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Instrumente Structurale 2014-2020

Proiect cofinanțat din Fondul Social European prin Programul Operațional Capacitate Administrativă 2014-2020

ROMÂNIA DURABILĂ

Dezvoltarea cadrului strategic și instituțional pentru implementarea Strategiei Naționale pentru Dezvoltarea Durabilă a României 2030

Administrație publică pentru dezvoltare durabilă

- Program de studii postuniversitare de formare şi dezvoltare profesională continuă, înregistrat în Registrul Național al Programelor Postuniversitare cu nr. 338.
- Ocupația/ Grupa de bază din COR pentru care se organizează programul postuniversitar: ”expert dezvoltare durabilă”, cod COR 242232.
- Organizator: Academia de Studii Economice din București

Modalități de colectare, analiză și interpretare a datelor statistice pentru dezvoltare durabilă

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Material realizat în mai 2022 de lectorul Markus Hametner pentru uzul participanților la programul de studii postuniversitare de formare şi dezvoltare profesională continuă „Administrație publică pentru dezvoltare durabilă”.

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Dezvoltarea cadrului strategic și instituțional pentru implementarea Strategiei Naționale pentru Dezvoltarea Durabilă a României 2030

Collecting, analysing and interpreting sustainable development statistical data

Table of contents

Context

Sustainable Development Indicators (SDIs): background, definition & functions

Since the early days of the sustainable development (SD) discourse, there has been a controversy on how to best measure, monitor and assess progress towards SD. A major recurring issue of this controversy is the critique of the Gross Domestic Product (GDP) concept. Since decades, critics have highlighted several social and environmental problems that emerge when GDP is misunderstood as an indicator for economic wealth. Consequently, SD scholars have developed several alternative or complementary indices to GDP, such as the Genuine Progress Index (GPI) or the Ecological Footprint (Böhringer and Jochem, 2007). However, also due to methodological problems, none of these aggregated indicators came out on top of the SD discourse. Instead, countries began to develop and adopt sets of sustainable development indicators (SDIs) that depict selected economic, social and environmental aspects of SD. Nowadays, SDI sets are the standard way to monitor progress towards SD in Europe and in other parts of the world (Hametner and Kostetckaia, 2020).

> *An indicator can be defined as "a parameter, or a value derived from parameters, which points to, provides information about, describes the state of a phenomenon/environment/area, with a significance extending beyond that directly associated with a parameter value." (OECD, 2003)*

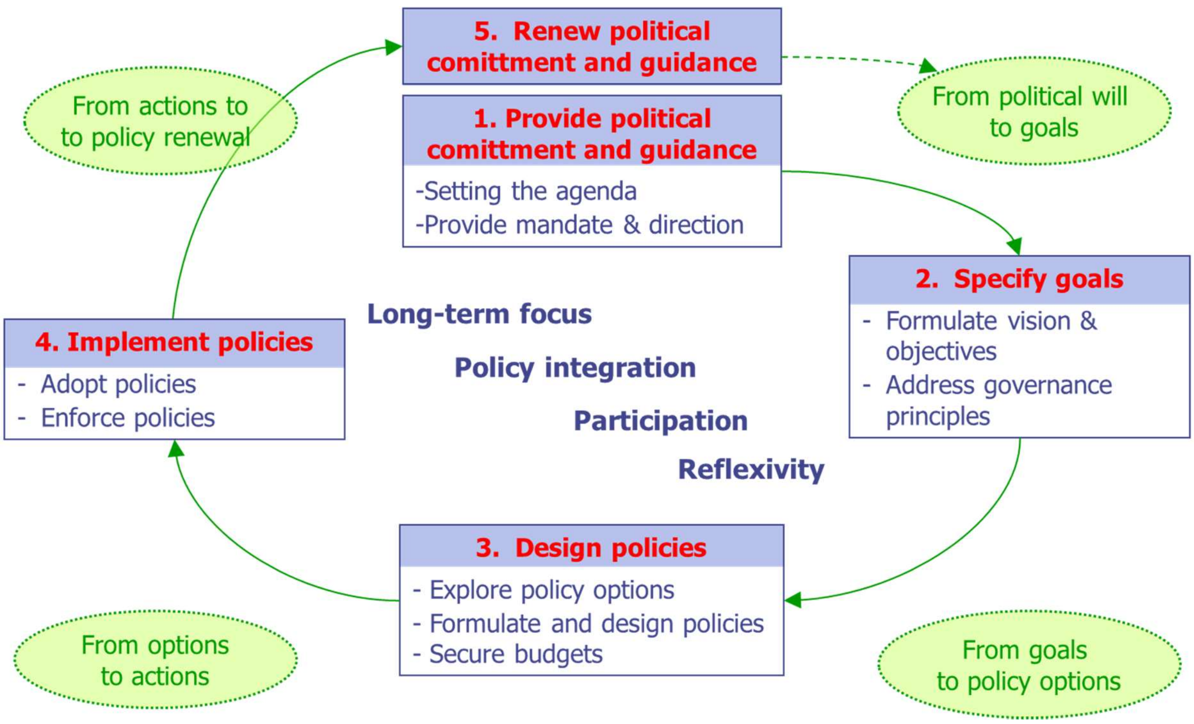
Generally speaking, indicators have three main functions. Firstly, they reduce the number of measurements necessary to give an exact description of a situation (OECD, 2003). As such, they are indispensable for **measuring progress** towards achieving set goals (Dalal-Clayton and Krikhaar, 2007) and thus constitute a key tool for evaluating the effectiveness of policies (European Commission, 2005). Secondly, indicators simplify the **communication** of positive and negative developments to politicians, administrators, the public and others (OECD, 2003). Both functions rely on the main feature of indicators, i.e. to summarize complexity into a manageable amount of meaningful information that can be understood and interpreted easily. In doing so, indicators can, thirdly, provide crucial **guidance for policymaking processes** (Bossel, 1999, UNCSD, 2001), in particular regarding the better integration of policies horizontally across sectors, and vertically between different levels of government. SDIs can facilitate vertical integration when they are compared and benchmarked across Europe.

In how far SDIs fulfil the measuring function is foremost a question of methodological reliability and validity. Because they ought to reveal where we stand on the way to SD, in which areas progress has been made and where further political actions are needed (Dalal-Clayton and Krikhaar, 2007), methodological challenges in developing and applying SDIs are anything but trivial. In how far they can fulfil the communication and guidance functions is primarily a question of political willingness to learn and improve policies based on evidence (Steurer and Hametner, 2013). This is especially so in political arenas in which opposition parties are eager to benefit from a government's negative performances and weaknesses (see section 0 below).

SDIs as key features of strategic processes

Setting objectives and measuring progress in achieving them with indicators are two closely related features that are typical for serious strategic management approaches in general, and for virtually all SD strategies in the EU in particular. According to the Resource Book on SD strategies, "*Being* *strategic is about developing an underlying vision through a consensual, effective and iterative process; and going on to set objectives, identify the means of achieving them, and then monitor that achievement as a guide to the next round of this learning process.*" (IIED, 2002). As this quote emphasises, developing a long-term vision and setting concrete objectives are two initial key steps of a strategic process (see ***Figure 1***). Ideally, these steps are based on an assessment of the status quo and current trends, and they are accompanied by high-level political commitment. Monitoring efforts using SD indicators, on the other hand, should track SD performances and trends that are relevant for the objectives formulated in the SD strategy. SDI monitoring most often accompanies implementation efforts, and its findings are summarised annually or bi-annually in indicator or progress reports (Steurer and Martinuzzi, 2005). Eventually, the periodic progress reports should lead to the renewal of an SD strategy or some of its objectives.

Figure 1: Principles and steps of an ideal-type sustainable development (SD) strategy cycle



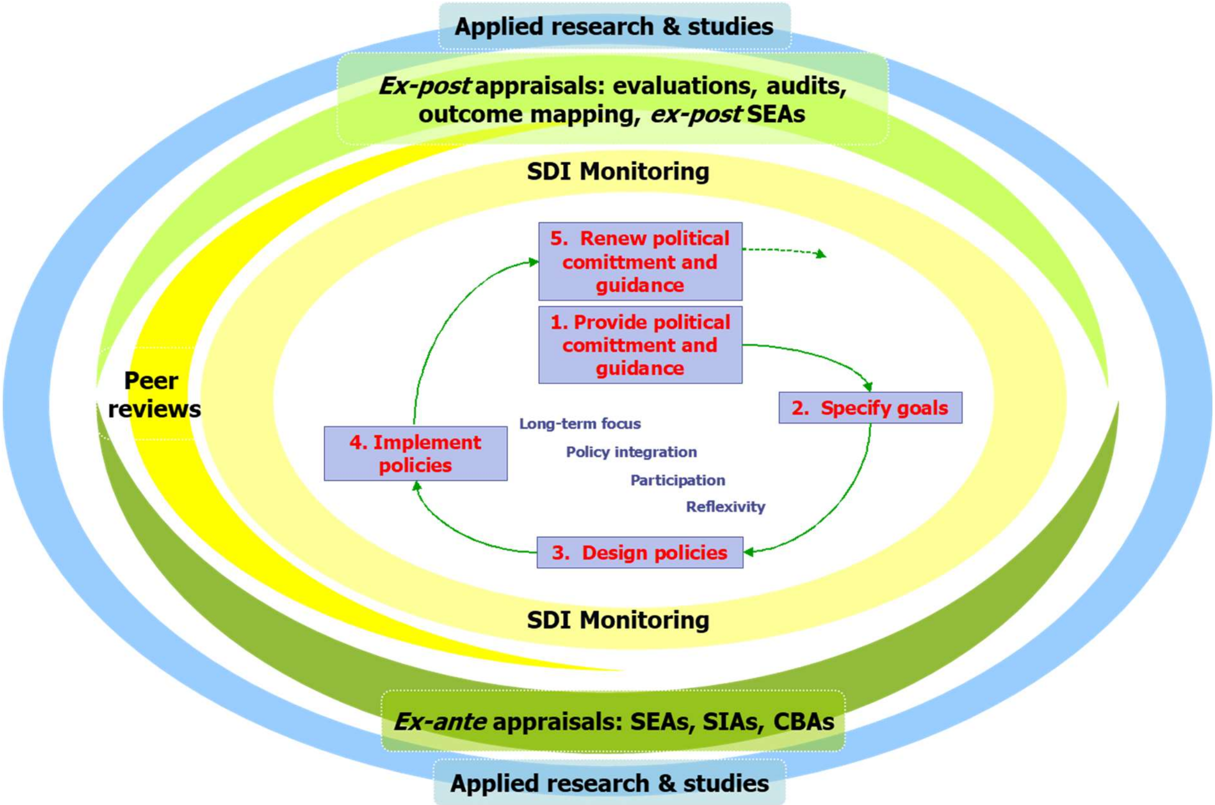
Source: loosely based on Volkery et al. (2006)

Put simply, while SD objectives ought to guide sectoral policies towards SD, monitoring with SDIs ought to reveal how governments are doing in this respect. In the context of SD strategies, the linkage between the two features should be close because

- Objectives without a clear link to SDIs cannot be monitored, which makes it difficult to assess and advance respective policies;
- An SDI without reference to a policy objective may be politically insignificant because it is monitoring something that seems to have little political salience.

However, because SDIs chart SD performance mostly in quantitative terms, they can neither reveal causalities nor can they identify success factors and challenges of policymaking. Therefore, SDI monitoring should be complemented by qualitative reviews or evaluations of SD strategy processes, as shown in ***Figure 2***.

Figure 2: Appraisals around the SD strategy cycle



Note: SDI = sustainable development indicators, SEAs = strategic environmental assessments, SIAs = strategic impact assessments, CBAs = cost-benefit analyses.

Role of SDIs at the different stages of the policy cycle

The most important aspect of the policy cycle is that at all stages there is an information need where information can serve general audiences and individual public decision-makers, as shown in ***Figure 2***. SDIs can help fulfil this need — from agenda setting to policy assessment. The role of the statistical community is to provide high quality data, in respect of the appropriate codes of practice, including defining international standards, ensuring adequacy of resources, quality commitment, statistical confidentiality, impartiality and objectivity.

In the first two stages (**provide political commitment and guidance** and **specify goals**), policymakers need to understand and clearly define the problem they want to solve and the policy objectives they want to reach. Indicators can facilitate this by quantitatively capturing the problem that the agenda should address, and/or by quantitatively illustrating the objectives that should be reached. Indicators available in time series and for many different geographic units (such as countries, regions, sub-regions) help in agenda setting as they provide benchmarks and can be used for time and country comparisons. Examples of respective indicators (or indicator sets) include the *Macroeconomic Imbalance Procedure (MIP) Scoreboard* used by the EU to detect economic imbalances in the Member States and the *Harmonised Index of Consumer Prices (HICP)* as an indicator of inflation and price stability.

Once objectives have been identified and quantified, policymakers need to identify the political options in order to reach them. In the third stage (**design policies**), the political options available and their impacts are compared in order to opt for the best way forward. Indicators can add value in impact assessments by helping to understand the causality chains between measures and the impacts of the policy measure.

Once the decision on specific policies has been reached, they need to be implemented by the relevant authorities in stage four (**implement policies**). In this stage, indicators are used in the monitoring process, including the assessment of the effectiveness of existing policies. Indicators that help policymakers to understand trends and their drivers, which enables them to see which policies work and which next policy actions might be necessary. Examples of respective indicator sets include the *EU SDG indicators*, the *Quality of life indicators* or the indicators for the *European Pillar of Social Rights*. The policy assessment can lead to a new policy cycle, starting with another agenda setting stage (**renew political commitment and guidance**).

In order for indicators to meet the information need at the different stages of the policy cycle, they must be closely linked with the respective policy objectives. The strength of this link depends on how the SDIs were developed in the first place, for which two basic approaches can be distinguished. When the so-called **'model-based approach'** is used, SDIs are developed on the basis of an underlying conceptual/theoretical model of SD. The risk of this approach is that the SDI set does not reflect political priorities and may lack political salience. When the so-called **'policy-based approach'** is applied, SD objectives are defined by political documents, and respective SDIs are derived. Because policies change over time, the corresponding SDI set also has to be revised continuously, making it sometimes difficult to track long-term trends (Hass, 2006). Nevertheless, due to its strong link with the policy cycle, the policy-based approach can be considered to be the predominant way for developing SD indicators across Europe (Steurer and Hametner, 2013).

Different types of indicator use

Three main types of indicator use

Literature defines three broad categories of how indicators are used, referring to the instrumental, conceptual and political functions of the indicators (Lehtonen et al., 2016, Sébastien and Bauler, 2013).

Instrumental use refers to the use of indicators as direct input to specific decisions. In this case, policymakers use them to steer policy along the different stages of the policy cycle. Indicators play a crucial role in monitoring and assessment of the impacts of existing policies on political decisions, such as keeping, broadening or abandoning the policy measure in question. For instance, indicators can help in the decision making stage to choose among several policy options, or in the policy assessment stage to identify strengths and weaknesses and provide recommendations for improvement. The instrumental use can be illustrated by the example of policymakers using CO_2 emissions observed over time in different sectors to set priorities for the emission-reduction policy.

Conceptual use (enlightenment) is the use of indicators to shape conceptual frameworks for assessments, ways of thinking and mental models. It relates to the percolation of new information, ideas and perspectives into the arenas in which decisions are made. In particular, the use of indicators may help decision-makers to define a problem and to provide new perspectives and insights. The conceptual use differs from the instrumental use in that sense that indicators do not directly influence a decision but generally improve the user's knowledge and information base.

Political use is the use of indicators as accountability tools or supporting arguments in the political discussion to promote specific ideas, such as sustainable development, transparency, improvement in social security level or trade liberalisation. For instance, indicators on the working poor showing a rise in poverty levels among households of employed persons might affect the plans for welfare policy. Political use can be further subdivided into three categories. Firstly, **legitimisation** is the use of indicators to justify decisions that have already been taken or policies that are already in place; often seen in a negative light but also essential to secure acceptance of policy in a democracy. In the case of **tactical** use, an evaluation is commissioned in order to postpone decision making. This can be also a type of indicator misuse. Finally, **symbolic** use can be identified when an indicator is primarily used for motivating existing policy positions or when there are clear instances of non-use or misuse.

The rationale behind the use of an indicator might change during the policy making process. For example, the above-mentioned indicator on the 'working poor' might first only be used conceptually to provide insight into the development of work patterns and wage structures in the labour market. If this leads to the identification of an existing problem, the same indicator might be used instrumentally to arrive at decisions on how to best influence wages and work patterns of the working poor. Finally, once the decisions are taken, the indicator might also be used for political reasons to defend and legitimise the decision.

Intended vs. unintended use

Generally, **intended use** is observed when an indicator is used for the specific purpose for which it was developed. Over time, however, people may start using it in different ways and interpreting it differently from its initial meaning, which results in an **unintended use**. For example, gross domestic product (GDP) was designed to measure and ultimately help steer the production of an economy (intended use), but over time it has started being used and communicated as an indicator of economic and even societal well-being (unintended use). While it remains a useful indicator to measure an economy’s level of production, it is generally seen as unfit and even misleading when employed as an indicator of overall societal welfare.

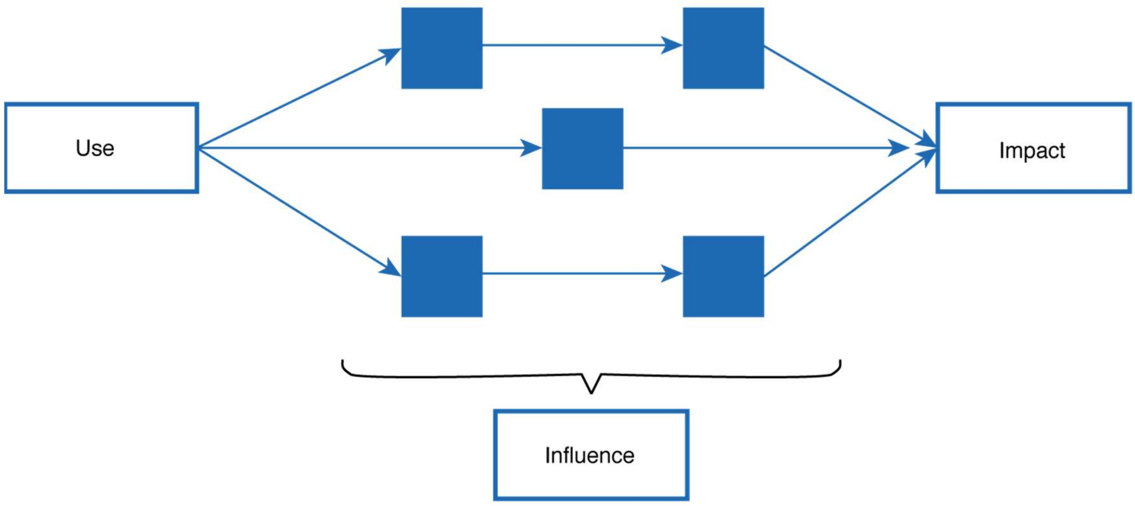
Misuse of indicators

Indicators can also be **misused** or abused when incorrect conclusions are deliberately reached from the data. For instance, indicators showing a cost shift can sometimes be wilfully misinterpreted as a cost savings. ‘Programme exits’ is a common indicator of the success of welfare programmes. However, few systematic attempts are made to discover why people leave welfare programmes, for how long and where they go. In some cases, individuals are merely transferred from one form of income support programme to another. Such misuse of indicators can happen more easily if no additional indicators and information are available to identify this misinterpretation. This behaviour is also sometimes called **deliberate manipulation**, which often appears in the form of underreported negative changes in performance and disproportionally reported positive changes. **Illegitimate suppression** is the most extreme form of a deliberate manipulation and occurs when relevant information is not only underreported but is deliberately not published or made available.

On the distinction between use, influence and impact of indicators

Although the terms 'use', 'influence' and 'impact' tend to be applied interchangeably, they are distinct concepts. The use of an indicator is only the first step in a chain of reactions (influence) that ultimately lead to its impact, which can be desired or undesired (Lehtonen et al., 2016, Sébastien and Bauler, 2013). **Use** relates to the handling of indicators in the policy context, whereas **influence** relates to the effects indicators potentially have on policies. In other words, it encompasses the effects of indicator use, which are likely to have an impact on policy (see ***Figure 3***).

Figure 3: The link between the use, influence and impact of indicators



Source: Eurostat (2017).

While influence relates to the process of changing or confirming the direction of policies, **impact** relates to the potential results stemming from the use of indicators and can be considered in two categories: '**direct intentional**' and '**indirect**'. Indicators can be intentionally developed to change policies (for example, collection of poverty data to force political action against poverty). However, in many cases indicators that were developed a long time ago are still being used for recent political problems. One reason for this is that it takes long to develop indicators, making timely provision of new ones for the political process challenging. Therefore, the observed impacts of indicators are 'typically indirect, unanticipated and systemic' (Lehtonen et al., 2016). The impact of indicators should not be confused with the impact of policies, which indicators can help measure.

The use of an indicator does not automatically imply that it has an influence on decision-making, or that an indicator can only be influential if the decision makers use it. Even when not used actively by any policy actor, an indicator can have an impact on policies and society through various indirect pathways, like, for example, the shaping of public opinion (i.e. conceptual use), which in turn influences policy making. The influence of an indicator can have different forms; for example, it can trigger changes in the targeted policy, as most often happens, or even changes to administrative structures or to the operations of democratic institutions. Such indirect influence can also be caused by indicators used in the decision process, for example when indicators 'open up' discussions instead of being used to provide an answer to important questions or to 'close' discussions.

Making sense of the data

The correct interpretation of an indicator is a challenging task. Some indicators are better suited for some purposes than others. For example, the ecological footprint may be useful for communicating with the public, while it is not suited for taking concrete policy decisions on measures to improve resource efficiency. For users not familiar with indicators or rarely using them, there is always a risk of 'simple' **misinterpretation**. Some might compare values without knowing in which direction the indicator should be interpreted. For instance, it might be difficult to assess if an increase in the Genuine Progress Index[1] for a country means a positive or negative development or what level of improvement would be sufficient or desirable.

Obviously, misinterpretation is not always unintentional. Indicators used in the political process may be intentionally misinterpreted to influence public opinion. For instance, reporting apparently alarmingly significant growth rates of crimes based on very low overall numbers is just one way of using the correct indicators in a misleading way. Another example would be choosing only those indicators that support certain pre-established policy objectives, rather than taking the entire set of indicators in order to provide a 'balanced' view. Obtaining and providing knowledge on the interpretation of indicator results and potential pitfalls in that process is therefore an important strategy against possible misinterpretation, both intentional and unintentional.

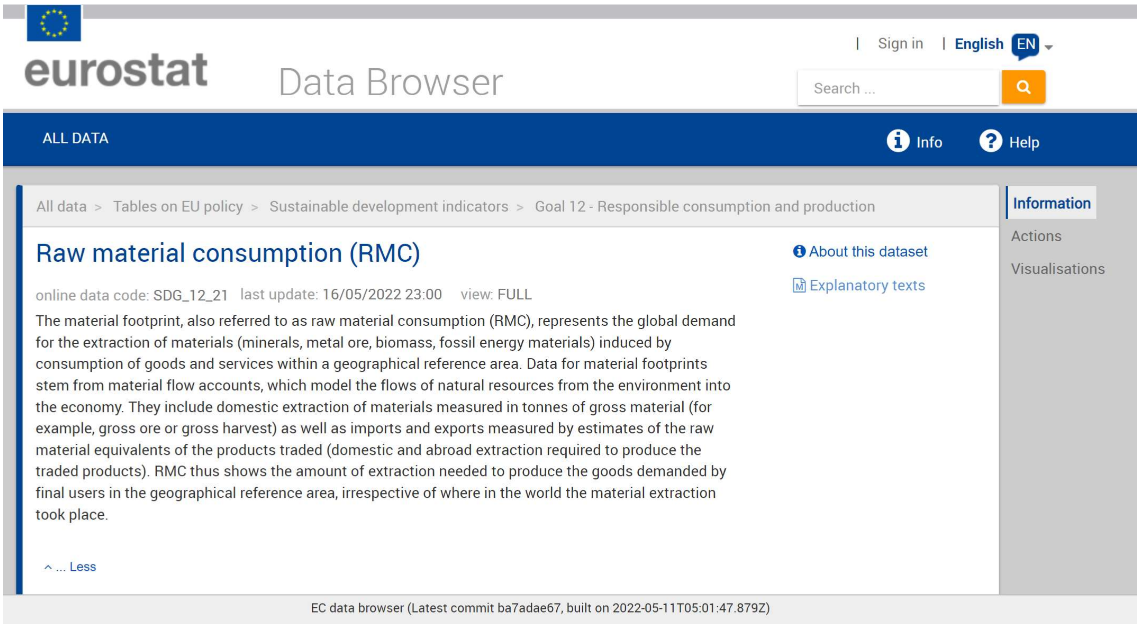
What does an indicator really measure?

Metadata contain essential information needed to understand and effectively use the data. In general, they provide users with background information on data sources, data collection, statistical processing, accessibility and quality. It is important to distinguish between metadata for a specific indicator (see ***Figure 5***) and the metadata for the underlying data set (see ***Figure 6***). In particular, indicator metadata should provide a deeper focus on the context in which the indicator is used (e.g. monitoring a policy strategy) and the exact definition and an explanation of the indicator-specific methodology, information which is normally not included in the metadata of data sets. On the other hand, methodological details on the underlying sources, normally included in metadata for data sets in general, may be less relevant for an indicator-specific documentation.

Metadata for indicators should also provide a concise grading summarising the overall quality of an indicator (see "Eurostat Quality Profile" in ***Figure 5***). It is important that users are able to understand "at a glance" the possibilities and limitations of using indicators, especially when used for decision making. Additionally, since the metadata are usually addressing more specialist users, it is good practice to provide a short description – or **definition** – of an indicator together with the disseminated data, so that users can quickly get a basic understanding of what an indicator is about. ***Figure 4*** shows the short description that is accompanying the statistical data published on the Eurostat website. Together, the short description (***Figure 4***), the indicator metadata (***Figure 5***) and the metadata of the underlying data set (***Figure 6***) should provide a clear understanding of what exactly an indicator is measuring (and the comparability of the data over time and across countries).

[1] The Genuine Progress Index (GPI) measures the economic growth of a country, like GDP, but includes both the positive and negative effects of economic growth in the calculation. An increase in GPI indicates an increase of economic welfare, while a decrease of the value is considered undesirable.

Figure 4: Definition of indicator "Raw material consumption" on the Eurostat website



eurostat Data Browser

| Sign in | English EN

Search ...

ALL DATA Info Help

All data > Tables on EU policy > Sustainable development indicators > Goal 12 - Responsible consumption and production

Information

Actions

Visualisations

Raw material consumption (RMC)

About this dataset

Explanatory texts

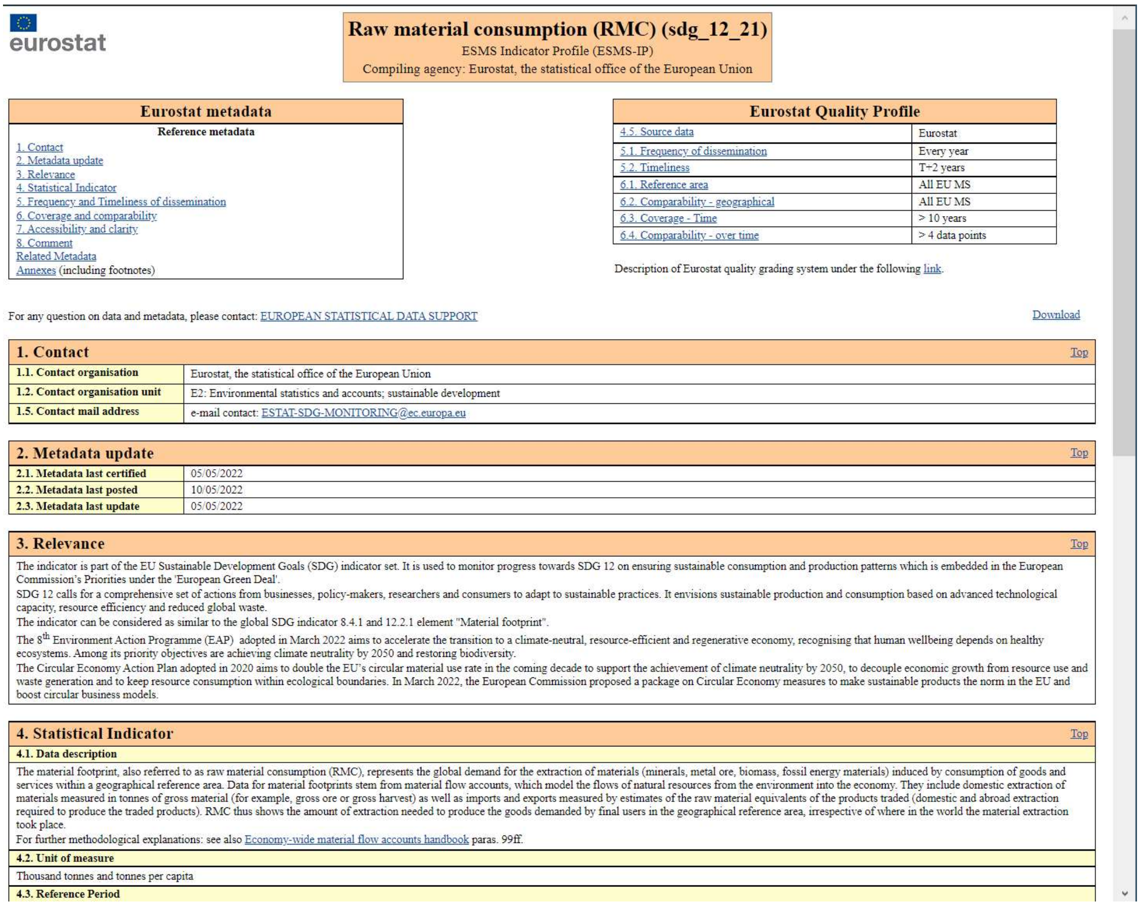
online data code: SDG_12_21 last update: 16/05/2022 23:00 view: FULL

The material footprint, also referred to as raw material consumption (RMC), represents the global demand for the extraction of materials (minerals, metal ore, biomass, fossil energy materials) induced by consumption of goods and services within a geographical reference area. Data for material footprints stem from material flow accounts, which model the flows of natural resources from the environment into the economy. They include domestic extraction of materials measured in tonnes of gross material (for example, gross ore or gross harvest) as well as imports and exports measured by estimates of the raw material equivalents of the products traded (domestic and abroad extraction required to produce the traded products). RMC thus shows the amount of extraction needed to produce the goods demanded by final users in the geographical reference area, irrespective of where in the world the material extraction took place.

^ ... Less

EC data browser (Latest commit ba7adae67, built on 2022-05-11T05:01:47.879Z)

Figure 5: Metadata for indicator "Raw material consumption" on the Eurostat website



eurostat

Raw material consumption (RMC) (sdg_12_21)

ESMS Indicator Profile (ESMS-IP)

Compiling agency: Eurostat, the statistical office of the European Union

Eurostat metadata

Reference metadata

1. Contact
2. Metadata update
3. Relevance
4. Statistical Indicator
5. Frequency and Timeliness of dissemination
6. Coverage and comparability
7. Accessibility and clarity
8. Comment

Related Metadata

Annexes (including footnotes)

Eurostat Quality Profile	
4.5. Source data	Eurostat
5.1. Frequency of dissemination	Every year
5.2. Timeliness	T+2 years
6.1. Reference area	All EU MS
6.2. Comparability - geographical	All EU MS
6.3. Coverage - Time	> 10 years
6.4. Comparability - over time	> 4 data points

Description of Eurostat quality grading system under the following link.

For any question on data and metadata, please contact: EUROPEAN STATISTICAL DATA SUPPORT

Download

1. Contact	Top
1.1. Contact organisation	Eurostat, the statistical office of the European Union
1.2. Contact organisation unit	E2: Environmental statistics and accounts; sustainable development
1.5. Contact mail address	e-mail contact: ESTAT-SDG-MONITORING@ec.europa.eu

2. Metadata update	Top
2.1. Metadata last certified	05/05/2022
2.2. Metadata last posted	10/05/2022
2.3. Metadata last update	05/05/2022

3. Relevance Top

The indicator is part of the EU Sustainable Development Goals (SDG) indicator set. It is used to monitor progress towards SDG 12 on ensuring sustainable consumption and production patterns which is embedded in the European Commission's Priorities under the 'European Green Deal'.

SDG 12 calls for a comprehensive set of actions from businesses, policy-makers, researchers and consumers to adapt to sustainable practices. It envisions sustainable production and consumption based on advanced technological capacity, resource efficiency and reduced global waste.

The indicator can be considered as similar to the global SDG indicator 8.4.1 and 12.2.1 element "Material footprint".

The 8th Environment Action Programme (EAP) adopted in March 2022 aims to accelerate the transition to a climate-neutral, resource-efficient and regenerative economy, recognising that human wellbeing depends on healthy ecosystems. Among its priority objectives are achieving climate neutrality by 2050 and restoring biodiversity.

The Circular Economy Action Plan adopted in 2020 aims to double the EU's circular material use rate in the coming decade to support the achievement of climate neutrality by 2050, to decouple economic growth from resource use and waste generation and to keep resource consumption within ecological boundaries. In March 2022, the European Commission proposed a package on Circular Economy measures to make sustainable products the norm in the EU and boost circular business models.

4. Statistical Indicator Top

4.1. Data description

The material footprint, also referred to as raw material consumption (RMC), represents the global demand for the extraction of materials (minerals, metal ore, biomass, fossil energy materials) induced by consumption of goods and services within a geographical reference area. Data for material footprints stem from material flow accounts, which model the flows of natural resources from the environment into the economy. They include domestic extraction of materials measured in tonnes of gross material (for example, gross ore or gross harvest) as well as imports and exports measured by estimates of the raw material equivalents of the products traded (domestic and abroad extraction required to produce the traded products). RMC thus shows the amount of extraction needed to produce the goods demanded by final users in the geographical reference area, irrespective of where in the world the material extraction took place.

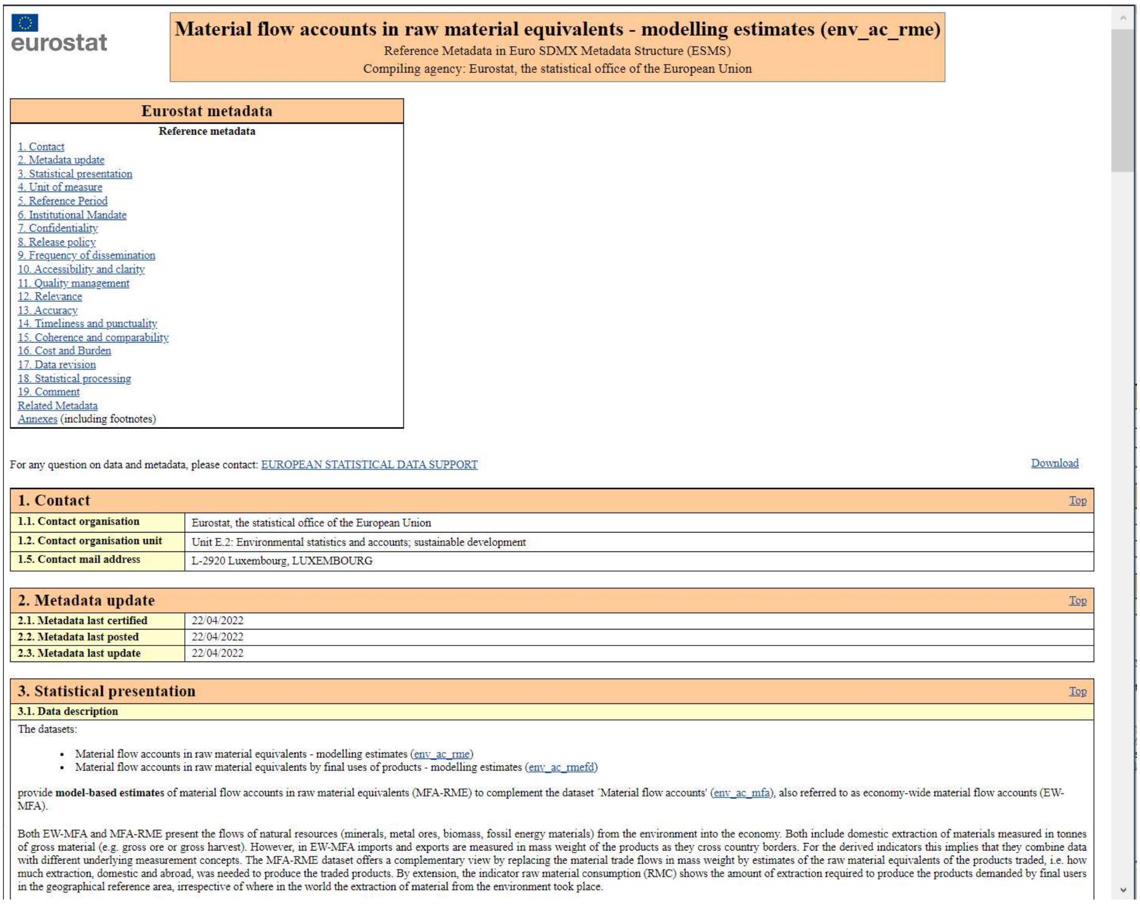
For further methodological explanations: see also Economy-wide material flow accounts handbook paras. 99ff.

4.2. Unit of measure

Thousand tonnes and tonnes per capita

4.3. Reference Period

Figure 6: Metadata for data set "Material flow accounts in raw material equivalents" on the Eurostat website



eurostat

Material flow accounts in raw material equivalents - modelling estimates (env_ac_rme)
Reference Metadata in Euro SDMX Metadata Structure (ESMS)
Compiling agency: Eurostat, the statistical office of the European Union

Eurostat metadata
Reference metadata
1. Contact
2. Metadata update
3. Statistical presentation
4. Unit of measure
5. Reference Period
6. Institutional Mandate
7. Confidentiality
8. Release policy
9. Frequency of dissemination
10. Accessibility and clarity
11. Quality management
12. Relevance
13. Accuracy
14. Timeliness and punctuality
15. Coherence and comparability
16. Cost and Burden
17. Data revision
18. Statistical processing
19. Comment
Related Metadata
Annexes (including footnotes)

For any question on data and metadata, please contact: EUROPEAN STATISTICAL DATA SUPPORT   Download

1. Contact	Top
1.1. Contact organisation	Eurostat, the statistical office of the European Union
1.2. Contact organisation unit	Unit E.2: Environmental statistics and accounts; sustainable development
1.5. Contact mail address	L-2920 Luxembourg, LUXEMBOURG

2. Metadata update	Top
2.1. Metadata last certified	22/04/2022
2.2. Metadata last posted	22/04/2022
2.3. Metadata last update	22/04/2022

3. Statistical presentation   Top

3.1. Data description

The datasets:

- Material flow accounts in raw material equivalents - modelling estimates (env_ac_rme)
- Material flow accounts in raw material equivalents by final uses of products - modelling estimates (env_ac_rmefd)

provide **model-based estimates** of material flow accounts in raw material equivalents (MFA-RME) to complement the dataset ´Material flow accounts' (env_ac_mfa), also referred to as economy-wide material flow accounts (EW-MFA).

Both EW-MFA and MFA-RME present the flows of natural resources (minerals, metal ores, biomass, fossil energy materials) from the environment into the economy. Both include domestic extraction of materials measured in tonnes of gross material (e.g. gross ore or gross harvest). However, in EW-MFA imports and exports are measured in mass weight of the products as they cross country borders. For the derived indicators this implies that they combine data with different underlying measurement concepts. The MFA-RME dataset offers a complementary view by replacing the material trade flows in mass weight by estimates of the raw material equivalents of the products traded, i.e. how much extraction, domestic and abroad, was needed to produce the traded products. By extension, the indicator raw material consumption (RMC) shows the amount of extraction required to produce the products demanded by final users in the geographical reference area, irrespective of where in the world the extraction of material from the environment took place.

Disaggregations can help with interpretation

While the use of a single time series – or even a single data point – might be adequate for contextual and political use (see section 0 above), it is usually insufficient for instrumental use. For example, which decision(s) should a policy maker take based on the knowledge that Romania's employment rate for people aged 20 to 64 was 67.1% in 2021, and that this represents a 6.8 percentage point increase since 2016[2]? Policies aimed at further increasing the employment rate would at least require knowledge about the population groups with relatively low employment rates, since these might contribute most to a further increase of the total employment rate of the country.

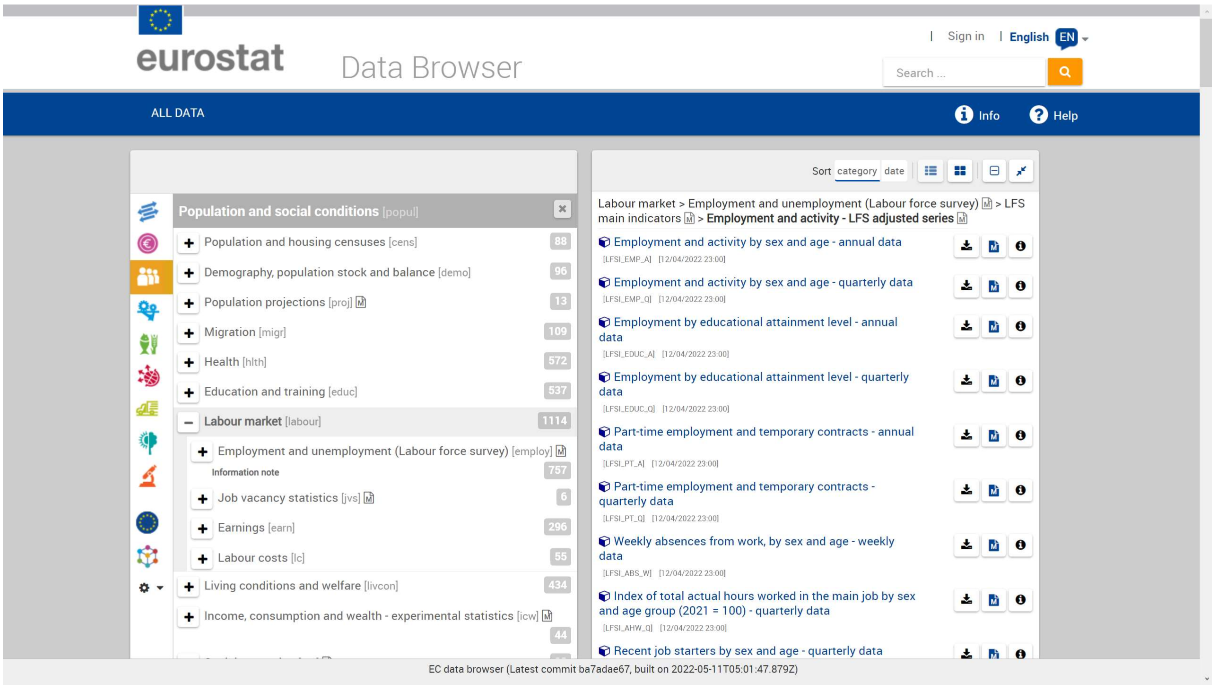
For this purpose, breakdowns exist for most indicators (especially for economic and social data), showing data **disaggregated** by, for example, sex, age, education, citizenship or degree of urbanisation. For example, looking at Romania's employment rate by sex reveals that 77.0% of men but only 56.9% of women were employed in 2021, meaning that the country had the largest gender employment gap across all EU Member States. Such information would indicate towards policy makers that programmes for further increasing the country's employment rate should ideally aim at increasing the labour market participation of women. Additionally, looking at data disaggregated by age group reveals that especially younger women aged 25 to 34 have considerably lower employment rates than their male counterparts, with gaps of 22.0 percentage points (age group 25-

[2] Source: Eurostat (online data code: sdg_08_30).

29) and 24.4 percentage points (age group 30-34)[3]. As such, labour market policies should ideally address the employment situation of younger women.

In the Eurostat database, indicators and their breakdowns can be identified and found by exploring the data navigation tree (see ***Figure 7***), in which data tables are managed in a meaningful categorisation of themes, categories, sub-categories, etc. Alternatively, the “Search” function (see right upper corner in ***Figure 7***) can be used.

Figure 7: Eurostat’s [new data navigation tree](#)



The EU SDG indicator set and related dissemination products

The European Commission is committed to monitoring progress towards the SDGs in the EU context. Since the adoption of the first EU SDG indicator set in May 2017, Eurostat has led the further development of the indicator framework in close cooperation with other Commission services, the European Environment Agency and Member State organisations in the European Statistical System (ESS), involving also Council Committees and Working Parties as well as the civil society.

The EU SDG indicator set is structured along the 17 SDGs and covers the social, economic, environmental and institutional dimensions of sustainability as represented by the Agenda 2030. Each SDG is covered by six main indicators. They have been selected to reflect the SDGs’ broad objectives and ambitions. In the EU SDG indicator set from 2022, thirty-one indicators are ‘multi-purpose’, meaning they are used to monitor more than one goal. This allows the link between different goals to be highlighted (also see section 0 below). Sixty-seven of the current EU SDG indicators are aligned with the UN SDG indicators.

The indicators have been selected to take into account their policy relevance from an EU perspective, availability, country coverage, data freshness and quality. Elements of the 2030 Agenda that are less relevant to the EU internally because they focus on other parts of the world, for instance where targets specifically refer to developing countries, are not considered. The EU SDG indicator set is

[3] Source: Eurostat (online data code: lfsa_ergan)

open to regular reviews to consider new policy developments and include new indicators as methodologies, technologies and data sources evolve over time. The reviews involve many Commission services, European agencies such as the European Environment Agency (EEA), Member State institutions in the ESS, Council Committees and Working Parties as well as the civil society.

Data from the EU SDG indicator set are disseminated via Eurostat's database (see ***Figure 8***) as well as via reports and online tools (see ***Table 1***).

Figure 8: Eurostat's SDG indicator database

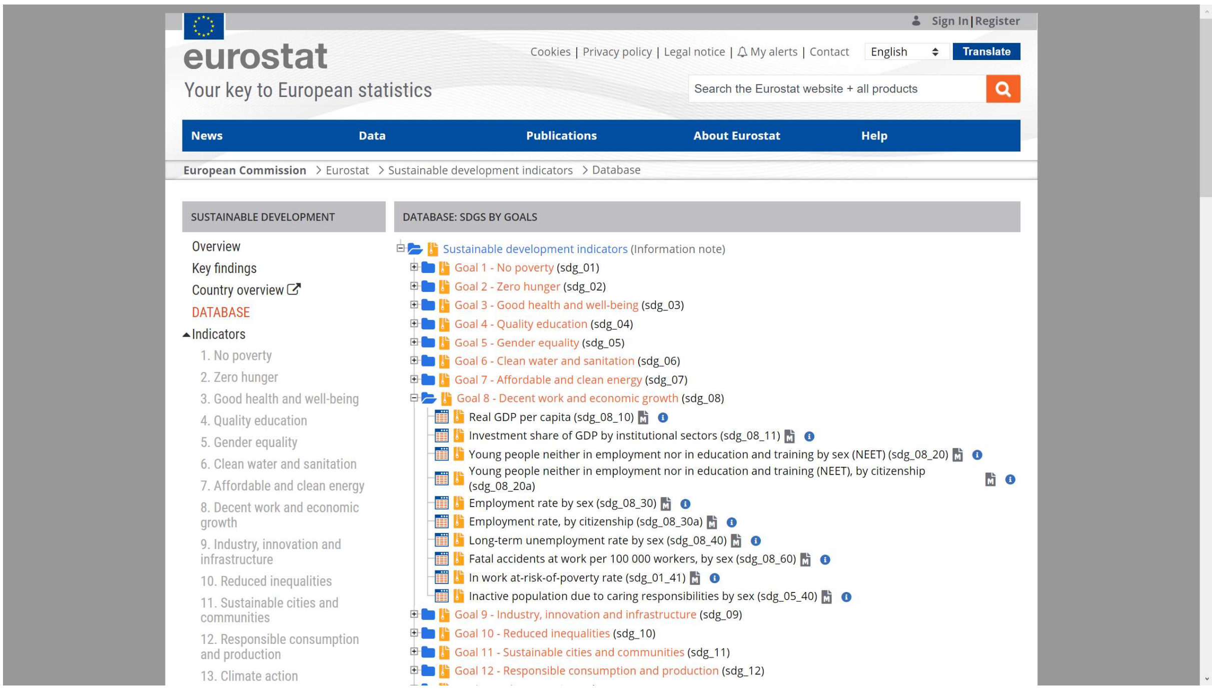
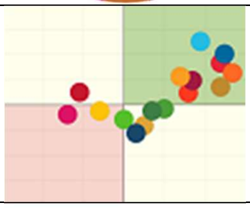


Table 1: Dissemination products related to Eurostat's SDG indicator set

	**SDG monitoring report 2022** Our publication provides a detailed description of the situation in the EU and its Member States, in relation to the 17 SDGs in an EU context.
	**SDGs at a glance** Not much time? Have a look at the 2022 brochure that offers a concise and visual overview of the key findings of the 2022 EU SDG monitoring report.

	Visualise the SDGs Have a look at the new features of our innovative interactive publication 'SDGs & me' and explore and evaluate the situation of your country compared to others for a subset of the EU SDG indicators.
	**Discover the progress of SDGs in the EU** Our visualisation tool will give you a quick overview of the current progress towards each of the SDGs and its sub-goals on an EU level.
	**Compare your country's progress** Do you want to know how your country performs for the SDGs compared to the EU average? Did it make any progress? Our tool will show you!
	**Sustainable development in the European Union** Sustainable development in the European Union is an online Eurostat publication presenting recent statistics on sustainable development in the European Union (EU).

Methods for assessing progress

As mentioned in section 0 above, indicators are used for communicating trends to the broader public and for providing guidance to policy making. While some experts might be able to interpret the raw numbers of an indicator, other audiences might require some additional information to make sense of the data (e.g. to determine whether an employment rate of 70% is already quite high or still insufficient). Especially when quantified targets exist, it is useful to provide some kind of assessment whether a country is currently on track towards these targets or not.

Eurostat's approach for assessing indicator trends

Eurostat's SDG monitoring reports (see ***Table 1*** above) provide an assessment of indicator trends against SDG-related EU objectives and targets. The applied assessment method considers whether an indicator has moved towards or away from the sustainable development objective, as well as the speed of this movement. The method focuses on developments over time and not on the 'sustainability' of the current status ([4]).

Ideally, the trends observed for each indicator would be compared against theoretical trends necessary to reach either a quantitative target set within the political process or a scientifically established threshold. However, this is only possible for a limited number of indicators, where an explicit quantified and measurable target exists. In the remaining cases, Eurostat applies a transparent and simple approach to avoid ad hoc value judgments. The two approaches are explained in more detail in sections 0 and 0 below.

Eurostat visualises the assessment of indicator trends in the form of coloured arrows (see ***Table 2***). The direction of the arrows shows whether the indicators are moving in a sustainable direction or not. This direction does not necessarily correspond to the direction in which an indicator is moving. For example, a reduction of the long-term unemployment rate, or of greenhouse gas emissions, would be represented with a green upward arrow, as reductions in these areas mean progress towards the sustainable development objectives.

Table 2: Assessment categories and associated symbols used in Eurostat's SDG monitoring reports

Symbol	With quantitative target	Without quantitative target
	Significant progress towards the EU target	Significant progress towards SD objectives
	Moderate progress towards the EU target	Moderate progress towards SD objectives
	Insufficient progress towards the EU target	Moderate movement away from SD objectives
	Movement away from the EU target	Significant movement away from SD objectives
:	Calculation of trend not possible (e.g. time series too short)	

([4]) The following study discusses and analyses the differences in assessment methods of status (in a given year) and progress (change over time) for the EU Member States: Hametner, M., Kostetckaia, M. (2020), *Frontrunners and laggards: How fast are the EU member states progressing towards the sustainable development goals?*, Ecological Economics 177.

Method 1: Indicators without quantitative targets

In the absence of a quantified target, it is only possible to compare the indicator trend with the desired direction. An indicator is making progress towards the SD objectives if it moves in the desired direction, and is moving away from the SD objectives if it develops in the wrong direction. The assessment is generally based on the 'compound annual growth rate' (CAGR) formula, which assesses the pace and direction of an indicator trend. The CAGR formula uses the data from the first and the last years of the analysed time span and is used to calculate the average annual rate of change of the indicator (in %) between these two data points:

$$(1)\ CAGR = \left(\frac{y_t}{y_{t_0}}\right)^{\frac{1}{t-t_0}} - 1$$

whereby: t_0 = base year, t = most recent year, y_{t0} = indicator value in base year, y_t = indicator value in most recent year

The trend assessment is based on comparing the calculated growth rate of an indicator with a certain threshold, which Eurostat has set at 1 % growth per year. The 1 % threshold is easy to communicate, and Eurostat has used it in its monitoring reports for more than 10 years. It is discerning enough to ensure there is a significant movement in the desired direction (Eurostat, 2021). ***Table 3*** shows the applied thresholds and the resulting symbols.

Table 3: Thresholds for assessing trends of indicators without quantitative targets used by Eurostat

Growth rate (CAGR) in relation to desired direction	Symbol
≥ 1 %	↑
< 1 % and ≥ 0 %	↗
< 0 % and ≥ - 1 %	↘
< - 1 %	↓

Other countries and studies use different thresholds than Eurostat, e.g. 3% instead of 1%, especially since at country level more variation in the indicator development can be expected than at the aggregate EU level (Eurostat, 2014, Hametner and Kostetckaia, 2020, Hametner, 2022).

Method 2: Indicators with quantitative targets

The assessment of trends for indicators with targets is based on the CAGR described above and also takes into account concrete targets set in relevant EU policies and strategies. In this case, the actual (observed) growth rate is compared with the (theoretical) growth rate that would have been required up to the most recent year for which data are available in order to meet the target in the target year. This comparison consequently does not take into account projections of possible future developments of an indicator. The calculation of actual and required indicator trends is based on the CAGR formula and includes the following three steps:

1. Actual (observed) growth rate:

(2a) $$CAGR_a = \left(\frac{y_t}{y_{t_0}}\right)^{\frac{1}{t-t_0}} - 1$$

whereby: t_0 = base year, t = most recent year, y_{t0} = indicator value in base year, y_t = indicator value in most recent year

2. Required (theoretical) growth rate to meet the target:

(2b) $$CAGR_r = \left(\frac{x_{t_1}}{y_{t_0}}\right)^{\frac{1}{t_1-t_0}} - 1$$

whereby: t_0 = base year, t_1 = target year, y_{t0} = indicator value in base year, x_{t1} = target value in target year

3. Ratio of actual and required growth rate:

(2c) $$R_{a/r} = \frac{CAGR_a}{CAGR_r}$$

The calculated $R_{a/r}$ ratio is then compared against pre-defined thresholds in order to determine the assessment result (see ***Table 4***). Again, other organisations such as the Sustainable Development Solutions Network (SDSN) use different thresholds (Sachs et al., 2021).

Table 4: Thresholds for assessing trends of indicators with quantitative targets as used by Eurostat

Ratio of actual and required growth rate	Symbol
≥ 95 %	↑
< 95 % and ≥ 60 %	↗
< 60 % and ≥ 0 %	↘
< 0 %	↓

Other approaches for assessing progress

In addition to the methods described above, it could be of interest (when analysing indicators with targets) to consider the **time-lag of a trend** or to indicate **when a given target will actually be reached** at the current growth rate.

Time-lag compared to target path

The so-called "**S-time-distance method**"[5] measures the distance in time (in the horizontal dimension) between two time series when reaching a specific level. Comparing, for instance, the time-lag of an indicator to its theoretical target path reveals when (at which year) the current level should already have been achieved in order to be "on track" to meeting the target, or, in other words, how many years the indicator lags behind its target path.

This method can be used for indicators (with targets) that comply with the following two rules:

- they have moved in the favourable direction since the base year but with a significant distance compared to the target path, and
- their progression started to be in line with the target path in the first years but the pace has slowed down (compared to the target path) or stopped in recent years (i.e. the gap between the target path and the actual indicator trend is widening)

The time-lag (TL), i.e. the amount of years behind/in front of target path, can be calculated by using the following formula (*Note: negative values indicate "behind target path"*):

(3) $$TL = \frac{\log\left(\frac{y_t}{y_{t_0}}\right)}{\log(1 + CAGR_r)} - (t - t_0)$$

whereby: t_0 = base year, t = most recent year, y_{t0} = indicator value in base year, y_t = indicator value in most recent year, $CAGR_r$ = required annual growth rate (see formula 2b above).

Year when target will be reached

Moreover, a method may be applied that calculates **the year when the target will be reached at the current annual growth rate**, that is, the year the targeted level will be met if the observed growth rate is sustained. This method makes use of the "S-time-distance method" described above, i.e. it calculates the projected time lag of an indicator in the year the target level is reached.

This method can be used for indicators (with targets) that comply with the following two rules:

- they have moved in the favourable direction since the base year but with a significant distance compared to the target path, and
- their growth rate (CAGR) remained stable since the base year, but at a lower pace than the target path.

The year when target will actually be reached (YTR) if the average annual growth rate observed so far is sustained in the future can be calculated by using the following formula:

(4) $$YTR = \frac{\log\left(\frac{x_{t_1}}{y_{t_0}}\right)}{\log(1 + CAGR_a)} + t_0$$

[5] Pavle Sicherl (2007), *Time Distance Method for Analysing and Presenting Indicators*, Contribution to the "Virtual Indicator Expo" of the Beyond GDP Conference (19-20 November 2007, Brussels).

whereby: t_0 = base year, t_1 = target year, y_{t0} = indicator value in base year, x_{t1} = target value in target year, $CAGR_a$ = actual annual growth rate (see formula 2a above).

Both results from formulas (3) and (4) have to be interpreted with care, in particular as regards the decimal places: A result of 2012.6 for YTR, for instance, means that the target will be reached in the year 2012 ("mid 2012" would be the precise date). The number of years resulting from TL has to be interpreted with reference to the latest year until data is available (*t*), for example "*in 2021, the EU was about 1.5 years behind its target path*".

Average (linear) annual growth rate (AAGR)

The compound annual growth rate (CAGR) presented above assumes, as its name suggests, an exponential development of an indicator trend between the two years used for the calculation (the formula originally comes from finance, where it is used to calculate compound interest rates of investments and savings). While it is used by Eurostat and statistical offices in Europe (Eurostat, 2014), other organisations such as the SDSN prefer to use formulas assuming a linear development between the two observed data points (Sachs et al., 2021). The average annual growth rate (AAGR) describes such linear development and can be calculated as follows:

(5) $$AAGR = \frac{y_t - y_{t0}}{t - t_0}$$

whereby: t_0 = base year, t = most recent year, y_{t0} = indicator value in base year, y_t = indicator value in most recent year.

In contrast to the CAGR formula above, which calculates the change of an indicator in "% per year" irrespective of the unit in which the indicator is given, the result of the AAGR calculation is **in the same unit as the indicator itself**. Growth rates calculated with the AAGR formula thus cannot be compared across different indicators (while this is the case for the CAGR). By replacing y_t and t in formula (5) with the target value and the target year, the growth required to meet the target can be calculated. The ratio of actual and required AAGR can then be calculated using formula (2c) above.

Analysing SDG interlinkages

The 2030 Agenda for Sustainable Development represents a complex holistic challenge. Understanding the nature of interlinkages between the SDGs and their scope is key to unlocking their full potential as well as ensuring that progress in one area is not made at the expense of another. Hence, investigating trade-offs and synergies emerging from relationships between the goals is crucial for achieving long-lasting sustainable development outcomes.

Interlinkages can be identified as positive (**synergies**) or negative (**trade-offs**). Trade-offs are negative interactions between different SDGs, indicators and targets when improvements in one dimension can constrain progress in another dimension. If achieving economic growth requires higher resource and energy consumption, it can create a trade-off between SDG 8 and SDGs 12 and 7. In contrast, synergies are positive interactions between goals, indicators and targets, meaning that achieving one target, such as a 20 % share of renewable energy in the EU, can also help to achieve another target, such as reducing greenhouse gas (GHG) emissions.

Common approaches for assessing SDG interlinkages

Several attempts have been made by international organisations and academics to assess interlinkages – synergies and trade-offs – between the SDGs and corresponding indicators. In general, studies agree that there are many more synergies between the goals than trade-offs, and that it is important to identify the positive and negative interlinkages in order to design the most efficient policy actions for delivering on the SDGs. However, the interlinkages strongly depend on the method and data used and on the geographical scope of the report (meaning whether the interlinkages are analysed on country, region or world level). A study by the European Commission's Joint Research Centre (JRC) revealed five main approaches to identify interlinkages between the SDGs (Miola et al., 2019):

- linguistic (i.e. based on the wording of the targets);
- literature review;
- expert judgement;
- quantitative analysis; and
- modelling complex system interactions.

Most quantitative methods (except for simulations) require relatively little time for application but necessitate specialised knowledge and computer support. In contrast, most qualitative methods (such as expert judgment and literature review) tend to be easier to apply but are more time demanding. Usually, a combination of methods (qualitative and quantitative) can provide the most robust information on interactions (Horvath et al., 2022). In the following, two of the most common approaches – a quantitative and a qualitative one – are presented.

Quantitative approach: correlation analysis

Correlation analysis, in particular **Spearman's rank correlation analysis**, is a prominent approach for quantitatively identifying SDG interlinkages. Spearman's rank-order correlation coefficient evaluates the strength of an association between two variables (Spearman, 1904) and has been used in several studies on SDG interlinkages (Kostetckaia and Hametner, 2022, Kroll et al., 2019, Miola et al., 2019, Pradhan et al., 2017, Ronzon and Sanjuan, 2019, Warchold et al., 2021). Spearman's rank correlation is usually chosen over Pearson's correlation due to its suitability for monotone non-linear relationships and low sensitivity to outliers (Hauke and Kossowski, 2011).

Eurostat's SDG monitoring reports also apply correlation analysis (Spearman's rank order correlation) for assessing the interlinkages between the 17 goals at EU level. In these reports, the correlation analysis is carried out across all indicator pairs with more than three common data points in the time series, using Member States' annual data from 2009 onwards. A correlation between an indicator pair is considered significant (and sufficiently strong) if its *p*-value is below 0.1 and if its correlation coefficient is above or below the threshold of ±0.5. If the correlation coefficient is above 0.5, it is considered a positive interlinkage (synergy), while coefficients below -0.5 are considered a negative interlinkage (trade-off). Indicator pairs with a correlation coefficient between -0.5 and 0.5 or with a *p*-value above 0.1 are labelled as non-correlations. The results are then aggregated over all countries at SDG level, to determine the share of synergies, trade-offs and non-correlations at EU level.

It is important to keep in mind that **correlation does not necessarily imply causality**. For example, it is obvious that the positive correlation between the sales of ice cream and the sales of sunglasses does not reflect a causal relationship. Instead, both variables are likely driven by an independent third variable, namely weather. Similarly, a negative correlation between the two variables does not always mean that there is a causal link. Increase in ice cream sales (positive trend) and increase in deaths by drowning (negative trend) are also likely driven by good weather.

Nevertheless, even though a significant correlation between two indicators does not imply that the indicators are causally linked, correlation analysis is still helpful in quantitatively assessing whether improvements in one SDG coincide with improvements in other SDGs (Pradhan et al., 2017). Moreover, if the correlation analysis is applied to many countries – as is done in Eurostat's SDG monitoring reports – and a specific synergy or trade-off is found repeatedly, it is likely that it does not appear by chance.

Qualitative approach: expert judgment

As mentioned above, significant correlations do not imply the existence of a causal relationship between two indicators. While Eurostat and other scholars attempt to counterbalance this with a large amount of data (i.e. many countries), analysing interlinkages for a single country requires a different approach. In this case, it would be more appropriate to apply a qualitative approach such as **expert judgement** instead of or in addition to correlation (or other quantitative) analysis. While setting up an expert panel is more time consuming than correlation analysis (and requires a larger group of people to be involved), the resulting interlinkages are able to represent causal relationships (according to the current state of knowledge).

One of the most prominent approaches for identifying interlinkages via expert judgment was developed by Måns Nilsson and colleagues for the International Council for Science (Nilsson et al., 2016, Nilsson et al., 2018). They established a seven-point scale for judging the interactions between SDG targets (see ***Figure 9***), ranging from "indivisible" (i.e. progress on one target automatically delivers progress on another) through "consistent" (i.e. there is no significant link between two targets' progress) to "cancelling" (i.e. progress on one target automatically leads to a negative impact on another) (Nilsson et al., 2018). In addition to assessing the type or strength of an interaction, the experts would need to provide information on (1) the directionality of the interaction, i.e. whether one indicator is the driving force behind developments in the other, or if they are bidirectional, (2) the time horizon that interlinkages would unfold in (immediately, short term or long term), (3) whether trade-offs are reversible through governance, and (4) whether trade-offs are reversible through technology. Depending on the composition of the expert panel, it might make sense to corroborate the identified interlinkages via literature review.

Figure 9: Seven types of interactions between SDG targets; source: Nilsson et al. (2016)

GOALS SCORING
The influence of one Sustainable Development Goal or target on another can be summarized with this simple scale.

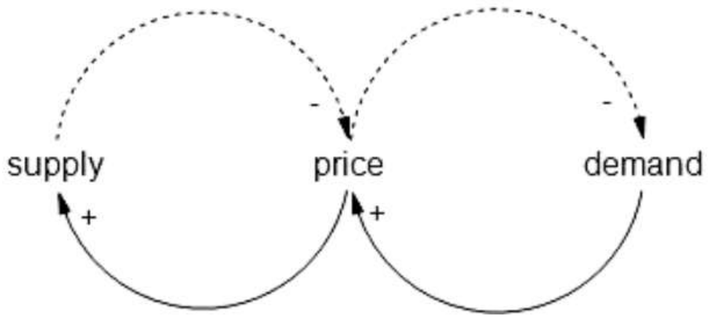
Interaction	Name	Explanation	Example
+3	Indivisible	Inextricably linked to the achievement of another goal.	Ending all forms of discrimination against women and girls is indivisible from ensuring women's full and effective participation and equal opportunities for leadership.
+2	Reinforcing	Aids the achievement of another goal.	Providing access to electricity reinforces water-pumping and irrigation systems. Strengthening the capacity to adapt to climate-related hazards reduces losses caused by disasters.
+1	Enabling	Creates conditions that further another goal.	Providing electricity access in rural homes enables education, because it makes it possible to do homework at night with electric lighting.
0	Consistent	No significant positive or negative interactions.	Ensuring education for all does not interact significantly with infrastructure development or conservation of ocean ecosystems.
–1	Constraining	Limits options on another goal.	Improved water efficiency can constrain agricultural irrigation. Reducing climate change can constrain the options for energy access.
–2	Counteracting	Clashes with another goal.	Boosting consumption for growth can counteract waste reduction and climate mitigation.
–3	Cancelling	Makes it impossible to reach another goal.	Fully ensuring public transparency and democratic accountability cannot be combined with national-security goals. Full protection of natural reserves excludes public access for recreation.

While the weakness of correlation analysis is that it might find correlations that are not causally linked, the expert judgment approach might result in (theoretical) causal relationships that are not confirmed by data. This might be the case when the identified linkage is context-dependent (i.e. the influence might only occur in very specific situations) or when other, third variables have an at least equally strong influence on an SDG target. For example, while it is usually expected that economic growth leads to higher employment, trends in labour productivity might distort this relationship, leading to “jobless growth” (i.e. when economic growth does not create additional jobs).

Using causal loop diagrams for visualising SDG interlinkages

So-called causal loop diagrams (CLDs) allow visualising the interdependencies between different variables at the same time, offering a more systemic view on how different SDG targets reinforce and balance each other. ***Figure 10*** shows an example of a CLD that illustrates the interdependencies between prices, supply and demand. Positive relationships, meaning that an increase in one variable results in an increase in another one, are tagged with a plus sign, while negative relationships are tagged with a minus.

Figure 10: Example of a causal loop diagram (CLD) with three variables (price, supply and demand)

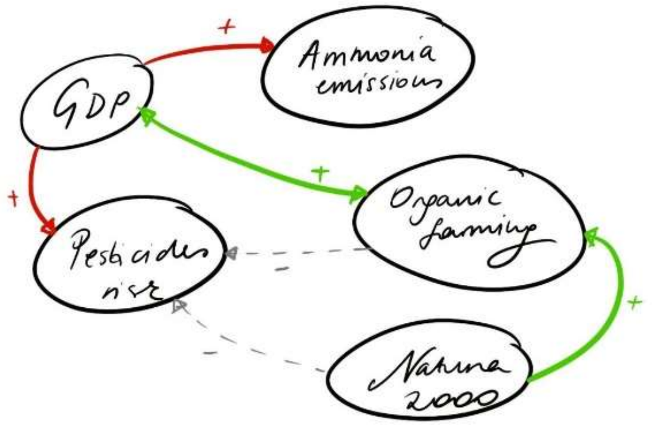


When using CLDs for visualising interlinkages, it is **important to not confuse positive and negative relationships with synergies and trade-offs**. The assessment of the relationship only refers to whether an increase in one variable leads to an increase in another one (and vice versa) without taking into account the desired direction in which a variable should ideally evolve from an SDG point of view. The following three examples help to explain the difference:

- **GDP and employment:** an increase in GDP leads to an increase in the employment rate, which therefore constitutes a positive relationship. At the same time, this positive relationship also constitutes a synergy, since both variables should increase from an SDG point of view.
- **GDP and material consumption:** an increase in GDP is usually associated with increased material consumption (and vice versa), which therefore constitutes a positive relationship. However, from an SDG point of view this positive relationship constitutes a trade-off, since GDP should increase while material consumption should decrease.
- **Renewable energy and greenhouse gas emissions:** an increase in the share of renewable energy leads to a reduction in greenhouse gas emissions, which therefore constitutes a negative relationship. Here, this negative relationship constitutes a synergy, because from an SDG point of view renewable energy sources should increase while greenhouse gas emissions should decrease.

It might therefore make sense to use different colours for the interdependencies, depending on whether they constitute a synergy or a trade-off. *Figure 11* shows an example CLD from applying a combination of correlation analysis and expert judgment for assessing SDG interlinkages in Austria (not yet published), with synergies coloured in green, trade-offs coloured in red and relationships claimed by the experts but not confirmed by the data shown grey (and with dotted lines).

Figure 11: Example for visualising SDG interlinkages with a causal loop diagram



Further reading

Eurostat (2014), *Getting messages across using indicators - A handbook based on experiences from assessing Sustainable Development Indicators*

Eurostat (2014), *Towards a harmonised methodology for statistical indicators — Part 1: Indicator typologies and terminologies*

Eurostat (2017), *Towards a harmonised methodology for statistical indicators — Part 2: Communicating through indicators*

Eurostat (2017), *Towards a harmonised methodology for statistical indicators — Part 3: Relevance for policy making*

Eurostat (2022), *Sustainable development in the European Union — 2022 monitoring report on progress towards the SDGs in an EU context*

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