The methodology for assessing the EU Member States status and progress towards SDGs

This document describes in detail the approach applied for the SDG status and progress calculations of EU Member States (MSs). The results of these calculations are presented in a dedicated chapter of the SDG monitoring report (MR) and in the Commission's European Semester country reports. The chapter 'Selection of indicators' outlines the adjustments made for the 2023 evaluation exercise in cases when country data are not available for at least two-thirds of the indicators at goal level.

Definitions

The **status** of each SDG in a MS is an aggregation of all the indicators of a specific goal relative to the other MS and the EU average, based on the most recent available data. In contrast, the **progress** score of a MS is based on the average annual growth rates of all assessed indicators in each SDG over the past five years. The progress calculation is identical to the evaluation approach used for the EU throughout the MR, such as for calculating the EU's aggregated progress at goal level that is presented in the MR synopsis. **In short, a country's status thus refers to a snapshot of its SDG performance relative to all other MSs for a single year** (it is important to keep in mind that the most recent year differs between indicators and might also differ between countries for the same indicator, depending on data availability). On the other hand, **a country's progress score is an absolute temporal assessment over the most recent five-year period** that is not influenced by the performance of other MSs.

The status calculation requires relative data that are comparable across countries (e.g. in % or per capita), while the progress can be calculated with both relative and absolute data. In a few cases, the status and progress calculations for the same indicator are consequently based on different units (e.g. data in % for the status calculation, and data in million people for the progress calculation) ([1]). In order for the status and progress scores to be based on the same data sources, indicators with only one year of available data are excluded from both calculations.

Calculation of status score

A country's status score of a specific SDG is a composite index encompassing all of that goal's indicators, based on the most recent available data. For each indicator, a country's status score is calculated relative to the range of values from the worst to the best performing country, whereby the worst country gets a score of 0 and the best country a score of 100. For each country, the status scores at indicator level are then aggregated at SDG level using the arithmetic mean, and this goal-

level score is then put in relation to the EU aggregate status score of the same goal, to show how much (in %) a country's SDG status is above or below the EU average. The status calculation involves the following steps:

STEPS AT INDICATOR LEVEL

1) Determination of desired direction: in order to be able to distinguish between the best and the worst country, it is required to determine whether higher or lower indicator values are better, i.e. whether an indicator should increase or decrease from an SDG point of view. This information is usually available from the EU-level assessments in the MR.

2) Checking data availability and comparability: in the next step, it needs to be checked whether the data are available in a relative unit that allows comparing different countries (e.g. in %, per capita, etc.). If this is not the case, it needs to be checked whether relative data can be retrieved from another Eurobase table or calculated manually (e.g. dividing the data by population). Then, the most recent available data (year) needs to be checked for each country, and decided if for individual countries an earlier year needs to be used. For example, it might be the case that for an indicator 2021 data are available for most countries, while for a few countries 2020 data need to be used instead due to missing 2021 values.

In case a country's data availability is significantly worse than for other countries (e.g. most recent data refers to 2011, while most other countries have data up to 2021), this country is excluded from the status calculations (i.e. it is treated like country data for this indicator are not available). In case country data are missing for an indicator (see e.g. the three water quality indicators in SDG 6), the subsequent steps described below are performed on the available data from the remaining countries. There are no procedures in place to estimate data for missing countries.

3) Exclusion of outliers: outliers with extreme values can distort the status calculation, especially for those countries whose rank (based on the data) is very close to the outlier country. Outliers – both on the top and the bottom of the country distribution – thus need to be excluded from the calculation. If outliers are detected, they are assigned the best/worst status score (100 or 0), and the status calculation (see next step) is only performed for the remaining country values. Outliers are identified by means of the interquartile range (IQR) method ([2]). This method involves calculating the first and third quartiles of the country distribution, with the IQR representing the difference between these two values. The boundaries for identifying outliers are then determined by multiplying the IQR by the factor two and by subtracting/adding these values from/to the first/third quartile, respectively. Values below/above these thresholds are considered outliers and are excluded during indexing, meaning that countries identified as outliers with this method are assigned the value of the next best/worst country for the indexing. Table **1** illustrates the IQR calculations using the indicator sdg_01_10 'at risk of poverty and social exclusion' (AROPE) as example.

Table 1: IQR calculations for AROPE (sdg_01_10)

Values	Description
17.3	First quartile
22.7	Third quartile
6.5	Lower bound (= Q1 minus two times the difference between Q1 and Q3)
33.4	Upper bound (= Q3 plus two times the difference between Q1 and Q3)
1	# Outliers identified (here: Romania with a value of 34.4)

4) Calculation of countries' indicator status score: after outliers in the country distribution have been identified and excluded, the indicator status scores of the countries are calculated with a min-max-normalisation approach:

Eq. 1a $\quad X_{ic} = \frac{x_{ic} - min_i\{x_{ic}\}}{max_i\{x_{ic}\} - min_i\{x_{ic}\}} * 100$

Eq. 1b $\quad X_{ic} = \frac{max_i\{x_{ic}\} - x_{ic}}{max_i\{x_{ic}\} - min_i\{x_{ic}\}} * 100$

where X_{ic} is the normalised value of indicator x_{ic}, with i being the indicator, c the country, and max_i and min_i being the maximum and minimum values of the indicator across all MSs for the most recent year of available data. In line with Step 1 (see above), equation (1a) is used when higher indicator values are better (e.g. employment rate), while equation (1b) is used when lower values are better (e.g. greenhouse gas emissions per capita). Indicator status scores for the aggregate EU level are calculated in the same way, using the EU aggregates for each indicator from the Eurostat database, and are later used (see step 6 below) to calculate a country's status relative to the EU status. For each indicator, the status scores range from 0 (worst country) to 100 (best country).

STEPS AT GOAL LEVEL

5) Calculating average status score at goal level: for each country (and for the EU aggregate), the average status at goal level is calculated as the simple (arithmetic) mean over all indicators of that goal (including multi-purpose indicators). The status at goal level is only calculated if country data are available for at least two-thirds of this goal's indicators. If this share is below this threshold, the respective SDG is not shown in the country's status/progress chart.

6) Calculating status relative to EU: in the final step, a country's status score at goal level is divided by the EU's status of the same goal. This results in a figure expressed in % that illustrates how much a country's goal status is above or below (i.e. better or worse than) the EU status. In the example shown in Figure 1, the fictitious country's status for SDG 16 is 15 % above (i.e. better than) the EU.

Figure 1: Example calculation of the status score for SDG 16 for a fictitious country
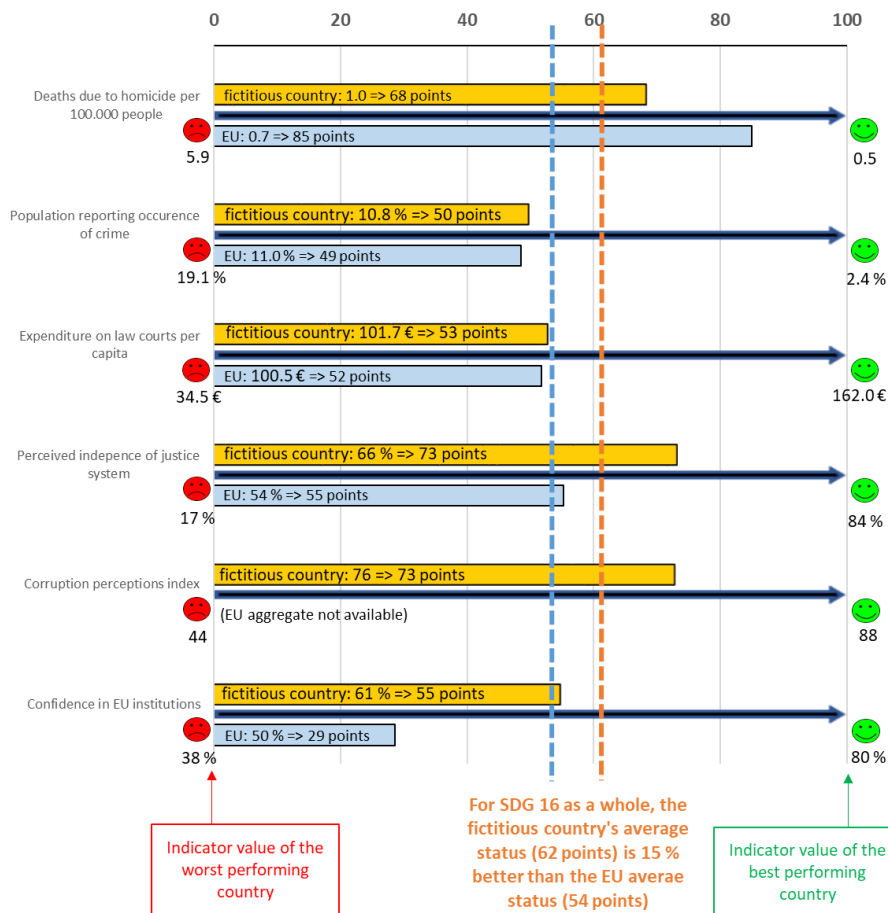
Note: the best and worst country values exclude outliers identified by means of the interquartile range (IQR) method, for example for expenditure on law courts.

Calculation of progress score

Progress is an aggregate score of the short-term (five-year) growth rates for all of the indicators assessed for each goal. The methodology uses a scoring function and is identical to the calculation of progress at EU level for indicators without quantitative targets, resulting in values between -5 (strong unsustainable trends) and +5 (strong sustainable trends), with 0 meaning no movement in either direction. It is important to note that the progress score calculation at MS level does not take into account any target values, since most EU policy targets are only valid for the aggregate EU level. The progress calculation involves the following steps:

STEPS AT INDICATOR LEVEL

1) Determination of desired direction: this step is identical to step 1 of the status calculation (see above) and is based on the EU-level assessments in the MR.

2) Checking data availability: in the next step, it needs to be checked whether a sufficiently long time series is available for each country to perform the growth rate (CAGR) calculation (see below), and whether the comparability of data within a country's time series is affected by breaks in time series. As a result of these checks, the time series used for a country might differ from other countries, for example using 2015-2020 data instead of 2016-2021 (in case the available time series ends in 2020 instead of 2021), or using a longer or short time series (e.g. past 3 or 4 years, or past 6 or 7 years ([3])) to account for breaks or data gaps in the time series.

In contrast to step 2 for the status calculation (see above), the comparability of data between countries (i.e. using relative data) is not an issue for the progress calculation (and therefore, also the detection of outliers in the MS distribution is not required), since the calculation is performed independently for each country. Instead, the progress calculation usually uses the same data (unit) that is used for the indicator evaluation at EU level. This means that for some indicators, the progress score calculation is based on a different unit than the status calculation. For example, for primary and final energy consumption (sdg_07_10 and sdg_07_11), the progress calculation is based on absolute data (million tonnes of oil equivalent), whereas the status calculation is based on relative data (tonnes of oil equivalent per capita).

3) Calculating the compound annual growth rate (CAGR): once the two data points for the progress calculation have been fixed for each country, the compound annual growth rate (CAGR) is calculated with the following formula:

Eq. 2 $$CAGR = \left(\frac{y_t}{y_{t_0}} \right)^{\frac{1}{t-t_0}} - 1$$

where t_0 = base year, t = most recent year, y_{t0} = indicator value in base year, y_t = indicator value in most recent year. At this stage, some countries' progress scores need to be manually adjusted, for example when a country has already achieved the maximum possible value of an indicator (e.g. 100 % of young children participating in early childhood education) and has maintained this level over time. Also, the CAGR calculation is not possible in case the value in the base year (t_0) is zero, and it delivers wrong results when one of the values is negative and the other one is positive. In all these cases, the CAGR is manually set to + 100 % or – 100 %, depending on the desired direction of an indicator (as defined in step 1).

4) Transformation of growth rates into scores: the calculated indicator growth rates are then transformed using the transformation function illustrated in **Figure 2**. This scoring function is identical to the one used for calculating aggregated goal-level scores at EU level (for indicators without targets). The scoring function is a linear transformation, with cut-off points set at growth rates (CAGR) of 2.0 % and – 2.0 %. Indicators with a growth rate of exactly 0.0 % receive a score of 0. Indicators with growth rates of 2.0 % or above in the desired direction receive a score of + 5, indicators with growth rates of 2.0 % or above in the wrong direction receive a score of – 5.

Figure 2: Scoring function for indicators without quantitative target
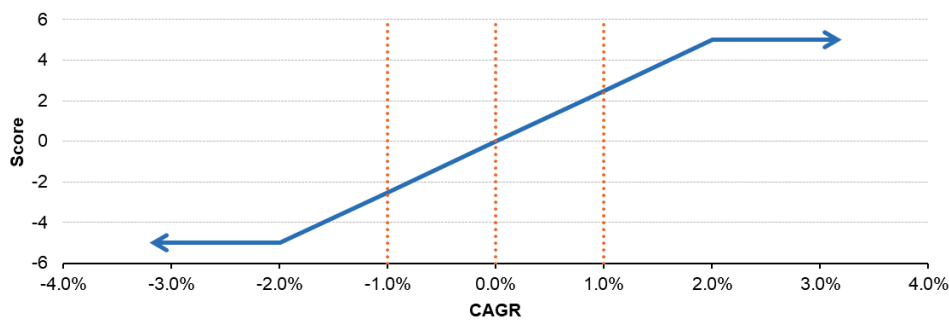
STEPS AT GOAL LEVEL

5) Calculating average progress score at goal level: for each country, the average progress at goal level is calculated as the simple (arithmetic) mean over all indicators of that goal (including multi-purpose indicators). The progress at goal level is only calculated if country data are available for at least two-thirds of this goal's indicators. If this share is below this threshold, the respective SDG is not shown in the country's status/progress chart. Figure 3 presents an example of the calculation of the progress score for a fictitious country and a fictitious goal containing four indicators (for all of which an increase is the desired direction). It shows how the indicator growth rates are transformed into scores between +5 and – 5 that are then averaged at SDG level to calculate a country's goal-level progress score.

Figure 3: Example calculation of the progress score for a fictitious country
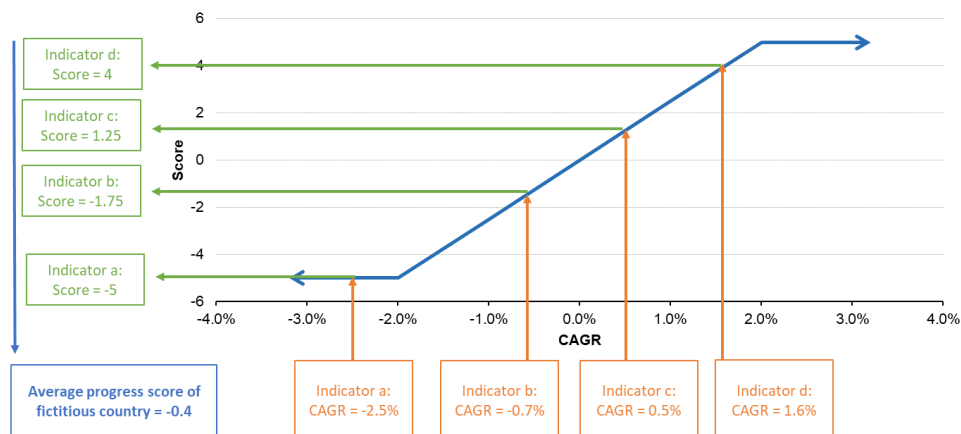
Interpretation of status/progress charts

In chapter 18 of the MR, countries' progress scores are plotted against their status scores (for each goal for which at least two-thirds of the indicators have data for the country). The vertical axis shows the status of SDGs in the depicted country within the distribution of Member States and relative to the EU average. SDGs in the upper part of the graph have a status above the EU average, and for SDGs in the lower part the status is below the EU average. The right side of the graph displays

SDGs where the country has made progress whereas the left side indicates movements away from the SDGs. This results in four "quadrants" which can be characterised as follows:
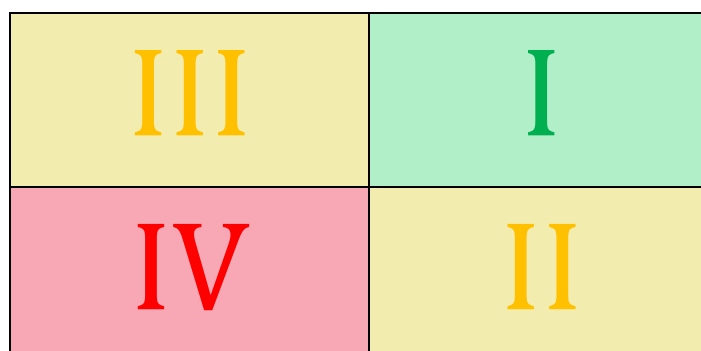
i.   The country is progressing towards these SDGs, and on average the indicator values are above the EU average.

ii.   The country is progressing towards these SDGs, but on average the indicator values are below the EU average.

iii.   The country is moving away from these SDGs, but on average the indicator values are above the EU average.

iv.   The country is moving away from these SDGs, and on average the indicator values are below the EU average.

Adjustments applied to the status/progress calculations for the 2023 SDG monitoring exercise

INDICATOR SELECTION

As mentioned above, the aggregation of the status and progress calculations at goal level are only performed if for a country data are available for at least two-thirds of the indicators of that goal (including multi-purpose indicators). As some indicators do not have country-level data, the selection of indicators for the status/progress calculations at MS level has been adjusted and is thus not necessarily identical to the selection of indicators for the EU-level assessment shown in the MR. In the following, the exceptions applied to the status/progress calculations for the MR 2023 are described:

- **SDG 2:** country data for the **farmland bird index** from table env_bio2 are included in the status/progress calculations (MPI from SDG 15).

- **SDG 4:** the indicator **Share of individuals having at least basic digital skills (sdg_04_70)** is excluded from both the status and progress calculations since it only has data for a single year (2021). It is however still considered for calculating data availability against the threshold as country data is available. For the indicator **Low achieving 15-year-olds in reading, mathematics or science (sdg_04_40)**, only one of the three subject categories – "reading" as the most basic of the three skills measured – is used for the progress and status calculation.

- **SDG 5:** the indicator **Physical and sexual violence to women (sdg_05_10)** is excluded from both the status and progress calculations since it only has data for a single year (2012). It is however still considered for calculating data availability against the threshold as country data is available.

- **SDG 10:** the indicators **Disparities in GDP per capita (sdg_10_10)**, **Disparities in household income per capita (sdg_10_20)** and **Asylum applications (sdg_10_60)** are excluded from the calculations and are also <u>not</u> considered for calculating data availability against the threshold. For the first two indicators (sgd_10_10 and sdg_10_20), this is because the calculation of disparities is only relevant at EU level (since the indicators monitor inequalities between countries). The third indicator (sdg_10_60) is excluded because the desired direction is unclear (it is also not evaluated at EU level for the same reason).

- **SGD 12:** the indicator **Consumption of hazardous chemicals (sdg_12_10)** is excluded from the calculations and also <u>not</u> considered for assessing data availability against the threshold, since it does not have country-level data.

- **SDG 14:** the indicators **Estimated trends in fish stock biomass (sdg_14_21)**, **Estimated trends in fishing pressure (sdg_14_30)** and **Global mean surface seawater acidity (sdg_14_50)** are excluded from the calculations and also <u>not</u> considered for calculating data availability against the threshold. This is because the scope of the data is not applicable to individual countries.

- **SDG 15:** the indicators **Common bird index (sdg_15_60)** and **Grassland butterfly index (sdg_15_61)** are excluded from the calculations and also <u>not</u> considered for calculating data availability against the threshold, since they do not have country-level data.

- **SDG 17:** the indicator **EU financing to developing countries (sdg_17_20)** is excluded from both the status and progress calculations since it only has absolute data (EUR million) that are not comparable across countries. It is therefore also <u>not</u> considered for calculating data availability against the threshold.

SPECIAL CASES FOR UNITS USED

In addition to above-mentioned exceptions, the following table lists the indicators for which different units are used for the status and progress calculations (due to the EU-level assessment being based on an absolute unit that is not comparable between countries).

Indicator	Absolute unit for progress calculation	Relative unit for status calculation
People at risk of poverty or social exclusion (sdg_01_10)	Million people	% of population
People at risk of income poverty after social transfers (sdg_01_20)	Million people	% of population
Severe material and social deprivation (sdg_01_31)	Million people	% of population
People living in households with very low work intensity (sdg_01_40)	Million people aged less than 65	% of population aged less than 65

Indicator	Absolute unit for progress calculation	Relative unit for status calculation
Agricultural factor income per annual work unit (AWU) (sdg_02_20)	Both progress and status calculations are based on unit "EUR, chain linked volumes (2010)" ([4])	
Government budget appropriations or outlays on R&D (sdg_02_30)	Million euro	Euro per inhabitant
Ammonia emissions from agriculture (sdg_02_60)	Million tonnes	Kg per hectare of utilised agricultural area
Primary energy consumption (sdg_07_10)	Million tonnes of oil equivalent (Mtoe)	Tonnes of oil equivalent (Toe) per inhabitant
Final energy consumption (sdg_07_11)	Million tonnes of oil equivalent (Mtoe)	Tonnes of oil equivalent (Toe) per inhabitant
Energy productivity (sdg_07_30)	EUR per kgoe	PPS per kgoe
Patent applications to the European Patent Office (sdg_09_40)	Number	Number per million inhabitants
Road traffic deaths (sdg_11_40)	Number	Rate
Premature deaths due to exposure to fine particulate matter ($PM_{2.5}$) (sdg_11_52)	Number	Rate
Raw material consumption (sdg_12_21)	Billion tonnes	Tonnes per inhabitant
Gross value added in environmental goods and services sector (sdg_12_61)	Million euro	% of GDP
Net greenhouse gas emissions (sdg_13_10)	Index 1990 = 100	Tonnes per inhabitant
Net greenhouse gas emissions from land use and forestry (sdg_13_21)	Million tonnes of CO_2 equivalent	Tonnes of CO_2 equivalent per km²
Climate-related economic losses (sdg_13_30)	Million euro	Euro per inhabitant
Contribution to the international 100bn USD commitment on climate related expending (sdg_13_50)	Billion euro	% of GNI ([5])
Population covered by the Covenant of Mayors for Climate & Energy signatories (sdg_13_60)	Million people	% of population
Marine waters affected by eutrophication (sdg_14_60)	Km²	% of EEZ
Soil sealing index (sdg_15_41)	Index 2006 = 100	% of total surface
Estimated severe soil erosion by water (sdg_15_50)	Km²	% of the non-artificial erodible area
General government total expenditure on law courts (sdg_16_30)	Million euro	Euro per inhabitant
EU imports from developing countries (sdg_17_30)	Billion euro	% of extra-EU imports ([6])

EXAMPLE OF STATUS & PROGRESS CALCULATIONS FOR A COUNTRY

This section uses the case of Germany to illustrate the status and progress calculations described above for SDG 2, using the data featured in the MR 2022. **Table 2** shows the data for Germany used for the status and progress calculations, including the best and worst country values used for in the relative status assessment (including specification of outliers that were excluded before the calculations).

Table 2: Data for status & progress calculations for Germany for MR 2022 country charts

Indicator	Most recent year for DE (t)	t-5 years for DE (t₀)	Value for DE in (t) (absolute / relative)	Value for DE in (t₀) (absolute / relative)	Best country (relative unit only)	Worst country (relative unit only)
Obesity rate (sdg_02_10)	2019	2014	19.0 %	16.9 %	10.9 % (Romania)	28.7 % (Malta)
Agricultural factor income (sdg_02_20)	2020	2015	28 934 EUR per AWU	23 815 EUR per AWU	42 096 EUR per AWU (Netherlands)	3 868 EUR per AWU (Romania)
Gov. support to agri R&D (sdg_02_30)	2020	2015	1 028.53 mio EUR / 12.4 EUR per capita	812.92 mio EUR / 10.0 EUR per capita	18.7 EUR per capita (Ireland) = outlier → 15.5 EUR per capita (Denmark) used instead	0.4 EUR per capita (Luxembourg)
Organic farming (sdg_02_40)	2020	2015	9.59 %	6.34 %	25.3 % (Austria) in 2019	0.6 % (Malta)
Pesticides (sdg_02_52)	N/A	N/A	N/A	N/A	62 index (Luxembourg)	135 index (Bulgaria) = outlier → 118 index (Latvia) used instead
Ammonia emissions (sdg_02_60)	2019	2014	29.9 kg/ha	32.9 kg/ha	7.2 kg/ha (Bulgaria)	105.3 kg/ha (Malta) = outlier → 58.9 kg/ha (Netherlands) used instead
Nitrate in groundwater (sdg_06_40) → *smoothed 4-year average used*	2019	2014	27.16 mg	24.61 mg	4.64 mg (Estonia)	63.4 mg (Cyprus) = outlier → 58.17 mg (Malta) = outlier → 30.49 mg (Bulgaria) used instead
Soil erosion (sdg_15_50)	2016	2010	4150.5 km² / 1.3 %	4391.7 km² / 1.37 %	0 % (Denmark & Estonia)	24.93 % (Italy) = outlier →

Indicator	Most recent year for DE (t)	t-5 years for DE (t_0)	Value for DE in (t) (absolute / relative)	Value for DE in (t_0) (absolute / relative)	Best country (relative unit only)	Worst country (relative unit only)
						18.99 % (Slovenia) = outlier → 15.5 % (Austria) used instead
Farmland bird index (sdg_15_60 / env_bio2)	2016	2011	84.37 index	80.33 index	107.37 index (Ireland)	53.67 index (Belgium) in 2019

Based on the data in the table above, the following status and progress scores are calculated for Germany per indicator (note that if both absolute and relative data are given in the table above, the CAGR calculations are based on the absolute values, while the status calculations use the relative data):

- **Obesity rate (sdg_02_10)**
  - CAGR (2014-2019) = 2.4 % → Progress score = -5.00
  - Status score (2019) = 54.5

- **Agricultural factor income (sdg_02_20)**
  - CAGR (2015-2020) = 4.0 % → Progress score = 5.00
  - Status score (2020) = 65.6

- **Gov. support to agri R&D (sdg_02_30)**
  - CAGR (2015-2020) = 4.8 % → Progress score = 5.00
  - Status score (2020) = 79.5

- **Organic farming (sdg_02_40)**
  - CAGR (2015-2020) = 8.6 % → Progress score = 5.00
  - Status score (2020) = 36.3

- **Pesticides (sdg_02_52)**
  - CAGR (2014-2019) = N/A → Progress score = N/A
  - Status score (2019) = N/A (i.e. indicator is excluded for status & progress calculations for this country)

- **Ammonia emissions (sdg_02_60)**
  - CAGR (2014-2019) = -1.9 % → Progress score = 4.74
  - Status score (2019) = 56.1

- **Nitrate in groundwater (sdg_06_40)**
    - CAGR (2014-2019) = 2.0 % → Progress score = -4.98
    - Status score (2019) = 12.9
- **Soil erosion (sdg_15_50)**
    - CAGR (2010-2016) = -0.9 % → Progress score = 2.34
    - Status score (2016) = 91.6
- **Farmland bird index (sdg_15_60 / env_bio2)**
    - CAGR (2011-2016) = 1.0 % → Progress score = 2.47
    - Status score (2016) = 57.2

The calculation of the goal-level scores using the arithmetic mean over all above-mentioned indicators results in the following SDG 2 scores for Germany:

- SDG 2 progress score: 1.82
- SDG 2 status score: 56.7

Putting Germany's status score in relation to the EU aggregate status of the same goal (50.5) results in the following:

- SDG 2 status relative to EU: 12.3 %

The progress and status (relative to EU) scores are reflected in the SDG 2 position in Germany's country graph in Figure 4 (SDG 2 is visually highlighted).

Figure 4: Germany's status & progress scores (MR 2022)
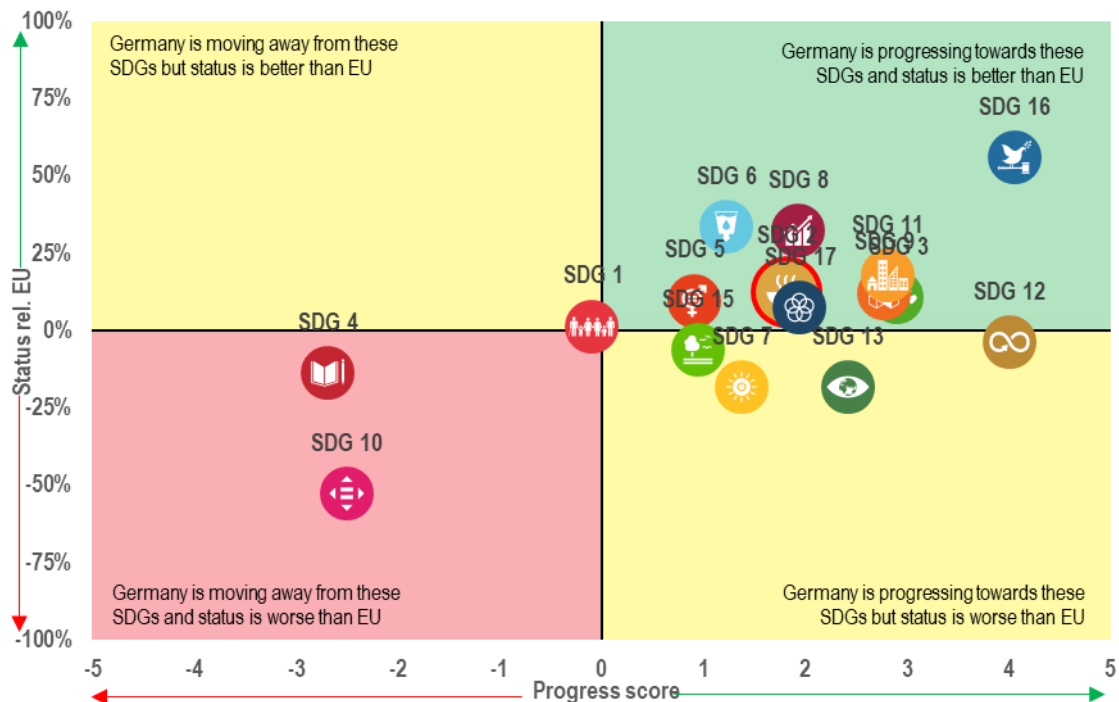
Notes

(¹) This is because the progress calculation at country level uses the same unit that is used for the indicator assessment at EU level, which in several cases refers to absolute data that are not comparable between countries.

(²) See Hoaglin, D. C., Iglewicz, B., & Tukey, J. W. (1986). Performance of Some Resistant Rules for Outlier Labeling. *Journal of the American Statistical Association*, 81(396), 991-999 and Hoaglin, D. C., & Iglewicz, B. (1987). Fine-Tuning Some Resistant Rules for Outlier Labeling. *Journal of the American Statistical Association*, 82(400), 1147-1149.

(³) Longer time series are used in cases where the data collection does not take place annually (e.g. for the indicator sdg_15_50 "Estimated severe soil erosion by water", the two most recent available data are from 2010 and 2016) or where data gaps of more than five years exist in a country's time series.

(⁴) EU-level assessment in the MR is based on unit "Index 2010 = 100". However, using this unit for the MS progress calculations would mean that the two calculations (progress and status) are based on data from different sources and different time periods.

(⁵) Data in this unit are not available in table sdg_13_50 but have been calculated manually using GNI data from table NASA_10_NF_TR.

(⁶) Data in this unit are not available in table sdg_17_30 but have been calculated manually using data on extra-EU imports per country from EXT_LT_INTRATRD.