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HOW TO MEASURE THE WELL-BEING OF A NATION: A NEW PROPOSAL BASED ON A MULTIDIMENSIONAL APPROACH

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Abstract

Measuring the well-being of a nation means identifying all the tools that enable its individuals to live well without worsening the lives of their neighbours or those to come in the future. For many years, the focus has been solely on the economic dimension, creating critical problems in the social and environmental spheres that will take years and large investments to remedy. This article gives an overview of the measurements used over the years in the international arena by recognised and respected bodies. The application of these indicators to the realities of countries has made it possible to identify models to be followed in order to enable the growth of the well-being of societies as a whole.

Keywords: Economic dimension. Environmental. Virtuous countries. Gross Domestic Product. Social welfare. Sustainable development. Circular economy.

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Introduction

All living beings seek to be well in the environment in which they live and try to gain satisfaction from the activities they do throughout their lives. To place a value on each individual's well-being, it is necessary to analyse subjective aspects peculiar to each lived experience and objective aspects valid for the whole community. These evaluations must be contextualized within a broader family and social sphere in order to obtain collective evaluations (VANDERWEELE et al., 2020).

Through this thesis, the evolution that the research world has made over time to measure these aspects of societies has been represented. From the earliest economic assessments of state property, there has been a move to a complex and standardized system of national accounting that has seen the emergence of quantitative synthetic indicators that have conditioned countries' decisions for several years (DELSIGNORE et al., 2023).

An ever-changing economy, which did not adjust its measurements as fast as the production of goods and services changed, found itself many times uncovered in front of very large decreases. Adjustments to these measurement methodologies have been proposed over the years to try to synthesize economic reality in the best way, adding as much information as possible. An economic reality that has heavily impacted all other aspects of social living (MANAGI et al., 2024).

Measuring the collective well-being of a purely agrarian society requires a different instrument than that used for industrialised societies or for tertialised societies with a strong technological drive. One cannot think of measuring such different realities with the same indicator and one cannot think that a single value can adequately represent complex structures that have several dimensions to evaluate. The economic dimension must be accompanied by a social and environmental assessment in order to have a balance between all the components of human living (LIBÓRIO et al., 2022).

One-dimensional solutions (economic, environmental or subjective) or multi-dimensional solutions (economic-social-environmental, economic-subjective-social or economic-social-environmental-subjective) have been proposed internationally. We will go on to analyse each proposal and see what countries have achieved with these indicators. In this article we will look at the one-dimensional propositions of well-being (economic and environmental) and their overcoming by a multidimensional vision that takes into account the different aspects of human life.

This latter vision has been adopted by the OECD in the United Nations and by ISTAT in Italy with the creation of the BES. As the economist Stiglitz points out: 'If we measure the wrong thing today, we will do the wrong thing tomorrow. If we do not measure something, it will be ignored, as if the problem did not exist.'

Economic Dimension of Well-being

One of the first dimensions of collective well-being to be measured was the economic one, as it represents a fundamental measure that strongly conditions, for better or worse, all other dimensions (COHEN KAMINITZ, 2023).

Measuring National Accounting

Man has always sought a way to measure the value of objects. Since barter, the search has never stopped. Even the rulers of states have, over time, sought an ever more efficient way to measure the wealth they possessed. The forerunner of these measurements can be traced to William Petty, who in the 1650s attempted to create a system of national accounting for Great Britain that would serve as a measure of the nation's wealth (PURWANTO; SISWAHADI, 2021).

A few decades later came the Physiocratic economists, who assessed a country's wealth primarily in terms of agricultural production, relegating the production of goods and services to the margins of the economy. This view was opposed by Adam Smith, who identified labour and its productivity as the true wealth of the nation. In the same vein came the thinking of David Ricardo, who identified productivity as the true value of a commodity. For Marx, this wealth of the nation was only created by human labour, which was exploited to secure the surplus value that generated the employer's profit. You have to go back to the early 1900s to find macroeconomic works that take into account all the variables related to consumption, investment, government spending, imports and exports (FIORAMONTI, 2019).

The need for a synthetic indicator that truly represented the wealth of a country arose in the period between the two world wars, with Europe threatened by fascism and nazism, the collapse of the Russian empire and the US Great Depression. At a time of great social and economic upheaval, there was a need for an instrument that could point the way forward. In 1934, Simon Kuznets presented Gross Domestic Product (GDP) to the US Congress, an indicator designed to help policymakers in their search for the best allocation of available resources. Thanks to this instrument, the US government was able to convert part of its civilian industry into a war industry in a very short time, while keeping the civilian part more productive to satisfy domestic demand (CARSON, 1975).

The US victory in World War II sanctioned the proclamation of GDP as the most influential tool used by politicians and the mass media to proclaim a country's success or defeat (FIORAMONTI, 2017). The use of GDP on a global level was also reinforced by the Bretton Woods conference that in 1944 initiated a process of international cooperation in both trade and exchange rates in order to avoid the recurrence of international instability that was one of the main causes of the outbreak of World War II (KUBISZEWSKI et al., 2013).

Over the next 90 years, the major international institutions, the World Bank and the International Monetary Fund pushed economic growth in all countries in an uncontrolled manner without thinking about the progressive depletion of natural resources and the impact on all ecosystem services related to natural capital (KUBISZEWSKI et al., 2013).

Methodology for measuring GDP

GDP is the main indicator used by countries to measure the size of their economies and represents the value of all new goods and services produced in a country over a given period - usually one year (HANDOYO; ISNADI, 2023). This calculation excludes goods and services produced abroad by domestic production, but also includes all foreign production that takes place in the host country. It also excludes all production of intermediate goods and services, as these are included in the final product and would therefore be counted twice.

The word gross means that the value does not take into account depreciation, i.e. the reduction in the value of an asset due to physical wear and tear or obsolescence, which producers must incur in order to replace it. As it is measured over a fixed period, usually a year, it is a flow variable.
There are three equivalent methods of calculating GDP:

- The expenditure method: Expenditure by households, businesses and government is added together GDP = private consumption + private investment + government expenditure + net exports
Investment can be in machinery or production equipment, stocks or dwellings. Exports are less imports

- Income method: labour income, capital income, depreciation, net indirect taxes, net income of foreigners are added together.

- Production method: as the sum of value added at each stage of production. For each enterprise, the difference is made between the value added of the goods produced and the expenditure incurred in purchasing the intermediate goods needed for production (STIGLITZ; MARCHIONATTI, 1995; COYLE, 2016).

GDP can be nominal, when current prices are used without taking inflation into account, or real, when price changes are included in the calculations to assess the real purchasing power of the population. In the latter case, the price remains fixed in a base year and the deviation in GDP is only due to the change in quantity over time. In order to be able to compare the GDP of different countries that use different currencies and are affected by exchange rate fluctuations, it was decided to use purchasing power parity. Thus, for a given year, GDP at constant prices is used to make comparisons between countries with different currencies. In addition, a *per capita* value has been used to adjust the data for population size, which makes it possible to compare countries with very different population weights.

Figure 1 shows the top 20 countries in terms of absolute GDP and the top 25 *per capita* are represented, with purchasing power parity at constant 2021 prices. The absolute growth of China over the last 34 years is remarkable, followed by the United States, the European Union and India. China went from $1.868 trillion in 1990 to $31.227 trillion in 2023, increasing its GDP by 17 times at constant prices. The United States and the countries of the United Europe reached the same level of 24 trillion from 11 trillion and 14 trillion, respectively. A country that has grown a lot in recent years in economic terms (7 times) is India, from 1,906 in 1990 to 13,104 in 2023. On the other hand, the economies of Indonesia, Türkiye, South Korea and Egypt have grown four times.

Among the top 20 richest countries, those that have grown the least are Italy, Russia and Japan. Of these twenty countries, only the United States and Germany are in the top 25 in terms of GDP *per capita*, with 73,000 dollars and 62,000 dollars per annum respectively, with growth of 66% and 45% since 1990. The other top performers are Luxembourg with $132,000 (+61% since 1990, when it was $82,000), Singapore with $127,000, Ireland with $115,000, Qatar with $113,000 and Norway with $99,000. Among these countries, it is worth noting the strong growth of Ireland, which has almost quadrupled since 1990 (USD 29,000). On the *per capita* indicator, Norway, Denmark, Switzerland and Iceland are present and, as we shall see, they also score well on many social welfare indicators. GDP *per capita* is an important variable in determining the well-being of a population because it is closely linked to health and education services, which are some of the strongest pillars on which all other needs rest. Unfortunately, high levels of GDP *per capita* are often associated with high levels of environmental degradation, destabilising the foundations on which a community's well-being rests (TØNNESSEN, 2023). The challenge is to decouple these last two variables, to have good economic provision without compromising the environment in which we operate.

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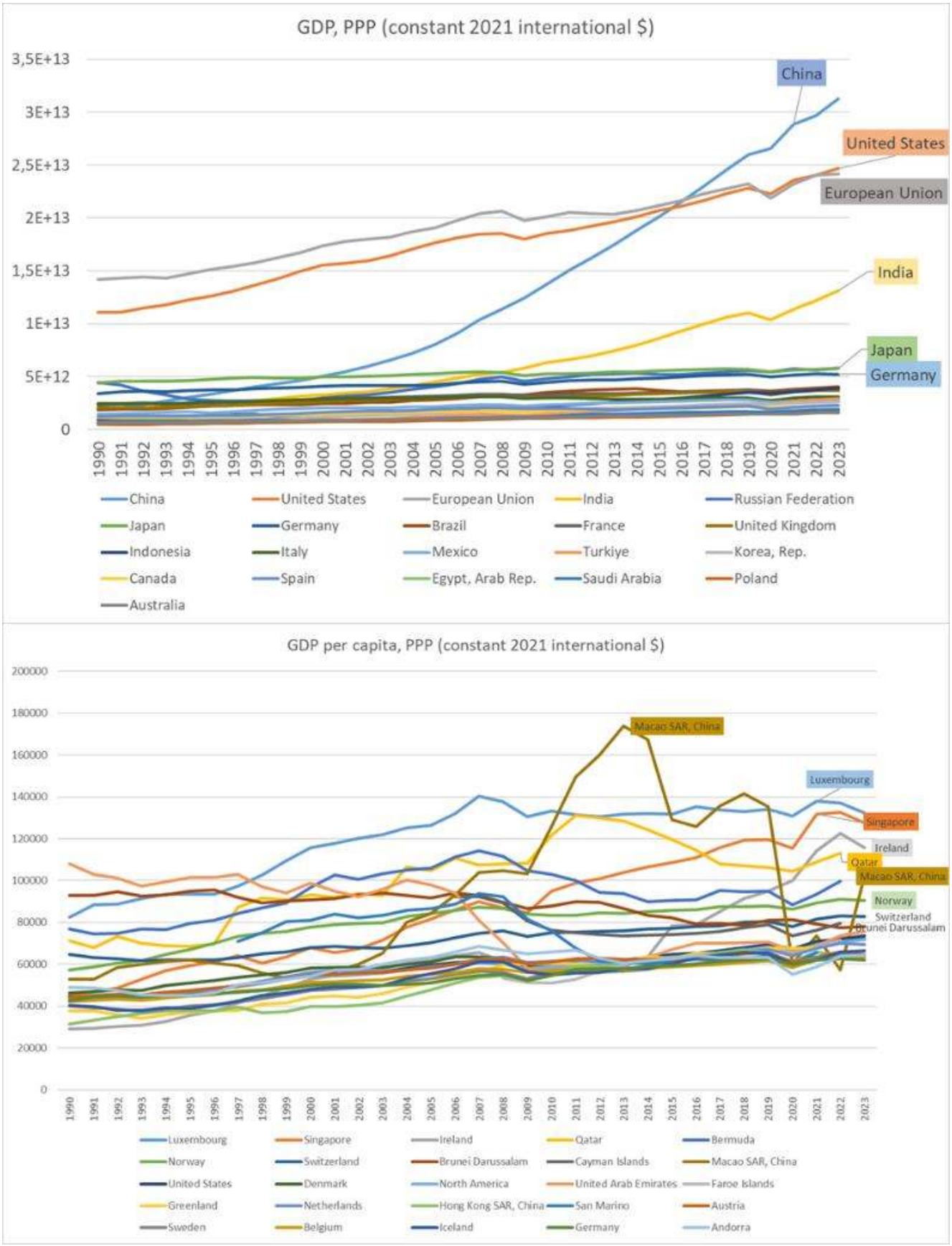

Figure 1. GDP in purchasing power parity at 2021 prices in absolute terms and *per capita*.
Source: World Bank, World Development Indicators Data Base.

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Usefulness and limitations of GDP

Gross domestic product (GDP) is a good indicator of a country's economic growth. It has the advantage of being synthetic and easy to understand, even if the calculation is quite complex and requires the informative contribution of all the economic actors involved in the production process (MANAGI et al., 2024).

Moreover, thanks to the international methodology, it is possible to make comparisons over time and space. However, these advantages are counterbalanced by the many criticisms of the indicator. The main problem is that it does not count all those activities that do not have a price and therefore do not enter the market: domestic work, voluntary work, activities that take place in leisure time in a non-paying space (FIORAMONTI, 2019).

Economic and demographic growth has found a valuable ally in technological progress, which has allowed ever greater exploitation of natural resources without respecting their natural replacement times. The improved productivity generated by technological progress is accompanied by a greater destructive impact on the natural resources involved in the production process (CASTELLUCCI, 2021).

According to the first theorem of welfare economics, the market achieves the Paretian optimum, the maximum welfare for the community, when resources, consumption and trade are allocated efficiently. But hardly any country is concerned about whether the rate of substitution of natural resources is optimal for the present and future community. For many countries, exploitation should only work for economic growth, without worrying about the externalities it creates. Infinite economic growth is inconceivable if the available natural resources are finite (COSCIEME et al., 2020).

Moreover, as a measure of all the goods and services that pass through the market, it is inevitable that all those private expenses, insurances of all kinds, that citizens take out to defend themselves against malfunctions, pollution or possible accidents are also counted positively. If we were to compare two productions of the same product with different negative environmental externalities in terms of GDP growth, it would be desirable to increase the production of the one with the greater impact, as it would activate other companies to clean it up. Both activities are carried out for economic reasons and therefore have their own market, which generates production and increases the total income of the country.

Counting all production positively, without distinguishing its quality, creates a perverse system in which the most polluting production is rewarded because it generates induced security, which generates other income.

This indicator was created to measure the value of new goods and services at a time when the agricultural and industrial sectors were dominant and had a material and quantifiable production. Over the years, the same indicator has continued to be used, but the predominant sector has become the tertiary sector, with less material production and therefore difficult to account for, and with a large number of services provided free of charge (SEMIENIUK, 2024).

Unfortunately, many non-specialist media and politicians have used GDP as the sole instrument for measuring the well-being of the population, contrary to its nature, and have ignored all the assessments that this indicator cannot take into account: from the failure to assess the quality of production to the problems of income distribution. For many years, economic science has stressed that a simple indicator cannot capture all the information needed to represent complex economies that are in constant flux and where technological progress has a strong, albeit heterogeneous, impact on production processes.

As summarised in table 1, GDP has several positive aspects, but also many criticalities that need to be corrected whether one wants to use it as an economic indicator or as an indicator of collective well-being. Most economists do not consider it suitable for this second function and have intervened over the past fifty years to make suggestions that would overcome many of the highlighted criticalities. The failure to measure free services, underground and informal economies, as well as the fact that it does not give information on the concentration of distribution and the positive accounting of all market transactions, mean that this indicator is not suitable in measuring the welfare of a community. Its pivotal function is to measure the growth of a country, over time and relative to other countries, and it should be used purely to explain this. It should be taken as a model the way in which this measurement is carried out, characterised by rigorous and standardised international guidelines that make its information load appreciated.

Developments in the measurement of well-being in economics

The first study to improve GDP as a measure of economic welfare was undertaken by Nordhaus and Tobin in 1972, when they proposed a measure of economic welfare and asked whether GDP was an appropriate measure of welfare and therefore whether it should be allowed to grow (NORDHAUS; TOBIN, 1972).

They concluded that there was no reason to stop growth, even though GDP was an imperfect measure of welfare. Nordhaus and Tobin's proposals were to start with the national accounts by reclassifying consumption and investment and adding the values of leisure and housework.

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Table 1. Summary quality and critical characteristics of GDP as an economic indicator or indicator of collective well-being.

	Quality	Criticality
Economic Indicator	- Economic flow variable - Standardised calculation system across the planet - Allows temporal and spatial comparisons - Periodic updating	- Does not consider the concentration of distribution - Does not measure free services - Does not assess quality - Does not account for black economy, voluntary work and self-consumption - Positively considers all market transitions, even externalities or defensive expenditures
Well-being Indicator	- Strong correlation between GDP growth and material well-being in the short-term - Standardised and periodically updated measure	- Does not consider income distribution in absolute terms and between generations or genders - Evaluates only economic aspects without information on quality of life - Negative factors for collective well-being lead to an increase in the indicator

They also proposed to split government purchases into intermediate consumption, final consumption and net investment, and to reclassify some private expenditure. They aimed at a measure of collective consumption even though they could not estimate the correlation between it and individual happiness, or how gratifying increases in consumption might be as a function of other people's consumption or as a function of the needs induced by sellers through advertising (NORDHAUS; TOBIN, 1972).

A few years later, as reported by Kubiszewski, Eisner proposed changing some of the GDP items: removing items relating to government spending on police, defence, justice and road repair, and adding domestic work and care for children and the elderly. In the late 1990s, Cobb and Daly proposed the Technical Progress Indicator as a replacement for GDP, complementing Tobin and Eisner's proposals by adding inequality in income distribution and the environmental costs represented by the depletion of non-renewable resources.

All these indicators were based on GDP and the System of National Accounts and incorporated social and environmental issues in monetary terms. In 1993, the United Nations proposed the System of Environmental-Economic Accounting (SEEA): an accounting structure similar to the System of National Accounts to facilitate the integration of environmental and economic statistics (UN, 2011).

In 2003, the IMF, OECD, World Bank and Eurostat identified four categories of national satellite accounts to complement the System of National Accounts (SNA): Expenditure accounts (spending by industry, households and government to protect the environment or manage natural resources), Natural Resource accounts (measuring the amount of resources such as land, fish, forests, water and minerals), Non-market flow accounts (market elements are valued and adjusted for the depletion and degradation of natural resources) and Flow accounts (information on the use of energy and materials as inputs in the generation of pollutants and solid waste) (UN, 2009).

Furthermore, as Hecht argues, natural assets such as forests or fisheries must be treated as depletion because the rate at which the natural resource can be replenished must be taken into account in order to avoid irreversible losses in terms of ecosystems. Instead, the SNA considers only the income generated by all the timber or fish sold, without assessing the rate at which it can be replenished.

Furthermore, not only the commercial income from the sale of timber should be taken into account, but also all the services provided by the forest, such as carbon sequestration by plants, protection of watersheds and recreational activities associated with forests. The loss of biodiversity associated with logging should also be taken into account (HECHT, 2005).

An early attempt to improve GDP responses was the calculation of Green GDP in China in 2004. They calculated and valued the consumption of natural capital in production and the damage caused by economic growth. Two years later, they published the first results showing that the environmental impact was about $66 billion, or 3% of GDP (FIORAMONTI, 2017).

In 1997, the World Bank developed Genuine Saving (GS), a measure that subtracts environmental degradation and natural resource depletion from GDP, while adding investment in human capital. With this measure, the World Bank highlighted how a country's wealth is given by an increase in formal and informal intangible wealth created by people (KUBISZEWSKI, 2013).

One of the first countries to engage in environmental accounting was Norway, which has an economy strongly linked to natural resources and which developed monitoring of forests, fisheries, energy and land use in the 1980s.

In 2001, the Netherlands also attempted to measure a national disposable income that took into account both environmental degradation and the depletion of natural resources (KARUNANITHI; BUI; TAN, 2024).

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Sustainable Economic Well-Being Index and the Genuine Progress Indicator

A series of corrections to GDP were proposed with the Index of Sustainable Economic Welfare (ISEW), which similarly to the Index of Real Progress added all those items that did not appear in the national accounts, but were important for economic welfare: volunteer work and housework. Similarly, all private defensive expenditures, the costs of environmental degradation and the depreciation of natural capital were subtracted, taking into account the long-term costs of climate change (CHELLI; CIOMMI; GIGLIARANO, 2013). The formula is:

$$ISEW = C + G * I + W - D - E - N$$

With:
C= Consumption weighted by the Gini index which is used to measure income concentration;
G= Government spending on consumer durables, capital growth and change in net international investment;
W= Domestic work and all items that have no market but are important for welfare;
D= Defensive private expenditure (increases as crime, divorce, commuting, road and work accidents increase)
E= Costs of environmental degradation related to habitat loss, pollution, depletion of non-renewable resources and climate change
N= Depreciation of natural capital.

In 1994, Clifford Cobb, Ted Halstead and Jonathan Rowe proposed to modify the ISEW by adding 25 supporting variables and transforming it into the Genuine Progress Indicator (GPI). This indicator sought to remove from GDP all environmental and social costs that are detrimental to collective well-being: the costs of environmental degradation, the loss of biodiversity and ecosystem services, the costs of unemployment, the costs of crime and family breakdown. It also includes the benefits of volunteering and domestic work, and an adjustment for income distribution (COSTANZA et al., 2018).

Currently, GDP rewards all forms of pollution, as it increases both when pollution occurs and when the damage is repaired. With the Genuine Progress Index, these gains become costs that subtract from national wealth. This index includes environmental and social variables not covered by GDP, but because of its subjectivity and difficulty of quantification, it does not allow comparison between countries and therefore loses its international relevance. The GPI does not take into account certain aspects of human well-being, such as a country's political freedom, and the choice of components to be included is subjective and may vary from country to country. Finally, the GPI does not have a solid theoretical basis. The main peculiarity of the GPI is that it measures the present value of economic well-being and not its long-term potential warmth (COSTANZA et al., 2018).

The GPI should be used in conjunction with other indicators that capture the quantity and quality of natural, human and social capital stocks. There is also a need for an accounting system that standardises and periodically measures the GPI for different countries (COSTANZA et al., 2018).

Beyond GDP

In November 2007, the European Commission, the European Parliament, the Club of Rome, the OECD and the World Wildlife Fund (WWF) organised a conference entitled 'Beyong the GDP' to identify concise and easy-to-understand indicators such as GDP that could measure climate change, poverty, resource depletion, quality of life and health in order to integrate them into policy-making (WANG; CHEN, 2022).

In July 2007 the most serious financial crisis since World War II began, which took all economic actors by surprise and without the right tools to deal with it. Too many analysts had blindly relied on the optimistic information of the GDP, which had recorded significant growth, without taking into account that this was based on a housing bubble in the American market that had led households and businesses to consume and invest more than they could, and the state budget had also benefited by obtaining more revenue (STIGLITZ; FITOUSSI; DURAND, 2021).

The financial analysts did not adequately evaluate the indicators of the financial and banking system, they also did not look at the percentage of households that had difficulty refinancing their mortgages. In this case, the choice of suitable indicators would have saved a lot of suffering and allowed economic agents to intervene promptly and effectively (STIGLITZ; FITOUSSI; DURAND, 2021).

In the wake of this crisis, French President Sarkozy appointed a commission to offer measures beyond GDP. This commission produced a report in three chapters analysing GDP, quality of life and sustainable and environmental development. For each of the aspects analysed, the main characteristics were identified, the alternatives available and recommendations to follow in order to have correct measurements (STIGLITZ; SEN; FITOUSSI, 2009).

The Commission urges countries and international organisations, which play a key role in standardising measurements, to invest in statistical information that gives decision makers the information they need.

The report they produced is based solely on the issue of measurement and not on policies that are useful for society to move forward.

It is emphasised that it is useful to keep GDP measurement, because it provides important information on monitoring economic activities and relations with other economic variables, but net national product should be used in parallel because it takes into account depreciation and real household and consumption income.

Furthermore, it is recommended to take into account real household income rather than *per capita* income, to which should be added the economic wealth of households and the distribution within households of income, consumption and wealth. Maintaining this household dimension recommends accounting for all non-market activities by measuring how people use their time, both in time and space, paying particular attention to the amount of leisure time (STIGLITZ; SEN; FITOUSSI, 2009).

It focuses on measuring quality of life by identifying eight dimensions along which well-being can be assessed using both objective and subjective measures through specific surveys. Quality of life depends on health, education, daily activities, the right to decent work and housing, participation in the political process, and the social and natural environment in which one lives (WANG; CHEN, 2022).

These assessments must take into account inequalities between genders, generations and groups. The Commission's most recent recommendations are to measure sustainability through a set of appropriate indicators that assess changes in stocks of natural, human, social and physical resources. At a later stage, these could be converted into a monetary equivalent, although the operation has considerable methodological difficulties. (STIGLITZ; SEN; FITOUSSI, 2009).

The environmental dimension

Economic and social processes are constrained by environmental variables that have insurmountable limits to sustaining the human species. Rockström and 29 other scientists have identified nine planetary tipping points: climate change, ocean acidification, ozone depletion, land-use change, alteration of the biogeochemical cycles of nitrogen and phosphorus, freshwater use, atmospheric aerosol dispersal, chemical pollution and loss of biosphere integrity. All these limits are interrelated, and for four of them we have reached the zone of maximum risk (biogeochemical fluxes of nitrogen and phosphorus, destruction of biodiversity, land-use change and climate change) (ROCKSTRÖM; WIJKMAN, 2014).

Ecological Footprint and Living Planet Index

Many indicators have also been proposed to measure the well-being of the population, with particular emphasis on environmental variables, without taking into account the economic variable, even if only marginally.

At the other end of the spectrum from GDP is the measurement of the Ecological Footprint (EF) (WWF, 2022), which is the difference between the hectares used for human consumption and its waste, and the hectares needed to regenerate the land or sea. The indicator, proposed by Wackernagel and Rees in 1996, is based on the equation of the IPAT model by Ehrlich and Holdren, who claimed in 1972 that environmental impact is directly proportional to population and GDP growth, while it is inversely proportional to technological innovation (WACKERNAGEL; REES, 1996).

The advantages of this indicator are that it is easy to understand and can be calculated for different spatial scales. Its limitations are that it does not take into account: the role of technological change, oceans and underground resources, the ethical problem of fair distribution between present and future generations. It is also a stock measure and not a flow measure (MOFFATT, 2000).

Globally, biocapacity per person was 3.1 hectares in 1961 and around 1.5 hectares in 2022, as shown in Figure 2, while the Ecological Footprint increased from 2.3 to 2.6 hectares. This means that until 1970 there was a biocapacity surplus, whereas since then there has been a deficit, which has increased every year.

At the individual country level, there are considerable differences, as can be seen in Figure 3, where the balance is positive for 49 countries out of 188 analysed (26%). The remaining 139 countries have an annual *per capita* biocapacity deficit, meaning that those nations are either: importing biocapacity through trade, liquidating national ecological resources or emitting carbon dioxide into the atmosphere.

The ecological footprint is used by the WWF in its Living Planet Report, and since 1998 it has enriched its analysis by calculating the Living Planet Index (LPI), which measures the average annual percentage changes in the population of some 21,000 mammals, birds, fish, reptiles and amphibians across the planet (WWF, 2022).

As can be seen in Figure 4 from 1970 to 2016 there has been an average decline of 68% in these populations. For a more complete assessment, the population figures for invertebrates will also need to be measured. For the tropical sub-regions of the Americas, the decline was 94% mainly due to ‘conversion of grasslands, savannas, forests and wetlands, overexploitation of species, climate change and the introduction of alien species’ (WWF, 2022).

Through this indicator, despite its limited representativeness of the welfare problem, the numerous impacts that humans have had on nature and especially on the poor preservation of biodiversity have been highlighted.

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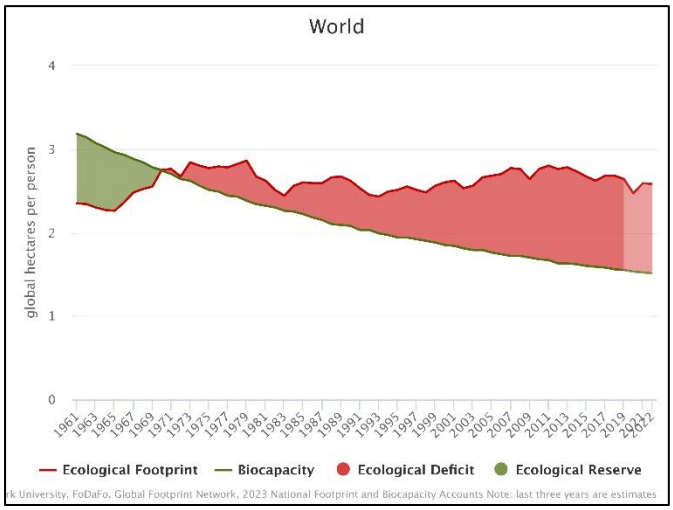

Figure 2. Biocapacity *per capita* and Ecological Footprint *per capita* trends from 1961 to 2022 Source and Elaboration: National Footprint and Biocapacity Accounts (Data Year 2022); GDP, World Development Indicators, World Bank 2023; Population, U.N. Food and Agriculture Organization, 2022.

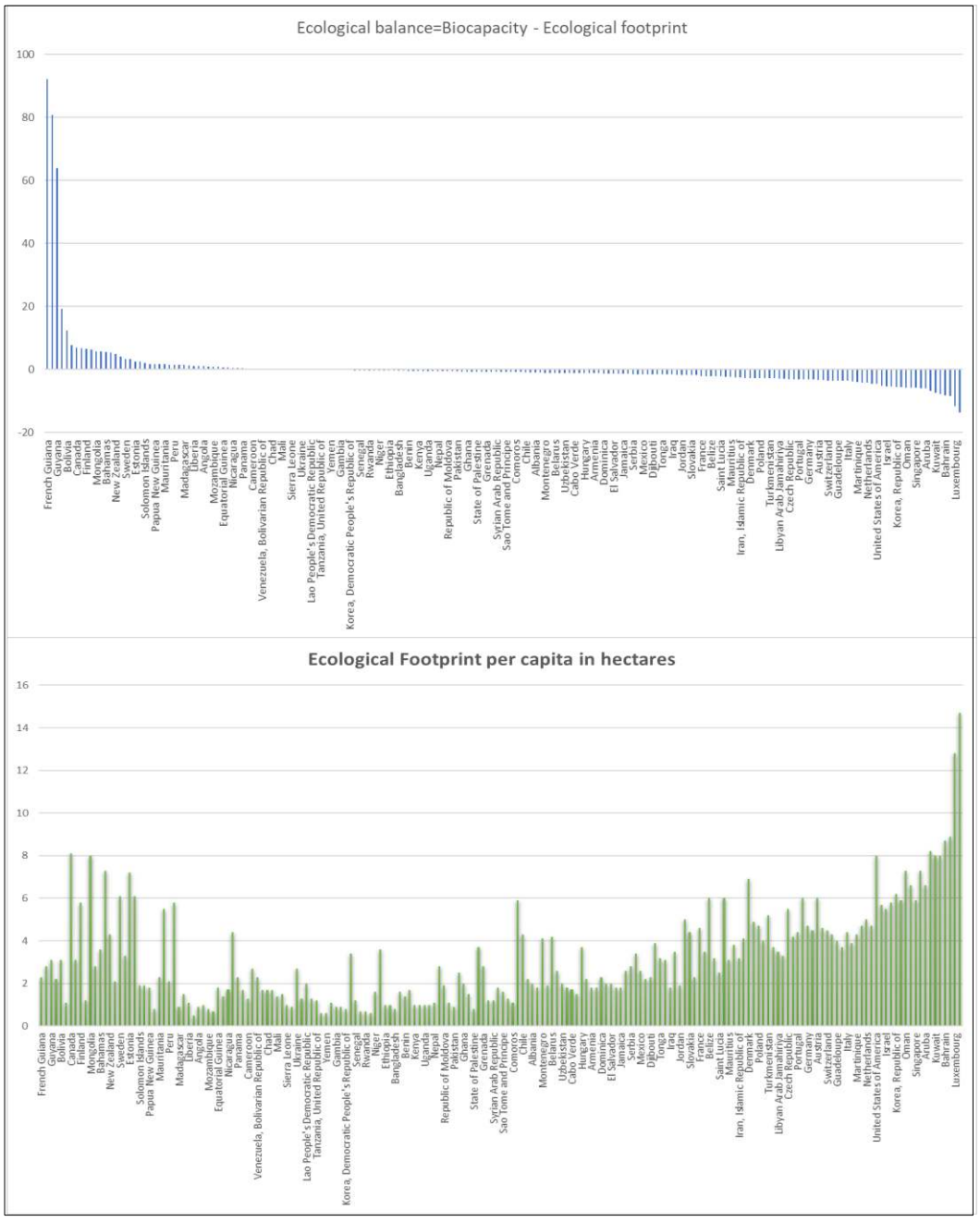

Figure 3. Ecological balance and ecological footprint in 188 countries.
Source: National Footprint and Biocapacity Accounts 2021 edition (Data Year 2017); GDP, World Development Indicators, The World Bank 2020; Population, U.N. Food and Agriculture Organization.

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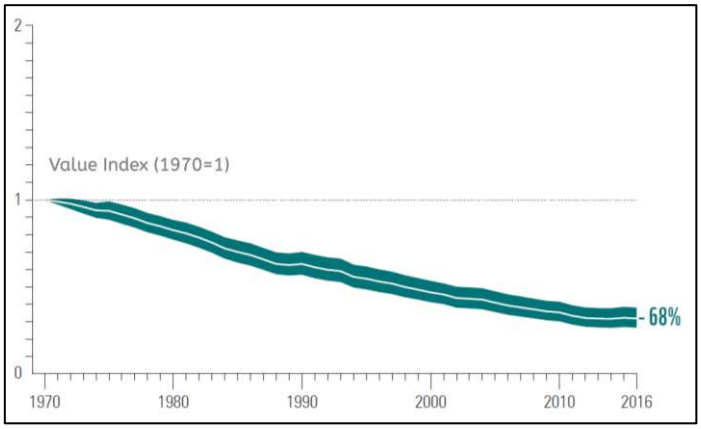

Figure 4. Global trend of the Living Planet Index from 1970 to 2016 Source and elaboration: WWF (World Wide Fund for Nature), ZSL, **Living Planet Report**, 2020, page 7.

Environmental Performance Index

Another prominent indicator in the environmental dimension is the Environmental Performance Index (EPI) from Yale and Columbia University in 2002 (BLOCK et al., 2024). This is an indicator composed of 32 other indicators that analysed the performance of 180 countries in 2020. This indicator takes into account environmental risk exposure, air and water quality, water treatment, nitrate use in agriculture, forest cover, fish stocks, marine and terrestrial protected areas, protected species and CO_2 trends. Prior to the EPI, Yale University and Columbia University had proposed the Environmental Sustainability Index (ESI) consisting of 21 different indicators (WENDLING et al., 2020).

As can be seen in Figure 5, the countries that score better on the index also have a better GDP *per capita*, and this can be explained by the huge investments needed in infrastructure to provide adequate drinking water and sanitation, as well as to reduce environmental pollution and control hazardous waste. The price these countries have to pay, with more industrialisation and urbanisation, is high air and water pollution but high-risk perception and therefore the implementation of policies to mitigate these impacts (WENDLING et al., 2020).

Being a composite index, the EPI for each country aggregates and weights the indicator scores, as seen in Figure 6, into 11 categories: Air Quality, Sanitation and Drinking Water, Heavy Metals, Waste Management, Biodiversity and Habitats, Ecosystem Services, Fisheries, Climate Change, Pollutant Emissions, Water Resources and Agriculture. This indicator is a good measure of the environmental dimension of well-being and should therefore be taken together with other indicators relating to economic, social and subjective dimensions.

Other parameters such as GDP *per capita*, population and urbanisation rate are given for each country, but these parameters are not explicitly intersected with the environmental variables, providing no indication of their links. Interesting is the indication of how each country's environmental variable has changed compared to the previous ten years, indicating what evolution is taking place. On each country's page, EPI comparisons are also made between similar countries for certain characteristics such as GDP *per capita*, political stability, regulatory quality or other characteristics.

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This indicator is a good measure of the environmental dimension of well-being and should therefore be taken together with other indicators relating to economic, social and subjective dimensions. Other parameters such as GDP *per capita*, population and urbanisation rate are given for each country, but these parameters are not explicitly intersected with the environmental variables, providing no indication of their links.

Interesting is the indication of how each country's environmental variable has changed compared to the previous ten years, indicating what evolution is taking place. On each country's page, EPI comparisons are also made between similar countries for certain characteristics such as GDP *per capita*, political stability, regulatory quality or other characteristics.

The countries that excel in the EPI indicator are those that have invested heavily in water sanitation and optimal waste management, as well as significant investments in energy decarbonisation that have had a significant impact on air quality. Unfortunately, they are still lagging behind in biodiversity management, marine protection, ecosystem services and the creation and management of protected areas. This is despite the fact that biodiversity and ecosystem services have an economic value of USD 125 billion and that one million species are threatened with extinction in the coming decades (WENDLING et al., 2020).

Multidimensionality

The decision to use more than one dimension to measure the well-being of a nation is based on the complexity of the object of research, which is composed of many different variables and conditioned by both objective and subjective elements.

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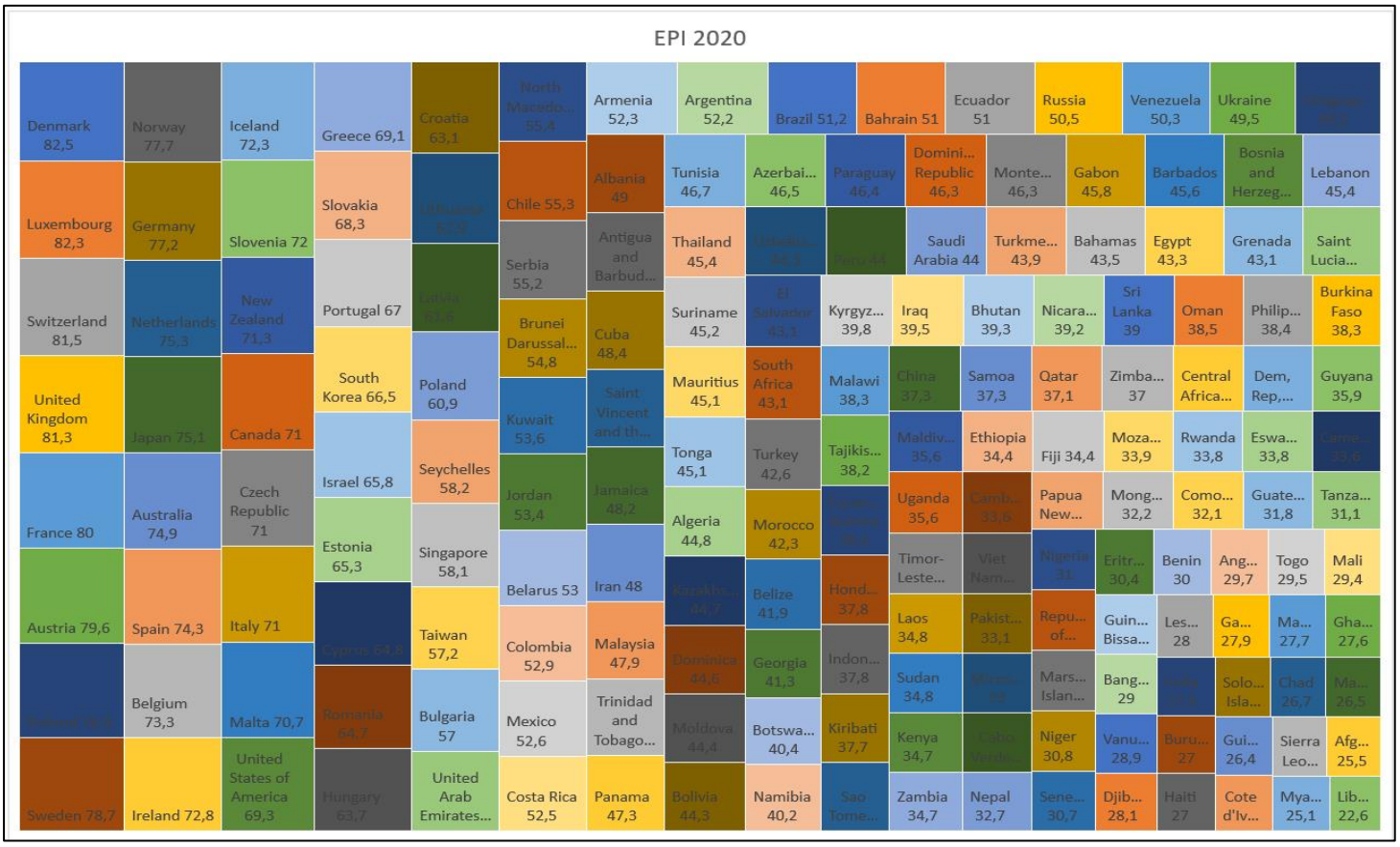

Figure 5. EPI index situation in 2019. Source: Yale University, Environmental Performance Index, 2020, page 32

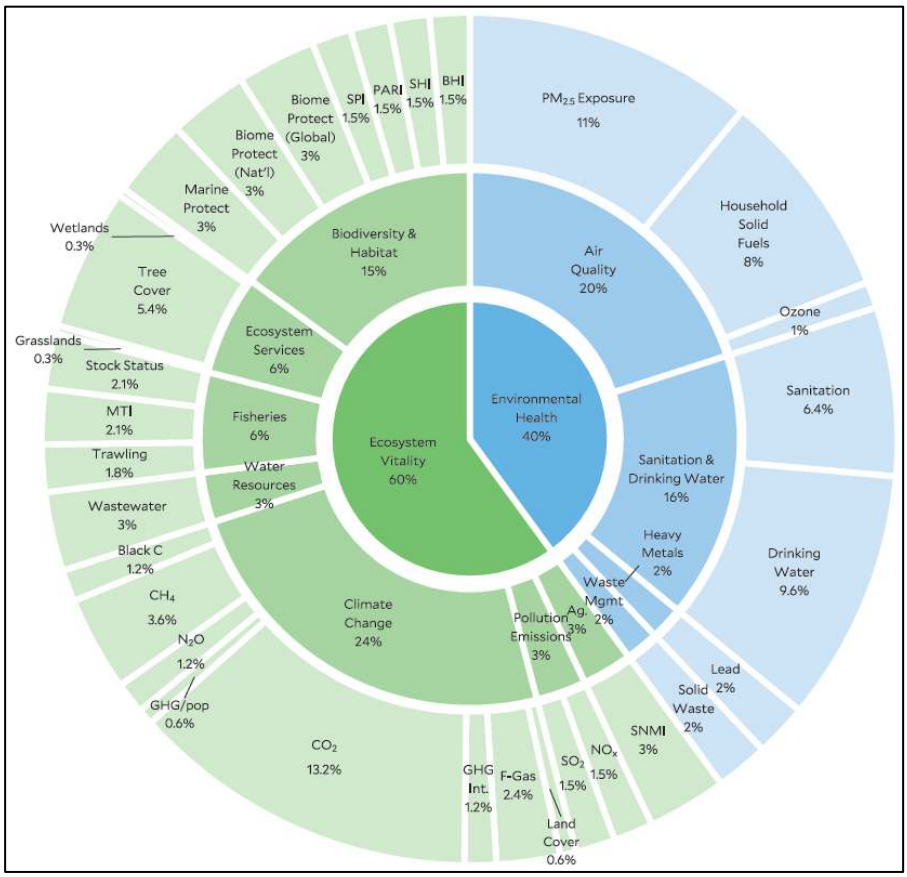

Figure 6. Weights associated with each of the 32 indicators that make up the EPI. Source: Yale University, Environmental Performance Index, 2020, page 17

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Sustainable Society Index

The Sustainable Society Index (SSI) is a complex indicator developed by the Sustainable Society Foundation in 2006, based on the Brundtland definition and comprising 21 indices measuring human, environmental and economic well-being.

Human well-being is measured by ten indicators: the number of undernourished people, the number of people with sustainable access to water, the number of people with sustainable access to sanitation, life expectancy at birth in years, air pollution affecting humans ($PM_{2.5}$) and surface water quality, enrolment in primary, secondary and tertiary education, the gender gap index, and the ratio of income of the richest 10% to the poorest 10% of the population. Environmental well-being is populated by six indicators: SO_2 emissions, size of protected areas, annual water withdrawal as a percentage of renewable water sources, carbon footprint minus carbon balance, renewable energy, CO_2 emissions *per capita*. For economic well-being, five indicators are used: organic farming, real savings, gross domestic product, labour force unemployment and public debt (SAISANA; PHILIPPAS, 2012).

The indicators are expressed in different units and therefore have different ranges and variances. They are therefore standardised by subtracting each value from its mean and dividing it by the mean square deviation. In this way, the mean is cancelled out and the standard deviation is equal to one. All indices thus have the same range from zero to one and the highest scores are those that give the best results. Cross-country comparisons can also be made easily in this way (SAISANA; PHILIPPAS, 2012).

The same weight is assigned to each indicator and the simple arithmetic mean is used for aggregation. Due to the different sign correlations between the three dimensions analysed, it is considered not useful to generate a single synthetic index. Should one wish to obtain a single measure, to be averaged, one could use the geometric mean of the eight topics analysed and not of all 21 indices (SAISANA; PHILIPPAS, 2012).

Preliminary 2020 data are published at the end of 2021 on the Th-Koeln website, which has replaced the Sustainable Society Foundation since 2018. One of the problems with this indicator is the delay in which data is provided, an important variable when policy decisions have to be made.

Figure 7 shows the comparison, in the macro-regions of the planet, between the values of 2006 and 2019 in order to understand how the values of the individual indices vary.

One of the most deficient indices over the 13 years analysed is the Biodiversity Index, which in this case is measured by the change in forest area and the size of protected areas in relation to the total area of the country.

This index shows a worrying trend in Europe (except in the East), North America and East Asia (including China, Japan and the two Koreas, according to the UN classification). On the other hand, the countries of Africa, Asia and Central and South America have difficulties with primary energy use, i.e. the sum of domestic production and imports minus exports.

Happy Planet Index

The Happy Planet Index (HPI) is a measure of sustainable well-being developed by the New Economics Foundation in 2006. It aims to rank countries according to how well they manage to provide a long and happy life by making efficient use of the limited environmental resources available. This indicator is made up of three variables: average life expectancy in years, a score from zero to ten on quality of life as measured by the Gallup World Poll, and the ecological footprint *per capita* measured in hectares (WEAll, 2024).

The rich countries of the West perform well in terms of life expectancy and subjective well-being, but their excessively high environmental costs weigh heavily on the Happy Planet Index. A good example comes from the countries of Latin America, which without having a large ecological footprint and with a good life expectancy and subjective well-being rating are at the top of the ranking.

The Covid-19 pandemic increased the global HPI by three points because: there was also a 6.5% decrease in the ecological footprint due to reduced travel, while the reduction in life expectancy was not high because mostly elderly people died. In contrast, subjective well-being, as measured by Gallup surveys, decreased for 40% of countries, including Latin America and Europe, while it increased for 32%, including China, India and Germany (WEAll, 2024).

From the downloadable data (Happy Planet Index) it is possible to see the indicator's trend from 2006 to 2020 for each of the 160 countries analysed and the aggregations by macro-regions.

As can be seen in Figure 8, Latin America leads all other macro-regions, although it has experienced a slight drop in the index over the past year. On the other hand, the trends in Africa, Europe and Central Asia are significantly increasing.

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Figure 7. Comparison of SSI indices by macro-regions in the years 2006 and 2019.
Source: FAO, World Bank, World Economic Forum, Global Footprint Network, EIA, Fibl.
Elaboration: Technology Arts Sciences TH Koln, Data Base 2021.

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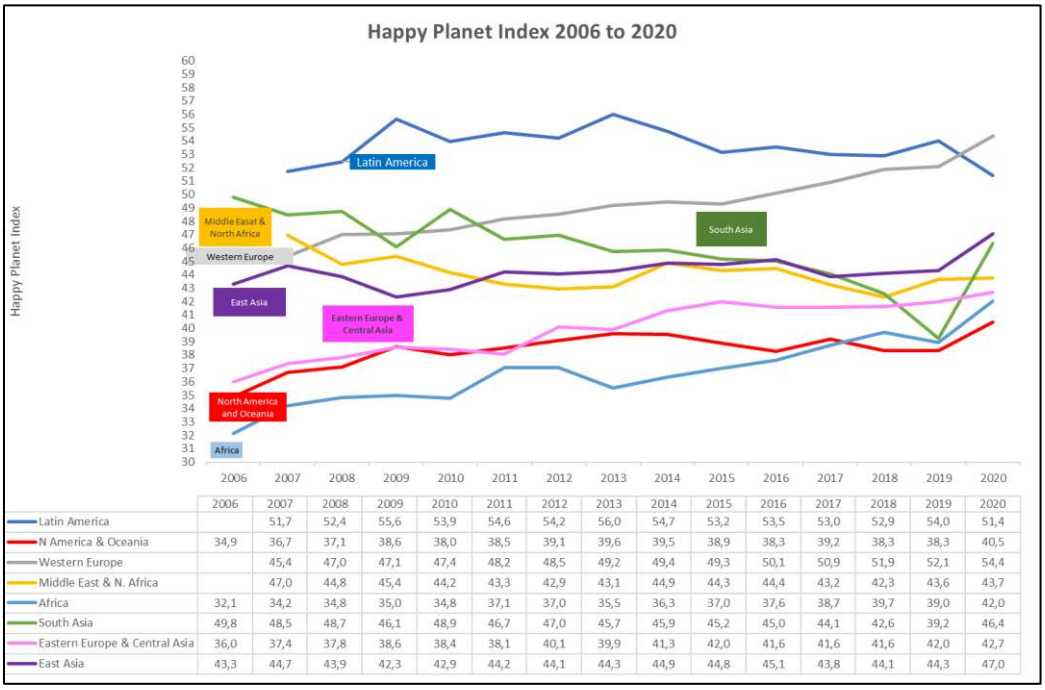

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Latin America		51,7	52,4	55,6	53,9	54,6	54,2	56,0	54,7	53,2	53,5	53,0	52,9	54,0	51,4
N America & Oceania	34,9	36,7	37,1	38,6	38,0	38,5	39,1	39,6	39,5	38,9	38,3	39,2	38,3	38,3	40,5
Western Europe		45,4	47,0	47,1	47,4	48,2	48,5	49,2	49,4	49,3	50,1	50,9	51,9	52,1	54,4
Middle East & N. Africa		47,0	44,8	45,4	44,2	43,3	42,9	43,1	44,9	44,3	44,4	43,2	42,3	43,6	43,7
Africa	32,1	34,2	34,8	35,0	34,8	37,1	37,0	35,5	36,3	37,0	37,6	38,7	39,7	39,0	42,0
South Asia	49,8	48,5	48,7	46,1	48,9	46,7	47,0	45,7	45,9	45,2	45,0	44,1	42,6	39,2	46,4
Eastern Europe & Central Asia	36,0	37,4	37,8	38,6	38,4	38,1	40,1	39,9	41,3	42,0	41,6	41,6	41,6	42,0	42,7
East Asia	43,3	44,7	43,9	42,3	42,9	44,2	44,1	44,3	44,9	44,8	45,1	43,8	44,1	44,3	47,0

Figure 8. Trend by macro-regions of the Planetary Happiness Index from 2006 to 2020.
Source: UNDP, Gallup World Pool, Global Footprint Network, World bank.
Elaboration: Wellbeing Economy Alliance (WEAll), Data base online.

The Wellbeing Economy Alliance has identified classes for each indicator in order to establish an optimal, a sufficient and a poor situation. The optimal situation is when life expectancy is greater than 75 years, the subjective rating is greater than 6 and the ecological footprint is less than 1.56 hectares. The worst situation is when life expectancy is less than 65 years, subjective well-being less than 5 and ecological footprint greater than 3.12 hectares.

In between is a situation of sufficiency. An analysis of the 2019 data, the 2020 data is not complete, shows that: 32% of countries perform well on life expectancy and subjective well-being at the same time and 2% perform well on life expectancy and ecological footprint.

Only the Philippines, performs well on subjective well-being and footprint simultaneously while life expectancy is 71 years so 4 years less than the 75-year limit. If the indices are analysed individually, as can be seen in Table 2, we have 47% of the countries that have a good measure on life expectancy, 39% perform well on subjective well-being and 28% on ecological footprint.

The worst situations concern the 16% of countries that do not exceed the limits on life expectancy and subjective well-being at the same time, while Türkiye is the only country with poor results on subjective well-being and ecological footprint. The ecological footprint indicator impacts 40% of the analysed countries individually while subjective well-being is poor for 33% of the total.

Table 2. Breakdown of the 152 countries according to exceedance of HPI limits.

	Expectation	Welfare	Education
Expectation	OK: 47% KO: 20%	OK: 32% KO: 16%	OK: 2% KO: 0%
Welfare		OK: 39% KO: 33%	OK: 1% KO: 1%
Education			OK: 28% KO: 40%

Source: New Economics Foundation, 2020.

Human Development Index and the Sustainable Development Index

The Human Development Index (HDI) is an indicator developed in 1990 by Pakistani economist Mahbub ul Hab and used since 1990 by the United Nations to assess the quality of life in any country (HICKEL, 2020).

The index has been calculated since 2010 as the geometric mean of three indices related to: life expectancy at birth, educational attainment and *per capita* income at constant prices (UN, 2021).

The indicator is calculated as follows:

$$\sqrt[3]{\frac{(LE-20)}{(85-20)} * \frac{\left(\frac{MYS}{15}+\frac{EYS}{18}\right)}{2} * \frac{\ln(GNI)-\ln(100)}{\ln(75.000)-\ln(100)}}$$

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With:

- LE= Life Expectancy in years (minimum 20, maximum 85);
- MYS= Mean years of schooling (minimum 0, maximum 15);
- EYS= Expected years of schooling (minimum 0, maximum 18);
- GNI= Gross national income *per capita* in dollars with Purchasing Power parity as of 2017.

As can be seen, minimum and maximum values are determined for each variable and then compared with the current value (UN, 2021). The biggest criticism of the Human Development Index is the absence of any indicator of environmental sustainability, which makes it impossible to record such a profound climate crisis on the planet.

In 2009, Rockström and 29 other earth science experts identified planetary boundaries that should not be crossed to keep the planet in a climate-stable state. The nine tipping points were: climate change, stratospheric ozone depletion, atmospheric aerosol dispersion, ocean acidification, changes in the biogeochemical cycles of nitrogen and phosphorus, global freshwater use, land use change, loss of ecological functions, and the rate of extinction of animal and plant species (BUTERA, 2021).

Humanity has already crossed four of these critical thresholds: climate change, loss of biodiversity, and changes in the chemical load of nitrogen and phosphorus in soils. Several modifications have been proposed to address this shortcoming of the HDI indicator: Bravo in 2014 proposed a Sustainable Human Development Index with the inclusion of the index of CO_2 emissions *per capita*, while Biggeri and Mauro in 2018 proposed the inclusion of a social indicator related to freedoms in addition to CO_2 emissions (HICKEL, 2020).

However, all the proposed variants consider only one ecological variable, neglecting all those that are part of the planetary limits and cannot be exceeded. To overcome these shortcomings, the use of the material footprint has been proposed, which allows the extraction of natural resources from the sea and land to be measured and allows the inclusion of a wide range of ecological impacts that are strongly correlated with this indicator. In addition, this indicator, together with the calculation of CO_2, takes into account both the environmental balance associated with the activities of exporting and importing raw materials, and the carbon dioxide emissions that occur in a country but are generated in the production of goods and services for export (HICKEL, 2020).

Human Development Index indicators have been observed to increase the Ecological Footprint exponentially. Furthermore, the material footprint of countries with a very high HDI exceeds the sustainability limit by a factor of four, while the average CO_2 *per capita* is six times higher. To attempt to decouple income and environmental impact, action should be taken on the energy component by switching from fossil fuels to renewable energy, while improving the efficient use of energy. In high-income countries, action should be taken on economic variables: promoting a better distribution of income, shortening the working week, improving wages and investing more in public services (HICKEL, 2020).

As Figure 9 shows, the countries with a high HDI index are all high-income countries, so the link between this indicator and *per capita* income is very strong. Almost all countries have improved their index over the years: Norway went from 0.85 to 0.96, while Ireland, thanks to its remarkable economic leap, is in second place, going from 0.77 to 0.95. Singapore has followed a similar path, rising from 0.72 to 0.94 over the last 27 years.

To correct some shortcomings, such as the absence of the environmental dimension, of the Human Development Index, the Sustainable Development Index (SDI) was proposed. In addition to modifying the upper limit of *per capita* income, lowering it from $75,000 to $20,000, it considers an ecological impact index that considers CO_2 emissions and material footprint in relation to their specific planetary boundaries. Countries that achieve more than $20,000 do not increase their score or ranking. This income sufficiency threshold brings this index in line with other human development indices (HICKEL, 2020).

The sustainable development index is calculated using the following formula:

$$\frac{\sqrt[3]{\frac{(LE-20)}{(85-20)} * \frac{\left(\frac{MYS}{15}+\frac{EYS}{18}\right)}{2} * \frac{\ln(GNI)-\ln(100)}{\ln(20.000)-\ln(100)}}}{1+\frac{e^{\sqrt[2]{\left(\frac{MF}{MF\ limit}\geq 1\right)\left(\frac{CO_2}{CO_2\ limit}\geq 1\right)}}-e}{e^4-e}}$$

With:
- LE= Life Expectancy in years (min. 20, max. 85);
- MYS= Mean years of schooling (min. 0, max. 15);
- EYS= Expected years of schooling (min. 0, max. 18);
- GNI= Gross national income *per capita* in dollars with Purchasing Power parity as of 2017;
- MF= Material footprint
- CO_2= Carbon dioxide emissions
- MF limit= Material footprint limit assumed to be 6.8t
- CO_2 limit= Limit on carbon dioxide emissions is assumed to be 1.74t

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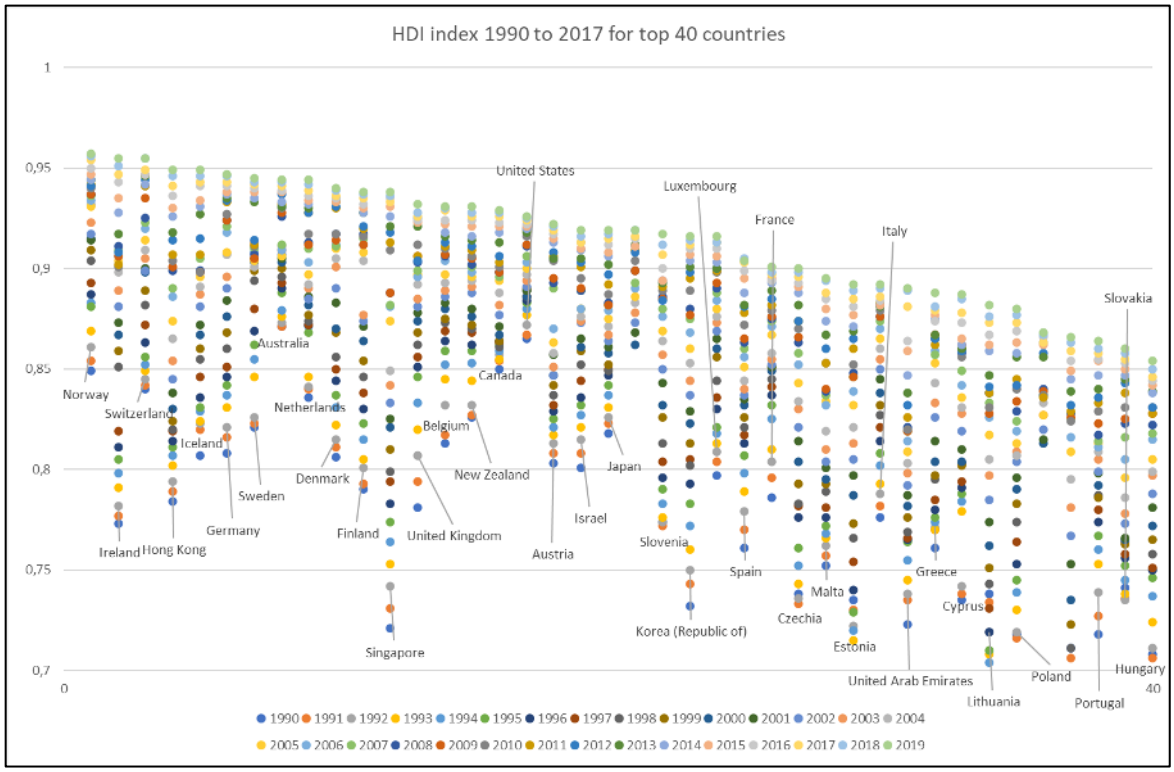

Figure 9. HDI index trend from 1990 to 2017 for the top 40 countries. Source: UNDP, Data Base online.

The expression $1+\frac{e^{\sqrt[2]{(\frac{MF}{Limite\ MF}\geq 1)(\frac{CO_2}{Limite\ CO_2}\geq 1)}}-e}{e^4-e}$ is referred to as the Ecological Impact Index.

Then $\sqrt[2]{(\frac{MF}{Limite\ MF}\geq 1)(\frac{CO_2}{Limite\ CO_2}\geq 1)}$ >4 the exponential disappears, and the index becomes this square root minus 2. Note that the material footprint and CO_2 emissions are both divided by the planetary boundary, which varies from year to year depending on the size of the population.

If either ratio is <1, it is assumed to be equal to 1, so that the two limits do not cancel each other out. If the overshoot is four times the planetary boundary, the Ecological Impact Index is set to 2, halving the Development Index (HICKEL, 2020).

The inclusion of indices measuring literacy and infant mortality was considered, but as they have a strong correlation with life expectancy, it was not appropriate to include them. These indices, along with access to food, electricity, sanitation and housing, are part of the seventeen goals identified by the United Nations in the 2030 Agenda for Sustainable Development. It has been observed that all nations that score well on life expectancy and education also score well on other basic needs (HICKEL, 2020).

The measurement of education, as in the Human Development Index and the Sustainable Development Index, is based on quantitative rather than qualitative data, and it only considers institutional models of education, excluding informal ones, which are very important in some cultures. Overall, the Sustainable Development Index proves to be quite comprehensive by including the three Human Development Indicators and two Ecological Impact Indicators (HICKEL, 2020).

The rapidity of human-induced changes has resulted in the disappearance of entire forests, the retreat of glaciers, the expansion of desert areas, and changes in the climate and chemical composition of the oceans. This phase of history has been called the Anthropocene, because humans have caused these changes that nature had caused in the previous 4.54 billion years (BUTERA, 2021).

Figure 10 shows the values for 165 countries in the world from 1990 to 2019. The highest values in 2019 are recorded for Costa Rica, Sri Lanka, Georgia, Armenia and Albania. This, says Hickel, can be a good model for poorer countries, given their investment in improving health, education and everything else needed to improve a country's social policy. As for the rich countries, the priority is to reduce their material and carbon footprints by implementing an ecological transition that can no longer be postponed.

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Figure 10. SDI ranking by year 2019. Source: Sustainable Development Index, Data base online.

Subjective evaluations through global surveys

Another way to measure the well-being of a nation is to use a sample survey that measures people's satisfaction with certain indicators. Since 2005, Gallup has conducted a survey in 160 countries around the world to measure well-being. The survey consists of more than 100 questions that are the same in each country and have been repeated over the years to allow for comparisons over time and space.

In countries with at least 80% telephone coverage, interviews are conducted by telephone with a random selection of numbers from a national list, while in countries with lower telephone coverage, face-to-face interviews are conducted with randomly selected households. The interview lasts 1 hour for face-to-face interviews and 30 minutes for telephone interviews. The sample size is around 1,000 respondents in each country, with at least twice as many in China and Russia.

The World Poll is conducted every 6, 12 or 24 months, depending on the country. In addition to this poll, the World Value Survey, which has been conducting interviews in nearly 80 countries since 1981 to help scholars and policymakers understand issues such as economic development, democratisation, religion, gender equality, social capital and subjective well-being, also provides very interesting results at the global level.

The seventh global survey was completed in December 2021, involving some 129,000 interviews in 77 countries (1,000 to 3,200 interviews per country). More than 300 indicators were analysed, based on a questionnaire that was the same in all countries. The questionnaire covered 14 themes: Attitudes and Stereotypes of Social Values, Social Wellbeing, Social Capital, Trust and Organisational Belonging, Economic Values, Corruption, Migration, Post-Materialist Index, Science and Technology, Religious Values, Security, Ethical Values and Norms, Political Interests and Participation, Political Culture and Regimes, and Demographics. The analysis of these surveys shows that income is fundamental in measuring life satisfaction, i.e. the higher the *per capita* income, the more satisfied people are with their lives.

By contrast, the measure of life expectancy at birth is unrepresentative in explaining international differences in life satisfaction. A very important variable in measuring satisfaction is the age of the respondent. All over the world, satisfaction declines with age, but in rich countries it takes a U-shape: that is, it declines in the early part of life and then rises again. Moreover, the decline increases with income. In all these surveys, the exception is Eastern European countries and Russia, which behave like low-income countries, although they are classified as middle-income. Health satisfaction is also directly related to income *per capita*: the higher the income, the more satisfied people are.

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The age variable affects health satisfaction: with increasing age, satisfaction decreases, but again, the decrease is smaller with higher *per capita* income. Age was found to be a stronger determinant of health satisfaction than life satisfaction. The link between income and health satisfaction is absent in some countries such as Cuba, Vietnam, Thailand and Malaysia: where income is low but satisfaction with health and the health system is high (DEATON, 2008). These surveys show that *per capita* income and health are the two most important determinants of life satisfaction, while life expectancy, education and social participation are perceived as secondary factors for a happy life (DEATON, 2008).

In 1972, the Kingdom of Bhutan, a small Himalayan state with a population of 760,000, decided to manage the country's economy not according to GDP growth but according to Buddhist principles, taking into account four dimensions of well-being: good governance, sustainable socio-economic development, preservation of cultural identity and environmental protection. It was only in 2005 that they decided to adopt a methodology for calculating Gross Domestic Happiness, which led to a pilot survey in 2007 and a national survey with face-to-face interviews in 2010. A questionnaire developed by the University of Oxford (FIORAMONTI, 2017).

Data from the Gallup World Pool is the main basis for the World Happiness Report, which has been analysing studies and surveys on happiness and satisfaction around the world since 2012 (KUBISZEWSKI et al., 2013).

As shown in Figure 11, the countries with the highest subjective ratings are mainly northern European countries, Australia, Canada and Costa Rica. The least satisfied countries are those in Africa and Asia.

Subjective measurement is a key dimension in measuring the well-being of a population, although it is a very dynamic assessment that changes rapidly over time and space and is influenced by variables such as age, gender, nationality, education, culture, income, employment and marital status. This information highlights the difficulty of finding an objective and universally accepted measure of being. They also show how difficult it is to generalise this concept for an entire population, but to segment the analysis by homogeneous groups within a territory.

This information may not provide a territorial summary measure, but rather a range of heterogeneous situations that need to be addressed in a diversified manner.

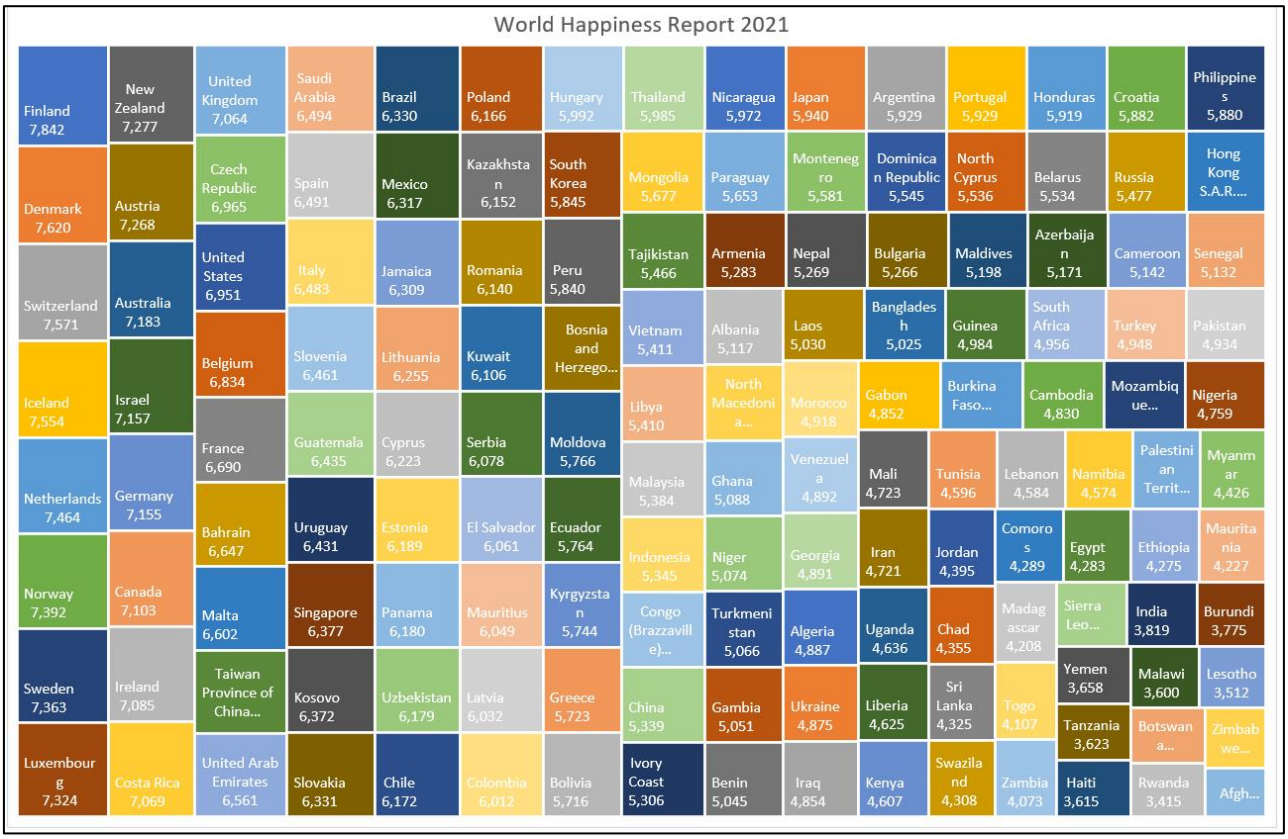

Figure 11. World Happiness Report year 2021. Source: Gallup, Data Base online.

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UN goals and the OECD's Better Life Index

In 2000, the United Nations identified eight Millennium Development Goals (MDGs) to be achieved by 2015: eradicate extreme poverty and hunger; achieve universal primary education; promote gender equality; reduce child and maternal mortality; combat HIV, malaria and other diseases; ensure environmental sustainability; and develop a global partnership for development. Forty-eight indicators have been identified to measure progress towards these goals (CNEL, 2005).

In 2015, the United Nations launched a global action plan for planetary development that respects people and the environment. The 2030 Agenda was implemented, which adopted the Sustainable Development Goals (SDGs) to replace the Millennium Development Goals, made up of 17 goals and 169 sub-goals to be monitored by 244 indicators (FELICI et al., 2018).

The first goal set by the United Nations is to eradicate poverty in the world: in 2020, 9.5% of the world's population lived in extreme poverty, i.e. on less than USD 1.9 per day. This situation has been exacerbated over the past year by the Aids pandemic, which has hit hard the informal economy where many of the working poor are employed. It is estimated that 4 billion people have no social cash benefits to cover them in times of need. The second goal is to eradicate hunger in the world by achieving food security and improved nutrition and promoting more sustainable agriculture.

In 2019, an estimated 690 million people around the world will be hungry and 2 billion will be moderately to severely food insecure. Children under the age of five are the most vulnerable, with stunted growth. The third objective is to ensure a healthy life and promote well-being: the arrival of the pandemic has wiped out all the positive results achieved in the health sector. The entire network of care and prevention has slowed down, leaving millions of people without support. The leading infectious disease in terms of mortality is tuberculosis, followed by malaria, while 74% of the leading causes of death are non-communicable diseases (cardiovascular, cancer, diabetes or chronic respiratory diseases).

About 700,000 people committed suicide in 2019, while both alcohol and tobacco consumption have declined over the years, leading to a decrease in related diseases. The fourth goal of the 2030 Agenda aims to ensure inclusive and equitable education, but here too the pandemic has caused severe intergenerational damage, with schools closed for long periods of time, resulting in learning delays that are difficult to recover from. Generational, geographical and economic inequalities were more acutely felt during this phase of the pandemic, when alternative forms of education had to be found, requiring technology that was not always available.

Goal 5 aims to achieve gender equality and empower women. Around the world, women continue to suffer from physical and sexual violence, forced early marriage and increased domestic and informal work. The pandemic has also aggravated uncomfortable situations, leaving many women more alone and more easily subjugated by the men in their lives. Goal 6 aims to ensure the management and sustainability of water and sanitation. Worldwide, 2 billion people live without safe drinking water and 3.6 billion live without safe sanitation, with many health risks. Over the past 100 years, the use of drinking water has doubled in relation to population growth, creating multiple water stresses that, together with climate change and water pollution, make this element increasingly precious.

Goal 7 moves on to affordable, reliable and sustainable electricity: significant progress has been made in this area, with 90 per cent of the world's population having access to electricity, although only 17 per cent of this is renewable. Goal 8 is to promote sustained, inclusive and sustainable economic growth and full and productive employment and decent work for all. The covid pandemic reduced global GDP by 5.3 per cent, negatively impacting employment, particularly among young people and women. An estimated 1.6 billion people working in informal jobs have been severely affected by this economic slowdown and are at high risk of falling into poverty. The 33 million unemployed caused by the pandemic were added to the 81 million seeking work. The sector hardest hit by the pandemic was tourism, with the risk of 100-120 million unemployed.

Goal 9 calls for building resilient infrastructure and promoting inclusive and sustainable industrialisation by fostering innovation. Even this last goal was scaled back as a result of the pandemic, which caused a 4% drop in shipping and an 8% drop in manufacturing. Goal 10 of the UN calls for the reduction of inequalities within and between countries. Inequalities in income, opportunity and wealth exist both within and between countries, leading to increased migration between countries in search of more humane situations.

Goal 11 aims to make cities and human settlements inclusive, safe, resilient and sustainable, but indicators show that around 1 billion people live in the world's slums, mostly in Asia (596 million) and sub-Saharan Africa (238 million). Rapid and haphazard urbanisation has put great pressure on urban services, making it difficult to integrate newcomers and reducing the quality of life of those already living there. Goal 12 aims to ensure sustainable consumption and production patterns. Current consumption and production patterns are at the root of the three global crises we are currently experiencing: climate, biodiversity and pollution. There is a need to decouple economic growth from human well-being by reducing resource use and environmental impacts.

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The material footprint *per capita* and material consumption *per capita* have increased by 40% in the last 17 years. It is estimated that 16% of food produced is lost before it is sold, and waste has increased significantly, with only a small proportion being properly recycled. Goal 13 is to take urgent action to combat climate change and its effects.

Climate change is one of the reasons why many of the goals set by the United Nations are unlikely to be achieved. Under the 2015 Paris Agreement, the 196 member states of the United Nations Framework Convention on Climate Change (UNFCCC) aim to limit global warming to 1.5°C above pre-industrial levels, which would require the world to: reduce 2010 emissions by 45% by 2030; and achieve net zero carbon dioxide emissions by 2050. In 2019, the reduction in developed countries was 6.5%, while emissions in 70 developing countries increased by 14.4%.

Goal 14 aims to conserve and sustainably use the oceans, seas and marine resources for sustainable development. The oceans support more than 3 billion people and carry 80% of the world's goods. They are under constant threat from pollution, warming and acidification, which are destroying marine ecosystems. Ocean acidification is caused by the absorption of carbon dioxide, which lowers the pH of the water.

The increase in the average coverage of marine protected areas from 28% in 2000 to 44% in 2020 has been uneven across the world. The importance of sustainable management of fish stocks is crucial to ensure a natural rebalancing of the ecosystem. Protecting, restoring and promoting the sustainable use of terrestrial ecosystems, sustainable forest management, combating desertification, halting and reversing land degradation and halting the loss of biodiversity are all part of the UN's fifteenth goal.

The world's forest cover in 2020 is 31.2%, with a net loss of almost 100 million hectares of global forest over the last 20 years. During this period, forest cover increased in Asia, Europe and North America, but decreased significantly in Latin America and sub-Saharan Africa. As this covid pan-demic has shown, the threat to biodiversity poses a serious challenge to the survival of the human species.

Considerable efforts are being made to improve sustainable forest management, increase the coverage of green spaces, and write laws and treaties to protect biodiversity, but much remains to be done to integrate the protection of the planet into all national plans and policies.

In Goal 16, the UN aims to promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels. In 2019, there were 79.5 million forcibly displaced people worldwide, or 1% of the world's population, and 437,000 victims of homicide.

In 2020, there were 331 murders of human rights defenders and 62 journalists, demonstrating that voices against regimes are always silenced with blood. The final goal identified by the UN is to strengthen the means of implementation and reinvigorate the Global Partnership for Sustainable Development. This goal aims to strengthen cooperation between countries and with international organisations to implement all the other goals on the agenda. This requires the most developed countries to help the least developed countries to achieve shared and cooperative sustainable development.

This can be achieved through fair international trade without additional tariffs on products and services from poorer countries. Technology and scientific knowledge must also be shared to reduce the gap between countries. Aid from richer countries must be increased to invest in communications infrastructure that bridges the gap between the world's rich and poor countries (https://sdgs.un.org/).

Since 2001, the OECD has measured the Better Life Index for the 40 countries of the Organisation for Economic Co-operation and Development. The measurement covers 11 themes: housing, income, work, social relations, education, environment, governance, health, personal satisfaction, security and work-life balance. Each theme is measured by one to four indicators. The Better Life Index is an interactive tool, available online, where anyone can assign different weights to each of the proposed themes and find their own indicator to compare and share with those proposed in other countries (OECD, 2013).

As can be seen in Table 3, the United States performs well in all areas of the survey, excelling in housing and *per capita* income. With the availability of 2.4 rooms *per capita* and the presence of toilets in almost all dwellings, citizens on average have safe and satisfactory housing conditions in one of the primary goods.

The average *per capita* housing expenditure of American households is about 19 per cent, while the average *per capita* income is about $45,000 per year, much higher than the OECD average of about $33,000. Moreover, the average wealth of each family (i.e. total financial assets in securities and real estate) is $632,000, compared with $408,000 for the OECD average. It is worth noting the wide disparity in income distribution within the country.

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Table 3. Situation of the 40 countries for 11 evaluation topics in the year 2020. Source: OCDE, Data Base online.

	Housing	Income	Employment	Social relations	Education	Environmental	Civic engagement	Health	Satisfaction	Security	Balance	Mean	Median
United States	8.50	9.00	8.40	6.30	7.00	6.80	7.00	8.90	7.40	7.50	6.00	7.53	7.40
Australia	7.90	5.70	8.00	8.60	7.40	9.60	6.40	8.70	9.90	10.00	8.50	8.25	8.50
Norway	8.30	4.70	8.30	8.20	7.40	9.60	6.40	8.70	9.90	10.00	8.50	8.18	8.30
Canada	7.80	5.40	8.00	7.60	7.90	8.30	6.80	9.60	9.10	9.10	7.30	7.90	7.90
Sweden	6.90	4.60	8.10	6.70	7.70	9.10	6.80	8.50	8.90	8.50	8.40	7.65	8.10
Switzerland	6.50	6.90	9.30	7.80	7.40	7.30	3.40	9.00	9.60	9.50	8.40	7.74	7.80
Denmark	6.20	3.00	8.30	8.80	7.90	8.30	7.00	7.90	9.70	9.30	9.00	7.76	8.30
The Netherlands	7.30	3.30	8.30	6.50	7.40	7.20	7.80	8.40	9.30	9.20	9.50	7.65	7.80
Luxembourg	6.70	9.10	8.40	7.40	5.00	6.40	6.90	8.00	7.50	8.60	8.00	7.45	7.50
United Kingdom	5.50	6.00	8.00	8.10	6.80	6.70	7.20	7.70	7.20	8.90	6.40	7.14	7.20
Finland	6.20	3.70	7.50	8.60	8.90	8.90	5.20	7.90	10.00	9.30	8.00	7.65	8.00
New Zealand	6.20	4.30	8.00	8.90	6.90	8.50	7.30	9.50	8.90	7.60	5.90	7.45	7.60
Belgium	7.40	5.00	7.30	6.50	7.50	5.90	7.40	8.20	7.60	8.00	8.40	7.20	7.40
Germany	6.80	4.70	8.20	6.20	7.60	7.00	5.30	7.40	7.80	8.30	8.40	7.06	7.40
Austria	6.20	5.00	8.10	6.90	6.60	6.60	4.80	7.90	8.30	9.10	6.80	6.94	6.80
Ireland	7.30	3.10	7.20	8.60	7.40	7.60	3.10	9.10	7.70	8.60	7.90	7.05	7.60
Iceland	5.20	5.90	9.90	10.00	6.90	10.00	6.40	8.60	9.50	9.60	5.10	7.92	8.60
France	6.60	4.40	6.80	6.20	6.10	5.90	5.80	7.70	6.10	8.20	8.70	6.59	6.20
Slovenia	6.80	2.30	6.80	6.80	7.90	6.40	4.20	7.30	4.20	9.60	7.40	6.34	6.80
Estonia	6.80	1.80	6.90	6.80	7.90	7.40	6.00	5.60	3.50	7.50	7.90	6.19	6.80
Czech Republic	5.00	2.10	7.10	6.30	7.50	5.30	3.40	6.50	6.80	8.30	7.60	5.99	6.50
Spain	6.70	4.00	4.70	7.70	5.50	5.30	4.70	8.40	5.50	9.20	8.80	6.41	5.50
Italy	5.10	3.70	5.20	6.80	4.80	3.80	6.60	8.30	4.40	7.00	9.40	5.92	5.20
Israel	5.00	3.20	7.30	4.80	5.60	2.70	6.50	9.30	8.50	7.80	4.60	5.94	5.60
Japan	6.00	4.40	8.10	5.70	7.80	6.50	1.90	5.30	4.10	8.60	4.60	5.73	5.70
Slovakia	4.50	1.60	5.60	6.40	5.70	4.90	6.10	6.70	5.00	7.40	7.90	5.62	5.70
Poland	4.60	2.20	6.50	4.00	7.60	4.20	4.90	6.20	4.80	7.80	6.80	5.42	4.90
Latvia	3.70	0.70	6.00	4.00	7.10	6.30	4.30	4.50	4.20	6.60	6.90	4.94	4.50
Korea	6.60	3.10	7.40	0.00	7.60	2.40	7.80	4.70	4.00	7.70	4.10	5.04	4.70
Lithuania	5.30	1.80	6.50	4.80	7.30	5.80	3.80	4.20	4.20	6.30	8.60	5.33	5.30
Portugal	6.30	2.60	5.80	4.90	4.60	7.20	2.50	5.80	2.40	8.30	7.00	5.22	5.80
Greece	4.80	1.50	1.80	0.70	6.10	3.70	4.10	8.20	2.20	7.10	7.10	4.30	4.10
Brazil	4.50	0.30	4.10	6.20	1.80	5.50	6.60	6.60	5.80	0.00	6.60	4.36	5.50
Hungary	5.60	1.30	6.40	4.00	5.90	4.30	3.40	5.90	3.10	6.70	8.00	4.96	5.60
Russian Federation	4.50	1.90	6.60	5.70	6.80	2.50	2.30	3.60	3.70	4.40	8.30	4.57	4.40
Mexico	3.10	0.60	5.90	1.40	1.10	4.00	6.90	6.30	6.10	2.20	1.10	3.52	3.10
Türkiye	4.70	1.60	5.00	3.80	3.00	2.70	5.90	7.20	2.60	7.00	3.10	4.24	3.80
Chile	5.40	1.00	5.90	3.30	4.50	4.20	1.00	6.40	6.00	5.40	5.00	4.37	5.00
Colombia	4.70	0.40	5.50	5.50	1.40	5.90	2.00	7.80	5.30	1.20	0.90	3.69	4.70
South Africa	2.50	0.30	0.00	4.90	2.60	2.60	4.70	3.10	0.00	2.50	5.50	2.61	2.60

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The comparison between the 40 countries analysed shows a very heterogeneous situation: the number of rooms *per capita* ranges from 2.6 in Canada to 0.9 in the Russian Federation; in general, more than 80% of dwellings have basic sanitary facilities, although in some countries, such as South Africa, only 63% of dwellings have them. The ratio of housing expenditure to income also varies widely between countries, ranging from 15% in South Korea to 26% in New Zealand.

When analysing *per capita* income and wealth, it ranges from $45,000 in the United States to $11,000 *per capita* per year in South Africa, while household wealth ranges from $769,000 in Luxembourg to $70,000 in Latvia. Interestingly, income distribution is much more equal in Iceland, with a value of 3.5 (1 being equal distribution) compared to 37 in South Africa.

In the United States, the very low unemployment rate of around 0.7 per cent (the range between countries goes from 0 per cent in Korea to 16 per cent in South Africa) and the very high secondary education rate of 91 per cent (higher than Japan's 94 per cent, the lowest being Mexico's 37 per cent) provide greater security in the face of the adversities of the world of work. The subjective measure of life satisfaction for Americans is 6.9 out of 10, an excellent rating that places them 17th out of the 40 countries surveyed, a ranking led by Finland with 7.6 and followed by South Africa with 4.7.

The case of Italy is noteworthy, where in recent years several indicators have been produced by major research institutes and foundations, which in 2010 find their best synthesis in the measurement of Equitable and Sustainable Well-being (BES).

This measurement is done by analysing 12 domains and 168 regional indicators disaggregated by gender, age, educational level, social status and family type. The 12 domains are: health, education, work, economic well-being, social relations, politics and institutions, security, subjective well-being, landscape and cultural heritage, environment, research and innovation, quality of services (ISTAT, 2022).

Virtuous countries

From the analysis of 7 indicators (Gallup, HPI, HDI, EPI, GDP *per capita*, EP and SDI) applied worldwide, we can try to identify a group of countries that could show the way forward. There is no such thing as a model country, as the variables that positively affect welfare indicators often have inverse relationships. Economic growth almost always has a negative effect on environmental variables and a positive effect on life expectancy, health, education and services.

The model country should have a medium to high level of wealth and a high level of environmental protection, i.e. low emissions of pollutants into the air and water, protection of biodiversity, renewable energy, sustainable mobility, organic agriculture, low use of non-renewable resources.

It was decided to divide the positions obtained for each indicator into quartiles. The first quartile is made up of the 25 per cent of countries analysed for that indicator, representing the best performers according to this methodology. The second quartile is made up of the countries in the second quarter of the ranking, the third quartile is made up of the countries in the middle to the 75th percentile, and the last quartile is made up of the 25 per cent of countries at the bottom of the ranking.

Figure 12 shows a group of 10 countries that rank high on the Gallup (subjective) indicators, the Happy Planet Index, the Human Development Index, the Environmental Performance Index and GDP *per capita*, but are in deficit on the Ecological Footprint and the Sustainable Development Index. 9/10 of these countries are European: Spain, the UK, Switzerland, France, Germany, Ireland, the Netherlands, Finland and Norway. The only non-European country is New Zealand.

After these countries, there is another group of 20 countries, 12 of which are European, plus Canada, the United States, South Korea, Australia, Israel and the United Arab Emirates. There is a third group, made up of Costa Rica, Mexico and Brazil, which have excelled on the Gallup, Happy Planet and Sustainable Development Indexes, while being in the second or third quartile on the other four indicators, demonstrating that they are able to meet the health and education needs of their populations, while achieving environmental sustainability and without very high incomes.

All these European countries are at the top of the OECD's Better Life Index, which confirms the other indicators used. The Central American countries are not monitored by the Better Life Index, so it was not possible to compare them with the other indicators analysed. It is to be hoped that this OECD indicator will be extended to other countries in the coming years, as it is indeed a good measure of social wellbeing, including the four main dimensions for its measurement (economic-environmental-social-subjective).

In Table 4 the indicators were divided according to the dimensions used to classify the collective well-being of countries. In addition, the years of measurement, the countries monitored, and the number of indicators used have been indicated.

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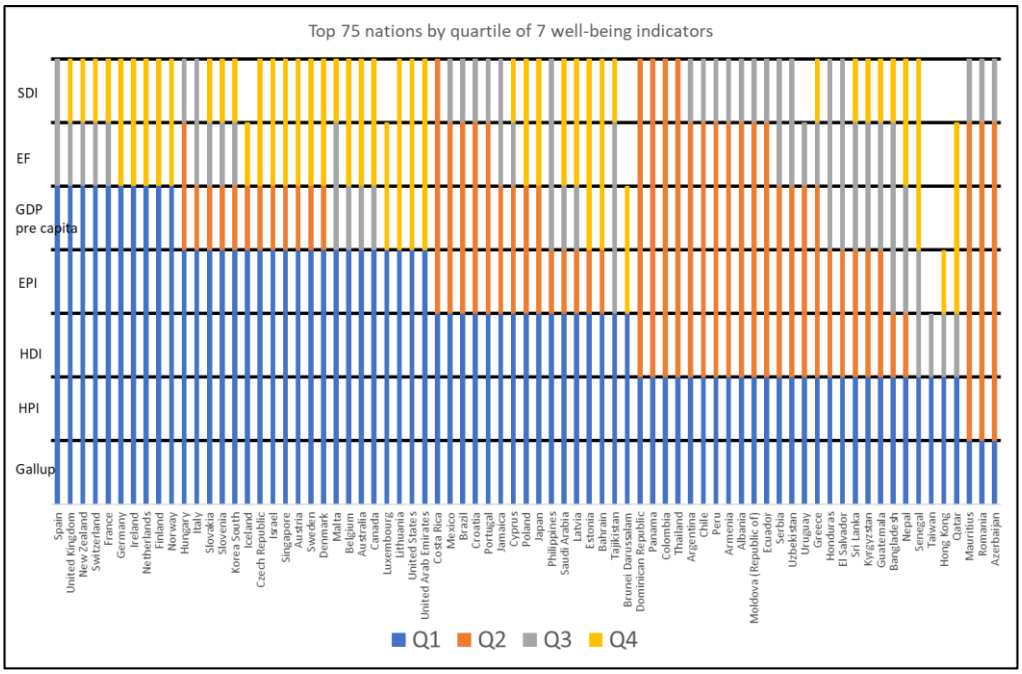

Figure 12. Using indicators to identify more virtuous countries.
Source: Gallup, World Bank, Global Footprint Network, Yale University, UNDP, Sustainable Development INDEX.

Table 4. Indicators for Measuring the Well-being of a Nation.

Economic	Environmental	Subjective	Economic Environmental Social	Environmental Social Subjective
GDP *pre capita* PPP Years 1990 - 2020 Countries 190 World Bank	Ecological Footprint Years 1961 - 2017 Countries 188 Global Footprint Network	World Happiness Report Years 2005 - 2021 Countries 160 Gallup	Human Development Index Years 1990 - 2020 Countries 189 United Nations Indicators 3	Happy Planet Index Years 2006 - 2020 Countries 160 New Economics Foundation Indicators 3
	Living Planet Index Years 1970 - 2017 Countries 190 WWF	World Value Survey Years 1981 - 2020 Countries 80 World Value Survey	Sustainable Development Index Years 1990-2019 Countries 165 Sustainable Development Index Indicators 6	
	Environmental Performance Index Years 2002-2020 Countries 180 Yale University Indicators 32		Sustainable Society Index Years 2006 -2020 Countries 190 Sustainable Society Foundation Indicators 21	
			Sustainable Development Goals Years 2015 - 2020 Countries 190 United Nations Indicators 244	
Economics - Environmental - Social-Subjective				
	Better Life Index Years 2001 - 2020 Countries 40 OCSE Indicators 24		Sustainable Fair Welfare Years 2010 - 2020 Countries 1 ISTAT Indicators 130	

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Conclusions

This paper has described some of the indicators most commonly used by national and international bodies to measure the well-being of a nation. One-dimensional measures (economic, environmental, subjective) and multi-dimensional measures (economic-environmental-social, economic-social-subjective, economic-social-environmental-subjective) have been considered. It was found that there is a very high loss of information in the case of one-dimensional measures and therefore the best way forward would be the multi-dimensional measure.

Once the set of indicators that best represents the dimensions to be measured has been identified, it is necessary to work on their international standardisation, dictated by guidelines accepted by most countries. This process will be achieved by allocating resources and specialised staff, as has been done for national accounts measurements. A good starting point is the OECD's Better Life Index, which is currently limited to measuring indicators for 40 countries, but should be extended to all the nations of the world. The Italian proposal (this study) for a set of indicators as a basis for the calculation of fair and sustainable well-being seems to go in the more plausible direction, as it combines objective indicators with subjective measurements obtained through special questionnaires to a sample of families.

The environmental dimension, with the depletion of natural resources and the mismanagement of natural capital, sets limits that can no longer be crossed and that should condition the political choices of all countries on the planet. The indicators analysed do not provide any models to follow, but the countries that have placed social, educational and environmental protection, as well as investment in scientific research, at the 'heart' of their policies are also those that occupy the top positions in the rankings of collective well-being. Much remains to be done to protect terrestrial and marine biodiversity (both in terms of accuracy of measurement and actual protection), the loss of non-renewable natural resources, and gender, income, generational and citizenship inequalities.

Collective well-being is a measure of the civilisation of a country and the maturity of its citizens, who improve their lives without worsening the lives of their neighbours or those who will come after them.

CREDIT AUTHORSHIP CONTRIBUTION STATEMENT

The author declares that he has participated alone in all section of this manuscript, including all the research.

DECLARATION OF INTEREST

The author discloses that they have no known competing financial interests or personal relationships that could have appeared to influence the study reported in this manuscript.

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REFERENCES

BLOCK, S.; EMERSON, J.W.; ESTY, D.C.; De SHERBININ, A.; WENDLING, Z.A., et al. **2024 Environmental Performance Index**. New Haven: Yale Center for Environmental Law & Policy, 2024. Available from: http://epi.yale.edu/downloads/2024-epi-report.pdf

BUTERA, F.M. **Affrontare la complessità:** Per governare la transizione ecologica. Milan: Edizioni Ambiente, 2021. Available from: https://www.edizioniambiente.it/catalogo/affrontare-la-complessita. Accessed on: 10 Aug. 2024.

CARSON, C.S. The history of the United States national income and product accounts: the development of an analytical tool. **Review of Income and Wealth**, v. 21, n. 2, p. 153-181, 1975. Available from: https://doi.org/10.1111/j.1475-4991.1975.tb00687.x

CASTELLUCCI, L. **Lezioni di economia delle risorse naturali**. Bologna: Società Editrice Esculapio, 2021. Available from: https://www.editrice-esculapio.com/. Accessed on: 10 Aug. 2024.

CHELLI, F.M.; CIOMMI, M.; GIGLIARANO, C. The index of sustainable economic welfare: A comparison of two Italian regions. **Procedia - Social and Behavioral Sciences**, v. 81, p. 443-448, 2013. Part of the 1st World Congress of Administrative & Political Sciences (ADPOL-2012). Available from: https://doi.org/10.1016/j.sbspro.2013.06.457

CNEL (Consiglio Nazionale dell'Economia e del Lavoro). **Indicatori per lo sviluppo sostenibile in Italia** – Rapporto Finale. Rome: CNEL, 2005. Available from: https://www.mef.gov.it/export/sites/MEF/ministero/commissioni/ccba/documenti/CNELx20Rapportox20Finalex20Indicatori.pdf. Accessed on: 10 Jul. 2024.

COHEN KAMINITZ, S. The significance of GDP: a new take on a century-old question. **Journal of Economic Methodology**, v. 30, n. 1, p. 1-14, 2023. Available from: https://doi.org/10.1080/1350178X.2023.2167228

COSCIEME, L.; MORTENSEN, L.F.; ANDERSON, S.; WARD, J.; DONOHUE, I.; SUTTON, P.C. Going beyond Gross Domestic Product as an indicator to bring coherence to the Sustainable Development Goals. **Journal of Cleaner Production**, v. 248, art. 119232, 2020. Available from: https://doi.org/10.1016/j.jclepro.2019.119232

COSTANZA, R.; HART, M.; KUBISZEWSKI, I.; POSNER, S.; TALBERTH, J. Lessons from the history of GDP in the effort to create better indicators of prosperity, well-being, and happiness. In: BELL, S.; MORSE, S. **Routledge Handbook of Sustainability Indicators**. London: Taylor and Francis, 2018. p. 117-123. Available from: https://doi.org/10.4324/9781315561103

COYLE, D. **GDP:** A Brief but Affectionate History. Revised and expanded Edition. Princeton: Princeton University Press, 2016. Available from: https://press.princeton.edu/books/paperback/9780691169859/gdp?srsltid=AfmBOorSH-evhEekTlfnWYHEMT9BMv4jG4HLIHx7uIbZavjmcvYpyHfl. Accessed on: 10 Aug. 2024.

DEATON, A. Income, health, and well-being around the world: Evidence from the Gallup World Poll. **Journal of Economic perspectives**, v. 22, n. 2, p. 53-72, 2008. Available from: https://doi.org/10.1257/jep.22.2.53

DELSIGNORE, G.; AGUILAR-LATORRE, A.; GARCIA-RUIZ, P.; OLIVÁN-BLÁZQUEZ, B. Measuring happiness for social policy evaluation: a multidimensional index of happiness. **Sociological Spectrum**, v. 43, n. 1, p. 16–30, 2023. Available from: https://doi.org/10.1080/02732173.2022.2163444

FELICI, F.; GAWRONSKI, P.G.; LAMBIASE, F.; LOIERO, R.; SOLIPACA, A. Il benessere equo e sostenibile: Aspetti teorici, empirici e istituzionali. **Senato della Repubblica**: Rome, Documento di Analisi n.12, Ufficio Valutazione Impatto, 2018. Available from: https://elearning.unite.it/pluginfile.php/216942/mod_resource/content/2/Il_benessere_equo_e_sostenibile_Dossier.pdf. Accessed on: 10 Jul. 2024.

FIORAMONTI, L. **Presi per il PIL:** Tutta la verità sul numero più potente del mondo. Rome: L'asino d'oro edizioni, 2017. Available from: https://lasinodoroedizioni.it/catalogo/le-api/presi-per-il-pil/. Accessed on: 10 Aug. 2024.

FIORAMONTI, L. **Il mondo dopo il PIL:** Economia e politica nell'era della post-crescita. Milan: Edizioni Ambiente, 2019. Available from: https://www.edizioniambiente.it/catalogo/il-mondo-dopo-il-pil. Accessed on: 10 Aug. 2024.

HANDOYO, A.; ISNADI, Y. The insignificance of GDP growth rate to people's welfare: a political economy analysis of China's impressive GDP. **Otoritas: Jurnal Ilmu Pemerintahan**, v. 13, n. 2, p. 217-232, 2023. Available from: https://doi.org/10.26618/ojip.v13i2.10424

HECHT, J. **National environmental accounting:** Bridging the gap between ecology and economy. Routledge: New York, 2005.
Available from: https://doi.org/10.4324/9781936331369

HICKEL, J. The sustainable development index: Measuring the ecological efficiency of human development in the anthropocene. **Ecological Economics**, v. 167, art. 106331, 2020. Available from: https://doi.org/10.1016/j.ecolecon.2019.05.011

ISTAT (Istituto Nazionale di Statistica). **Il benessere equo e sostenibile in Italia**, Rapporto Bes 2021. ISTAT: Rome, 2022. Available from: https://www.istat.it/produzione-editoriale/rapporto-bes-2021-il-benessere-equo-e-sostenibile-in-italia/. Accessed on: 10 Jul. 2024.

KARUNANITHI, K.; BUI, W.K.T.; TAN, H.C. Green gross domestic product: A bibliometric analysis. **Sustainable Development**, p. 1-12, 2024. Available from: https://doi.org/10.1002/sd.3006

KUBISZEWSKI, I.; COSTANZA, R.; FRANCO, C.; LAWN, P.; TALBERTH, J.; JACKSON, T.; AYLMER, C. Beyond GDP: Measuring and achieving global genuine progress. **Ecological Economics**, v. 93, p. 57-68, 2013. Available from: https://doi.org/10.1016/j.ecolecon.2013.04.019

LIBÓRIO, M. P.; MARTINUCI, O.S.; MACHADO, A.M.C.; MACHADO-COELHO, T.M.; LAUDARES, S.; BERNARDES, P. Principal component analysis applied to multidimensional social indicators longitudinal studies: limitations and possibilities. **GeoJournal**, v. 87, p. 1453-1468, 2022. Available from: https://doi.org/10.1007/s10708-020-10322-0

MANAGI, S.; CHEN, S.; KUMAR, P.; DASGUPTA, P. Sustainable matrix beyond GDP: investment for inclusive growth. **Humanities and Social Sciences Communications**, v. 11, art. 185, p. 1-10, 2024. Available from: https://doi.org/10.1057/s41599-024-02659-5

MOFFATT, I. Ecological footprints and sustainable development. **Ecological Economics**, v. 32, n. 3, p. 359-362, 2000. Available from: https://doi.org/10.1016/S0921-8009(99)00154-8

NORDHAUS, W.D.; TOBIN, J. **Economic research:** Retrospect and prospect. vol. 5, Economic growth. New York: National Bureau of Economic Research, 1972. Available from: https://www.nber.org/books-and-chapters/economic-research-retrospect-and-prospect-volume-5-economic-growth. Accessed on: 10 Aug. 2024.

OECD (Organisation for Economic Co-operation and Development). **OECD Guidelines on measuring subjective well-being**. OECD Publishing: Paris. 2013. Available from: https://doi.org/10.1787/9789264191655-en

PURWANTO, H.; SISWAHADI, S. Paradigm of national income in Islamic economy. **Syariati: Jurnal Studi Al-Qur'an dan Hukum**, v. 7, n. 1, p. 93-102, 2021. Available from: https://doi.org/10.32699/syariati.v7i1.1851

ROCKSTRÖM, J.; WIJKMAN, A. **Natura in bancarotta:** Perché rispettare i confini del pianeta. Rapporto al Club di Roma. Milan: Edizioni Ambiente, 2014. Available from: https://www.wwf.it/pandanews/ambiente/club-di-roma-e-wwf-per-la-peccei-lecture-natura-in-bancarotta/. Accessed on: 10 Aug. 2024.

SAISANA, M.; PHILIPPAS, D. **Sustainable Society Index (SSI):** Taking societies' pulse along social, environmental and economic issues. Institute for the Protection and Security of the Citizen (Joint Research Centre), Publications Office of the European Union, 2012. Available from: https://doi.org/10.2788/6330

SEMIENIUK, G. Inconsistent definitions of GDP: Implications for estimates of decoupling. **Ecological Economics**, v. 215, art. 108000, 2024. Available from: https://doi.org/10.1016/j.ecolecon.2023.108000

STIGLITZ, J.E.; FITOUSSI, J.-P.; DURAND, M. **Misurare ciò che conta:** Al di lá del PIL. Turin: Giulio Einaudi Editore, 2021. Available from: https://www.einaudi.it/catalogo-libri/problemi-contemporanei/misurare-cio-che-conta-joseph-e-stiglitz-9788806249724/. Accessed on: 10 Jul. 2024.

STIGLITZ, J.E.; MARCHIONATTI, R. **Principi di macroeconomia**. Turin: Bollati Boringhieri, 1995. Available from: https://www.unilibro.it/libro/stiglitz-joseph-e-marchionatti-r-cur-/principi-di-macroeconomia/9788833955506?srsltid=AfmBOoq47A-qlILEpPJpsjqB11T9ErdkY51m0ZpU54nQqNrYsKAcXUNN. Accessed on: 10 Aug. 2024.

STIGLITZ, J.E.; SEN, A.; FITOUSSI, J.-P. **Report by the Commission on the measurement of economic performance and social progress**. Paris: OFCE (Observatoire Français des Conjonctures Économiques), 2009. Available from: https://ec.europa.eu/eurostat/documents/8131721/8131772/Stiglitz-Sen-Fitoussi-Commission-report.pdf. Accessed on: 10 Aug. 2024.

TØNNESSEN, M. Wasted GDP in the USA. **Humanities and Social Sciences Communications**, v. 10, art. 681, 2023. https://doi.org/10.1057/s41599-023-02210-y

UN (United Nations). **System of National Accounts 2008 - 2008 SNA**. New York: United Nations Statistics Division, 2009. Available from: https://unstats.un.org/unsd/nationalaccount/sna2008.asp. Accessed on: 10 Aug. 2024.

UN (United Nations). **Report of the World Commission on Environment and Development:** Our Common Future. New York: World Commission on Environment and Development, 2011 (First publication in 1987). Available from: https://sustainabledevelopment.un.org/content/documents/5987our-common-future.pdf. Accessed on: 10 Aug. 2024.

UN (United Nations). **System of Environmental-Economic Accounting—Ecosystem Accounting:** Final Draf. New York: Committee of Experts on Environmental-Economic Accounting, Statistics Division, 2021. Available from: https://unstats.un.org/unsd/statcom/52nd-session/documents/BG-3f-SEEA-EA_Final_draft-E.pdf. Accessed on: 10 Jul. 2024.

VANDERWEELE, T.J.; TRUDEL-FITZGERALD, C.; ALLIN, P.; et al. Current recommendations on the selection of measures for well-being. **Preventive Medicine**, v. 133, art. 106004, 2020. Available from: https://doi.org/10.1016/j.ypmed.2020.106004

WACKERNAGEL, M.; REES, W. **Our ecological footprint:** Reducing human impact on the Earth. Philadelphia: New Society Publishers, 1996. Available from: https://faculty.washington.edu/stevehar/footprint.pdf. Accessed on: 10 Jul. 2024.

WANG, B.; CHEN, T. Social progress beyond GDP: A Principal Component Analysis (PCA) of GDP and twelve alternative indicators. **Sustainability**, v. 14, n .11, art. 6430, 2022. Available from: https://doi.org/10.3390/su14116430

WEAll (WELLBEING ECONOMY ALLIANCE). **For an economy in service of life**. Available from: https://weall.org/. Accessed on: 10 Aug. 2024.

Manuscript ID: es20240008

WENDLING, Z.A.; EMERSON, J.W.; De SHERBININ, A.; ETSY, D.C., et al. **Environmental Performance Index 2020**. New Haven, CT: Yale Center for Environmental Law & Policy, 2020. Available from: https://doi.org/10.13140/RG.2.2.21182.51529

WWF (World Wide Fund). **Living Planet Report:** Costruire una società nature-positive. 2022. Available from: https://www.wwf.it/uploads/WWF-LivingPlanetReport2022.pdf. Accessed on: 10 Jul. 2024.