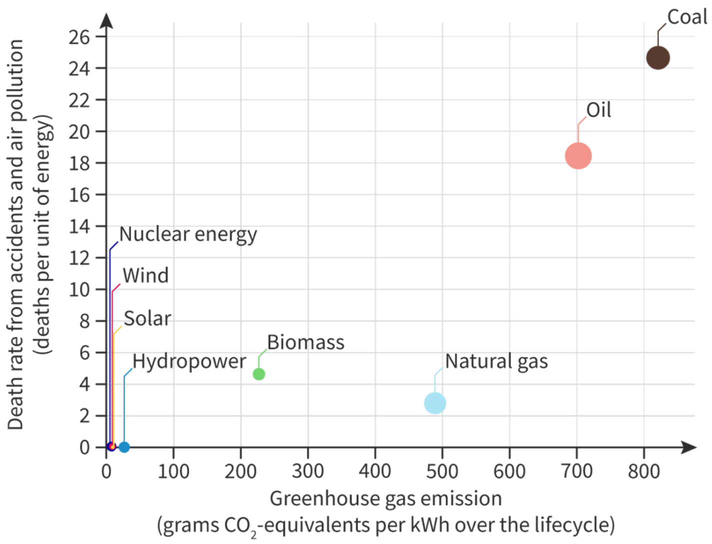


Figure 3. Sustainable sources of energy are also better for people.

Source: Our World in Data (https://ourworldindata.org/energy)

More information for figure 3

The image is a graph that plots different sources of energy according to their death rate from accidents and air pollution (deaths per unit of energy) on the Y-axis, and greenhouse gas emissions (grams CO2-equivalents per kWh over the lifecycle) on the X-axis. The X-axis ranges from 0 to 800 grams CO2-equivalents per kWh, while the Y-axis ranges from 0 to 26 deaths per unit of energy.

Several energy sources are plotted as points on this graph: - Nuclear energy: Located near the bottom of the chart with low death rates and low emissions. - Wind and Solar: Close to the origin, indicating very low death rates and emissions. - Hydropower: Slightly higher in emissions compared to Solar and Wind but still low in both metrics. - Biomass: Higher death rate but moderate emissions. - Natural gas: Moderate emissions around 500 grams and low in deaths, positioned above the Biomass point. - Oil: Positioned in the mid-range for both death rate and emissions. - Coal: Highest death rate and emissions, positioned at the top right of the graph.

Overall, sustainable energy sources like Wind, Solar, and Hydropower have lower death rates and emissions compared to fossil fuels such as Coal and Oil.

[Generated by AI]

Generally speaking, sustainable sources of energy like hydropower, solar, wind and biomass have lower rates of death from accidents and air pollution than non-renewable sources of energy. Among fossil fuels, natural gas has better development credentials than oil or coal.

Sources of energy

International Mindedness

Countries' energy mixes are highly determined by physical geography. Certain areas of the world have access to abundant sources of energy. Iceland has access to geothermal, Saudi Arabia to oil, Scotland to wind, Costa Rica to hydroelectric. It is important to be aware of the role that physical geography plays in each country's energy mix to appropriately explore policies to increase the use of renewable sources.

Primary energy consumption by source

Countries use a range of sources of energy: wind, water and tide flows, geothermal heat flows, nuclear, solar and fossil fuels. In high-income countries, fossil fuels have dominated as sources of energy for at least 100 years. In recent decades, other sources of energy have been growing. But as **Figure 4** shows, these renewable sources still make up a small percentage of the energy used globally.

Overview
(/study/ap
186-
cid-
754025/

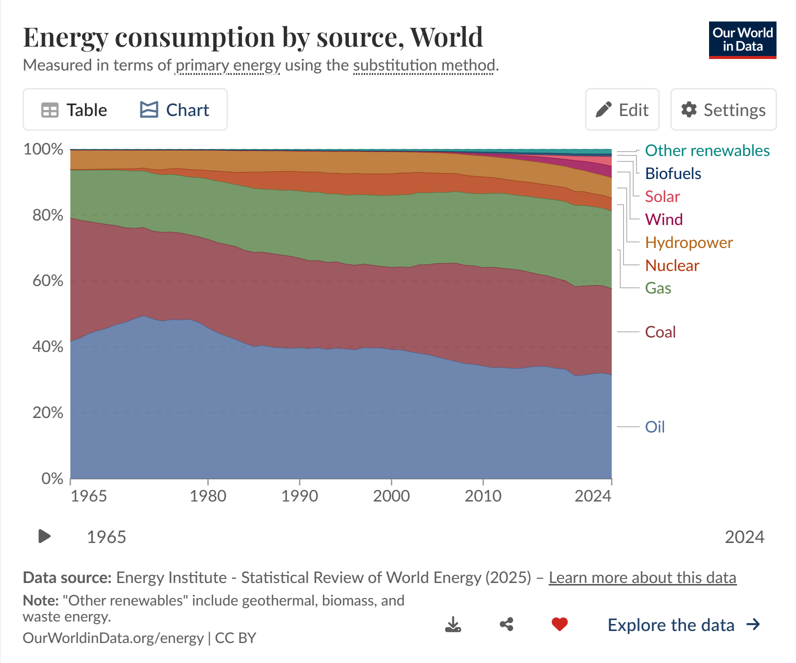


Figure 4. World energy consumption by source, 1965—2018.

More information for figure 4

The graph, presented as a stacked area chart, illustrates global energy consumption trends from 1965 to 2023. The x-axis represents the years, while the y-axis displays the percentage contribution of each energy source to primary energy consumption. The colored areas correspond to various energy sources, including Oil, Coal, Gas, Nuclear energy, Hydropower, Wind energy, Solar energy, Biofuels, and Other renewable resources.

The visualization highlights the dominance of Oil and Coal, which occupy the largest areas for the majority of the timeline, reflecting their role as primary energy sources. Gas demonstrates consistent growth, expanding its share over the years. The areas for renewable sources like wind energy, solar energy, and biofuels gradually increase, signaling a transition toward more sustainable energy practices. Nuclear energy and hydropower maintain relatively stable contributions, with modest variations over the timeline. Users can explore country-specific energy trends by adjusting regions or countries through a settings panel.

A timeline slider allows users to investigate shifts in energy consumption patterns across decades. Additionally, options to download or share the dataset offer flexibility for further analysis.

The table tracks energy consumption from Other renewables (including geothermal and biomass) across various countries for the years 1965 and 2023. It includes columns for Country/area, a timeline spanning from 1965 to 2023, Absolute Change, and Relative Change, with all values measured in terawatt-hours (TWh).

Learners gain insights into the global energy landscape through the graph and table by analyzing trends in energy consumption and production. The trend shows that while fossil fuels continue to hold the majority share, alternative energy sources have been growing in recent decades.

Student view

Share of electricity production from renewables

Countries differ significantly in the amount of energy they produce from renewable resources. This is primarily related to the availability of natural resources and access to technologies. Iceland, for example, has significant hydroelectric and geothermal capacities due to its location in one of the most active volcanic regions. **Figure 5** shows the percentage of electricity generated from renewable resources from 2014 (latest World Bank data available).

Overview
(/study/ap
186-
cid-
754025/

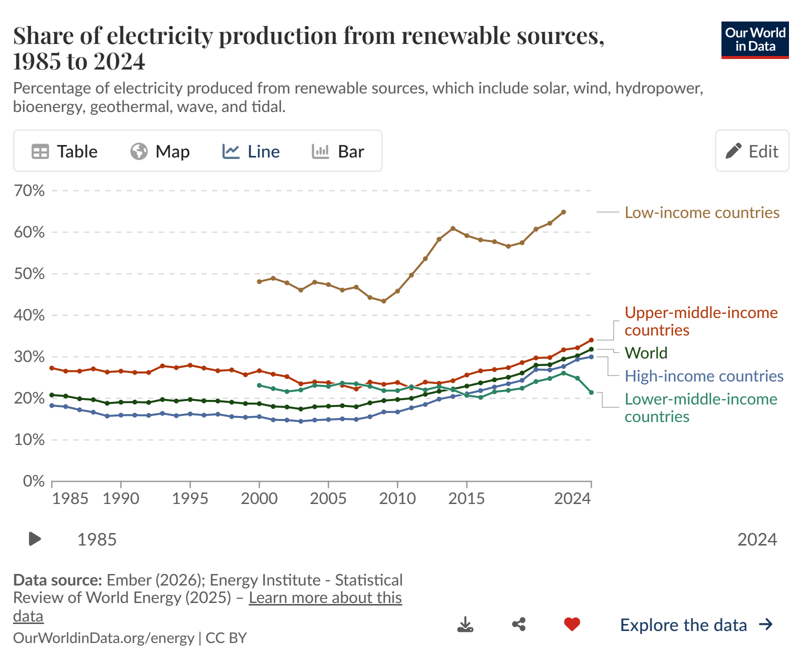


Figure 5. Percentage of electricity produced through renewable sources, 1990-2014.

More information for figure 5

The interactive line graph illustrates the share of electricity production from renewable sources, covering the period from 1985 to 2023. The x-axis represents the years, while the y-axis shows the percentage of electricity generated from renewable sources. Each income group or region is represented by a distinct line, differentiated by color: low-income countries (brown), lower-middle-income countries (blue), upper-middle-income countries (red), high-income countries (green), and the world average (black).

The graph highlights clear trends. Low-income countries lead with the highest share of renewables, consistently above 40%, driven by heavy reliance on hydropower and biomass. Upper-middle-income countries exhibit steady growth, nearing 30% by 2023, while high-income countries and the world average show gradual increases, reaching around 25% and 28%, respectively. Conversely, lower-middle-income countries lag behind, with renewable energy shares remaining below 20%, reflecting challenges in transitioning to sustainable energy systems. Countries like Iceland and Norway lead with nearly 100% renewable energy shares, due to abundant hydropower resources. In contrast, nations with limited renewable infrastructure, such as many Middle Eastern countries, have lower proportions. Emerging economies in South America and Asia demonstrate steady growth in renewable energy adoption, while developed nations like Germany and the United States exhibit substantial but partial reliance on renewables. A timeline slider provides a view of renewable energy trends across decades.

Users have the option to see and compare the data provided in table and map format. The table tracks the share of electricity production from renewable sources (including biomass, hydropower, solar, wind, geothermal, and marine energy) across various countries for the years 1985 and 2023. It includes columns for Country/area, a timeline spanning from 1985 to 2023, Absolute Change, and Relative Change, with all values measured in percentages. Learners gain insights into energy transitions, growth patterns, regional disparities, and the impact of policies.

Student
view

Activity

You may find some of the high rates in the choropleth map in **Figure 5** surprising. Choose a country with a high percentage of renewable energy production and spend a few minutes researching on the internet to find out what accounts for that high percentage.

Some questions to consider:

- To what extent is the high rate of renewable energy use related to physical geography and access to resources?
- To what extent is it related to significant investments in technology?
- Does a high rate of renewable energy production always mean that production is sustainable?

Overview
(/study/ap
186-
cid-
754025/

Energy consumption per capita

Figure 6 shows per capita energy use from 1960 to 2015. The data includes all forms of energy (electricity, transport, heating). The data is measured in kilowatt-hours per person per year. The choropleth map shows that per energy consumption has been growing over time, but also that there are large inequalities between countries. The average US resident consumes many times as much energy as those in poor and middle-income countries.

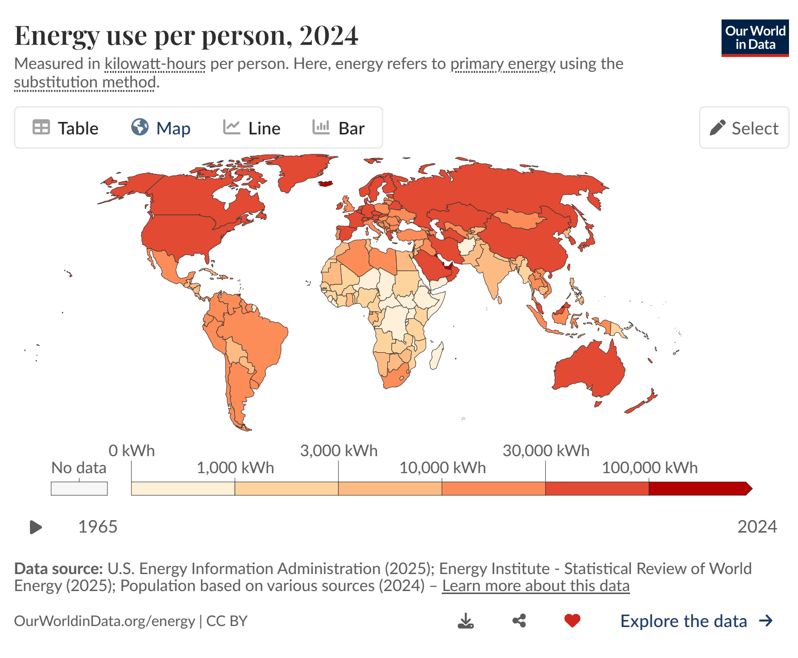


Figure 6. Energy use per capita, kilowatt-hours per person per year.

More information for figure 6

The interactive map displays global energy use per person in 2023, measured in kilowatt-hours per person. It helps users understand the disparities in energy use and access worldwide. The map represents the energy consumption by shading countries—darker shades indicate higher energy use per person, while lighter shades represent lower energy use. The map features high energy use in economically developed nations like the United States, Canada, and Russia, reflecting their access to robust infrastructure and energy resources. In contrast, countries with limited infrastructure and resources, such as many nations in Sub-Saharan Africa, show lower energy consumption rates. Emerging economies in regions like Asia and South America display steady growth in energy use per person, pointing to economic development and increasing access to energy.

There is an option to view the data in graph and table format. The table tracks primary energy consumption per capita across various countries for the years 1965 and 2023. It includes columns for Country/area, a timeline spanning from 1965 to 2023, Absolute Change, and Relative Change, with all values measured in kilowatt-hours (kWh) per person.

The information provides learners with a comprehensive understanding of global trends in energy production, consumption, disparities, and economic development over decades. It also conveys that on average, a US resident consumes several times more energy than individuals in low- and middle-income nations.

Student view
Section
Feedback

Making connections

Energy is an important topic in both the IB Environmental Systems and Societies course (subtopic 4.8) and the IB Geography course (Unit 3).

Complete section with 3 questions

Overview
(/study/app/pp/sid-186-cid-754025/

Start questions

Previous section(/study/app/pp/sid-186-cid-754025/book/single-indicators-economicsocial-inequality-id-30575/)

Next section (/study/app/pp/sid

Student view

Single indicators: environment

Figure 1. Measuring changes in the environment is important to ensure a sustainable future.

Source: 'Sustainable Development Goals (https://www.un.org/sustainabledevelopment/)' by UN and UNESCO

The previous sections have shown much progress on human development indicators. Human beings have been enormously successful in using Earth's resources to meet the demands of growing populations and to improve standards of living. But this progress has a cost. The environmental damage associated with increased global output is extensive.

In section 4.7.3 (/study/app/pp/sid-186-cid-754025/book/modelling-sustainable-development-id-30436/), you were introduced to the Planetary Boundaries model. You may remember that this model identified nine dimensions of Earth system processes and the boundaries beyond which we may face irreversible and catastrophic environmental changes. There are environmental indicators for most of these dimensions.

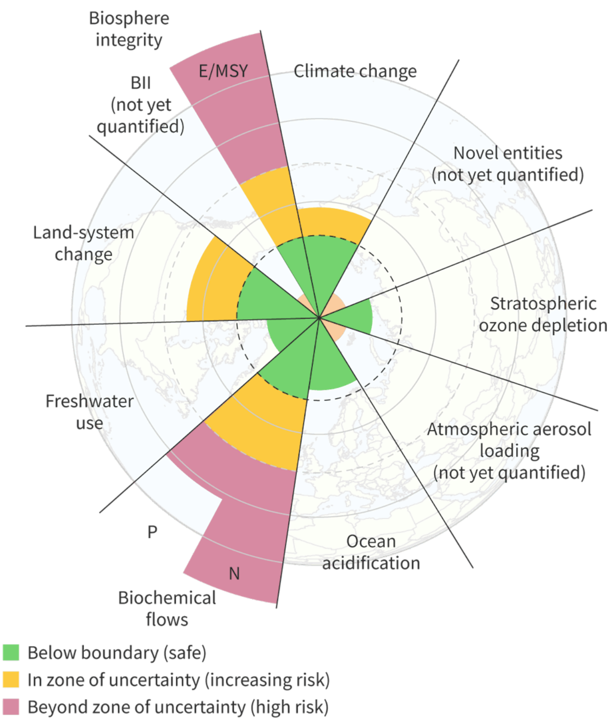


Figure 2. The Planetary Boundaries Model.

Source: "Planetary boundaries research (https://www.stockholmresilience.org/research/planetary-boundaries.html)"

More information for figure 2

Overview
(/study/ap
186-
cid-
754025/

The image is a circular diagram representing the Planetary Boundaries model. It is divided into several sectors, each one labeled with different Earth system processes: Biosphere integrity, Climate change, Novel entities, Stratospheric ozone depletion, Atmospheric aerosol loading, Ocean acidification, Biochemical flows, Freshwater use, and Land-system change. The sectors are color-coded to indicate different levels of risk: green for below boundary (safe), yellow for in zone of uncertainty (increasing risk), and red for beyond the zone of uncertainty (high risk). Some segments, like Biosphere integrity and E/MSY, are marked in red, indicating high risk, while others show varying colors indicating different risk levels or unquantified states.

[Generated by AI]

International Mindedness

Achieving sustainable development is not a goal that one country can achieve alone. We share a biosphere and only by working together can we hope to meet the needs of all within our planetary boundaries. Collective action is necessary to steer Earth's systems away from environmental disaster.

Carbon dioxide emissions

One important indicator is CO_2 (carbon dioxide) emissions. CO_2 is a greenhouse gas (one of several), released when fossil fuels are burned, that warms the planet. Scientists believe that exceeding a temperature rise of 1.5 °C above pre-industrial levels (we are already at more than +1 °C) may result in a tipping point, where positive feedback loops cause an even more rapid rise in temperature that could dramatically change Earth's biosphere and climate. Climate change is one of the dimensions of the Planetary Boundaries model.

Increased economic activity, particularly since the Industrial Revolution and further during the Great Acceleration, have resulted in high CO_2 emissions that are not sustainable. **Figure 3** shows the relationship between incomes and CO_2 emissions per person.

Student
view

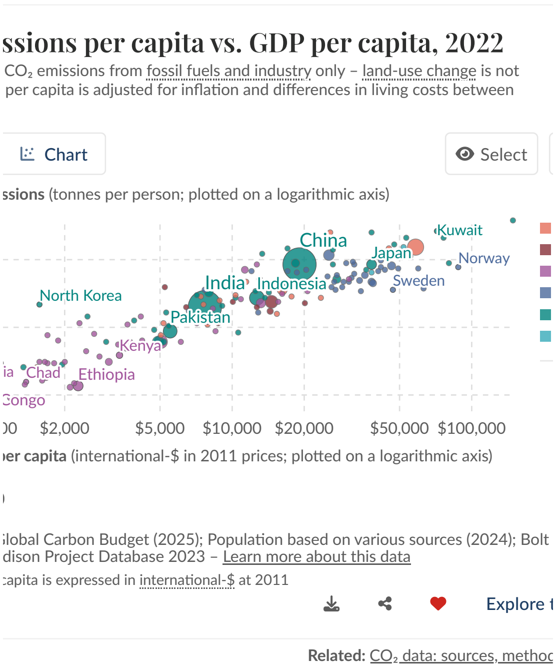


Figure 3. CO_2 emissions per capita versus GDP per capita, 1800—2016.

More information for figure 3

An interactive color-coded scatter plot represents data on CO_2 emissions per capita versus Gross Domestic Product (GDP) per capita for the year 2022, showcasing the relationship between environmental impact and economic wealth across different countries. CO_2 emissions are measured in tonnes per person, while GDP per capita is expressed in international dollars (adjusted for inflation and living cost differences). The x-axis represents GDP per capita, while the y-axis displays CO_2 emissions per capita. Countries above the gray diagonal line have higher CO_2 emissions relative to their economic output, while countries below the line exhibit more efficient or lower emissions.

African countries, such as Niger, Ethiopia, and the Democratic Republic of Congo, are clustered with low GDP per capita and minimal CO_2 emissions, highlighting low industrial activity. In contrast, North American nations, particularly the United States, show high GDP per capita and significant emissions per capita, emphasizing the environmental cost of economic prosperity. Asian countries like China and India reflect a mixed pattern; China demonstrates higher GDP and emissions, while India remains lower on both measures. Outliers include Singapore, which shows a high GDP per capita but relatively lower emissions compared to other affluent nations, and Qatar, with exceptionally high emissions relative to its economic size.

On the right-hand side, users can search for specific countries and regions or sort them by name. This feature provides an easy way to locate individual nations within the visualization. Below the scatter plot, a timeline slider enables users to adjust the year, tracing historical trends back to 1750.

At the bottom, data sources and credits are provided, linking to the original research. Additional controls allow users to download the visualization, share it, or expand it to full-screen mode. The chart visually emphasizes the intricate relationship between economic prosperity and environmental impact. It also shows GDP per capita correlates with CO_2 emissions and identifies regional disparities.

The three graphs below show the changes in atmospheric CO_2 concentrations over three time periods. As **Figures 4,5, and 6** show, the current data indicates alarmingly high concentrations of CO_2 at well above 400ppm. Scientists are extremely concerned about these levels and have been sounding the alarm for decades. In 2015, most countries signed the Paris Climate Agreement (https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement), committing to reduce greenhouse gas emissions. Progress on meeting these commitments has been slow. Monitoring greenhouse gas emissions is very important so we can evaluate the steps that we are collectively taking to tackle this threat.

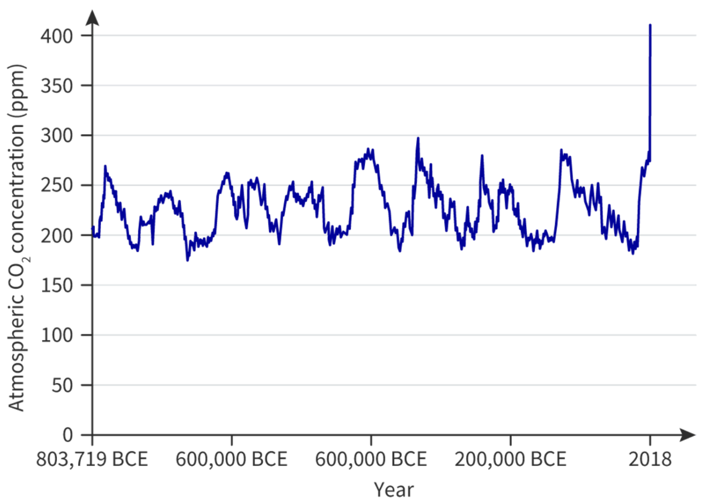


Figure 4. Atmospheric CO_2 concentration over hundreds of thousands of years.

Source: "Our World in Data (https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions)"

More information for figure 4

This graph displays atmospheric CO2 concentration in parts per million (ppm) over hundreds of thousands of years. The X-axis represents the year, ranging from 803,719 BCE to 2018. The Y-axis represents CO2 concentration in ppm, with values ranging from 0 to 400. The data shows fluctuations in CO2 levels, peaking above 250 ppm multiple times over the past, before a significant and alarming rise past 400 ppm in recent years.

[Generated by AI]

Overview
(/study/ap
186-
cid-
754025/

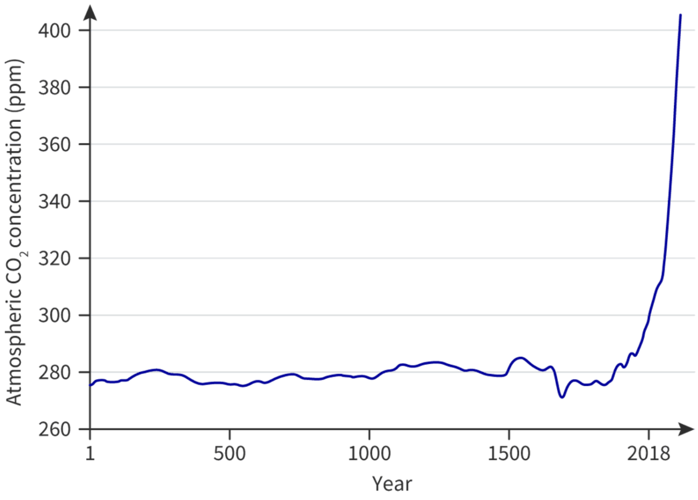


Figure 5. Atmospheric CO_2 concentration over 2000 years.

Source: "Our World in Data (https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions)"

More information for figure 5

The graph represents atmospheric CO2 concentration over the course of 2000 years. The X-axis covers the period from the year 1 to 2018, and it is labeled as "Year." The Y-axis represents atmospheric CO2 concentration in parts per million (ppm), ranging from 260 to 400 ppm. The graph shows a relatively stable CO2 level from year 1 to the late 1800s, fluctuating slightly around 280 ppm. There is a dramatic increase starting in the mid-20th century, with levels reaching up to 400 ppm by 2018. This indicates a sharp rise in atmospheric CO2 concentration in recent years, suggesting rapid industrialization and increased fossil fuel usage.

[Generated by AI]

Student
view

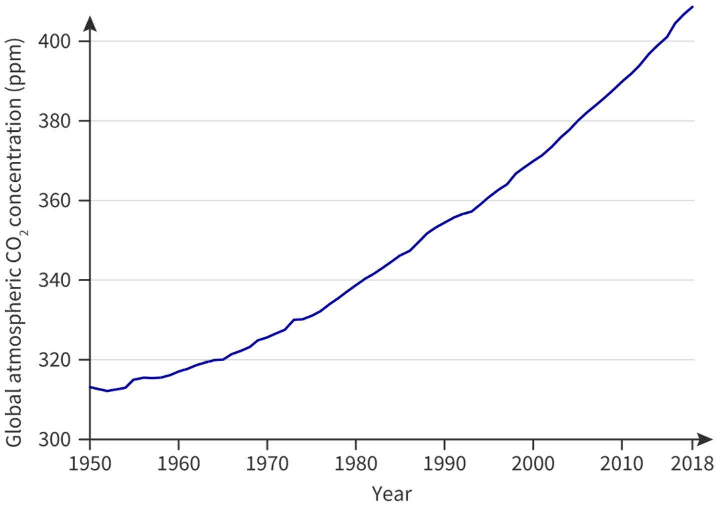


Figure 6. Global CO2 concentration, 1950—2018 (the Great Acceleration).

Source: "Our World in Data (https://ourworldindata.org/co2-and-other-greenhouse-gas-emissions)"

More information for figure 6

The graph displays global atmospheric CO2 concentration in parts per million (ppm) from the years 1950 to 2018. The x-axis represents the years, ranging from 1950 to 2018, with labels at intervals of ten years: 1950, 1960, 1970, 1980, 1990, 2000, 2010, and 2018. The y-axis shows CO2 concentrations in ppm, ranging from 300 to 400 with labeled intervals at 20 ppm steps: 300, 320, 340, 360, 380, and 400. The graph shows a steadily increasing trend in CO2 levels over the years, with noticeable acceleration after the 1950s. The line representing CO2 concentration starts slightly above 310 ppm in 1950, rising gradually, with the steepest increase occurring post-2000, reaching around 408 ppm by 2018.

[Generated by AI]

Worked example 2

Examine **Figures 4, 5, and 6** above. The graphs all plot CO_2 emissions over time, but their presentation is different.

1. How do the graphs differ?
2. How could these differences affect your interpretation of the data?
3. Which of these graphs would give the reader the greatest sense of urgency about reducing CO_2 emissions? Why?

1.(a) The time scale is different. **Figures 4** and **5** plot CO_2 concentrations over a much longer period of time than **Figure 6**. **Figure 4** plots the data over millennia, **Figure 5** plots the data from year 1 to 2018, while **Figure 6** plots the data from 1950 to 2018.

(b) **Figures 4** and **5** have a wider range of values on the *y*-axis than **Figure 6**. **Figure 4** ranges from 0 to 400 ppm, **Figure 5** ranges from 260 to 400 ppm, while **Figure 6** ranges from 300 to 400 ppm.

2. The differences in scale on both the x- and y-axes make the changes in CO_2 concentrations appear more gradual in **Figure 6** than in **Figures 4** and **5**.

3. **Figures 4** and **5** are probably the more useful graphs if the goal is to convey an understanding of how extraordinary the increase in CO_2 concentrations is since the Industrial Revolution. The fact that the current CO_2 increases appear exponential, and that in the case of **Figure 4,** you can clearly see that the CO_2 variation is much greater than past spikes, is likely to convey a greater sense of urgency about taking action. It is very important to consider the visual/communications impact of data when determining appropriate ranges of values for axes on a graph.

Ecological footprint (EF)

The Ecological Footprint (EF) is a model that can be used to estimate the demands that a human population places on the environment. It is a measure of the amount of land needed to support a population. As human populations grow, it is becoming more important to measure the environment's capacity to meet our ever-increasing demands.

Overview
(/study/ap
186-
cid-
754025/

Making connections

Subtopic 8.4 of the IBDP Environmental Systems and Societies (ESS) course provides a much more extensive explanation of the components of the Ecological Footprint and how changes in those components might affect the EF values.

The EF considers two aspects:

- Biocapacity: this is Earth's bioproductive land and sea, which includes forests, cropland, pastures and fisheries. These areas not only provide food, but they also absorb waste.
- Demand: this considers the amount of bioproductive land we need to provide our resources and space for infrastructure and absorb the waste.

The available biocapacity per person is 1.7 global hectares. A hectare is 100m × 100m, about the size of the interior field of an athletics track. **Figure 7** shows the estimated EF per person, using country averages. As you can see many countries, particularly higher-income countries, have EFs that are too high for Earth's biocapacity. The pressure on Earth's resources is unsustainable.

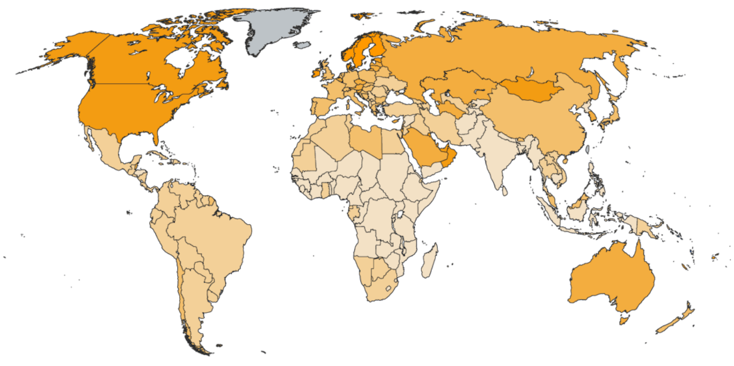


Figure 7. Ecological Footprint per person.

Student
view

More information for figure 7

The image is a world map illustrating the ecological footprint per person by country, measured in global hectares. It uses a color gradient to indicate different ranges of ecological footprints:

- Light beige represents countries with a footprint less than 1.7 global hectares.
- Light orange indicates a footprint between 1.7 and 3.4 global hectares.
- Medium orange shows 3.4 to 5.1 global hectares.
- Dark orange displays 5.1 to 6.7 global hectares.
- Darkest orange signifies countries with a footprint greater than 6.7 global hectares.

Overview
(/study/ap
186-
cid-
754025/

Countries in North America, parts of Europe, and Australia show darker orange shades, indicating higher ecological footprints. In contrast, many African and some Asian countries are depicted in lighter shades, reflecting lower ecological footprints. The key at the bottom of the map provides a clear legend for interpreting these color codes.

[Generated by AI]

Section

Feedback

Activity

Access the Ecological Footprint Calculator (http://www.footprintcalculator.org/) at the website of the Global Footprint Network.

1. Answer the questions to calculate your own ecological footprint.
2. How do you compare with the average for your country?
3. What can you do to reduce your ecological footprint?

Complete section with 3 questions

Start questions

Previous section(/study/app/pp/sid-186-cid-754025/book/single-indicators-energy-id-30576/)

Next section (/study/app/pp/sid-186-cid-754025/b

Student
view

Composite indicators

Human Development Index (HDI)

The Human Development Index (HDI) is a summary of three key dimensions of human development: having a long and healthy life, being educated and having a decent standard of living.

The health dimension is measured by the life expectancy at birth indicator. The education component is measured by two indicators: the mean years of schooling for adults aged 25 years and expected years of schooling for children at school-entering age. You learned about these two indicators in section 4.8.3 (/study/app/pp/sid-186-cid-754025/book/single-indicators-health-and-education-id-30574/). The standard of living dimension is measured by gross national income per capita ($ at PPP).

The values of the three HDI dimension indicators are then aggregated into a composite index with values from 0 to 1. Further, countries are divided into four categories: very high human development, high human development, medium human development and low human development, as shown in**Table 1**.

International Mindedness

The UN Human Development Report (http://report.hdr.undp.org/) (UN HDR) is a fascinating exploration of data and real-world examples related to development from around the world. Reading through parts (or all!) of the report can really enhance your understanding of global development conditions and trends.

The UN HDR also has a section with country profiles (http://hdr.undp.org/en/countries) that can help you develop case studies.

Table 1. Four categories of human development.

Very high human development	0.800 and above
High human development	0.700 – 0.799
Medium human development	0.550 – 0.699
Low human development	Less than 0.550

Table 2 shows the data for selected countries. Each country is ranked based on its HDI value for 2018 and the indicators for each HDI dimension are listed. The final column subtracts the country's HDI rank from its GNI per capita ($PPP) rank.

Table 2. Selected HDI data (2018 data from the 2019 UN Human Development Report).

HDI rank	Country	HDI, 2018	Life expectancy at birth (years), 2018	Expected years of schooling (years), 2018	Mean years of schooling (years), 2018	GNI per capita ($ PPP), 2018	GNI per capita ($ PPP) rank — HDI rank 2018
Very high human development							
1	Norway	0.954	82.3	18.1	12.6	68 059	5
9	Singapore	0.935	83.5	16.3	11.5	83 793	- 6
15	United States	0.920	78.9	16.3	13.4	56 140	- 4
41	Qatar	0.848	80.1	12.2	9.7	110 489	- 40
57	Uruguay	0.808	77.8	16.3	8.7	19 435	5
High human development							
63	Serbia	0.799	75.8	14.8	11.2	15 218	15
79	Brazil	0.761	75.7	15.4	7.8	14 068	2
85	China	0.758	76.7	13.9	7.9	16 127	- 13
102	Jordan	0.723	74.4	11.9	10.5	8 268	10
113	South Africa	0.705	63.9	13.7	10.2	11 756	- 22
Medium human development							
121	Morocco	0.676	76.5	13.1	5.5	7 480	- 3
126	Guatemala	0.651	74.1	10.6	6.5	7 378	- 7
129	India	0.647	69.4	12.3	6.5	6 829	- 5
135	Bangladesh	0.614	72.3	11.2	6.1	4 057	6
144	Equatorial Guinea	0.588	58.4	9.2	5.6	17 796	- 80
Low human development							
158	Nigeria	0.534	54.3	9.7	6.5	5 086	- 22
162	Madagascar	0.521	66.7	10.4	6.1	1 404	19
165	Côte d'Ivoire	0.516	57.4	9.6	5.2	3 589	- 16
170	Afghanistan	0.496	64.5	10.1	3.9	1 746	1

Overview (/study/ap 186- cid- 754025/

HDI rank	Country	HDI, 2018	Life expectancy at birth (years), 2018	Expected years of schooling (years), 2018	Mean years of schooling (years), 2018	GNI per capita ($ PPP), 2018	GNI per capita ($ PPP) rank — HDI rank 2018
185	Burundi	0.423	61.2	11.3	3.1	660	4

Be aware

Keep in mind that a high ranking country will have a low rank number. For example, if Norway is ranked number one; this is a high rank, even though the rank number is low. This can be a point of confusion so make sure that you have understood the meaning of high rank and low rank.

Exam tip

Questions about the Human Development Index (HDI) are very likely to be presented with data on the indicators used to find the HDI value. When responding to a question prompt on the HDI, it is very important to use data from the text in your response to show full understanding of the material. This is shown in the worked example below.

Worked example 1

1. Using information from **Table 2**, explain why Jordan has a higher HDI ranking than South Africa.
2. Using information from **Table 2**, explain Equatorial Guinea's low GNI per capita rank – HDI rank (-80).

Student view

1. The HDI is composed of four indicators: life expectancy at birth, mean years of schooling, expected years of schooling, and GNI per capita ($PPP).

   Jordan's HDI ranking is 102, while South Africa's HDI ranking is 113. Jordan has a lower GNI per capita ($PPP) figure of $8 268 compared to South Africa at $11 756. Jordan also has a lower number of expected years of schooling than South Africa, 11.9 vs. 13.7. However, Jordan has a significantly higher life expectancy. A Jordanian born now can expect to live to 74.4 years; a South African can only expect to live to 63.9, more than 10 years less. This seems to account for Jordan's higher HDI figures and overall rank.

1. The column to the far right in **Table 2** subtracts the HDI rank from the GNI per capita ($PPP) rank. This number indicates the discrepancy between national income figures and human development. When the value is positive, it means that the country is doing better on the health and education indicators than might be expected for its income level. When the value is negative, it means that the country is doing worse than might be expected for its income level.

   Equatorial Guinea's GNI – HDI rank is –80. This is because the GNI per capita ($PPP) is relatively high at $17 796, but life expectancy (58.4) and expected (9.2) and mean (5.6) years of schooling values are very low. This

Overview
(/study/ap
186-
cid-
754025/

means that the country is achieving lower levels of development than might be expected given its relatively high average income levels.

Inequality-adjusted Human Development Index (IHDI)

The UN Human Development Report includes a second index, the Inequality-adjusted Human Development Index, which adjusts the HDI figure to account for inequalities within a country in life expectancies, education and income. Each indicator is adjusted to account for inequalities in outcomes among income groups in the country. Given the levels of inequality present in all countries, this means that HDI values are lowered according to the extent of inequality present.

Table 3 below shows a selection of data from the countries in**Table 2**, to illustrate how much some countries' HDI is lowered to account for inequality. The full data set can be found on the Inequality-adjusted Human Development Index (http://hdr.undp.org/en/content/table-3-inequality-adjusted-human-development-index-ihdi) page of the Human Development Report for 2019.

Table 3. Comparison of HDI rank and value with IHDI rank and value, 2018 (2019 report).

Country	HDI rank	HDI value	IHDI rank	IHDI value
Very high human development				
Norway	1	0.954	1	0.889
Singapore	9	0.935	23	0.810
High human development				
Brazil	79	0.761	93	0.574
China	85	0.758	81	0.636
Medium human development				
India	129	0.647	128	0.477
Guatemala	126	0.651	128	0.472
Low human development				
Nigeria	158	0.534	163	0.349
Côte d'Ivoire	165	0.516	168	0.331

Student
view

Overview (/study/ap 186- cid- 754025/

Gender Inequality Index (GII)

Figure 1. Gender equality supports development.

Source: 'Sustainable Development Goals (https://www.un.org/sustainabledevelopment/)' by UN and UNESCO

As the UN states, ending discrimation against women and girls is a basic human right and is critical for a sustainable future. Empowering women and girls helps both economic growth and development. Gender equality plays a key role in the United Nations' work and there has been significant progress in the last 20 years. More girls are in school and in government, and pay has increased.

But though there are more women in the labour market, there are still significant inequalities in some countries and regions. Sexual violence and exploitation is still prevalent and there are large inequalities in allocation of unpaid care and domestic work and discrimination. Conflict, migration, climate change and disasters all have a disproportionately large impact on women and girls.

The Gender Inequality Index (GII) attempts to capture gender inequalities by measuring them in three important aspects of human development:

Student view

- **reproductive health**, indicated by the maternal mortality ratio and adolescent birth rates
- **empowerment**, indicated by the proportion of parliamentary seats held by women and the proportions of both women and men aged 25 and older with some secondary education
- **economic status**, indicated by the labour force participation rate of men and women aged 15 and older

The GII measures the impact of gender inequality on development. The higher the GII value, the more inequality there is between women and men and the greater the negative impact on human development.

Table 4 below shows the data from the same countries as**Table 3**, to illustrate those countries' levels of gender inequality. The full data set can be found in the UN Human Development Report, in the section on the Gender Inequality Index (GII) (http://hdr.undp.org/en/content/gender-inequality-index-gii).

Table 4. Gender Inequality Index for selected countries 2018 (2019 report).

Source: GII (http://hdr.undp.org/sites/default/files/hdro_statistical_data_table5.pdf)

Overview (/study/app/pp/sid-186-cid-754025/...)

Country	GII rank	Maternal mortality ratio (deaths per 100,000 live births)	Adolescent birth rate (births per 1,000 women ages 15—19)	Share of seats in parliament % held by women	Population with at least some secondary education		Labour force participation rate	
					F	M	F	M
Very high human development								
Norway	5	5	5.1	41.4	96.1	94.8	60.2	66.7
Singapore	11	10	3.5	23.0	76.3	83.3	60.5	76.3
High human development								
Brazil	89	44	59.1	15.0	61.0	57.7	54.0	74.4
China	39	27	7.6	24.9	75.4	83.0	61.3	75.9
Medium human development								
India	122	174	13.2	11.7	39.0	63.5	23.6	78.6
Guatemala	118	88	70.9	12.7	38.4	37.2	41.1	85.0
Low human development								
Nigeria	....	814	107.3	5.8	.....	.....	50.6	59.8
Côte d'Ivoire	157	645	117.6	9.2	17.8	34.1	48.3	66.0

Student view

Happy Planet Index (HPI)

The Happy Planet Index (HPI) (http://happyplanetindex.org/) is a composite indicator that aims to show how well countries are doing at achieving long, happy, sustainable lives. You were already introduced to the HPI in subtopic 3.1 (/study/app/pp/sid-186-cid-754025/book/the-big-picture-id-29927/), but as a reminder, the HPI includes three dimensions and their indicators:

- **well-being**, through the indicator of subjective well-being rated on a scale out of 10
- **health**, through the indicator of life expectancy
- **inequality**, through the indicator of inequality-adjusted life expectancy, and inequality-adjusted experienced well-being
- **sustainability**, through the Ecological Footprint

It is worth noting that many countries that come out highest in the Human Development Index (HDI) fare far worse in the Happy Planet Index. This is because of their poor results on measures of sustainability. In other words, many high-income countries are overusing resources to achieve their development outcomes. Instead, several countries in Latin

Overview (/study/ap 186- cid- 754025/c

America and the Asia Pacific region lead the way, achieving high life expectancy and well-being with much smaller Ecological Footprints. The HPI also includes several country profiles (http://happyplanetindex.org/case-studies) that can be used for case studies.

Be aware

The Happy Planet Index was last published in 2016. The New Economics Foundation (https://neweconomics.org/), which was responsible for creating the Index, is no longer updating the information. Nonetheless, it is important to be aware of how sustainability might be included in composite indices to put income and development into the context of sustainable use of resources.

Case study

Biodiversity

Figure 2. Costa Rica's biodiversity is a national treasure.
Source: "Strawberry Poison Frog (49703014893) (https://www.flickr.com/photos/chaz_pics/49703014893/)" by Charlie Jackson is licensed under CC BY 2.0 (https://creativecommons.org/licenses/by/2.0/)

Student view

Costa Rica is located in Central America and is known for its stunning landscapes, biodiversity, stable democracy and educated population. Approximately 8% of GDP is spent on education; the world average is just 4.8%. Costa Rica's high life expectancy and happiness is helped by a culture of social networks of family, friends and neighbourhoods.

Costa Rica gets more than 99% of its electricity from renewable resources, mainly hydroelectricity, though other non-renewable sources are used for other energy needs.

Forests are important for Costa Rica. Much of it was lost a few decades ago, but forest coverage is back over 50% of land area. This is important for protecting biodiversity. Costa Rica hosts more than 5% of the world's species on just 0.03% of the Earth's land. Efforts to preserve nature have also spawned a robust tourism industry.

Table 5. Selected data, Costa Rica.

Category	Value
Life expectancy (http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components-1)	79.83 years

Overview
(/study/ap
186-
cid-
754025/c

Section Feedback

Category	Value
Happiness (https://s3.amazonaws.com/happiness-report/2019/WHR19_Ch2A_Appendix1.pdf)	7.2/10
Ecological footprint (http://happyplanetindex.org/countries/costa-rica)	2.8 gha/person
Human Development Index (HDI) (rank) (http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components-1)	0.794 (68)
GNI per capita rank — HDI rank (http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components-1)	12
Inequality-adjusted HDI (IHDI) (rank) (http://hdr.undp.org/en/content/table-3-inequality-adjusted-human-development-index-ihdi)	0.645 (80)
Gender Inequality Index (GII) (rank) (http://hdr.undp.org/en/content/table-5-gender-inequality-index-gii)	0.285 (61)
GNI per capita ($PPP) (http://hdr.undp.org/en/content/table-1-human-development-index-and-its-components-1)	USD 14 790

1. Use the table data above to explain why Costa Rica ranks first in the Happy Planet Index (HPI).
2. What does the GNI per capita rank — HDI rank tell you about Costa Rica?
3. What does Costa Rica's lower relative ranking on the IHDI tell you about the country?

Single and composite indicators do not give us a complete picture of development. Identify and explain two things you would like to know about Costa Rica, not mentioned in this case study, to help assess its development.

Complete section with 4 questions

Start questions

Student view

Previous section(/study/app/pp/sid-186-cid-754025/book/single-indicators-environment-id-30577/)

Next section (/study/app/pp/sid-186-cid-754(