SDG Index and Dashboards

Detailed Methodological paper

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INTRODUCTION

This methodological paper is a companion to the SDG Index and Dashboards Report produced annually since 2016 by the Bertelsmann Stiftung and the Sustainable Development Solutions Network (SDSN). The SDG Index and Dashboards Report benchmarks the performance of countries on the Sustainable Development Goals (SDGs) adopted in September 2015 by the global community. In the 2018 edition, country profiles are generated for all 193 member states but total country scores and ranks are available for 156 countries. 37 countries did not meet the thresholds in terms of data availability to be considered for inclusion in the total rankings and scores.

Key findings from the 2018 edition are described in the report including insights by region and a detailed analysis of G20 implementation efforts. In addition, a data visualisation tool has been developed allowing users to compare rapidly their country results to others (https://dashboards.sdgindex.org/#/). Additional monitoring tools and analyses have been developed by SDSN for Africa (https://sdgcafrica.org/reports) and cities in the United-States (http://unsdsn.org/resources/publications/leaving-no-u-s-city-behind-the-2018-u-s-cities-sdgs-index/) using a similar approach and methodology.

The purpose of this methodological paper is threefold: First, it describes the objectives and content of the 2018 Global SDG Index and Dashboards Report and highlights how to interpret results. Second, it provides more detailed information on the underlying metrics used including data sources and coverage and describes the rationale for key methodological choices such as weighting and aggregation techniques. Third, it presents the results from various robustness tests derived from the suggested tests included in the JRC-OECD Handbook on Constructing Composite Indicators.

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1. GENERAL APPROACH

1.1 Objective

In September 2015, global leaders adopted the new 2030 Agenda for Sustainable Development, including the Sustainable Development Goals (SDGs). The 17 new Sustainable Development Goals, also known as the Global Goals, aim to end poverty, hunger and inequality, take action on climate change and the environment, improve access to health and education, build strong institutions and partnerships, and more. Compared to its processor, the Millennium Development Goals (MDGs), the SDGs to all 193 UN Member States and therefore both to developing and developed countries alike.

Good data and clear metrics are critical for each country to take stock of where it stands, devise pathways for achieving the goals and track progress. The UN Statistical Commission has recommended a first set of 230 global indicators to measure achievement of the SDGs, but many suggested indicators lack comprehensive, cross-country data and some even lack agreed statistical definitions. More and better data are needed, but it will take years to build the necessary statistical systems even if adequate resources were mobilized, which is currently not the case. Some governments have begun voluntary national reviews of progress on the SDGs, but they use indicators that are not harmonized internationally and lack comparability.

In order to assist countries in measuring their SDG baselines and to measure future progress, the Bertelsmann Stiftung and the Sustainable Development Solutions Network (SDSN) jointly released the first SDG Index and Dashboards in July 2016. This report aims to achieve four main objectives:

1. Establish SDGs as a useful, operational tool for policy action.
2. Support national debates on prioritization and formulation of SDG implementation strategies.
3. Complement efforts to develop a robust SDG monitoring framework by the UN Statistical Commission.
4. Identify SDG data gaps, need for investments in statistical capacity and research, and new forms of data.

The SDG Index and Dashboards is not officially endorsed by the UN National Assembly.

1.2 Conceptual framework

The conceptual framework corresponds to the 17 Sustainable Development Goals adopted by global leaders at the United-Nations General Assembly in September 2015. The 17 SDGs include 169 more specific targets and means for implementation.

Table 1: The 17 Sustainable Development Goals

SDG	Short title	Description	#Targets
SDG 1	No poverty	End poverty in all its forms everywhere	7
SDG 2	Zero Hunger	End hunger achieve food security and improved nutrition and promote sustainable agriculture	8
SDG 3	Good health and well-being	Ensure healthy lives and promote well-being for all at all ages	13
SDG 4	Quality education	Ensure inclusive and quality education for all and promote lifelong learning	10

SDG 5	Gender equality	Achieve gender equality and empower all women and girls	9
SDG 6	Clean water and sanitation	Ensure access to water and sanitation for all	8
SDG 7	Affordable and clean energy	Ensure access to affordable, reliable, sustainable and modern energy for all	5
SDG 8	Decent work and economic growth	Promote inclusive and sustainable economic growth, employment and decent work for all	12
SDG 9	Industry, innovation and infrastructure	Build resilient infrastructure, promote sustainable industrialization and foster innovation	8
SDG 10	Reduced inequalities	Reduce inequality within and among countries	10
SDG 11	Sustainable cities and communities	Make cities inclusive, safe, resilient and sustainable	10
SDG 12	Responsible consumption and production	Ensure sustainable consumption and production patterns	11
SDG 13	Climate action	Take urgent action to combat climate change and its impacts	5
SDG 14	Life below water	Conserve and sustainably use the oceans, seas and marine resources	10
SDG 15	Life on land	Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss	12
SDG 16	Peace, justice and strong institutions	Promote just, peaceful and inclusive societies	12
SDG 17	Partnerships for the goals	Revitalize the global partnership for sustainable development	19

Source: https://www.un.org/sustainabledevelopment/sustainable-development-goals/

1.3 Fundamental assumptions

There are five fundamental assumptions underpinning the methodology and construction of the SDG Index and Dashboards:

- **Number of indicators evolves when new evidence become available:** First, the authors of the report acknowledge that the SDGs are part of a dynamic agenda including inside the statistical community. Therefore, the basket of indicators evolves from year to another as new evidence become available. The methodology for certain indicators is also revised based on efforts at the global level to improve the quality of the measures to monitor the SDGs. This means that the SDG Index and Dashboards results are not directly comparable from one year to another.

Table 2: Number of global indicators in the three SDG Index and Dashboards edition

	2016	2017	2018
Number of indicators	60	83	88

- **The 17 SDGs are the final overarching framework (no re-clustering of the goals):** Second, the SDG Index and Dashboards uses the 17 SDGs as the final overarching conceptual framework. The report does not re-organize goals into sub-categories such as the 5Ps (People, Planet, Prosperity, Peace and Partnership) or between economic, social, environmental and governance related goals[1]. Beyond the fact that there are no agreements on the re-clustering of these goals, the authors also argue that the SDGs are an overarching framework that encourage policymakers to incorporate each dimension into the policymaking process for each sector and not see these issues as independent issues to be addressed within each siloes. The report uses expert judgement to deal with overlaps between goals.

- **Non-official data help bridge current data gaps:** Third, the report focuses on data available at the moment. The authors consider that official indicators are not sufficient to monitor comprehensively the implementation of the SDGs and that non-official data sources can help bridge this gap. Non-official data sources include data produced in research institutions, Universities, civil society and other partners. They sometimes use new data collection methods such as satellite imagery data and other forms of data. The use of non-official datasets to measure some of the SDGs complements on-going efforts taking place in international statistical committees to generate new standardized measures in NSOs to monitor the SDGs.

- **Monitoring the SDGs requires estimating absolute country performance based on distance to invariant sustainable development targets:** The report focuses on absolute country performance (not relative to other countries performance) and normalizes each indicator from 0-100 where 100 corresponds to determined "technical optimums". Therefore, the report measures what it aims to measure which is the distance to achieving sustainability. The detailed method for calculating these technical optimums is presented in section 1.6.
- **Results need to be accessible for a wide audience:** The SDG Index and Dashboards aims to strike a balance between scientific soundness and easily communicable results accessible for a wide audience (policymakers, civil society, layman citizens etc.). Therefore, as a general rule, when two methods yield similar results the easier method was retained. The SDG Index and Dashboards result are accessible for free online so that users can replicate the results. A number of sensitivity tests and robustness tests to various methodological assumptions are presented in part 3 for transparency.

1.4 Selection of indicator

Where possible, the 2018 SDG Index and Dashboards reports official SDG indicators endorsed by the UN Statistical Commission. Where insufficient data is available for an official indicator and to close data gaps, we include other metrics from official and unofficial providers. Five criteria for indicator selection were used to determine suitable metrics for inclusion in the global SDG Index and Dashboards:

1. **Global relevance and applicability to a broad range of country settings:** The indicators are relevant for monitoring achievement of the SDGs and applicable to the entire continent. They are

[1] Annex 7, explores statistical clustering of the SDGs based on the SDG Index and Dashboards Report 2018.

internationally comparable and allow for direct comparison of performance across countries. In particular, they allow for the definition of quantitative performance thresholds that signify SDG achievement.

2. **Statistical adequacy**: The indicators selected represent valid and reliable measures.

3. **Timeliness:** The indicators selected are up to date and published on a reasonably prompt schedule.

4. **Data quality:** Data series represent the best available measure for a specific issue, and derive from official national or international sources (e.g. national statistical offices or international organizations) or other reputable sources, such as peer-reviewed publications. No imputations of self-reported national estimates are included.

5. **Coverage:** Data have to be available for at least 80% of the 149 UN Member States with a national population greater than 1 million.

1.5 Interpreting the SDG Index and Dashboards results

1.5.1 The SDG Index

The global SDG Index score and scores by goal can be interpreted as the percentage of achievement. The difference between 100 and countries' scores is therefore the distance in percentage that needs to be completed to achieving the SDGs and goals. Sweden's overall Index score (85) suggest that the country is on average 85% of the way to the best possible outcome across the 17 SDGs.

The same basket of indicators is used for all countries to generate comparable scores and rankings[2]. It should be noted that differences in rankings may be due to small differences in the aggregate score. The SDG Index score signifies a country's position between the worst (0) and the best or target (100) outcomes.

1.5.2 The SDG Dashboards

To assess a country's progress on a particular indicator, we considered four bands. The green band is bounded by the maximum that can be achieved for each variable (i.e. the upper bound) and the threshold for achieving the SDG. Three color bands ranging from yellow to orange and red denote an increasing distance from SDG achievement. The red band is bound at the bottom by the value of the 2.5th percentile of the distribution. Upper and lower bounds are the same as for the SDG Index.

Additional thresholds were established based on statistical techniques (typically using the mean and standard deviations) and in consultation with experts. The country assessments were subject to a public consultation and direct consultations with members of the Sustainable Development Solutions Network and other experts, including national and international statistical offices. All thresholds were specified in absolute terms and apply to all countries.

The purpose of the global SDG Dashboards is to highlight those SDGs that require particular attention in each country and therefore should be prioritized for early action. For the design of the SDG Dashboards, the same issues related to weighting and aggregation of indicators apply, as discussed above for the SDG Index.

[2] The very few exceptions are presented in section 3.3.

Averaging across all indicators for an SDG might hide areas of policy concern if a country performs well on most indicators but faces serious shortfalls on one or two metrics within the same SDG. This applies particularly to high-income and upper-middle-income countries that have made significant progress on many SDG dimensions but may face serious shortfalls on individual variables.

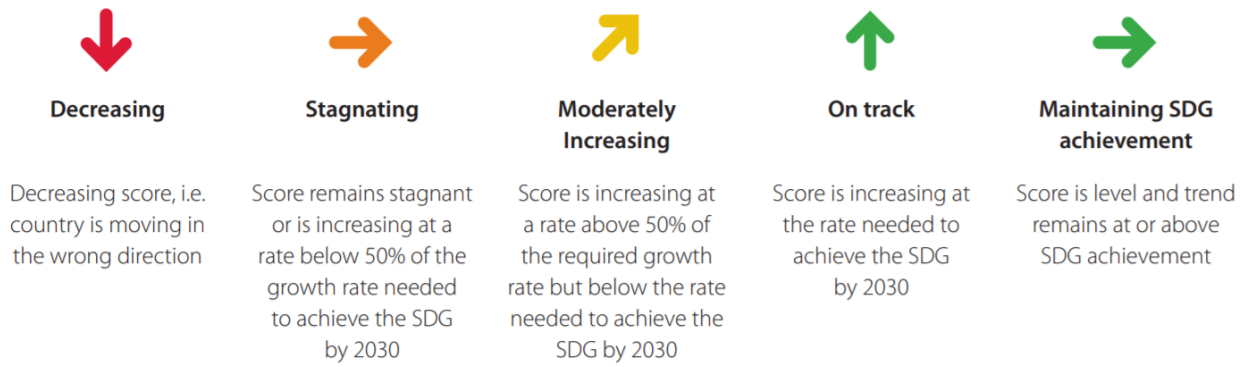
As a result, the global SDG Dashboards aggregate indicator ratings for each SDG by estimating the average of the two variables on which a country performed worst. To this end, the indicator values were first rescaled from 0 to 3, where 0 corresponds to the lower bound, 1 to the value of the threshold between red and orange ("red threshold"), 2 to the value of the threshold between yellow and green ("green threshold"), and 3 to the upper bound. For all indicators, the yellow/orange threshold was set as the value halfway between the red and green thresholds (1.5). Each interval between 0 and 3 is continuous.

We then took the average of the two rescaled variables on which the country performed worst to identify the rating for the goal. We applied the added rule that in order to score green for the goal both indicators had to be green – otherwise the goal would be rated yellow. Similarly, a red score was applied only if both worst-performing indicators score red. If the country has only one data point under the SDG then the color rating for that indicator determines the overall rating for the goal. If the country has less than 50% of the indicators available under a goal the dashboard color for that goal is "grey".

1.5.3 The SDG Trend Dashboard

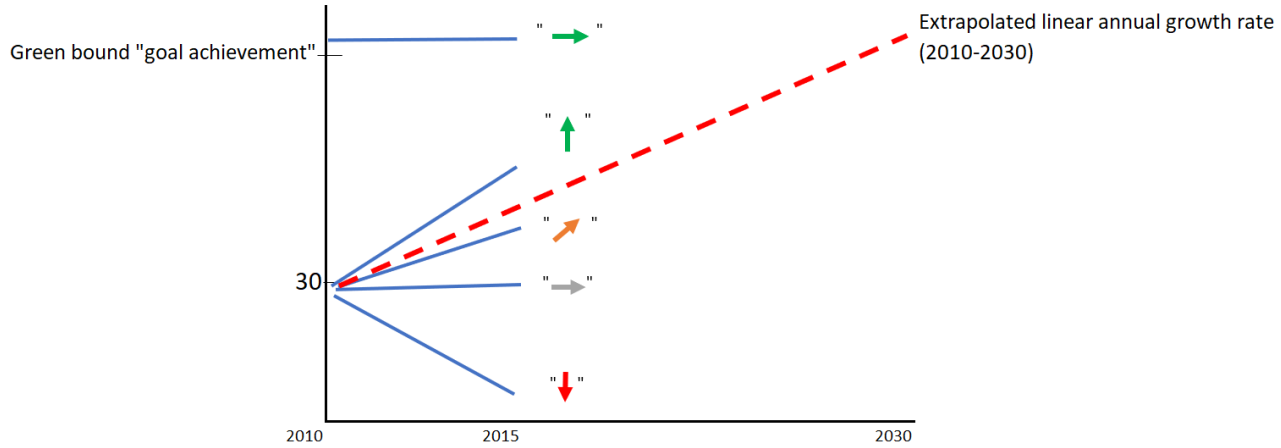
Using historic data, we estimate how fast a country has been progressing towards an SDG and determine whether – if continued into the future – this pace will be sufficient to achieve the SDG by 2030. For each indicator, SDG achievement is defined by the green threshold set for the SDG Dashboards. The difference in percentage points between the green threshold and the normalized country score denotes the gap that must be closed to meet that goal. To estimate SDG trend, we calculated the linear annual growth rates (i.e. annual percentage improvements) needed to achieve the goal by 2030 (i.e. 2010-2030) which we compared to the average annual growth rate over the most recent period (usually 2010-2015). Progress towards goal achievement on a particular indicator is described using a 5-arrow system (Figure 1). Figure 2 illustrates the methodology graphically.

Figure 1: The 5-arrow system for denoting SDG Trends



Source: Authors' analysis

Figure 2: Graphic representation of the SDG Trends methodology



Source: Authors' analysis

To estimate overall trend for an SDG, each indicator trend for that SDG was re-normalized on a linear scale from 0-4. The trend for an SDG was calculated as the arithmetic average of all trend indicators for that goal. An average between 0-1 corresponds to a "decreasing" goal trend, between 1-2 to a "stagnating" goal trend, 2-3 "moderately improving goal trend", 3-4 "on track" goal trend. Maintaining SDG achievement corresponds to a normalized score of exactly 3. Trends are reported at the SDG level only if trend data were available for at least 75% of SDG Dashboards indicators under that goal.

SDG trends are based on data points that precede the adoption of SDGs, because data is reported with long lags at the international level due to lengthy validation processes. Over time, we will update the data to use 2015 as baseline year for SDG Trends.

Annex 1, provides the list of indicators used to compute SDG trends. Trend indicators were selected from among the indicators included in the SDG Dashboards based on the availability of trend data. When the value for one year was not available we used the closest available value with a maximum of one-year difference. The table also indicates the period over which the trend was calculated.

Several other calculation methods were considered. For instance, we tested the sensitivity of the results when using technical optimums (100 score) as "goal achievement" and calculate distance to technical optimums. This approach yielded harsher results and is not consistent with our conceptual assumption that lower green thresholds correspond to goal achievement. We also considered using compound annual growth rates (CAGR) instead of linear growth rates. The two approaches yield rather similar results and we could not identify a strong argument for using the more sophisticated CAGR method. Finally, while the dashboards are based only on the two-worst indicators trends are generated using all indicators under the goal. This is because the dashboards aim to highlight goals where particular attention is required due to very poor performance on some of the underlying indicators whereas trends aim to reflect insights on the overall goal evolution including all indicators.

1.6 Setting indicator targets

For each indicators, sustainability "targets" (also called "technical optimums" or "upper bounds") were determined using a five-step decision tree[3]:

[3] Based on Sachs and al, 2017.

1. **Use absolute quantitative thresholds in SDGs and targets:** e.g. zero poverty, universal school completion, universal access to water and sanitation, full gender equality. Some SDG Targets propose relative changes (Target 3.4: […] reduce by one third premature mortality from non-communicable diseases [..]) that cannot be translated into a global baseline today. Such targets are addressed through step 5 below.

2. **Where no explicit SDG target is available, apply the principle of "leave no one behind" to set upper bound to universal access or zero deprivation for the following types of indicators:**
    a. Measures of extreme poverty (e.g. wasting), consistent with the SDG ambition to end extreme poverty in all its forms ("leave no one behind").
    b. Public service coverage (e.g. access to contraception).
    c. Access to basic infrastructure (e.g. mobile phone coverage, wastewater treatment).

3. **Where science-based targets exist that must be achieved by 2030 or later, use these to set 100% upper bound** (e.g. zero greenhouse gas emissions from electricity as required by no later than 2070 to stay within 2°C, 100% sustainable management of fisheries).

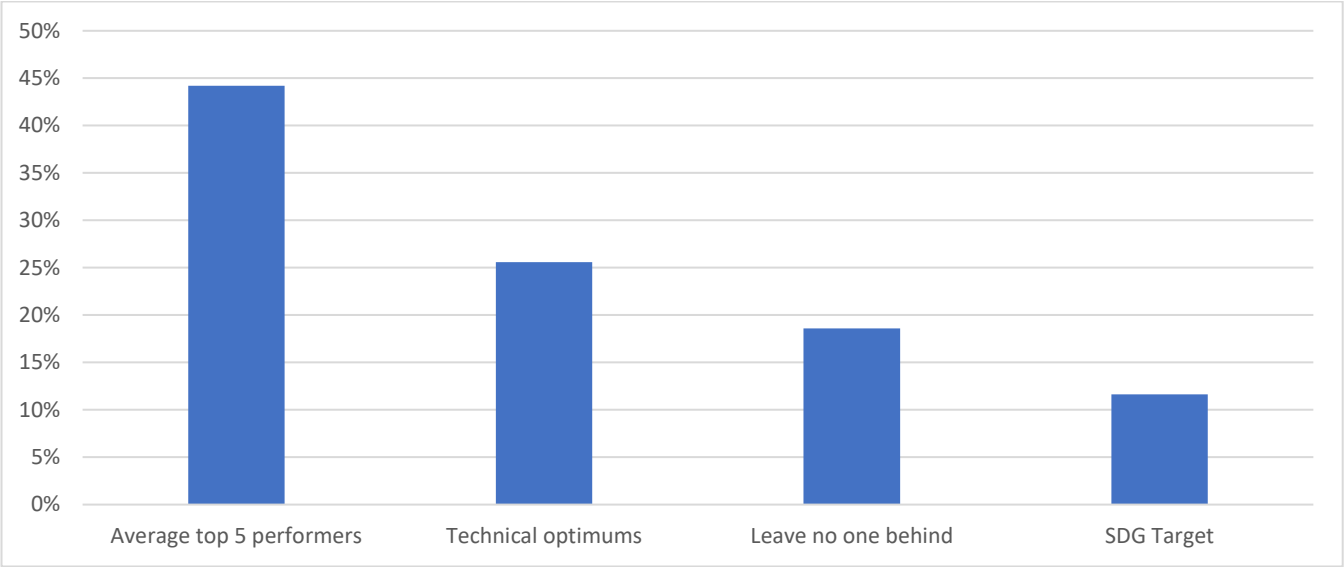
4. **Where several countries already exceed an SDG target, use the average of the top 5 performers** (e.g. child mortality).

5. **For all other indicators, use the average of the top performers.** In the case of global indicators retained, the upper bound was set by taking the average value of the top 5 global performers. For OECD indicators, the average top 3 performers.

In some cases, the upper bound exceeded the thresholds to be met by 2030 in order to achieve the SDGs. For example, the SDGs call for reducing child mortality to no more than 25 per 1000 live births, but many countries have already exceeded this threshold (i.e. have mortality rates under 25 per 1000). By defining the upper bound as the "best" outcome (e.g. 0 mortality per 1000) – not the SDG achievement threshold – the SDG Index rewards improvements across the full distribution. This is particularly important for countries that have already achieved some SDG thresholds, but still lag behind other countries on this metric.

Overall, only 12% of the targets assigned in the 2018 SDG Index and Dashboards Report are designed based on explicit targets specified in the SDGs. The rest are designed by using the average of top 5 performers (44%), using technical optimums (e.g. 0 imported CO2 emissions) (26%) and using Leave no one behind criteria (universal access to safe water and sanitation) (19%). Annex 4 provides detailed targets for each indicators.

Figure 3: Rationale used to define targets for global indicators, 2018

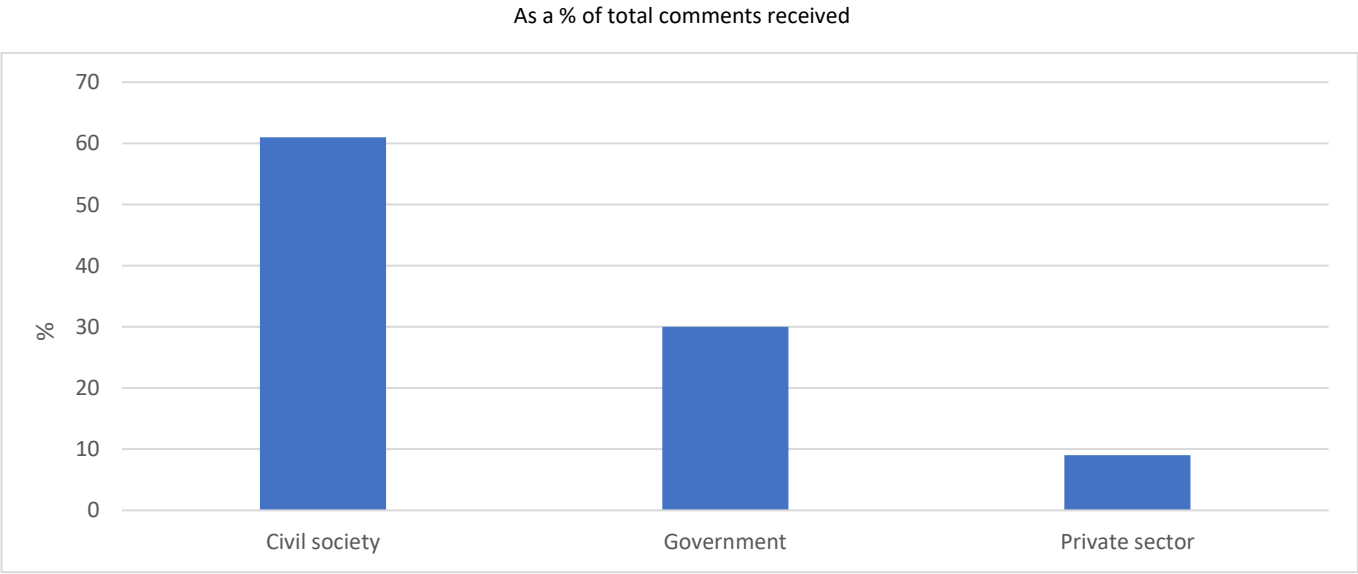


Source: Authors' analysis

1.7 Collaboration with experts

As a global network of experts on the SDGs, SDSN consults extensively with a wide range of stakeholders at various stages of the production process of the SDG Index and Dashboards Report. Experts are consulted on an on-going basis in early stages to identify new indicators and data. These include primarily international institutions (World Bank, OECD, WHO, ILO etc.), civil society organizations, and research institutions. A large-scale consultation was organized from May 1st to May 15th 2018 on indicator selection, data reported and suggested bounds and thresholds for generating scores and dashboards. In total, we received 23 formal comments on draft results (in addition to various informal requests for information and clarifications). Civil society organizations (research centers, Universities, NGOs) provided 61% of the comments received, national governments 30% and private sector organizations 9% (figure 4).

Figure 4: Formal comments received during the consultation period on the draft SDG Index and Dashboards Report 2018 by type of institution



Source: Authors' analysis

In addition, each national UN missions were informed by e-mail that this consultation was taking place. Individual e-mail responses were provided to each organization/individual that commented on those elements of the reports. The table below provides a summary of key consultation stages as part of the production of the SDG Index and Dashboards 2018.

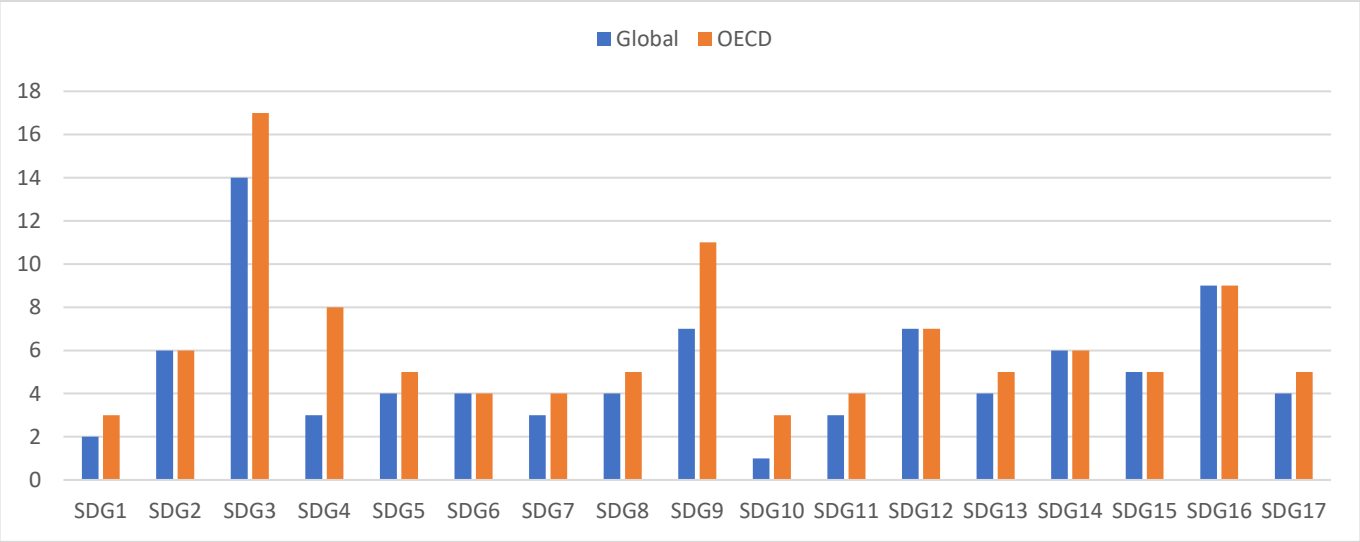
Date	Phase	Organization consulted
January-March	Identify new indicators	International organizations, civil society and research institutions
May 1st-15th	Large scale public consultations on draft list of indicators, preliminary results and bounds/thresholds used	Large scale public consultation. Targeted e-mails to specific partners and all national UN missions.
Early June	Incorporation of comments and individual e-mail response	International organizations, national governments, civil society and research institutions
On-going basis	All phases	International organizations, national governments, civil society, research institutions, private companies and financial institutions

2. DATA QUALITY AND COVERAGE

2.1 Number of indicators

The 2018 edition includes 86 global indicators. Considering the range of data available for OECD countries, additional indicators were added for the 35 OECD member states. Altogether, the total number of indicators included in the 2018 edition is equal to 109 (including OECD indicators). On average, there are around 5 global indicators per goal. This hides major variations between SDG3 (14 indicators) and SDG10 (one indicator).

Figure 5: Number of indicators per goals, 2018



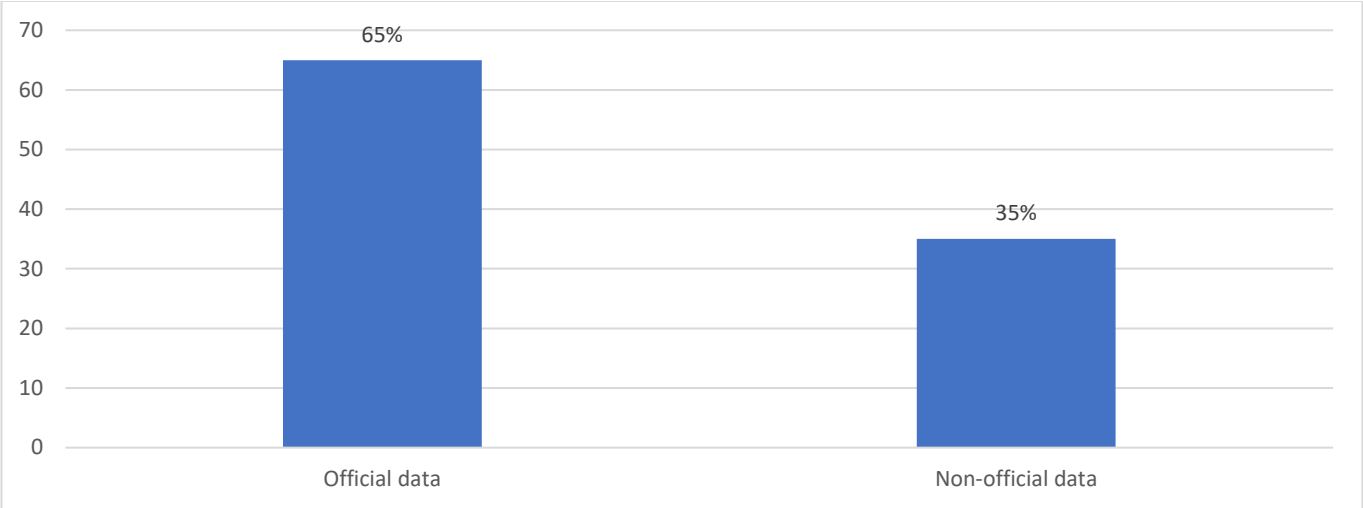
Note: Additional indicators were used for constructing the "OECD Dashboards".
Source: Authors' analysis. Based on Sachs and al, 2018.

2.2 Data sources

The SDG Index and Dashboards uses a mix of official data sources and non-official data sources. Official data correspond to data usually reported by national governments to international organizations. Official data usually involve a process to ensure comparability of concepts, data collection methods and results. Non-official data are typically collected by non-governmental actors (research institutions, Universities, NGOs, private sector) using different techniques (estimations, satellite imageries, expert surveys, others).

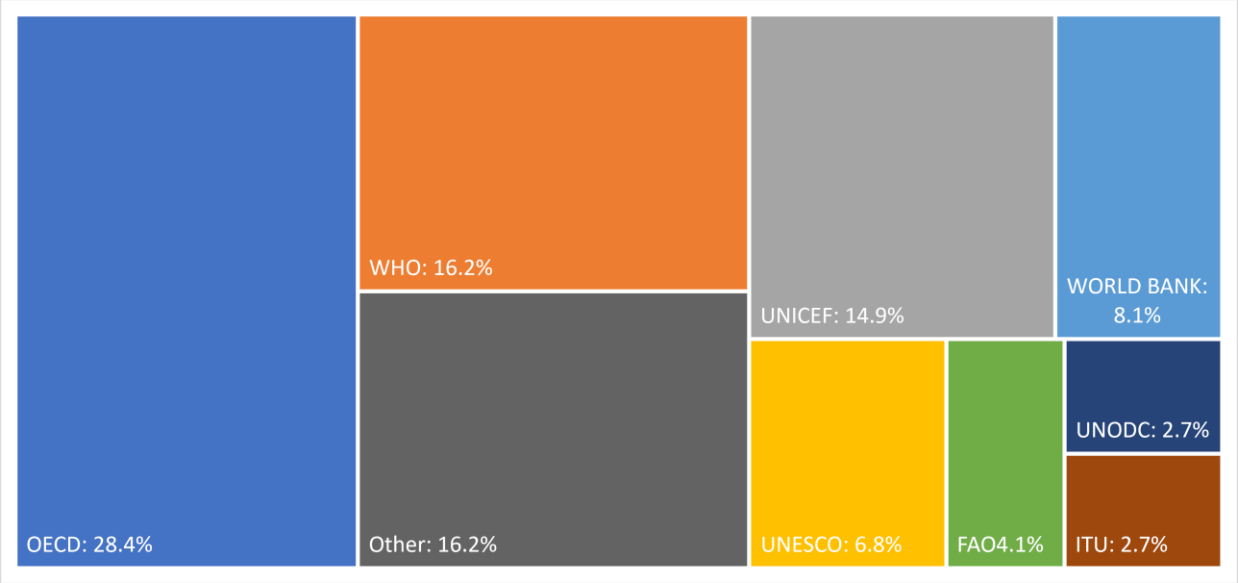
Overall the SDG Index and Dashboards report uses 65% of official data and 35% of non-official data (figure 6). More than half of the official data used come from three organizations: the OECD, WHO and UNICEF (figure 7).

Figure 6: Percentage of official versus non-official data used in the 2018 SDG Index and Dashboards Report



Source: Author's analysis, based on Sachs and al. 2018

Figure 7: Main official data sources used in the 2018 SDG Index and Dashboards Report

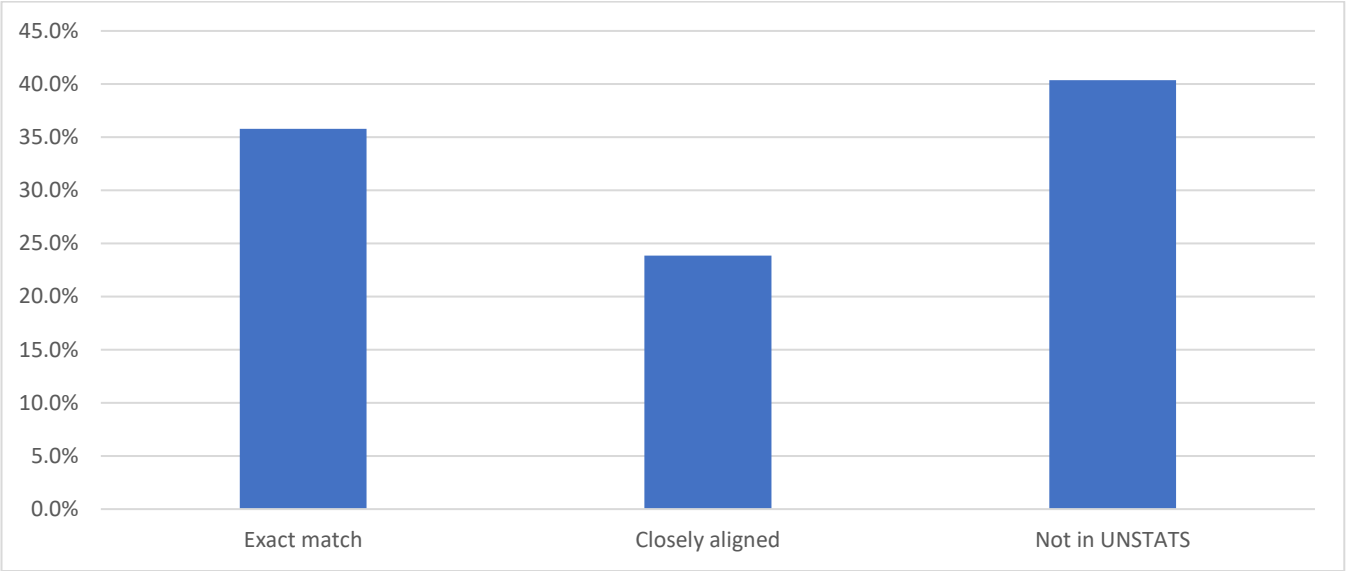


Note: Other includes UNEP, UNDESA, ILO, UN Women and IPU.
Source: Author's analysis, based on Sachs and al. 2018

Non-official data are used to bridge some of the data gaps in official statistics. These are use in the report in particular to gauge environmental spillover effects embodied into trade via input-output estimations and lifecycle assessments. They are also used in specific areas such as Goal 14 (Life Below Water) where reliable official measures of the sustainability of fisheries are still lacking. Finally, in some cases, non-official data are used to improve official estimates which have important biases. In the 2018 edition, the "adjusted GINI coefficient" provides an adjusted measure of income inequality to correct for the under reporting of top incomes in budget surveys on which GINI coefficients are based (Chandy, L and Seidel, B, 2017).

Overall, a rough estimate provided in the report suggests that 35% of the indicators used in the report match exactly the list of indicators included by the Inter-Agency and Expert Group on SDG Indicators (IAEG-SDGs), 24% are closely aligned and 40% are not included in UNSTATS.

Figure 8: Match between official IAEG-SDG indicators and indicators used in the 2018 SDG Index and Dashboards Report



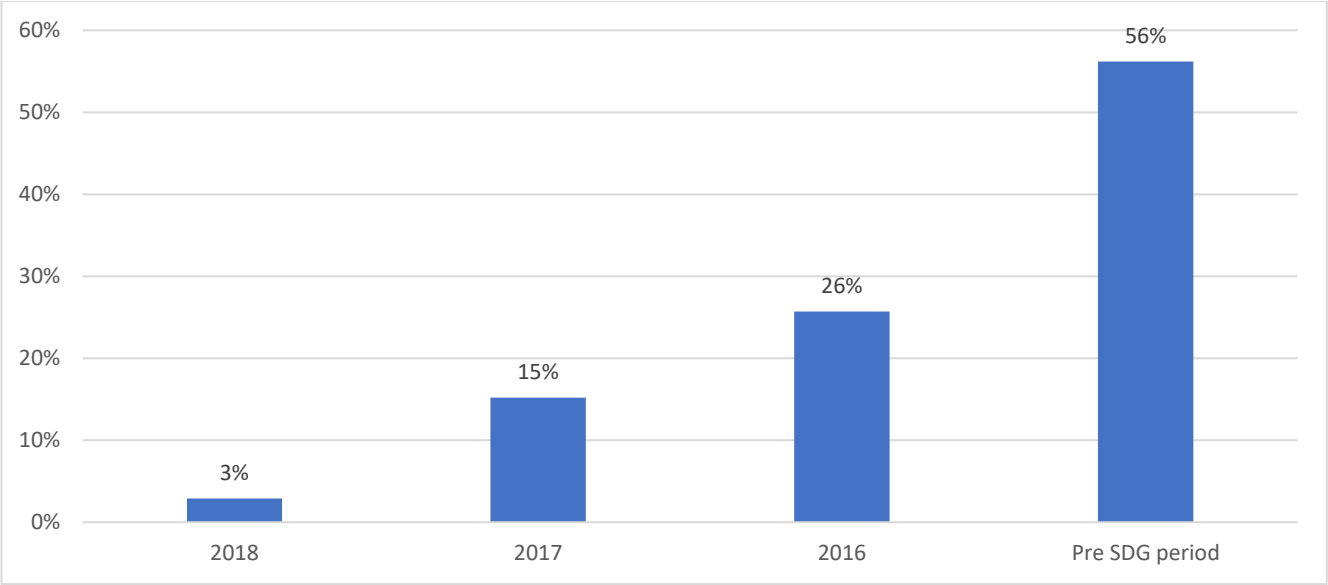
Source: Author's analysis. Based on Sachs and al. 2018.

2.3 Year of reference

Overall, the year of reference of the data included in the 2018 SDG Index and Dashboards Report is post SDG adoption for 44% of the indicators and pre-SDG adoption for 56% of the indicators (figure 9). The length of the validation processes by international organizations can lead to significant delays in publishing some data. For the first time the 2018 SDG Index and Dashboards Report included an assessment of *current* government efforts to implement the SDGs looking at the existence of statements, strategies, coordinating units and websites for the SDGs in G20 country. This is a first step to making the report timelier and more relevant to current administrations.

The year of reference for each indicator varies in the report depending on the types of data. Typically, modelled data and estimations, household survey data and composite indices tend to be more regularly updated and available for closest years (2018 or 2017). Generally, for composite indicators (Ocean Health Index, WEF Competitiveness Report), only a portion of the indicators pooled together are updated every year. Due to timely data validation processes and unsystematic reporting by countries, data coming from official data sources (OECD, WHO, UNICEF, etc.) usually has a time lag of 2-3 years with the release of the report. However, in some cases the time lag is even higher for a significant share of countries including on global indicators of education outcomes and income inequalities (GINI) among others. Finally, the timeliness data produced by research centres varies greatly. Some indicators of spillover effects pre-date for instance the SDG period. Hopefully the timeliness of data reporting for SDG related measures will improve as the global statistical community mobilizes around the monitoring of the goals.

Figure 9: Year of reference of indicators used in the 2018 SDG Index and Dashboards Report



Source: Author's analysis. Based on Sachs and al. 2018.

2.4 Missing data

2.4.1 Imputations and data coverage

At the overall Index level, various procedures are in place to address missing data biases:

1) In order for an indicator to be included it has to be available for at least 80% of the 149 UN Member States with a national population greater than 1 million.
2) Only countries having data for at least 80% of the indicators included in the report are included in the Global Index ranking and scores. Annex 2 provides the list of countries that do not meet the cut-off.
3) For the purpose of calculating the Index scores and rankings, the regional average value is imputed for countries that are missing a score for one entire goal. This applies primarily to SDG10 (Reduced inequalities) and SDG14 (Life Below Water).

At the indicator level, considering that many SDG priorities lack widely accepted statistical models for imputing country-level data, we generally did not impute or model any missing data. We made exceptions for the following variables that would otherwise not have been included because of missing data:

- Prevalence of wasting in children under 5 years of age (%):UNICEF et al. (2016) report an average prevalence of wasting in high-income countries of 0.75%. We assumed this value for high-income countries with missing data.

- Prevalence of stunting (low height-for-age) in children under 5 years of age (%): UNICEF et al. (2016) report an average prevalence of wasting in high-income countries of 2.58%. We assumed this value for high-income countries with missing data.

- Prevalence of undernourishment (% of population): FAO et al. (2015) report 14.7 million undernourished people in developed regions, which corresponds to an average prevalence of 1.17% in the developed

regions. We assumed a 1.2% prevalence rate for each high-income country (World Bank, 2016b) with missing data.

- Times Higher Education Universities Ranking, Average score of top 3 universities (0-100): We assumed a value of 0 for countries with no universities in the rankings

- Research and development expenditure (% of GDP): We assumed zero R&D expenditure for low-income countries that did not report any data for this variable.

- Percentage of children 5-14 years involved in child labor: The best performing upper-middle-income countries have a child labor rate of 1% (UNICEF, 2015). We assumed 0% child labor for high-income countries for which no data was reported.

- CO2 emissions embodied in fossil fuel exports (kg/capita): We assumed a value of 0 for countries with little or no production of fossil fuels when export data was missing.

- Transfers of major conventional weapons (exports) (constant 1990 US$ million per 100,000 people): We assumed a value of 0 for countries with unreported export data.

The number of observations for each variable is provided in Annex 3.

2.4.2 Major indicator and data gaps for the SDGs

In spite of our best efforts to identify data for the SDGs, several indicator and data gaps persist (Table 9). As underscored in previous versions of this report, and through the work of SDSN TReNDS (http://unsdsn.org.trends), governments and the international community must increase investments in SDG data and monitoring systems to close these gaps.

Table 3: Major indicator and data gaps

SDG	Issue	Desired metrics
1	Poverty	International poverty rates at $3.20 PPP per day
2	Agriculture and nutrition	Agricultural yield gaps by cropping system
		Resource use efficiency (nutrients, water, energy)
		Food loss and food waste
		Greenhouse gas emissions from land use
		Diets and nutrient deficiencies
3	Health	Affordability of healthcare
4	Education	Internationally comparable primary and secondary education outcomes
		Early childhood development
5	Women empowerment	Gender pay gap and other empowerment measures
		Violence against women
6	Water	Water embedded in trade adjusted for environmental impact
		Quality of drinking water and surface waters
8	Decent work	Decent work
		Child labor
		Labor rights protections

10	Inequality	Wealth inequality
		Vertical mobility
12	Sustainable consumption and production	Environmental impact of material flows
		Recycling and re-use (circular economy)
		Chemicals
13	Climate change	Leading indicators for decarbonization
		Greenhouse gas emissions from land use
		Climate vulnerability metrics
14	Marine ecosystems	Maximum sustainable yields for fisheries
		Impact of high-sea and cross-border fishing
		Protected areas by level of protection
15	Terrestrial ecosystems	Leading indicators for ecosystem health
		Trade in endangered species
		Protected areas by level of protection
16	Peace and justice	Modern slavery and human trafficking
		Access to justice
		Financial secrecy
		Violence against children
		Protection of the rights of civil society organizations
17	Means of implementation	Non-concessional development finance
		Climate finance
		Unfair tax competition
		Development impact of trade practices

Source: Authors' analysis

2.5 Calculating Index scores

The procedure for calculating the SDG Index comprised three steps: (i) censor extreme values from the distribution of each indicator; (ii) rescale the data to ensure comparability across indicators; (iii) aggregate the indicators within and across SDGs.

2.5.1 Outliers

To remove the effect of extreme values, which can skew the results of a composite index, the OECD (OECD and JRC, 2016) recommends censoring the data at the bottom 2.5th percentile as the minimum value for the normalization. We applied this approach to the lower bound and censored data at this level.

2.5.2 Normalization

To make the data comparable across indicators, each variable was rescaled from 0 to 100 with 0 denoting worst performance (2.5th percentile) and 100 describing the technical optimum (see section 1.6). Rescaling is usually very sensitive to the choice of limits and extreme values (outliers) at both tails of the distribution. The latter may become unintended thresholds and introduce spurious variability in the data. Consequently, the choice of upper and lower bounds can affect the relative ranking of countries in the index. This applies in particular to the lower bounds that affect the value and the units of the variable, which may in turn affect rankings, while the upper bound only affects the units (Booysen, 2002; OECD and JRC, 2016).

Each indicator distribution was censored, so that all values exceeding the upper bound scored 100, and values below the lower bound scored 0.

After establishing the upper and lower bounds, variables were transformed linearly to a scale between 0 and 100 using the following rescaling formula for the range [0; 100]:

$$x' = \frac{\mathrm{x} - min(x)}{max(x) - min(x)} \qquad (Eq.S1)$$

where *x* is raw data value; *max/min* denote the bounds for best and worst performance, respectively; and *x'* is the normalized value after rescaling.

The rescaling equation ensured that all rescaled variables were expressed as ascending variables (i.e. higher values denoted better performance). In this way, the rescaled data became easy to interpret and compare across all indicators: a country that scores 50 on a variable is half-way towards achieving the optimum value; a country with a score of 75 has covered three quarters of the distance from worst to best.

2.5.3 Weights

To arrive at a composite SDG Index, the constituent components needed to be weighted and aggregated. Different weightings of individual SDGs can have important implications on countries' performance and relative rankings in an SDG Index (Booysen, 2002). This issue is further compounded by the fact that the SDGs combine policy means (e.g. official development assistance) and policy ends (e.g. healthy life expectancy).

The literature identifies four main approaches to designing weights:

1. Equal weights [option retained for the SDG Index and Dashboards Report]
2. Mathematical weights
3. Expert weights
4. Subjective/flexible weights

The SDG Index and Dashboards uses equal weighting at the goal and indicator level.

- At goal level this is justified by the fact that all SDGs are considered as having equal importance as part of the 2030 Agenda.

- At the indicator level equal weighting was retained because all alternatives were considered as being less satisfactory.

    - *Mathematical weights (derived from PCA and factor loadings):* Mathematical weights derived from Principal Component Analysis (PCA) are commonly used to assign weights to individual variables correlated among each other and measuring a common underlying factor. While in general, most SDGs measure a broadly complementary set of policies (SDG3, SDG4, SDG9) there are notable exceptions which prevent from having a consistent approach for setting variable weights mathematically across all goals. For instance, SDG2 (No Hunger) incorporates at least three different factors which are not correlated (undernourishment, obesity and sustainable agriculture) (Box 1). Using existing measures, similar results apply to other goals. As stated in the JRC-OECD

Handbook: “Weights, […] cannot be estimated with these methods [PCA, FA] if no correlation exists between indicators.” (JRC-OECD, 2014). The level of heterogeneity within some of the goals made it clear that assigning weights mathematically would require conceptualizing further the content of the SDGs (i.e. moving uncorrelated measures to other goals despite what the official targets indicate) which is out of scope of this report. Combined to the limited number of observations (n=156), mathematical weights derived from PCA and factor loadings was therefore discarded.

- *Expert Weights:* The results of several rounds of expert consultations on earlier drafts of the SDG Index made clear that there was no consensus across different epistemic communities on assigning higher weights to some SDGs or to specific indicators over others. This confirms experiences with other composite indices that there is no universally agreed answer to this “weighting problem” (Booysen, 2002).

- *Subjective/flexible weights:* Some composite indices, such as the OECD Better Life Index (OECD, 2015), allow users to select the weights they attach to the components of an index. Such a flexible weighting methodology can be appropriate for measures of well-being because each user has an immediate and subjective experience of what a “better life” means for her or him. In contrast, the SDGs describe a broad spectrum of policy challenges that few individuals or institutions master in their full breadth. Moreover, flexible weightings might encourage countries to “cherry-pick” the SDGs that are easier to achieve and leave aside equally important ones that require deeper transformations. For these reasons, we considered subjective and flexible weightings less suitable for the SDG Index.

Equal weights were therefore retained and considered as the most suitable option. However, equal weights do not mean “no weights” (JRC-OECD, 2018). Considering that goals are measured using an uneven number of indicators so called “implicit weighting” is introduced whereby the 14 global indicators under SDG3 (Health and Well-Being) weight individually relatively less than the single global indicator used to measure SDG 10 (Reduced inequalities). Removing outliers (SDG1, SDG3, SDG9, SDG10, SDG12 and SDG16) the rest of the goals are all measure using between 3 to 6 indicators thus implying limited implicit weighting. We are also hopeful that, as the availability of data increases to measure some of the goals, implicit weighting would be reduced across goals.

Box 1: Principal Component Analysis – SDG 2 (No Hunger)

Principal Component Analyses were conducted for each goal as complementary information. The examples below provide some of insights from the PCA results on SDG2 and highlights the heterogeneity embodied in the content of some of the goals. In the case of SDG2, using current available measures there are at least three underlying factors which do not all correlate among each others. It is beyond the scope of the SDG Index and Dashboards Report to generate sub-categories within goals or assign to another goal uncorrelated factors (e.g. obesity) and for this reason mathematical weights derived from PCA and factor loadings was discarded.

Correlation between underlying variables, SDG2

	Prevalence of Undernourishment	Prevalence of stunting under -5s	Prevalence of wasting under -5s	Prevalence of adult obesity	Cereal yield	Sustainable Nitrogen Management Index
Prevalence of Undernourishment	1.0000					
Prevalence of stunting under -5s	**0.7336***	1.0000				
	0.0000					
Prevalence of wasting under -5s	**0.4688***	**0.7085***	1.0000			
	0.0000	*0.0000*				
Prevalence of adult obesity	**-0.5277***	**-0.6988***	**-0.5509***	1.0000		
	0.0000	*0.0000*	*0.0000*			
Cereal yield	**0.5204***	**0.5939***	**0.4016***	**-0.4073***	1.0000	
	0.0000	*0.0000*	*0.0000*	*0.0000*		
Sustainable Nitrogen Management Index	**0.2656***	**0.2701***	**0.2223***	-0.1149	**0.4967***	1.0000
	0.0020	*0.0016*	*0.0101*	*0.1845*	*0.0000*	

Principal Component Factor Analysis, SDG2

Factor analysis/correlation	Number of obs	126
Method: principal-component factors	Retained factors	2
Rotation: orthogonal varimax (Kaiser off)	Number of params	11

Factor	Variance	Difference	Proportion	Cumulative
Factor1	2.92342	1.368	0.4872	0.4872
Factor2	1.55543	.	0.2592	0.7465

LR test: independent vs. saturated: chi2(15) = 359.24 Prob>chi2 = 0.0000

Factor loadings, SDG2

Variable	Factor1	Factor2	Uniqueness
Prevalence of Undernourishment	0.7456	0.3186	0.3426
Prevalence of stunting under -5s	0.8952	0.2674	0.1271
Prevalence of wasting under -5s	0.8003	0.0977	0.35
Prevalence of adult obesity	*-0.8555*	*-0.0029*	*0.2681*
Cereal yield	0.4393	0.7242	0.2825
Sustainable Nitrogen Management Index	0.0289	0.921	0.1509

Source: Authors' analysis. Based on Sachs and al, 2018

2.5.4 Aggregation

The aggregation for the SDG Index proceeded in two steps[4]. First, the rescaled variables were combined for each SDG before being aggregated across goals. This approach also allows for the later addition of new variables for a particular SDG without affecting the relative weight of each SDG in the overall score.

Just like the weighting, the method for aggregating different variables into a single index can have profound implications on the overall ranking (OECD and JRC, 2016; Rickels et al., 2014). To allow for maximum flexibility in aggregating data, one can use the standard constant-elasticity-of-substitution (CES) function (Arrow et al., 1961; Blackorby and Donaldson, 1982) (equation 2) to generate the SDG Index score I_{ij} for SDG *j* and country *i*.

$$I_{ij}(N_{ij}, I_{ijk}, \rho) = \left[\sum_{k=1}^{\mathrm{N_{ij}}} \frac{1}{\mathrm{N_{ij}}} I_{ijk}^{-\rho}\right]^{-\frac{1}{\rho}} \qquad (Eq.2)$$

Where I_{ijk} is the score of indicator *k* under SDG *j* for country *i*; N_{ij} denotes the number of indicators for SDG_i; and ρ describes the substitutability across components of the indicator with a permissible range of $-1 \leq \rho \leq \infty$ (Arrow et al., 1961). An equivalent CES equation is used to aggregate the SDG Index scores I_{ij} for country *i* into the overall country score I_j.

The elasticity of substitution σ across components of the SDG Index is defined as:

$$\sigma = \frac{1}{1+\rho} \qquad (Eq.3)$$

With $0 \leq \sigma \leq \infty$ and

$$\rho = \frac{1-\sigma}{\sigma} \qquad (Eq.4)$$

Three special cases of this CES function are frequently considered. First, if the components of the aggregate index are perfect substitutes ($\sigma = \infty$, $\rho = -1$) then regress on one indicator (e.g. Gini index) can be offset by progress on another indicator (e.g. child mortality rate). This case is often referred to as "weak sustainability". The CES function with equal weights across components then assumes the form of the arithmetic mean:

$$I_{ij}(N_{ij}, I_{ijk}) = \sum_{\mathrm{k=1}}^{\mathrm{N_{ij}}} \frac{1}{\mathrm{N_{ij}}} \mathrm{I_{ijk}} \qquad (Eq.5)$$

Second, strong sustainability occurs when the components of the SDG Index are not substitutable ($\sigma = 0$, $\rho = \infty$). In this case the CES function turns into a Leontief production function with orthogonal isoquants where the score I_{ij} of a country *i* and SDG j is determined by the country's lowest score I_{ijk} across all SDG indicators *k*:

$$I_{ij}(\, I_{ijk}) = Min\{I_{ijk}\} \qquad (Eq.6)$$

[4] Based on Sachs and al, 2017.

Finally, an intermediate case of linear substitutability is given by the Cobb-Douglas production function with $\sigma = 1$ and $\rho = 1$. In this case the SDG Index I_{ij} becomes the geometric mean of the indices I_{ijk}:

$$I_{ij}(N_{ij}, I_{ijk}) = \prod_{k=1}^{N_{ij}} \sqrt[N_{ij}]{I_{ijk}} \qquad (Eq. 7)$$

The geometric mean is often used to aggregate heterogeneous variables with limited substitutability and in cases where the focus of the analysis is on percentage changes instead of absolute changes. A prominent example is the Human Development Index (HDI), which changed its method of aggregation across three dimensions from arithmetic to geometric mean in 2010 (UNDP, 2015a).

To aggregate indicator scores within each SDG we used the arithmetic mean ("weak sustainability") because each SDG describes a set of broadly complementary policy priorities (despite some notable exceptions highlighted above). This implies that countries are indifferent to adding a unit of progress on any of the indicators comprised under an SDG. In line with our method for weighting across goals, each indicator was weighted equally. As a result, the relative weight of each indicator in a goal was inversely proportional to the number of indicators considered under that goal.

We considered all three options (arithmetic mean, geometric average, and Leontief function) for aggregating SDG scores I_{ij} across SDGs j. Since the SDGs are an integrated and indivisible agenda requiring progress towards all goals, perfect substitutability across goals, as required for using the arithmetic mean, cannot be assumed outright. The geometric average has the advantage of reflecting an assumed "penalty" on very low scores, unlike the arithmetic mean. Meanwhile, the Leontief minimum function focuses on the single SDG and where a country performs worst, which is a poor indication of how the country performs across the 17 goals. We therefore considered both the arithmetic and geometric averages as two plausible approaches. Both yielded similar results with a correlation coefficient of 0.977 and very similar rankings.

Compared with the geometric mean the arithmetic average has the advantage of simplicity of interpretation: an index score between 0 and 100 reflects the average initial placement of the country between worst and best on the average of the 17 goals. Based on the similarity of results confirmed by additional sensitivity tests (see below) and the greater ease of interpretation of the arithmetic mean, we opted for the latter to aggregate goal indices I_{ij} across SDGs j.

A country's overall SDG Index score was therefore estimated by combining equation 4 for aggregation within and across SDGs to yield equation 8:

$$\mathrm{I_i}(\mathrm{N_i}, \mathrm{N_{ij}}, \mathrm{I_{ijk}}) = \sum_{j=1}^{N_i} \frac{1}{N_i} \sum_{\mathrm{k=1}}^{\mathrm{N_{ij}}} \frac{1}{\mathrm{N_{ij}}} \mathrm{I_{ijk}} \qquad (Eq. 8)$$

Where Ii is the index score for country i, Ni the number of SDGs for which the country has data, Nij the number of indicators for SDG j for which country i has data, and Iijk denotes the score of indicator k under SDG j for country i.

3. STATISTICAL SOUNDNESS

3.1 Collinearity/redundancy

Collinearity (redundancy) between goals and between indicators under each Goal was assessed. Pairwise Pearson correlation coefficients are presented in Figure X. There are no signs of collinearity (defined at > 0.9) across goals.

Figure 10: Pearson correlation coefficients across SDGs (2018)

	SDG1	SDG2	SDG3	SDG4	SDG5	SDG6	SDG7	SDG8	SDG9	SDG10	SDG11	SDG12	SDG13	SDG14	SDG15	SDG16	SDG17
SDG1	1.00																
SDG2	0.58	1.00															
SDG3	**0.76**	**0.78**	1.00														
SDG4	**0.62**	**0.74**	**0.85**	1.00													
SDG5	0.36	**0.62**	**0.62**	**0.73**	1.00												
SDG6	0.41	0.55	0.48	0.52	**0.64**	1.00											
SDG7	**0.77**	**0.69**	**0.87**	**0.79**	0.50	0.45	1.00										
SDG8	0.57	**0.76**	**0.74**	**0.69**	**0.66**	0.48	0.55	1.00									
SDG9	0.54	**0.79**	**0.82**	**0.71**	0.57	0.34	**0.67**	**0.75**	1.00								
SDG10	0.34	0.39	0.34	0.17	0.09	0.07	0.21	0.32	0.41	1.00							
SDG11	0.48	**0.60**	**0.71**	**0.70**	**0.72**	**0.62**	**0.66**	**0.60**	**0.61**	0.08	1.00						
SDG12	-0.42	**-0.61**	**-0.69**	-0.58	-0.44	-0.26	-0.56	**-0.61**	**-0.78**	-0.29	-0.49	1.00					
SDG13	-0.10	-0.11	-0.20	-0.16	-0.07	0.19	-0.10	-0.20	-0.26	-0.01	-0.03	0.44	1.00				
SDG14	0.06	0.10	0.11	0.15	0.19	0.08	0.11	0.14	0.16	-0.03	0.20	-0.09	0.01	1.00			
SDG15	-0.19	0.05	-0.09	-0.02	0.03	0.05	-0.10	-0.03	-0.01	0.09	-0.05	0.11	0.24	0.23	1.00		
SDG16	0.49	0.59	0.69	0.52	0.33	0.10	0.50	**0.61**	**0.77**	0.47	0.43	**-0.63**	-0.31	0.09	-0.04	1.00	
SDG17	-0.07	-0.02	-0.01	0.01	0.12	0.10	0.00	-0.13	-0.07	-0.11	0.07	0.04	-0.06	0.07	-0.07	-0.09	1

Note: In bold 0.6 <.
Source: Authors' analysis based on Sachs and al, 2018.

At the indicator level, Pearson correlation coefficients were generated across indicators within goals. There are five cases where Pearson correlation coefficients exceed 0.9 (list below). These indicators belong to SDG1 (No poverty) and SDG3 (Health and well-being). Despite high correlation coefficients these indicators were retained because of their relevance and/or because they are specifically mentioned in Agenda 2030.

- SDG1: Poverty headcount ratio at 1.90$/day (% population) & Projected poverty headcount ratio at 1.90$/ day in 2030 (%population)
- SDG3: Maternal mortality rate (per 100,000 live births) & Mortality rate, under – 5 (per 1,000 live births)
- SDG3: Neonatal mortality rate (per 1,000 live births) & Mortality rate, under – 5 (per 1,000 live births)
- SDG3: Maternal mortality rate (per 100,000 live births) & Healthy Life Expectancy at birth (years)
- SDG3: Healthy Life Expectancy at birth (years) & Mortality rate, under – 5 (per 1,000 live births)

Three main reasons explain why we decided not to remove highly correlated variables from the Report: (i) we want to present as much data as possible, and each indicator has distinct policy implications (ii) the purpose of the SDG Index is not to model SDG achievement, but to track progress (iii) each indicator is supported by one or more expert communities. The SDG Index wants to support the SDG agenda as a whole.

3.2 Inter-item correlations within goals

Cronbach's Alpha is a coefficient of reliability based on the correlations between indicators. This statistic is generally used to investigate the degree of correlation among a set of variables and to check the internal reliability of items in a model or survey. A Cronbach's alpha coefficient equal to zero means that the variables are independent (e.g. the selection is not correlated and therefore is statistically not relevant), while a coefficient equal to one means that the variables are perfectly correlated. In general, a coefficient of above 0.7 is considered to be an acceptable indication that the variables are measuring the same underlying construct.

Overall, inter-item correlations are high (0.7<) for 8 SDGs, moderate (0.4 < x < 0.7) for 6 SDGs and low (<0.7) for 2 SDGs (figure 11). One SDG is based on one single metric – SDG10 (Reduced Inequalities).

- SDG5: The moderate inter-item correlations highlight moderate interlinkages between various components of gender equality.
- SDG6, 13 and 15: The inclusion of spillover indicators, especially environmental spillovers embodied into trade, for SDG 6, 13 and 15 affects inter-item correlations as those measures are not highly correlated with "access measures" (water, sanitation) and policy related measures (e.g. mean terrestrial and freshwater areas protected).
- SDG11 and 17: The content of these goals and variables included are quite heterogeneous which leads to weak correlations among each underlying item. SDG11 covers PM2.5 concentration, Improved Water Source and Satisfaction with local public transportations' systems. SDG17 includes health and education expenditure, Official Development Assistance (HICs and DAC countries) or Tax Revenues (MICs and LICs) and Tax Haven score.
- SDG14: Covers policy measures (mean area protected) and outcome measures (share of trawling fisheries) and includes highly aggregated measures of biodiversity, fisheries and clean waters (Ocean Health Index).

Figure 11: Inter-item correlations (chronbach's alpha) for each SDGs, 2018

	Average interitem covariance	Number of items in the scale	**Scale reliability coefficient**
SDG1	543.4669	2	**0.9567**
SDG2	316.0909	6	**0.8501**
SDG3	347.7293	14	**0.9534**
SDG4	465.6166	3	**0.8408**
SDG5	92.47943	4	**0.4188**
SDG6*	255.2959	4	**0.6433**
SDG7	483.6749	3	**0.7326**
SDG8	163.8546	4	**0.6027**
SDG9	560.285	7	**0.9531**
SDG10	Not applicable	1	**Not applicable**
SDG11	116.6433	3	**0.4731**
SDG12	366.4188	7	**0.8776**
SDG13	119.7892	4	**0.5556**
SDG14	14.84755	6	**0.1265**
SDG15	130.1181	5	**0.5052**
SDG16	233.4418	9	**0.8311**
SDG17**	68.27343	2	**0.2703**

*Excluding Safely Managed (High Income only)
**Exluding ODA (OECD only) and Tax revenues (Global Only)
Source: Authors' analysis based on Sachs and al, 2018.

3.3 Sensitivity/robustness tests

As a further robustness test we calculated the median rank between the arithmetic and geometric ranks as shown in the SDG Index and Dashboards Report 2017. The volatility between ranks is limited – only several countries have more than 10 positions difference between the arithmetic and the median rank. These differences were due to the property of geometric mean – unlike the arithmetic mean – to penalize very low scores on specific goals. As a result, countries at the bottom of the SDG Index distribution obtain extremely low overall scores with the geometric mean. This finding further corroborated our decision to opt for the simpler and easier-to-interpret arithmetic mean.

To test the robustness of the upper and lower bounds used for the normalization of variables (equation 1), we considered alternative approaches to setting "worst" (=0) performance. As an alternative to censoring the datasets at the 2.5th percentile to establish the lower bound, we also considered censoring at the 5th percentile, as well as using the average of the bottom 5 performers as the lower bound. Upper bounds were left unchanged since they reflect the goal benchmarks to be achieved by 2030. The resulting rankings showed that only a limited number of country rankings were affected by the method for setting upper and lower bounds. In view of this we conclude that our findings are robust with regards to the specification of the lower bounds.

Total SDG Index scores are based on a slightly different basket of indicators for OECD countries & HICs compared with other countries. On goal 6, instead of using "basis access to water & sanitation" we use "access to safely managed water & sanitation" for HICs and OECD countries. Similarly, on goal 17, instead of using "tax revenues" we use "share of ODA" of HICs and OECD countries. As complementary information, adjusted Index scores and ranking are presented in Annex 5 using the exact same basket of indicators for HICs, OECD, MICs and LICs. This impacts positively (5 ranks or more) the score of a number of OECD and HIC countries such as Australia, Cyprus, Greece, Israel, Mexico, Turkey and Saudi Arabia.

Sensitivity testing was conducted to verify the sensitivity of the indicators created based on different weighting schemes. Monte Carlo (MC) simulations were run to test the sensitivity of the composite indicators to different weighting schemes. This technique uses 1 000 sets of randomly generated simulated weights to calculate possible composite indicator scores for each country under different weighting schemes. This is equivalent to assuming uncertainty about the most appropriate value of each of the individual weights assigned to construct the composite indicators (Arndt and al, 2015).

MC was conducted at three levels:

1. Total Index score using all indicators (i.e. no clustering by SDGs)

2. Total Index score using varying goal weights

3. Total Goals score

Results are available in Annex 6. The diamonds represent the score assigned in the report and the line represents the range of possible scores that could be obtained using 1000 random combinations of weights. from the lowest 5th percentile to the highest possible score obtained. From this it is possible to generate two groups of countries: 1) Countries that score above the mean for 95% of random combinations. 2) Countries that score below the mean for 95% of random combinations. These two groups of countries can therefore be said to have indicator values

which are significantly different from each other independent of the weighting scheme. Small differences between country scores should be interpreted with caution.

The first graph in Annex 6 (random weights assigned to all indicators) shows that on average countries' total Index scores could be 5.7 p.p. higher and 4.3 p.p. lower based on random weights assignation and no clustering. From this graph thresholds can be identified to separate the performance across groups of countries that perform systematically above or below the world average.

The second graph in Annex 6 (random weights assigned to each goals) shows that on average country Index scores can vary by 8.4 p.p. up and by 4.4 p.p. down. the weighting of the goals might also alter the current countries' scores and ranking. Nevertheless, no matter what weighting scheme is used, the top 55 countries will always score above the world average and the bottom 29 countries will always score below it.

Results for each goals show that SDG3, SDG4, SDG9, SDG11, SDG13 and SDG15 are less affected by changes in variable weights whereas SDG2, SDG5, SDG6, SDG7, SDG8, SDG12, SDG14 and SDG16 are more highly affected.

Annexes

Annex 1: List of trend indicators

Goal	Period covered	Notes	Indicator
SDG1			
1	2010 - 2015		Poverty headcount ratio at $1.90/day (% population)
1	2010 - 2015	OECD only	Poverty rate after taxes and transfers, Poverty line 50% (% population)
SDG2			
2	2010 - 2016		Prevalence of obesity, BMI ≥ 30 (% adult population)
2	2010 - 2016		Cereal yield (t/ha)
2	2010 - 2016	Different Source	Prevalence of stunting (low height-for-age) in children under 5 years of age (%)
2	2010 - 2016	Different Source	Prevalence of wasting in children under 5 years of age (%)
SDG3			
3	2010 - 2015		Maternal mortality rate (per 100,000 live births)
3	2010 - 2015		Neonatal mortality rate (per 1,000 live births)
3	2010 - 2015		Mortality rate, under-5 (per 1,000 live births)
3	2010 - 2015		Incidence of tuberculosis (per 100,000 population)
3	2010 - 2015		HIV prevalence (per 1,000)
3	2010 - 2015		Age-standardised death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations age 30–70 years (per 100,000 population)
3	2010 - 2015		Traffic deaths rate (per 100,000 population)
3	2010 - 2015		Adolescent fertility rate (births per 1,000 women ages 15-19)
3	2010 - 2015		Percentage of surviving infants who received 2 WHO-recommended vaccines (%)
3	2010 - 2015		Universal Health Coverage Tracer Index (0-100)
3	2010 - 2015		Subjective Wellbeing (average ladder score, 0-10)
3	2010 - 2015	Different Source	Life Expectancy at birth (years)
3	2010 - 2015	OECD only	Daily smokers (% population age 15+)
SDG4			
4	2009 - 2015		Net primary enrolment rate (%)
4	2009 - 2015		Mean years of schooling (years)
4	2009 - 2015	OECD only	Population age 25-64 with tertiary education (%)
4	2009 - 2015	OECD only	Students performing below level 2 in science (%)
SDG5			
5	2010 - 2016		Estimated demand for contraception that is unmet (% women married or in union, ages 15-49)
5	2010 - 2016		Ratio of female to male labour force participation rate
5	2010 - 2016		Seats held by women in national parliaments (%)
5	2010 - 2016	OECD only	Gender wage gap (Total, % male median wage)
SDG6			
6	2009 - 2016		For all other countries : Population using at least basic drinking water services (%)
6	2009 - 2016		For all other countries : Population using at least basic sanitation services (%)
6	2009 - 2016		For high-income & OECD countries : population using safely managed water services (%)
6	2009 - 2016		For high-income & OECD countries : population using safely managed sanitation services (%)
SDG7			
7	2008 - 2014		Access to electricity (% population)
7	2008 - 2014		Access to clean fuels & technology for cooking (% population)

7	2008 - 2014		CO2 emissions from fuel combustion / electricity output (MtCO2/TWh)
7	2008 - 2014	OECD only	Share of renewable energy in total final energy consumption (%)
SDG8			
8	2011 - 2014		Adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider (%)
8	2011 - 2014	Global only	Unemployment rate (% total labor force)
8	2011 - 2014	OECD only	Employment-to-Population ratio (%)
8	2011 - 2014	OECD only	Youth not in employment, education or training (NEET) (%)
SDG9			
9	2009 - 2015		Population using the internet (%)
9	2009 - 2015		Mobile broadband subscriptions (per 100 inhabitants)
9	2009 - 2015		Quality of overall infrastructure (1= extremely underdeveloped; 7= extensive and efficient by international standards)
9	2009 - 2015	OECD only	Research and development researchers (per 1,000 employed)
9	2009 - 2015	OECD only	Triadic Patent Families filed (per million population)
SDG10			
10	2011 - 2014	OECD only	Gini Coefficient adjusted for top income (1-100)
10	2011 - 2014	OECD only	Palma ratio
SDG11			
11	2010 - 2016		Improved water source, piped (% urban population with access)
11	2010 - 2016		Satisfaction with public transport (%)
11	2010 - 2016	Different Source	Levels of particulate matter smaller than 2.5 microns (PM2.5)
SDG13			
13	2008 - 2014		Energy-related CO2 emissions per capita (tCO2/capita)
SDG14			
14	2012 - 2017		Ocean Health Index Goal - Biodiversity (0-100)
14	2012 - 2017		Ocean Health Index Goal - Clean Waters (0-100)
14	2012 - 2017		Ocean Health Index Goal - Fisheries (0-100)
14	2009 - 2014	Different Years	Fish caught by trawling (%)
SDG15			
15	2011 - 2017		Mean area that is protected in terrestrial sites important to biodiversity (%)
15	2011 - 2017		Mean area that is protected in freshwater sites important to biodiversity (%)
15	2011 - 2017		Red List Index of species survival (0-1)
SDG16			
16	2011 - 2015		Proportion of the population who feel safe walking alone at night in the city or area where they live (%)
16	2011 - 2015		Government Efficiency (1-7)
16	2011 - 2015		Property Rights (1-7)
16	2011 - 2015		Corruption Perception Index (0-100)
SDG17			
17	2008 - 2014		Government Health and Education spending (% GDP)
17	2008 - 2014		For all other countries: Tax revenue (% GDP)
17	2008 - 2014		For high-income and all OECD DAC countries: International concessional public finance, including official development assistance (% GNI)

Annex 2: List of countries not included in the 2018 SDG Index due to insufficient data availability

Country	Missing Values	Percentage of Missing Values
Andorra	40	49%
Antigua and Barbuda	33	38%
Bahamas, The	27	31%
Barbados	19	22%
Brunei Darussalam	17	20%
Comoros	19	22%
Dominica	41	47%
Equatorial Guinea	25	29%
Eritrea	18	21%
Fiji	20	23%
Grenada	34	39%
Guinea-Bissau	19	22%
Kiribati	38	44%
Korea, Dem. Rep.	26	30%
Libya	18	21%
Liechtenstein	54	67%
Maldives	17	20%
Marshall Islands	45	52%
Micronesia, Fed. Sts.	42	48%
Monaco	52	60%
Nauru	55	63%
Palau	52	60%
Papua New Guinea	20	23%
Samoa	30	34%
San Marino	58	67%
Sao Tome and Principe	17	20%
Seychelles	29	33%
Solomon Islands	23	26%
Somalia	19	22%
South Sudan	23	28%
St. Kitts and Nevis	49	56%
St. Lucia	27	31%
St. Vincent and the Grenadines	31	36%
Timor-Leste	20	23%
Tonga	32	37%
Tuvalu	53	61%
Vanuatu	19	22%

Source: Sachs and al, 2018

Annex 3: Summary statistics for indicators included in the 2018 SDG Index and Dashboards

SDG	Indicator	Obs	Mean	Std.Dev.	Min	Max
1	Poverty headcount ratio at $1.90/day (% population)	181	13.0	20.0	0.0	86.0
1	Projected poverty headcount ratio at $1.90/day in 2030 (% population)	181	8.8	16.6	0.0	95.5
1	Poverty rate after taxes and transfers, Poverty line 50% (% population)	35	11.5	3.7	5.5	17.7
2	Prevalence of undernourishment (% population)	177	10.8	11.4	1.2	58.6
2	Prevalence of stunting (low height-for-age) in children under 5 years of age (%)	182	18.1	14.7	1.3	59.3
2	Prevalence of wasting in children under 5 years of age (%)	181	4.9	4.8	0.0	22.7
2	Prevalence of obesity, BMI ≥ 30 (% adult population)	187	19.5	10.8	2.1	61.0
2	Cereal yield (t/ha)	174	3.5	3.0	0.2	24.7
2	Sustainable Nitrogen Management Index	136	0.8	0.2	0.3	1.3
3	Maternal mortality rate (per 100,000 live births)	181	170.2	233.2	3.0	1360.0
3	Neonatal mortality rate (per 1,000 live births)	192	13.3	10.9	0.6	45.6
3	Mortality rate, under-5 (per 1,000 live births)	192	30.4	30.3	2.1	132.5
3	Incidence of tuberculosis (per 100,000 population)	192	114.8	149.0	0.0	781.0
3	HIV prevalence (per 1,000)	186	0.5	1.1	0.0	8.0
3	Age-standardised death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations age 30–70 years (per 100,000 population)	183	19.2	5.8	8.3	36.1
3	Age-standardised death rate attributable to household air pollution and ambient air pollution (per 100,000 population)	184	84.2	66.8	0.2	261.8
3	Traffic deaths rate (per 100,000 population)	183	17.0	9.3	2.0	45.4
3	Healthy Life Expectancy at birth (years)	183	71.3	8.0	50.1	83.7
3	Adolescent fertility rate (births per 1,000 women ages 15-19)	183	48.0	40.5	0.3	194.0
3	Births attended by skilled health personnel (%)	180	85.0	21.2	9.4	100.0
3	Percentage of surviving infants who received 2 WHO-recommended vaccines (%)	192	85.7	15.6	19.0	99.0
3	Universal Health Coverage Tracer Index (0-100)	186	60.2	13.5	27.2	86.2
3	Subjective Wellbeing (average ladder score, 0-10)	158	5.4	1.2	2.7	7.8
3	Gap in life expectancy at birth among regions (years)	33	3.2	2.0	0.3	11.0
3	Gap in self-reported health by income (0-100)	33	19.1	8.2	3.7	41.1
3	Daily smokers (% population age 15+)	35	18.8	5.2	7.6	29.8
4	Net primary enrolment rate (%)	172	89.0	12.0	32.1	100.0
4	Mean years of schooling (years)	186	8.3	3.1	1.4	13.4
4	Literacy rate of 15-24 year olds, both sexes (%)	141	87.8	17.6	23.5	100.0
4	Population age 25-64 with tertiary education (%)	35	35.5	10.1	16.8	56.3
4	PISA score (0-600)	35	492.0	26.1	415.7	528.7
4	Percentage of variation in science performance explained by students' socio-economic status	35	12.9	4.0	4.9	21.4
4	Students performing below level 2 in science (%)	35	21.2	8.8	8.8	47.8
4	Resilient students (%)	35	29.2	9.2	12.8	48.8
5	Estimated demand for contraception that is unmet (% women married or in union, ages 15-49)	177	26.0	18.3	4.3	82.4
5	Ratio of female to male mean years of schooling of population age 25 and above	168	87.8	18.7	27.6	132.1
5	Ratio of female to male labour force participation rate	178	71.5	19.7	8.6	110.6
5	Seats held by women in national parliaments (%)	193	21.3	11.8	0.0	61.3
5	Gender wage gap (Total, % male median wage)	35	14.1	7.3	3.4	36.7
6	For high-income & OECD countries : population using safely managed water services (%)	42	96.1	4.9	81.5	100.0
6	For all other countries : Population using at least basic drinking water services (%)	93	76.8	19.4	19.3	99.9
6	For high-income & OECD countries : population using safely managed sanitation services (%)	47	86.1	12.1	60.1	100.0
6	For all other countries : Population using at least basic sanitation services (%)	107	57.9	28.9	7.1	100.0
6	Freshwater withdrawal as % total renewable water resources	180	65.4	287.3	0.0	2603.5
6	Imported groundwater depletion (m3/year/capita)	170	10.4	18.3	0.1	148.2
7	Access to electricity (% population)	193	80.3	29.8	4.5	100.0
7	Access to clean fuels & technology for cooking (% population)	189	64.2	38.6	2.0	100.0
7	CO2 emissions from fuel combustion / electricity output (MtCO2/TWh)	137	1.7	2.6	0.1	23.7
7	Share of renewable energy in total final energy consumption (%)	35	21.3	16.6	2.7	77.0
8	Adjusted Growth (%)	179	-2.2	2.8	-14.8	7.9
8	Slavery score (0-100)	164	65.0	28.3	0.0	100.0
8	Adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider (%)	154	58.8	27.4	6.4	99.9
8	Unemployment rate (% total labor force)	143	7.9	6.1	0.2	27.7
8	Employment-to-Population ratio (%)	35	69.4	7.2	51.6	86.1
8	Youth not in employment, education or training (NEET) (%)	34	14.0	5.3	5.3	28.2
9	Population using the internet (%)	190	49.4	28.4	0.0	98.2
9	Mobile broadband subscriptions (per 100 inhabitants)	193	53.7	39.7	0.0	254.4

9	Quality of overall infrastructure (1= extremely underdeveloped; 7= extensive and efficient by international standards)	149	4.0	1.1	1.5	6.6
9	Logistics performance index: Quality of trade and transport-related infrastructure (1=low to 5=high)	156	2.7	0.7	1.2	4.4
9	The Times Higher Education Universities Ranking, Average score of top 3 universities (0-100)	193	15.8	22.7	0.0	92.8
9	Number of scientific and technical journal articles (per 1,000 population)	193	0.4	0.6	0.0	2.5
9	Research and development expenditure (% GDP)	148	0.7	0.9	0.0	4.3
9	Research and development researchers (per 1,000 employed)	35	8.7	3.8	0.8	17.4
9	Triadic Patent Families filed (per million population)	35	30.6	35.0	0.1	142.4
9	Gap in internet access by income (%)	29	38.4	18.0	6.0	63.6
9	Women in science and engineering (%)	30	28.0	5.4	16.2	41.0
10	Gini Coefficient adjusted for top income (1-100)	134	42.6	9.0	26.7	67.1
10	Palma ratio	35	1.2	0.4	0.8	2.5
10	Elderly Poverty Rate (%)	35	13.0	9.8	3.1	45.7
11	Annual mean concentration of particulate matter of less than 2.5 microns of diameter (PM2.5) in urban areas (µg/m3)	186	28.7	19.9	3.4	107.3
11	Improved water source, piped (% urban population with access)	172	82.7	21.4	7.4	100.0
11	Satisfaction with public transport (%)	158	57.4	14.6	8.0	85.0
11	Rent overburden rate (%)	32	11.3	5.3	3.5	25.6
12	Municipal Solid Waste (kg/year/capita)	124	1.3	1.2	0.1	5.7
12	E-waste generated (kg/capita)	181	7.5	7.1	0.2	28.3
12	Percentage of anthropogenic wastewater that receives treatment (%)	167	26.1	33.5	0.0	100.0
12	Production-based SO2 emissions (kg/capita)	159	13.5	23.5	0.4	176.3
12	Net imported SO2 emissions (kg/capita)	187	1.6	12.0	-52.0	60.9
12	Nitrogen production footprint (kg/capita)	146	28.0	21.2	1.0	139.8
12	Net imported emissions of reactive nitrogen (kg/capita)	128	6.9	217.2	-1223.5	965.4
12	Non-Recycled Municipal Solid Waste (MSW in kg/person/year times recycling rate)	33	1.4	0.4	0.5	2.4
13	Energy-related CO2 emissions per capita (tCO2/capita)	191	4.5	6.1	0.0	45.4
13	Imported CO2 emissions, technology-adjusted (tCO2/capita)	175	0.3	4.4	-19.5	48.5
13	Climate Change Vulnerability Monitor (best 0-1 worst)	158	0.1	0.1	0.0	0.4
13	CO2 emissions embodied in fossil fuel exports (kg/capita)	168	4095.3	15973.0	0.0	150584.3
13	Effective Carbon Rate from all non-road energy, excluding emissions from biomass (€/tCO2)	34	18.4	16.5	-0.1	67.0
14	Mean area that is protected in marine sites important to biodiversity (%)	134	43.0	31.4	0.0	100.0
14	Ocean Health Index Goal - Biodiversity (0-100)	148	88.6	5.9	68.0	98.1
14	Ocean Health Index Goal - Clean Waters (0-100)	148	57.3	13.7	24.5	94.3
14	Ocean Health Index Goal - Fisheries (0-100)	148	47.0	18.0	14.3	97.9
14	Percentage of Fish Stocks overexploited or collapsed by EEZ (%)	116	31.5	22.7	0.1	100.0
14	Fish caught by trawling (%)	119	32.5	27.5	0.0	97.4
15	Mean area that is protected in terrestrial sites important to biodiversity (%)	188	43.9	26.5	0.0	100.0
15	Mean area that is protected in freshwater sites important to biodiversity (%)	136	48.9	30.1	0.0	100.0
15	Red List Index of species survival (0-1)	193	0.9	0.1	0.4	1.0
15	Annual change in forest area (%)	184	8.1	13.1	0.0	103.7
15	Imported biodiversity threats (threats per million population)	174	8.8	22.7	0.0	236.9
16	Homicides (per 100,000 population)	190	7.9	12.8	0.3	108.6
16	Prison population (per 100,000 population)	188	167.3	140.0	5.2	766.7
16	Proportion of the population who feel safe walking alone at night in the city or area where they live (%)	157	61.4	15.8	17.0	94.0
16	Government Efficiency (1-7)	149	3.6	0.8	1.6	5.8
16	Property Rights (1-7)	149	4.3	1.0	1.8	6.6
16	Birth registrations with civil authority, children under 5 years of age (%)	167	83.4	24.4	2.7	100.0
16	Corruption Perception Index (0-100)	177	42.8	19.0	9.0	89.0
16	Children 5–14 years old involved in child labour (%)	165	11.7	13.9	0.0	55.8
16	Transfers of major conventional weapons (exports) (constant 1990 US$ million per 100,000 population)	193	0.3	0.9	0.0	7.9
17	Government Health and Education spending (% GDP)	164	11.3	3.8	4.5	23.0
17	For high-income and all OECD DAC countries: International concessional public finance, including official development assistance (% GNI)	37	0.4	0.3	0.1	1.3
17	For all other countries: Tax revenue (% GDP)	104	16.3	6.1	1.5	37.2
17	Tax Haven Score (best 0-5 worst)	157	0.2	0.9	0.0	5.0
17	Financial Secrecy Score (best 0-100 worst)	35	55.3	7.1	41.8	76.5

Source: Sachs and al, 2018

Annex 4: Indicator targets and thresholds

SDG	Indicator	Best (value = 100)	Green	Yellow	Orange	Red	Worst (value = 0)
1	Poverty headcount ratio at $1.90/day (% population)	0	≤2	2 < x ≤ 7.4	7.4 < x ≤ 12.7	>12.7	72.6
1	Projected poverty headcount ratio at $1.90/day in 2030 (% population)	0	≤1	1 < x ≤ 2	2 < x ≤ 3	>3	66.9
1	Poverty rate after taxes and transfers, Poverty line 50% (% population)	6.1	≤10	10 < x ≤ 12.5	12.5 < x ≤ 15	>15	17.7
2	Prevalence of undernourishment (% population)	0	≤7.5	7.5 < x ≤ 11.3	11.3 < x ≤ 15	>15	42.3
2	Prevalence of stunting (low height-for-age) in children under 5 years of age (%)	0	≤7.5	7.5 < x ≤ 11.3	11.3 < x ≤ 15	>15	50.2
2	Prevalence of wasting in children under 5 years of age (%)	0	≤5	5 < x ≤ 7.5	7.5 < x ≤ 10	>10	16.3
2	Prevalence of obesity, BMI ≥ 30 (% adult population)	2.8	≤10	10 < x ≤ 17.5	17.5 < x ≤ 25	>25	35.1
2	Cereal yield (t/ha)	8.6	≥2.5	2.5 > x ≥ 2	2 > x ≥ 1.5	<1.5	0.6
2	Sustainable Nitrogen Management Index	0	≤0.3	0.3 < x ≤ 0.5	0.5 < x ≤ 0.7	>0.7	1.2
3	Maternal mortality rate (per 100,000 live births)	3.4	≤70	70 < x ≤ 105	105 < x ≤ 140	>140	814
3	Neonatal mortality rate (per 1,000 live births)	1.1	≤12	12 < x ≤ 15	15 < x ≤ 18	>18	39.7
3	Mortality rate, under-5 (per 1,000 live births)	2.6	≤25	25 < x ≤ 37.5	37.5 < x ≤ 50	>50	130.1
3	Incidence of tuberculosis (per 100,000 population)	3.6	≤10	10 < x ≤ 42.5	42.5 < x ≤ 75	>75	561
3	HIV prevalence (per 1,000)	0	≤0.2	0.2 < x ≤ 0.6	0.6 < x ≤ 1	>1	16.5
3	Age-standardised death rate due to cardiovascular disease, cancer, diabetes, and chronic respiratory disease in populations age 30–70 years (per 100,000 population)	9.3	≤15	15 < x ≤ 20	20 < x ≤ 25	>25	31
3	Age-standardised death rate attributable to household air pollution and ambient air pollution (per 100,000 population)	0	≤18.1	18.1 < x ≤ 84.5	84.5 < x ≤ 150.9	>150.9	368.8
3	Traffic deaths rate (per 100,000 population)	3.2	≤8.4	8.4 < x ≤ 12.6	12.6 < x ≤ 16.8	>16.8	33.7
3	Healthy Life Expectancy at birth (years)	73.6	≥65	65 > x ≥ 62.5	62.5 > x ≥ 60	<60	46.1
3	Adolescent fertility rate (births per 1,000 women ages 15-19)	2.5	≤25	25 < x ≤ 37.5	37.5 < x ≤ 50	>50	139.6
3	Births attended by skilled health personnel (%)	100	≥98	98 > x ≥ 94	94 > x ≥ 90	<90	23.1
3	Percentage of surviving infants who received 2 WHO-recommended vaccines (%)	100	≥90	90 > x ≥ 85	85 > x ≥ 80	<80	41
3	Universal Health Coverage Tracer Index (0-100)	100	≥80	80 > x ≥ 70	70 > x ≥ 60	<60	38.2
3	Subjective Wellbeing (average ladder score, 0-10)	7.6	≥6	6 > x ≥ 5.5	5.5 > x ≥ 5	<5	3.3
3	Gap in life expectancy at birth among regions (years)	0	≤4	4 < x ≤ 5.5	5.5 < x ≤ 7	>7	11
3	Gap in self-reported health by income (0-100)	0	≤20	20 < x ≤ 25	25 < x ≤ 30	>30	41.1
3	Daily smokers (% population age 15+)	10.1	≤20	20 < x ≤ 22.5	22.5 < x ≤ 25	>25	29.8
4	Net primary enrolment rate (%)	100	≥98	98 > x ≥ 89	89 > x ≥ 80	<80	53.8
4	Mean years of schooling (years)	13.2	≥12	12 > x ≥ 11	11 > x ≥ 10	<10	2.3
4	Literacy rate of 15-24 year olds, both sexes (%)	100	≥95	95 > x ≥ 90	90 > x ≥ 85	<85	45.2
4	Population age 25-64 with tertiary education (%)	52.2	≥25	25 > x ≥ 20	20 > x ≥ 15	<15	16.8
4	PISA score (0-600)	525.6	≥493	493 > x ≥ 446.5	446.5 > x ≥ 400	<400	415.7
4	Percentage of variation in science performance explained by students' socio-economic status	8.3	≤10.5	10.5 < x ≤ 15.3	15.3 < x ≤ 20	>20	21.4
4	Students performing below level 2 in science (%)	9.8	≤12	12 < x ≤ 21	21 < x ≤ 30	>30	47.8
4	Resilient students (%)	46.6	≥38	38 > x ≥ 29	29 > x ≥ 20	<20	12.8
5	Estimated demand for contraception that is unmet (% women married or in union, ages 15-49)	0	≤20	20 < x ≤ 30.7	30.7 < x ≤ 41.3	>41.3	85.8
5	Ratio of female to male mean years of schooling of population age 25 and above	100	≥98	98 > x ≥ 86.5	86.5 > x ≥ 75	<75	41.8
5	Ratio of female to male labour force participation rate	100	≥70	70 > x ≥ 60	60 > x ≥ 50	<50	21.5
5	Seats held by women in national parliaments (%)	50	≥40	40 > x ≥ 30	30 > x ≥ 20	<20	1.2
5	Gender wage gap (Total, % male median wage)	0	≤7.5	7.5 < x ≤ 11.3	11.3 < x ≤ 15	>15	36.7
6	For high-income & OECD countries : population using safely managed water services (%)	100	≥95	95 > x ≥ 87.5	87.5 > x ≥ 80	<80	10.5
6	For all other countries : Population using at least basic drinking water services (%)	100	≥98	98 > x ≥ 89	89 > x ≥ 80	<80	40

6	For high-income & OECD countries : population using safely managed sanitation services (%)	100	≥90	90 > x ≥ 77.5	77.5 > x ≥ 65	<65	14.1
6	For all other countries : Population using at least basic sanitation services (%)	100	≥95	95 > x ≥ 85	85 > x ≥ 75	<75	9.7
6	Freshwater withdrawal as % total renewable water resources	12.5	≤25	25 < x ≤ 50	50 < x ≤ 75	>75	100
6	Imported groundwater depletion (m3/year/capita)	0.1	≤5	5 < x ≤ 12.5	12.5 < x ≤ 20	>20	42.6
7	Access to electricity (% population)	100	≥98	98 > x ≥ 89	89 > x ≥ 80	<80	9.1
7	Access to clean fuels & technology for cooking (% population)	100	≥85	85 > x ≥ 67.5	67.5 > x ≥ 50	<50	2
7	CO2 emissions from fuel combustion / electricity output (MtCO2/TWh)	0	≤1	1 < x ≤ 1.3	1.3 < x ≤ 1.5	>1.5	3.3
7	Share of renewable energy in total final energy consumption (%)	51.4	≥20	20 > x ≥ 15	15 > x ≥ 10	<10	2.7
8	Adjusted Growth (%)	5	≥0	0 > x ≥ -1.5	-1.5 > x ≥ -3	<-3	-14.7
8	Slavery score (0-100)	100	≥80	80 > x ≥ 65	65 > x ≥ 50	<50	0
8	Adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider (%)	100	≥80	80 > x ≥ 65	65 > x ≥ 50	<50	8
8	Unemployment rate (% total labor force)	0.5	≤5	5 < x ≤ 7.5	7.5 < x ≤ 10	>10	25.9
8	Employment-to-Population ratio (%)	77.8	≥60	60 > x ≥ 55	55 > x ≥ 50	<50	51.6
8	Youth not in employment, education or training (NEET) (%)	8.1	≤10	10 < x ≤ 12.5	12.5 < x ≤ 15	>15	28.2
9	Population using the internet (%)	100	≥80	80 > x ≥ 65	65 > x ≥ 50	<50	2.2
9	Mobile broadband subscriptions (per 100 inhabitants)	100	≥75	75 > x ≥ 57.5	57.5 > x ≥ 40	<40	1.4
9	Quality of overall infrastructure (1= extremely underdeveloped; 7= extensive and efficient by international standards)	6.3	≥4.5	4.5 > x ≥ 3.8	3.8 > x ≥ 3	<3	1.9
9	Logistics performance index: Quality of trade and transport-related infrastructure (1=low to 5=high)	4.2	≥3	3 > x ≥ 2.5	2.5 > x ≥ 2	<2	1.8
9	The Times Higher Education Universities Ranking, Average score of top 3 universities (0-100)	91	≥20	20 > x ≥ 10	10 > x ≥ 0	<0	0
9	Number of scientific and technical journal articles (per 1,000 population)	2.2	≥0.5	0.5 > x ≥ 0.3	0.3 > x ≥ 0.1	<0.1	0
9	Research and development expenditure (% GDP)	3.7	≥1.5	1.5 > x ≥ 1.3	1.3 > x ≥ 1	<1	0
9	Research and development researchers (per 1,000 employed)	15.6	≥8	8 > x ≥ 7.5	7.5 > x ≥ 7	<7	0.8
9	Triadic Patent Families filed (per million population)	115.7	≥20	20 > x ≥ 15	15 > x ≥ 10	<10	0.1
9	Gap in internet access by income (%)	11.2	≤7	7 < x ≤ 26	26 < x ≤ 45	>45	63.6
9	Women in science and engineering (%)	38.1	≥33	33 > x ≥ 29	29 > x ≥ 25	<25	16.2
10	Gini Coefficient adjusted for top income (1-100)	27.5	≤30	30 < x ≤ 35	35 < x ≤ 40	>40	63
10	Palma ratio	0.9	≤1	1 < x ≤ 1.2	1.2 < x ≤ 1.3	>1.3	2.5
10	Elderly Poverty Rate (%)	3.2	≤5	5 < x ≤ 15	15 < x ≤ 25	>25	45.7
11	Annual mean concentration of particulate matter of less than 2.5 microns of diameter (PM2.5) in urban areas (µg/m3)	6.3	≤10	10 < x ≤ 17.5	17.5 < x ≤ 25	>25	87
11	Improved water source, piped (% urban population with access)	100	≥98	98 > x ≥ 86.5	86.5 > x ≥ 75	<75	6.1
11	Satisfaction with public transport (%)	82.6	≥72.2	72.2 > x ≥ 57.8	57.8 > x ≥ 43.4	<43.4	21
11	Rent overburden rate (%)	4.6	≤7	7 < x ≤ 12	12 < x ≤ 17	>17	25.6
12	Municipal Solid Waste (kg/year/capita)	0.1	≤1	1 < x ≤ 1.5	1.5 < x ≤ 2	>2	3.7
12	E-waste generated (kg/capita)	0.2	≤5	5 < x ≤ 7.5	7.5 < x ≤ 10	>10	23.5
12	Percentage of anthropogenic wastewater that receives treatment (%)	100	≥50	50 > x ≥ 32.5	32.5 > x ≥ 15	<15	0
12	Production-based SO2 emissions (kg/capita)	0.5	≤10	10 < x ≤ 20	20 < x ≤ 30	>30	68.3
12	Net imported SO2 emissions (kg/capita)	0	≤1	1 < x ≤ 8	8 < x ≤ 15	>15	30.1
12	Nitrogen production footprint (kg/capita)	2.3	≤8	8 < x ≤ 29	29 < x ≤ 50	>50	86.5
12	Net imported emissions of reactive nitrogen (kg/capita)	0	≤1.5	1.5 < x ≤ 75.8	75.8 < x ≤ 150	>150	432.4
12	Non-Recycled Municipal Solid Waste (MSW in kg/person/year times recycling rate)	0.6	≤1	1 < x ≤ 1.3	1.3 < x ≤ 1.5	>1.5	2.4
13	Energy-related CO2 emissions per capita (tCO2/capita)	0	≤2	2 < x ≤ 3	3 < x ≤ 4	>4	23.7

13	Imported CO2 emissions, technology-adjusted (tCO2/capita)	0	≤0.5	0.5 < x ≤ 0.8	0.8 < x ≤ 1	>1	3.2
13	Climate Change Vulnerability Monitor (best 0-1 worst)	0	≤0.1	0.1 < x ≤ 0.2	0.2 < x ≤ 0.2	>0.2	0.4
13	CO2 emissions embodied in fossil fuel exports (kg/capita)	0	≤100	100 < x ≤ 4050	4050 < x ≤ 8000	>8000	43996.4
13	Effective Carbon Rate from all non-road energy, excluding emissions from biomass (€/tCO2)	100	≥70	70 > x ≥ 50	50 > x ≥ 30	<30	-0.1
14	Mean area that is protected in marine sites important to biodiversity (%)	100	≥50	50 > x ≥ 30	30 > x ≥ 10	<10	0
14	Ocean Health Index Goal - Biodiversity (0-100)	100	≥90	90 > x ≥ 85	85 > x ≥ 80	<80	76
14	Ocean Health Index Goal - Clean Waters (0-100)	100	≥70	70 > x ≥ 65	65 > x ≥ 60	<60	28.6
14	Ocean Health Index Goal - Fisheries (0-100)	100	≥70	70 > x ≥ 65	65 > x ≥ 60	<60	19.7
14	Percentage of Fish Stocks overexploited or collapsed by EEZ (%)	0	≤25	25 < x ≤ 37.5	37.5 < x ≤ 50	>50	90.7
14	Fish caught by trawling (%)	1	≤6.3	6.3 < x ≤ 33.2	33.2 < x ≤ 60	>60	90
15	Mean area that is protected in terrestrial sites important to biodiversity (%)	100	≥50	50 > x ≥ 30	30 > x ≥ 10	<10	4.6
15	Mean area that is protected in freshwater sites important to biodiversity (%)	100	≥50	50 > x ≥ 30	30 > x ≥ 10	<10	0
15	Red List Index of species survival (0-1)	1	≥0.9	0.9 > x ≥ 0.9	0.9 > x ≥ 0.8	<0.8	0.6
15	Annual change in forest area (%)	0.6	≤3	3 < x ≤ 4.5	4.5 < x ≤ 6	>6	18.4
15	Imported biodiversity threats (threats per million population)	0.1	≤5	5 < x ≤ 10.3	10.3 < x ≤ 15.5	>15.5	26.4
16	Homicides (per 100,000 population)	0.3	≤1.5	1.5 < x ≤ 2.3	2.3 < x ≤ 3	>3	38
16	Prison population (per 100,000 population)	25	≤100	100 < x ≤ 150	150 < x ≤ 200	>200	475
16	Proportion of the population who feel safe walking alone at night in the city or area where they live (%)	90	≥80	80 > x ≥ 65	65 > x ≥ 50	<50	33
16	Government Efficiency (1-7)	5.6	≥4.5	4.5 > x ≥ 3.8	3.8 > x ≥ 3	<3	2.4
16	Property Rights (1-7)	6.3	≥4.5	4.5 > x ≥ 3.8	3.8 > x ≥ 3	<3	2.5
16	Birth registrations with civil authority, children under 5 years of age (%)	100	≥98	98 > x ≥ 86.5	86.5 > x ≥ 75	<75	11.3
16	Corruption Perception Index (0-100)	88.6	≥60	60 > x ≥ 50	50 > x ≥ 40	<40	13
16	Children 5–14 years old involved in child labour (%)	0	≤2	2 < x ≤ 6	6 < x ≤ 10	>10	39.3
16	Transfers of major conventional weapons (exports) (constant 1990 US$ million per 100,000 population)	0	≤1	1 < x ≤ 25.5	25.5 < x ≤ 50	>50	3.4
17	Government Health and Education spending (% GDP)	20.7	≥16	16 > x ≥ 12	12 > x ≥ 8	<8	5.1
17	For high-income and all OECD DAC countries: International concessional public finance, including official development assistance (% GNI)	1	≥0.7	0.7 > x ≥ 0.5	0.5 > x ≥ 0.4	<0.4	0.1
17	For all other countries: Tax revenue (% GDP)	30.4	≥25	25 > x ≥ 20	20 > x ≥ 15	<15	1.5
17	Tax Haven Score (best 0-5 worst)	0	≤1	1 < x ≤ 2.5	2.5 < x ≤ 4	>4	5
17	Financial Secrecy Score (best 0-100 worst)	42.7	≤40	40 < x ≤ 45	45 < x ≤ 50	>50	76.5

Source: Sachs an al, 2018.

Annex 5 : Sensitivity tests – using exact same indicators for all countries

Country	Normal Index score	Normal Index rank	Adjusted scores	Adjusted ranks	Score difference	Rank difference
Sweden	85.0	1	85.0	2	0.0	-1
Denmark	84.6	2	85.4	1	0.8	1
Finland	83.0	3	83.8	3	0.8	0
Germany	82.3	4	81.8	5	-0.5	-1
France	81.2	5	82.1	4	0.9	1
Norway	81.2	6	81.1	9	-0.1	-3
Switzerland	80.1	7	80.0	10	-0.1	-3
Slovenia	80.0	8	81.4	7	1.4	1
Austria	80.0	9	81.2	8	1.2	1
Iceland	79.7	10	81.8	6	2.0	4
Netherlands	79.5	11	79.8	12	0.3	-1
Belgium	79.0	12	79.8	13	0.8	-1
Czech Republic	78.7	13	79.8	11	1.1	2
United Kingdom	78.7	14	79.1	15	0.5	-1
Japan	78.5	15	78.9	16	0.4	-1
Estonia	78.3	16	78.5	17	0.2	-1
New Zealand	77.9	17	79.7	14	1.9	3
Ireland	77.5	18	78.4	18	0.9	0
Korea, Rep.	77.4	19	78.2	19	0.8	0
Canada	76.8	20	77.8	20	1.0	0
Croatia	76.5	21	77.0	21	0.5	0
Luxembourg	76.1	22	75.9	28	-0.2	-6
Belarus	76.0	23	76.0	26	0.0	-3
Slovak Republic	75.6	24	77.0	23	1.4	1
Spain	75.4	25	76.1	25	0.7	0
Hungary	75.0	26	77.0	22	2.0	4
Latvia	74.7	27	76.6	24	1.8	3
Moldova	74.5	28	74.5	33	0.0	-5
Italy	74.2	29	75.4	30	1.2	-1
Malta	74.2	30	75.7	29	1.5	1
Portugal	74.0	31	76.0	27	1.9	4
Poland	73.7	32	75.0	31	1.3	1
Costa Rica	73.2	33	73.2	37	0.0	-4
Bulgaria	73.1	34	73.1	38	0.0	-4
United States	73.0	35	73.7	34	0.6	1
Lithuania	72.9	36	73.6	35	0.7	1
Australia	72.9	37	74.6	32	1.7	5
Chile	72.8	38	72.7	39	-0.1	-1
Ukraine	72.3	39	72.3	41	0.0	-2
Serbia	72.1	40	72.1	43	0.0	-3
Israel	71.8	41	73.4	36	1.5	5
Cuba	71.3	42	71.3	45	0.0	-3
Singapore	71.3	43	71.6	44	0.3	-1
Romania	71.2	44	71.2	46	0.0	-2
Azerbaijan	70.8	45	70.8	48	0.0	-3
Ecuador	70.8	46	70.8	49	0.0	-3
Georgia	70.7	47	70.7	50	0.0	-3
Greece	70.6	48	72.6	40	1.9	8
Uruguay	70.4	49	71.2	47	0.8	2
Cyprus	70.4	50	72.3	42	1.9	8
Kyrgyz Republic	70.3	51	70.3	51	0.0	0
Uzbekistan	70.3	52	70.3	52	0.0	0
Argentina	70.3	53	70.3	53	0.0	0
China	70.1	54	70.1	54	0.0	0
Malaysia	70.0	55	70.0	55	0.0	0
Brazil	69.7	56	69.7	56	0.0	0
Vietnam	69.7	57	69.7	57	0.0	0
Armenia	69.3	58	69.3	58	0.0	0
Thailand	69.2	59	69.2	59	0.0	0
United Arab Emirates	69.2	60	67.4	70	-1.8	-10
Former Yugoslav Republic of Macedonia (FYROM)	69.0	61	69.0	60	0.0	1
Albania	68.9	62	68.9	61	0.0	1
Russian Federation	68.9	63	68.9	62	0.0	1

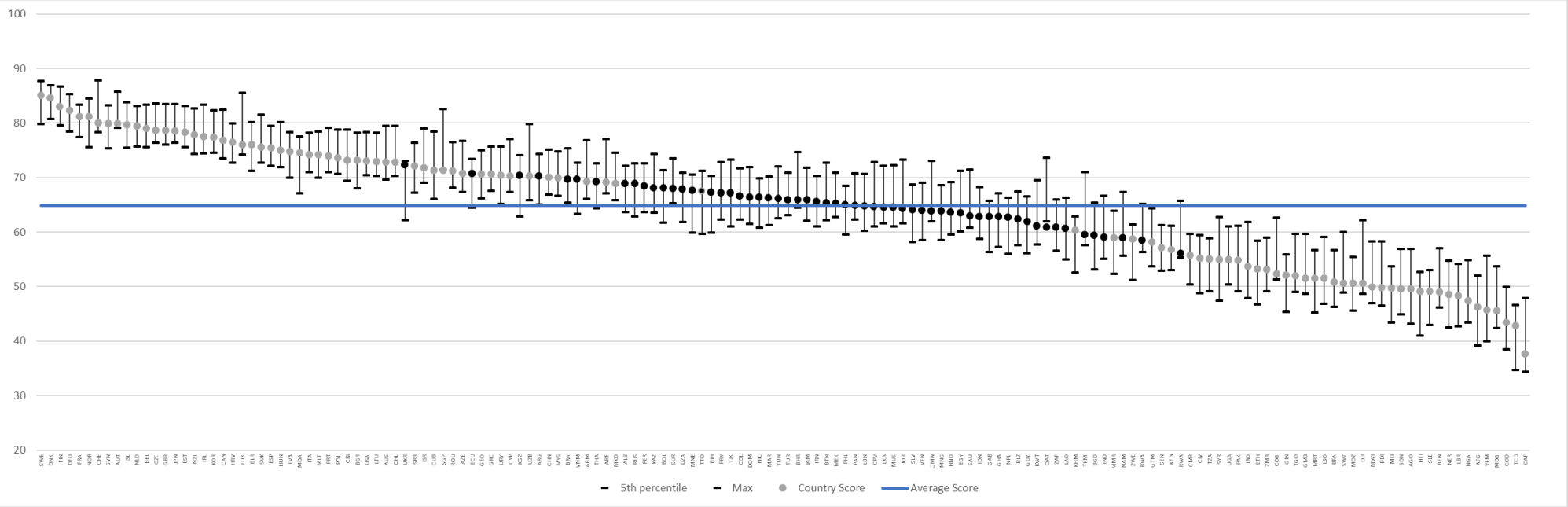
Peru	68.4	64	68.4	63	0.0	1
Kazakhstan	68.1	65	68.1	64	0.0	1
Bolivia	68.1	66	68.0	65	0.0	1
Suriname	68.0	67	68.0	66	0.0	1
Algeria	67.9	68	67.9	67	0.0	1
Montenegro	67.6	69	67.6	68	0.0	1
Trinidad and Tobago	67.5	70	67.5	69	0.0	1
Bosnia and Herzegovina	67.3	71	67.3	71	0.0	0
Paraguay	67.2	72	67.2	74	0.0	-2
Tajikistan	67.2	73	67.2	73	0.0	0
Colombia	66.6	74	66.6	76	0.0	-2
Dominican Republic	66.4	75	66.4	77	0.0	-2
Nicaragua	66.4	76	66.4	78	0.0	-2
Morocco	66.3	77	66.3	79	0.0	-2
Tunisia	66.2	78	66.2	80	0.0	-2
Turkey	66.0	79	67.3	72	1.3	7
Bahrain	65.9	80	66.0	81	0.1	-1
Jamaica	65.9	81	65.9	82	0.0	-1
Iran, Islamic Rep.	65.5	82	65.5	83	0.0	-1
Bhutan	65.4	83	65.5	84	0.1	-1
Mexico	65.2	84	66.7	75	1.5	9
Philippines	65.0	85	65.0	85	0.0	0
Panama	64.9	86	64.9	86	0.0	0
Lebanon	64.8	87	64.8	87	0.0	0
Cabo Verde	64.7	88	64.7	88	0.0	0
Sri Lanka	64.6	89	64.6	89	0.0	0
Mauritius	64.5	90	64.5	90	0.0	0
Jordan	64.4	91	64.4	91	0.0	0
El Salvador	64.1	92	64.1	92	0.0	0
Venezuela, RB	64.0	93	64.0	95	0.0	-2
Oman	63.9	94	64.0	94	0.1	0
Mongolia	63.9	95	63.9	96	0.1	-1
Honduras	63.6	96	63.6	97	0.0	-1
Egypt, Arab Rep.	63.5	97	63.5	98	0.0	-1
Saudi Arabia	62.9	98	64.1	93	1.2	5
Indonesia	62.8	99	62.9	100	0.0	-1
Gabon	62.8	100	62.9	99	0.0	1
Ghana	62.8	101	62.8	102	0.0	-1
Nepal	62.8	102	62.8	101	0.1	1
Belize	62.3	103	62.3	103	0.0	0
Guyana	61.9	104	61.9	105	0.0	-1
Kuwait	61.1	105	61.1	106	0.0	-1
Qatar	60.8	106	62.0	104	1.1	2
South Africa	60.8	107	60.8	107	0.0	0
Lao PDR	60.6	108	60.7	108	0.1	0
Cambodia	60.4	109	60.4	109	0.0	0
Turkmenistan	59.5	110	59.5	110	0.0	0
Bangladesh	59.3	111	59.3	111	0.0	0
India	59.1	112	59.1	113	0.0	-1
Myanmar	59.0	113	59.1	112	0.0	1
Namibia	58.9	114	59.0	114	0.0	0
Zimbabwe	58.8	115	58.8	115	0.0	0
Botswana	58.5	116	58.5	116	0.0	0
Guatemala	58.2	117	58.2	117	0.0	0
Senegal	57.2	118	57.2	118	0.0	0
Kenya	56.8	119	56.9	119	0.1	0
Rwanda	56.1	120	56.1	120	0.0	0
Cameroon	55.8	121	55.8	121	0.0	0
Cote d'Ivoire	55.2	122	55.2	123	0.0	-1
Tanzania	55.1	123	55.2	122	0.1	1
Syrian Arab Republic	55.0	124	55.0	124	0.0	0
Uganda	54.9	125	54.9	125	0.0	0
Pakistan	54.9	126	54.9	126	0.0	0
Iraq	53.7	127	53.8	127	0.0	0
Ethiopia	53.2	128	53.2	128	0.0	0
Zambia	53.1	129	53.2	129	0.0	0
Congo, Rep.	52.4	130	52.4	130	0.0	0
Guinea	52.1	131	52.2	131	0.0	0
Togo	52.0	132	52.0	132	0.0	0
Gambia, The	51.6	133	51.6	134	0.0	-1
Mauritania	51.6	134	51.6	133	0.0	1

Lesotho	51.5	135	51.5	135	0.0	0
Burkina Faso	50.9	136	50.9	136	0.1	0
Swaziland	50.7	137	50.7	138	0.0	-1
Mozambique	50.7	138	50.7	137	0.1	1
Djibouti	50.6	139	50.6	139	0.0	0
Malawi	50.0	140	50.0	140	0.0	0
Burundi	49.8	141	49.9	141	0.0	0
Mali	49.7	142	49.7	142	0.0	0
Sudan	49.6	143	49.6	143	0.1	0
Angola	49.6	144	49.6	144	0.1	0
Haiti	49.2	145	49.2	145	0.0	0
Sierra Leone	49.1	146	49.2	146	0.1	0
Benin	49.0	147	49.0	147	0.0	0
Niger	48.5	148	48.6	148	0.1	0
Liberia	48.3	149	48.3	149	0.0	0
Nigeria	47.5	150	47.5	150	0.0	0
Afghanistan	46.2	151	46.3	151	0.0	0
Yemen, Rep.	45.7	152	45.7	152	0.0	0
Madagascar	45.6	153	45.7	153	0.1	0
Congo, Dem. Rep.	43.4	154	43.5	154	0.1	0
Chad	42.8	155	42.9	155	0.1	0
Central African Republic	37.7	156	37.7	156	0.1	0

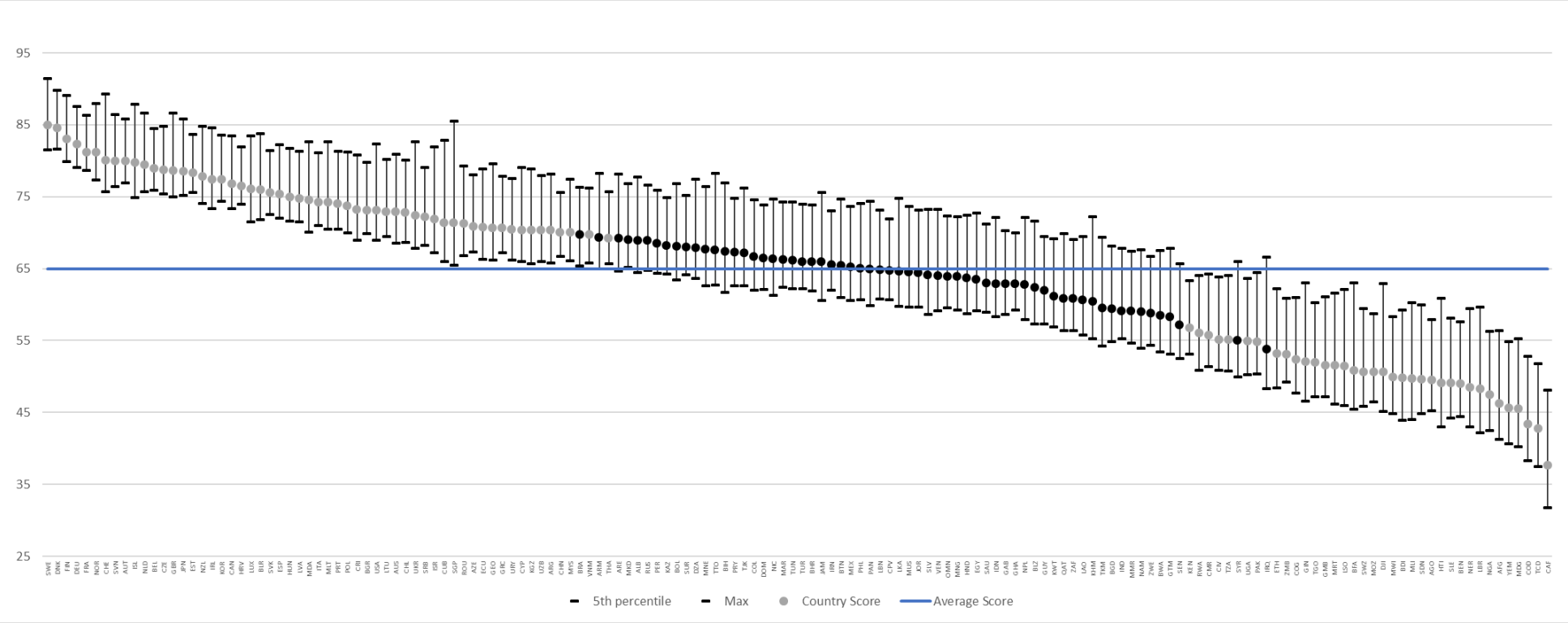
Source: Author's analysis based on Sachs and al, 2018.

Annex 6: Monte Carlo Simulations

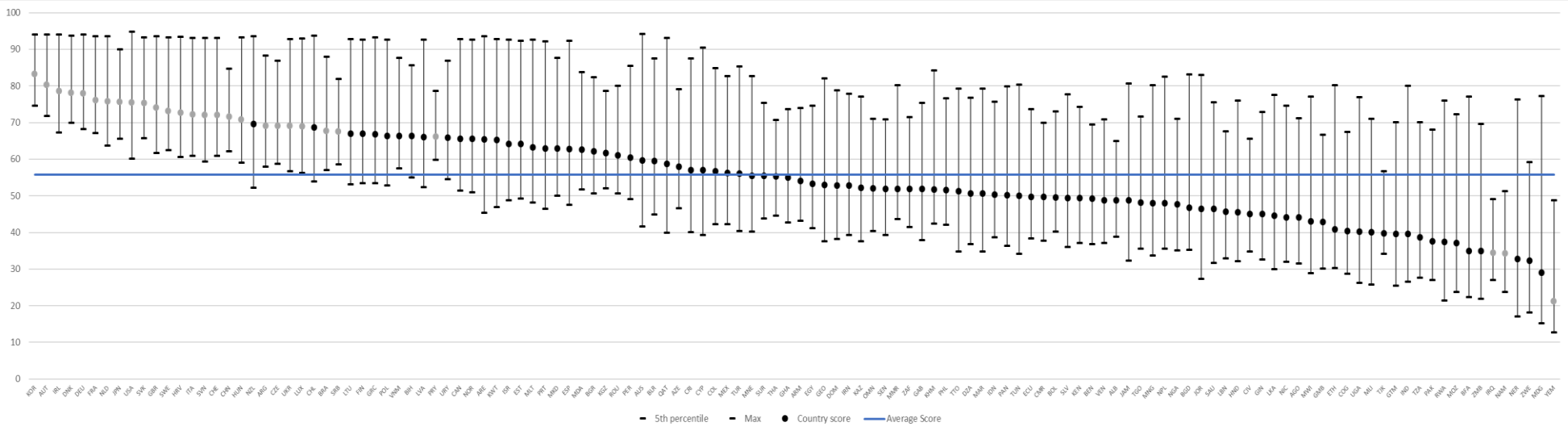
Monte Carlo Simulations: Impact on total index score of random combination of weights for each indicator (indicators not assigned to any specific goals)



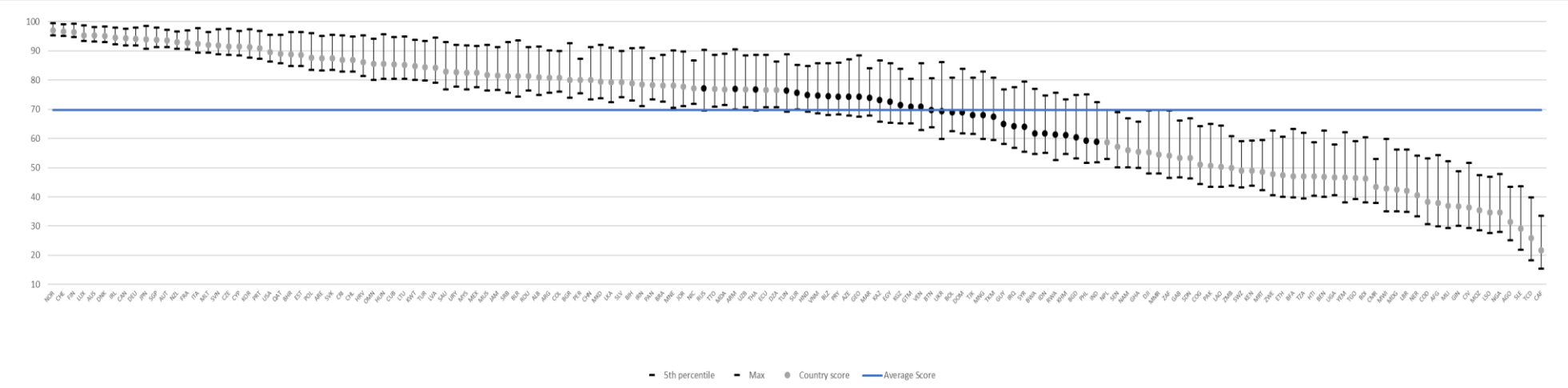
Monte Carlo Simulations: Impact on total index score of random combination of weights assigned to each goal



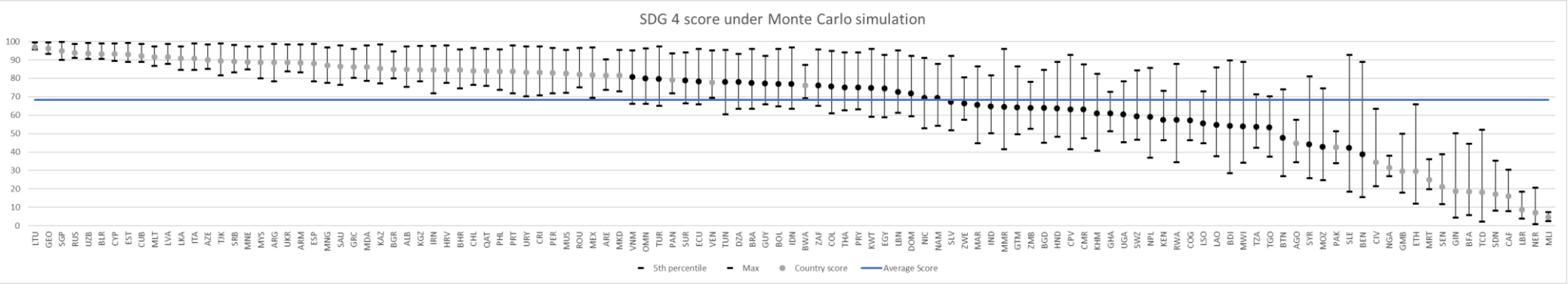
Monte Carlo Simulations: SDG 2



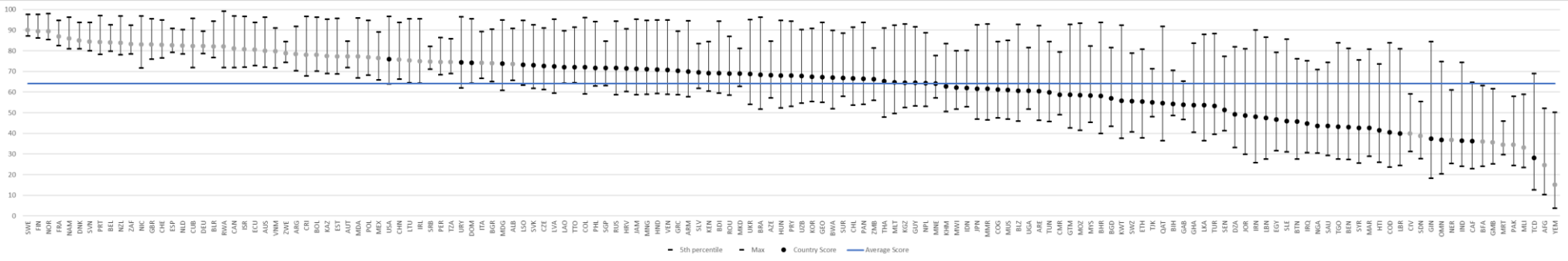
Monte Carlo simulations: SDG 3



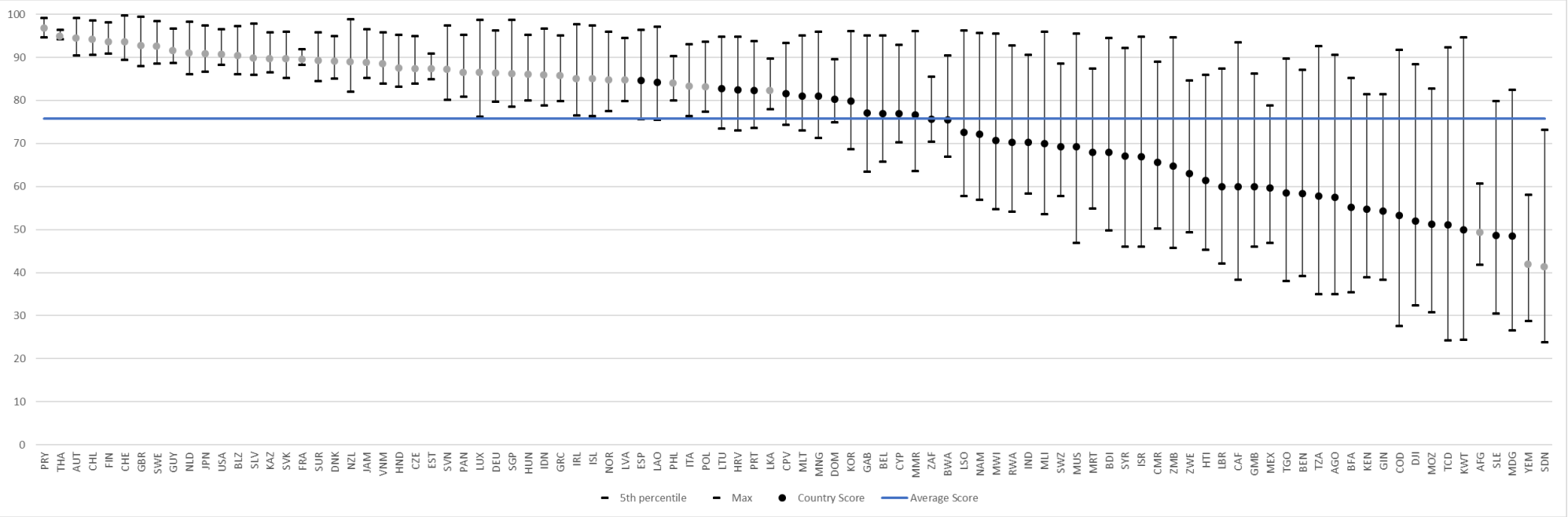
Monte Carlo simulations: SDG 4



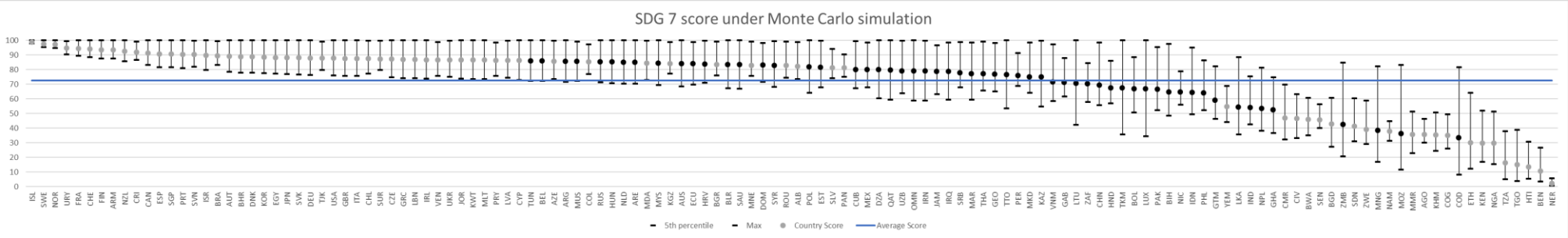
Monte Carlo simulations: SDG 5



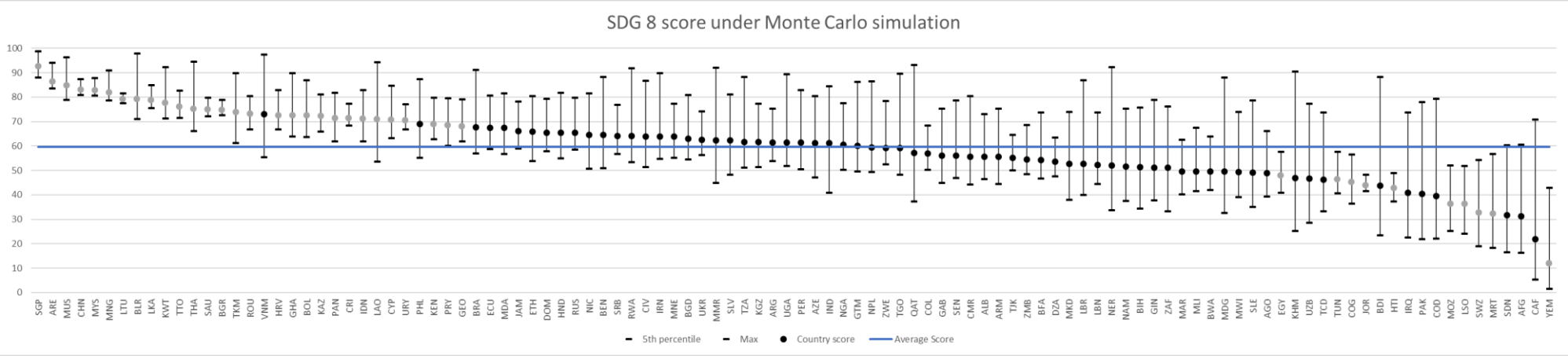
Monte Carlo simulations: SDG6



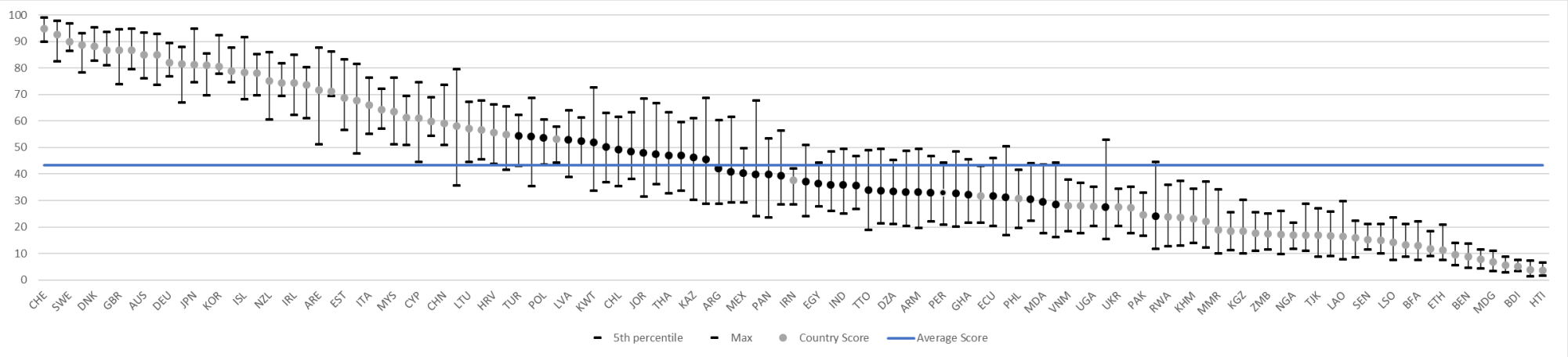
Monte Carlo simulations: SDG7



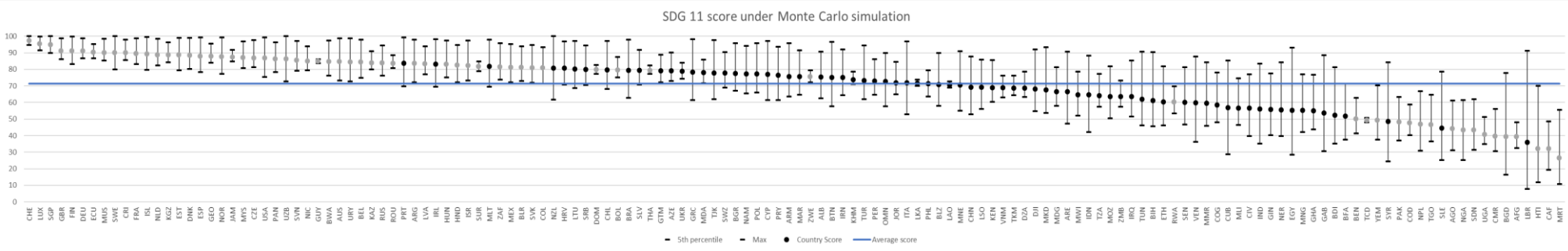
Monte Carlo simulations: SDG8



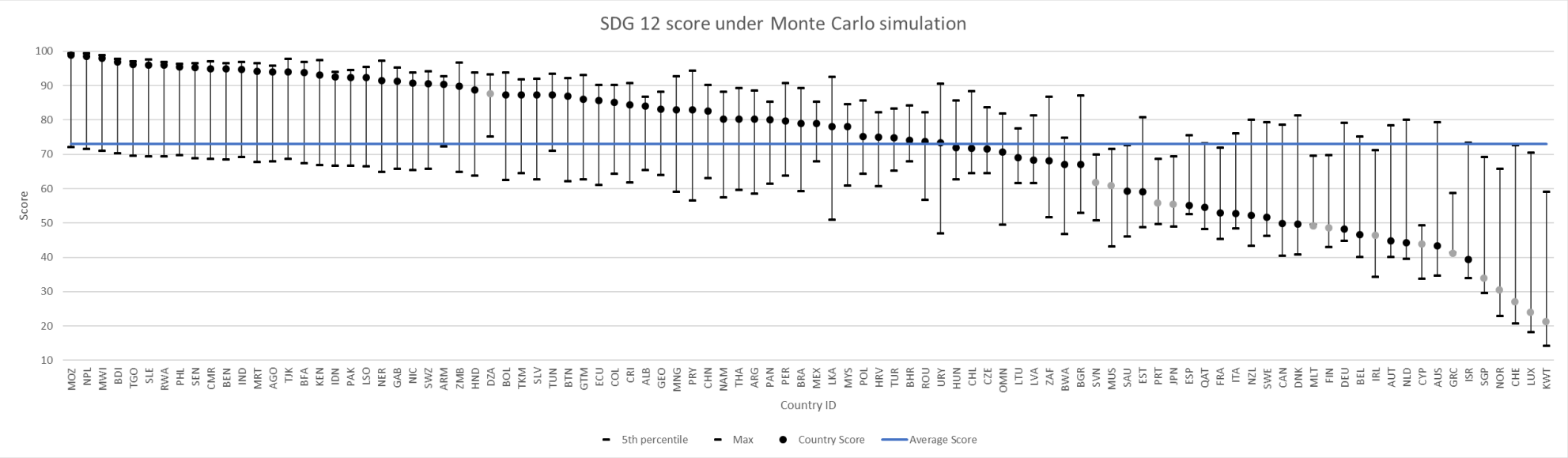
Monte Carlo simulations: SDG9



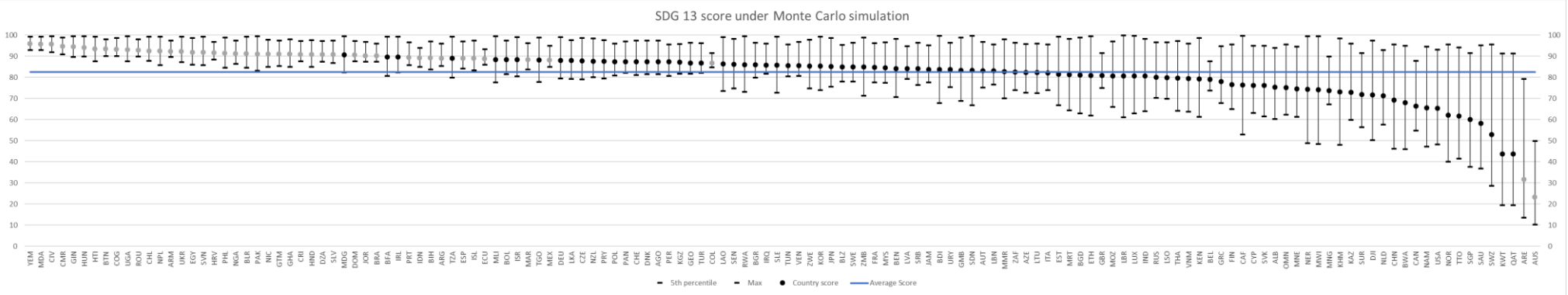
Monte Carlo simulations: SDG11



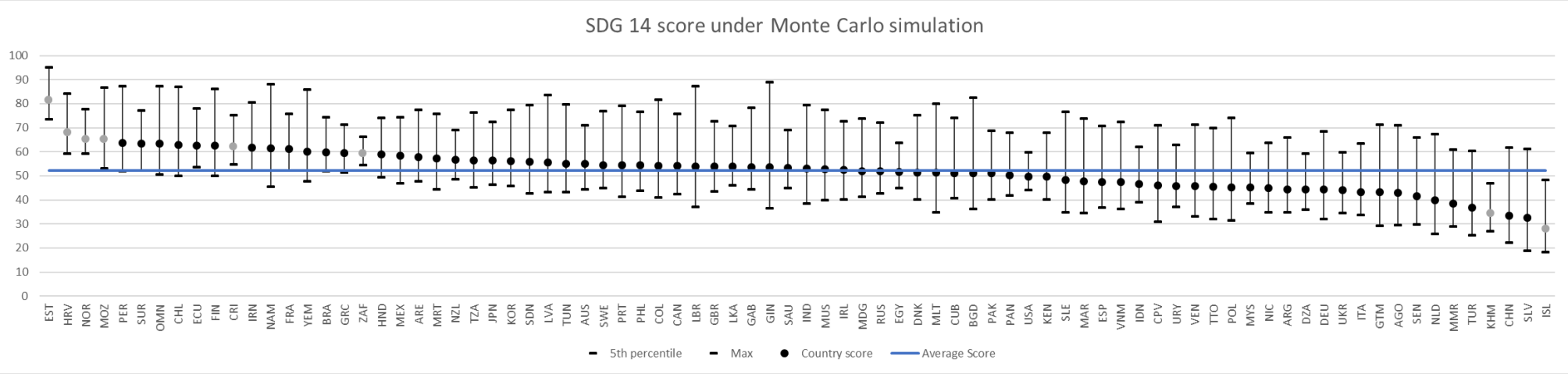
Monte Carlo simulations: SDG12



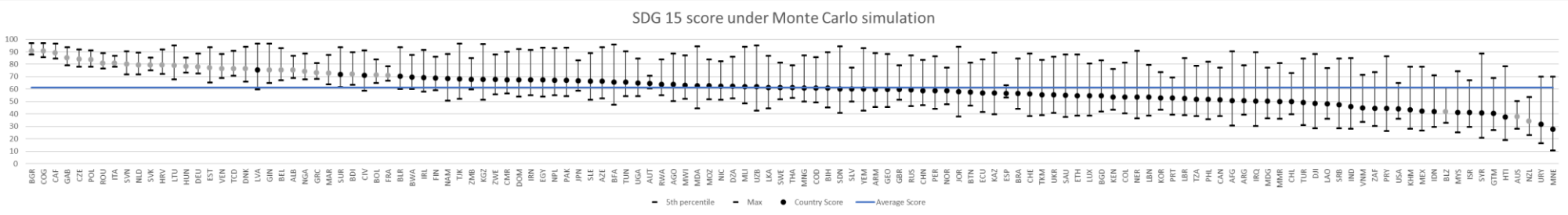
Monte Carlo Simulations: SDG13



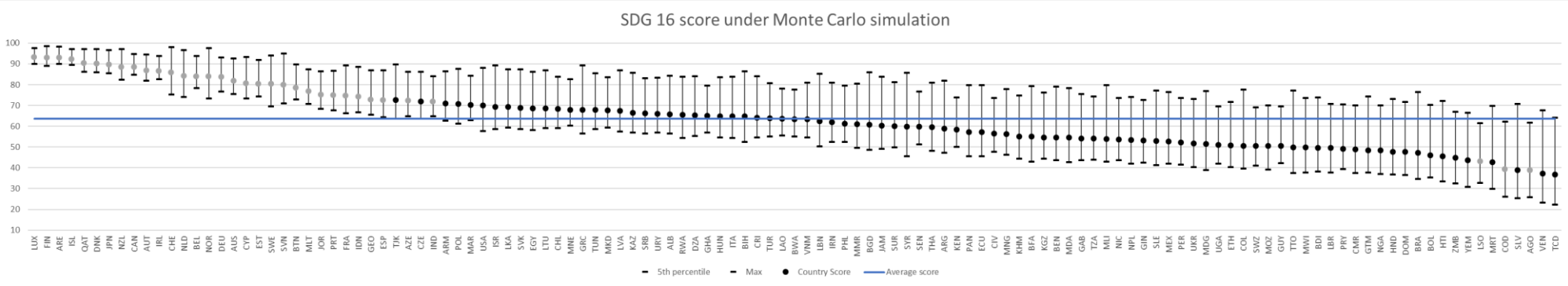
Monte Carlo simulations: SDG14



Monte Carlo simulations: SDG15



Monte Carlo simulations: SDG16



Annex 7: Statistical clustering of the goals (exploratory)

Principal Component Factor analysis (PCA) was conducted to explore groupings across SDGs. SDG17 (Partnerships) was excluded considering extremely low correlations with any of the other goals. For greater precision PCA was rotated. PCA identified 4 key factors with eigen values greater than 1 explaining altogether around 76% of total variance (cumulative). Loadings greater than 0.5 were considered acceptable and retained.

Results suggests the following classification:

- Factor 1: SDG1-11 "Economic and social outcomes"
- Factor 2: SDG10 & SDG 16 "Inequalities and strong institutions"
- Factor 3: SDG12 & 13 "Climate action & sustainable consumption and production"
- Factor 4: SDG 14 & 15 "Biodiversity protection"

Factor analysis/correlation Number of obs = 156
Method: principal-component factors Retained factors = 4
Rotation: orthogonal varimax (Kaiser off) Number of params = 58

Factor	Variance	Difference	Proportion	Cumulative
Factor1	6.81568	4.67867	0.4260	0.4260
Factor2	2.13700	0.26933	0.1336	0.5595
Factor3	1.86768	0.55504	0.1167	0.6763
Factor4	1.31263	.	0.0820	0.7583

LR test: independent vs. saturated: chi2(120) = 2038.81 Prob>chi2 = 0.0000

Rotated factor loadings (pattern matrix) and unique variances

Variable	Factor1	Factor2	Factor3	Factor4	Uniqueness
SDG 1	0.6655	0.3718	-0.0255	-0.2917	0.3332
SDG 2	0.7820	0.4065	-0.0910	0.0720	0.2098
SDG 3	0.8485	0.3573	-0.2260	-0.0781	0.0952
SDG 4	0.8752	0.1291	-0.1639	0.0216	0.1900
SDG 5	0.8328	-0.0999	-0.0408	0.1877	0.2596
SDG 6	0.7711	-0.1080	0.3611	0.0228	0.2628
SDG 7	0.8051	0.2404	-0.0992	-0.1531	0.2607
SDG 8	0.7493	0.3047	-0.2318	0.0791	0.2857
SDG 9	0.6971	0.4620	-0.3867	0.1142	0.1381
SDG 10	0.0912	0.8798	0.0461	0.0187	0.2151
SDG 11	0.8633	-0.0507	-0.0476	0.0686	0.2452
SDG 12	-0.5545	-0.3130	0.5772	-0.0202	0.2610
SDG 13	-0.0200	0.0253	0.8730	0.1138	0.2239
SDG 14	0.1816	-0.1502	-0.1704	0.7263	0.3879
SDG 15	-0.0746	0.2026	0.3087	0.7676	0.2688
SDG 16	0.4377	0.6038	-0.4602	0.0454	0.2300

Source: Authors analysis based on Sachs and al, 2018.