GGGI TECHNICAL REPORT NO. 6

Green Growth Potential Assessment – Methodology Report

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Green Growth Potential Assessment – Methodology Report

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List of Abbreviations

2G	second generation mobile-cellular network standard (narrowband)
3G	third generation mobile-cellular network standard
AOI	Agriculture Orientation Index
ATM	automated teller machine
BEA	Bureau of Economic Analysis
bbl	barrel
CCI-LC	Climate Change Initiative – Land Cover
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
C2ES	Center for Climate and Energy Solutions
CPF	Country Planning Framework
CPI	Corruption Perception Index
CRED	Centre for Research on the Epidemiology of Disasters
DALYs	disability-adjusted life years
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization of the United Nations
GDP	gross domestic product
GGGI	Global Green Growth Institute
GGKP	Green Growth Knowledge Platform
GGPA	Green Growth Potential Assessment
GHG	greenhouse gas
GNI	gross national income
GSI	Global Subsidies Initiative
GSMA	Groupe Speciale Mobile Association
Gt	giga ton
GVA	gross value added
GWP	global warming potential
GWP100	global warming potential within a 100-year period
HLPE	High Level Panel of Experts on Food Security and Nutrition
IEA	International Energy Agency
IISD	International Institute for Sustainable Development
ILO	International Labour Organization
IMF	International Monetary Fund
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
IQR	Inter Quartile Range
IRENA	International Renewable Energy Agency
ITU	International Telecommunication Union
ITUC	International Trade Union Confederation
IUCN	International Union for Conservation of Nature
LNG	liquefied natural gas
LTE	Long Term Evolution, third generation mobile-cellular network standard
MEA	multilateral environmental agreement
MODIS	Moderate Resolution Imaging Spectroradiometer
MSW	municipal solid waste
MCDM	multi-criteria decision-making
Munich Re	Munich Reinsurance Company

N_2O	nitrous oxide
NCE	New Climate Economy
ND-GAIN	Notre Dame Global Adaptation Initiative
NDCs	Nationally Determined Contributions
OECD	Organisation for Economic Co-operation and Development
pH	potential of hydrogen
PISA	Programme for International Student Assessment
$PM_{2.5}$	particulate matter of a diameter of 2.5 micrometers
PM_{10}	particulate matter of a diameter of 10 micrometers
Q1	first quartile (also lower quartile)
Q3	third quartile (also upper quartile)
R&D	research and development
SDG	Sustainable Development Goal
SE4All	Sustainable Energy for All
TPES	total primary energy supply
TFC	total final consumption
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNDRR	United Nations Office for Disaster Risk Reduction
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNEP-WCMC	United Nations Environment Programme – World Conservation Monitoring Centre
UN ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNSD	United Nations Statistics Division
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
USD	United States dollar
WHO	World Health Organization
WRI	World Resources Institute
WTI	West Texas Intermediate
WWAP	World Water Assessment Programme

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Executive Summary

GGGI defines green growth as a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive. Through the green growth model, countries seek opportunities for economic growth that are low-carbon and climate resilient, prevent or remediate pollution, and maintain healthy and productive ecosystems as well as create green jobs, reduce poverty, and enhance social inclusion. Several definitions and concepts of green growth exist in different development organizations, such as the OECD, UNEP, and World Bank. Common to all these definitions is that green growth balances economic growth, environmental sustainability, and social inclusion, aiming to minimize the trade-offs and maximize the synergies between them.

While the awareness of and commitment to green growth are rising worldwide, green growth is a broad concept, encompassing not only different economic sectors but also different levels of intervention. Furthermore, what green growth means in individual countries and how it can be translated into specific actions depend on a wide range of factors, such as a given economy's stage of development, its endowment with natural assets, and its social characteristics. Therefore, there is a need to clarify what green growth means in a specific country's context, identify priorities, and assess those priorities systematically.

For that purpose, GGGI developed the Green Growth Potential Assessment (GGPA). The GGPA is a diagnostic tool, consisting of a combination of data analysis and stakeholder consultation in order to identify and prioritize a country's opportunities for green growth. During the past four years, GGPAs have been successfully concluded in nine countries: Cambodia, Colombia, the Lao PDR, Mozambique, Myanmar, Nepal, Papua New Guinea, Peru, and Qatar. While the past four years have demonstrated the GGPA's usefulness, experiences made during that period have also triggered a wide range of revisions to the initial assessment process. This report provides a detailed overview of the assessment methodology in its current form and the extensive changes made to it since the first GGPA was conducted in 2015. These changes encompass all three stages of the assessment process: the preliminary assessment, consultation process, and final analysis.

Three major adjustments have been made to the preliminary assessment. First, the analytical framework has been extended to cover the dimension of social inclusion. In that way, the revised GGPA methodology largely follows the approach proposed by GGKP (2016) to measure green growth across the following five dimensions: (1) natural assets, (2) resource efficiency, (3) (climate) risk and resilience, (4) economic growth and innovation, and (5) social inclusion (GGKP 2013; GGKP 2016)—with the exception that, in case of the GGPA, indicators reflecting economic growth and innovation are integrated into the other four dimensions. Second, the set of indicators has been considerably extended from a selection of 48 individual indicators to more than 170 indicators, allowing for a more granular assessment. Third, the distinction between dashboard and diagnostic indicators has been discarded. Initially, the preliminary assessment was based on two separate sets of indicators, namely dashboard indicators and diagnostic indicators. The former were meant to help explain a country's performance in the latter. However, there was no systematic approach to establish the relationships between dashboard and diagnostic indicators, and no explanations for causality were provided or tested for. Instead, under the new approach, the indicators with the most explanatory power are chosen to illustrate relevant issues for a selected country.

The consultation process was subject to two major adjustments. First, the application of the Delphi survey technique has been refined, including the number of survey rounds, combination of presenting the results of the preliminary assessment and gathering participants' feedback, and design of the group discussions. There is a general trade-off between relying on more open questions leading to a less structured discussion—with the challenge of consolidating the results and determining consensus among participants—and relying on a set of targeted questions—with the risk of being too rigorous, limiting the options for participants to answer, and missing important aspects. The current approach is considered to offer a reasonable balance between these trade-offs. Second, the results of the consultation are summarized in a workshop report. This report provides workshop participants with a final opportunity to comment on and voice disagreement with the results of the consultation and thereby determine the scope and direction of the final analysis. In addition, the workshop report allows external audiences to understand the process and the results of the workshop.

Several major revisions were also made to the final analysis, such as the way its recommendations are developed, the format in which they are presented, and the scope that these recommendations address. First, initially, the development of recommendations relied exclusively on inputs gathered through expert interviews. As a result, recommendations were subject to individual bias, repeatedly in dissonance with the larger body of literature, and disconnected from the analysis in the report. Under the revised method, recommendations are developed based on analysis drawn from (1) existing research; (2) gaps in existing policies, plans, strategies, and regulation; and (3) a series of expert interviews conducted in the assessment country. Second, the format to present those recommendations has also evolved, strengthening the link between the recommendations and the underlying analysis. Under the revised methodology, the final report is explicitly designed around a set of recommendations. Each recommendation is introduced upfront in its own section, followed by the related analysis outlining its relevance and providing evidence for its effectiveness. The analysis generally aims to demonstrate why and how a specific recommendation can bring about a desired result. Third, under the new methodology, the scope of recommendations varies, depending on the purpose for which a government or GGGI itself wants an assessment to be conducted. This is a major change from the initial setup of the final analysis, with its exclusive focus on policy options. Finally, an approach to conduct a more rapid assessment has been developed, which can be applied in countries where a full-fledged GGPA is not needed.

This report is structured as follows. The opening chapter introduces the GGPA and the three stages of the assessment process: the preliminary assessment, stakeholder consultation, and final analysis. This is followed by an overview of the initial methodology, highlighting some of its shortcomings. The main chapter of this report discusses in detail the revised methodology for conducting a GGPA, explaining the revisions and adjustments as well as resolving the ambiguities that existed under the initial process. The chapter provides a comprehensive rationale for the revisions and highlights aspects where further improvements are desirable.

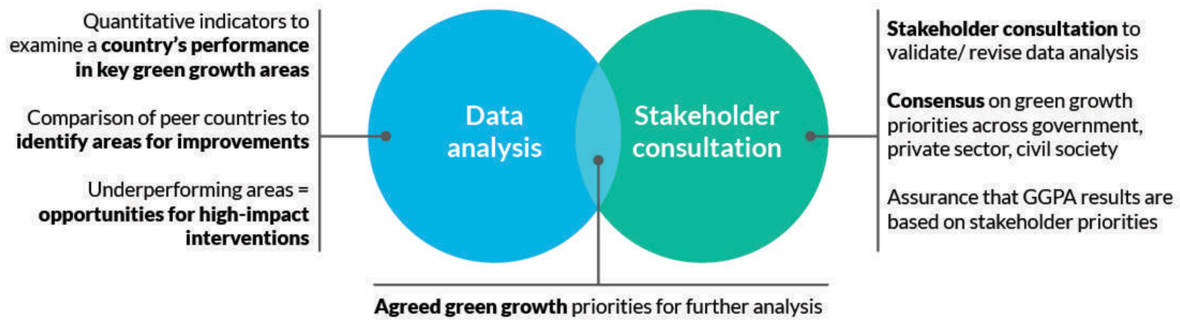
The methodological changes discussed in this report have made the GGPA a more useful tool for GGGI and the organization’s Partners. However, as with any methodology, these revisions do not mark the conclusion of the tool’s development process. Future adjustments and refinements will be needed when additional globally comparative data becomes available, and another round of assessments will provide further insights into the potential and limitations of the current methodology.

1. Introduction

GGGI defines green growth as a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive. Through the green growth model, countries seek opportunities for economic growth that are low-carbon and climate resilient, prevent or remediate pollution, and maintain healthy and productive ecosystems as well as create green jobs, reduce poverty, and enhance social inclusion. Several definitions and concepts of green growth exist in different development organizations, such as the OECD, UNEP, and World Bank. Common to all these definitions is that green growth balances economic growth, environmental sustainability, and social inclusion, aiming to minimize the trade-offs and maximize the synergies between them.

The entering into force of the Paris Agreement in November 2016, its ratification by 178 parties of the UN Framework Convention on Climate Change (UNFCCC 2015), and the unanimous adoption of the Sustainable Development Goals (SDGs) by all 193 UN members (UN General Assembly 2015) are evidence that awareness of and commitment to green growth are rising worldwide. Green growth is increasingly being integrated into national development plans, sectoral strategies, and other policies as a means of simultaneously achieving economic growth and social and environmental goals. However, as is evident from the definition above, green growth is a broad concept, encompassing not only different economic sectors but also different levels of intervention. Furthermore, what green growth means in individual countries and how it can be translated into specific actions depends on a wide range of factors, such as a given economy's stage of development, its endowment with natural assets, and its social characteristics. Given the concept's broad nature, there is a need to clarify what green growth means in a specific country's context, identify priorities, and assess those priorities systematically.

Figure 1. Conceptual schematic of the GGPA process



Source: Global Green Growth Institute

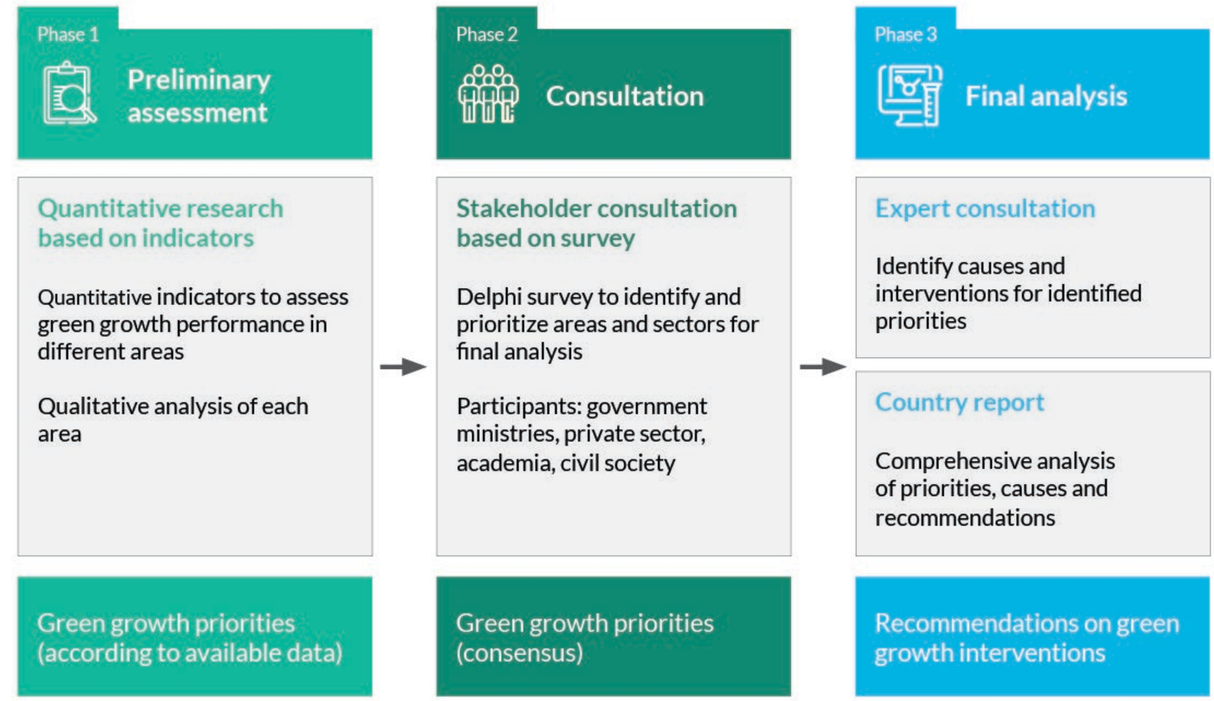
GGGI developed the Green Growth Potential Assessment (GGPA) for that aim. The GGPA is a diagnostic tool that combines data analysis and stakeholder consultation. Its purpose is to identify and prioritize a country's opportunities for green growth as well as to develop specific recommendations for each of the identified priorities (see figure 1).

The past four years have demonstrated the value of the Green Growth Potential Assessment in this respect. The GGPA has proven to be a useful tool, providing policymakers with empirically founded advice and helping them to determine areas where green growth interventions can have the highest impact. Furthermore, the GGPA gives recommendations regarding the means and actions to address those priorities, which are tailored to an individual country's context. In addition, the GGPA can serve governments to translate international commitments, such as the SDGs or Nationally Determined Contributions (NDCs), into local action. With its thorough technical analysis, the findings of the GGPA can also support in attracting donor funding or private sector investment. For example, findings from the assessment process may prove highly relevant in undergirding the rationale for funding proposals to the Green Climate Fund (GCF). Experience has shown that governments appreciate the systematic, objective, and participatory nature of the assessment process as much as the analytical insights it delivers.

Beyond supporting government partners, the GGPA serves GGGI itself for different purposes. First, the tool helps GGGI to identify areas in which the organization will focus its work, highlighting options for specific programs and projects that are technically feasible and enjoy political support in a given country. In that way, the assessment supports GGGI's entire value chain, using the results of the GGPA to catalyze tangible actions in the form of policy reforms, changes in regulations, and specific infrastructure projects, all grounded on the assessment's recommendations. Second, the GGPA serves as a communication and engagement tool. The assessment process and its results are helpful to foster interest in Partners to engage further with GGGI. Conducting an assessment is often one of the initial steps when GGGI is engaging with a new country, and the final report is, in many cases, the first service GGGI delivers to a Partner. Consequently, the quality of the assessment and the usefulness of its results contribute to convince Partners of the benefits that GGGI has to offer as well as the quality of the organization's services.

The GGPA process consists of the following three stages: (1) a preliminary assessment based on quantitative data analysis, (2) consultation with stakeholders to validate or revise the results of the preliminary assessment, and (3) final analysis built around a set of recommendations (figure 2). This design aims to ensure that the assessment process is systematic, objective, and participatory.

Figure 2. Overview of the GGPA process



Source: Global Green Growth Institute

Table 1. GGPAs conducted (2016–2019)

Country	Time frame	Number of stakeholders consulted	Priorities identified
Peru	November 2015–June 2016	Academia (1) Government (32) Private sector (5)	Agriculture Energy Forestry Mining Water supply and quality
Colombia	January–December 2016	Academia (10) Development partners (25) Government (57) Private sector (12)	Agriculture, forestry, and land use Natural capital management Renewable energy Water supply and quality
Nepal	July 2016–July 2017	Academia (6) Government (36) Private sector (4)	Agriculture Forestry and land use Renewable energy Water supply and quality
Lao PDR	November 2016–November 2017	Academia (15) Government (40) Legislative (4)	Agriculture Education Energy and mineral resources Forestry and land use Tourism Urban development and transport
Myanmar	October 2016–December 2017	Development partners (18) Government (36) Legislative (3)	Agriculture, forestry, and land use Education and good governance Energy Industry, mining, and tourism
Cambodia	June 2017–May 2018	Development partners (33) Government (70)	Agriculture Natural capital management Renewable energy Industry
Mozambique	June 2017–May 2018	Academia (2) Development partners (6) Government (22)	Agriculture Education and good governance Forestry and land use Renewable energy
Papua New Guinea	June 2018–June 2019	Academia (5) Development partners (3) Government (42) Private sector (1)	Agriculture Climate change Renewable energy Forestry and land use
Qatar	February 2019–July 2019	Academia (10) Government (15)	Water stress Energy consumption Climate change Food security Air quality Waste management and recycling

Source: Global Green Growth Institute

During the past four years, GGPAs have been successfully concluded in nine countries: Cambodia, Colombia, the Lao PDR, Mozambique, Myanmar, Nepal, Papua New Guinea, Peru, and Qatar.[1] Working closely with government counterparts, conducting a complete GGPA takes up to one year, as GGGI has generally conducted assessments in several countries in parallel.[2] In the process, GGGI consults with about fifty (e.g., Laos, Nepal) to up to one hundred stakeholders (e.g., Cambodia) in the country, identifying four to five priorities for green growth (table 1). The final report suggests a set of recommendations for each of those priorities, supported by analysis based on existing research, case studies, project evaluations, relevant examples from other countries, existing policies, and the results of expert interviews.

The experiences gained in these countries provided valuable lessons and triggered numerous revisions to the assessment methodology. The following two chapters present the initial methodology and describe the revisions that have been made to the assessment process, each going through the GGPA's three stages. These revisions encompass a large range of technical changes to the analytical methodology, such as the set of indicators for the preliminary assessment, design of the consultation workshop, and structure and design of the final report. Beyond that, the individual assessments led to several conceptual changes of how the GGPA is conducted, such as the analytical framework used for the preliminary assessments and the development of a more rapid assessment methodology that can be applied in countries where a full-fledged GGPA is not needed.

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[1] Technical reports for all countries can be accessed online. See GGGI (2016); GGGI (2017a); GGGI (2017c); GGGI (2017e); GGGI (2018a); GGGI (2018c); GGGI (2019a); GGGI (2019b). In addition, summary reports can be accessed for the following three countries: Cambodia (GGGI 2018b), Lao PDR (GGGI 2017b), and Myanmar (GGGI 2017d).

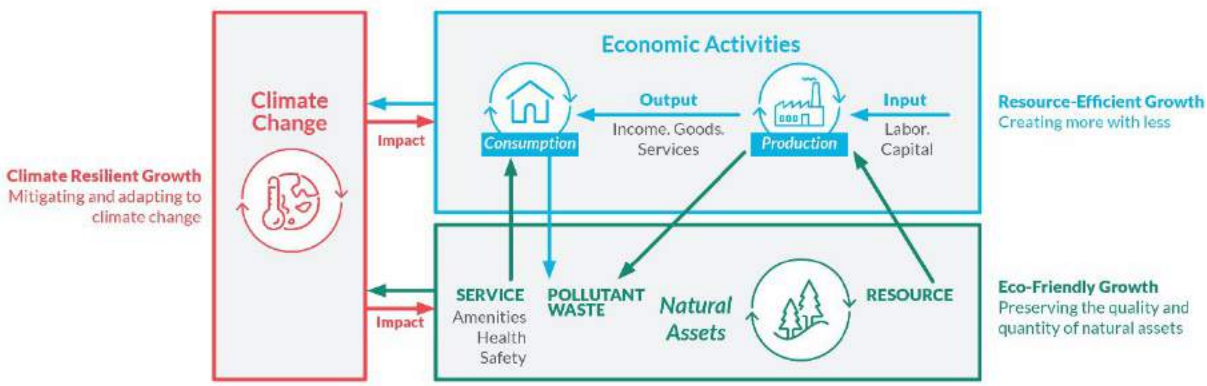
[2] Considering the effective work hours needed to conduct a single GGPA, a full assessment can be conducted in approximately five months. However, GGGI has generally conducted two to three GGPAs in different countries in parallel.

2. Initial Methodology

2.1 Preliminary Assessment

The first stage of the initial GGPA process consisted of a quantitative assessment based on two sets of indicators. The first set was comprised of 25 indicators across three areas relevant for green growth, used to measure different aspects within a country's endowment with natural assets, its economic activities, and its contribution to and vulnerability toward climate change (figure 3).

Figure 3. Framework of the preliminary assessment



Source: Global Green Growth Institute

Table 2 provides an overview of all 25 diagnostic indicators. Information on the definition and the data source of each indicator can be found in Appendix A2. Initially, a country's performance on each of these 25 indicators was benchmarked against the average of its income group and the average of the next higher income group.[3] For that purpose, the data was normalized using the 10th percentile as the lower boundary and the 90th percentile as the upper boundary. Values falling below the 10th percentile or above the 90th percentile were considered as outliers and excluded from the reference scale.

Each indicator represented an area relevant to green growth that included more than the corresponding data point captured by the individual indicator. For example, the indicator *transmission and distribution losses of electricity* was used as a proxy to measure the efficiency and reliability of the electricity system overall.

[3] Income groups were based on the World Bank definition following the classification of countries at the time of the assessment. Income groups are based on a country's gross national income (GNI) per capita, calculated using the World Bank Atlas method (for more information regarding the World Bank Atlas method, refer to World Bank 2019r).
For example, for the 2019 fiscal year, low-income economies are defined as those with a GNI per capita, calculated using the World Bank Atlas method, of USD 995 or less in 2017; lower middle-income economies are those with a GNI per capita between USD 996 and USD 3,895; upper middle-income economies are those with a GNI per capita between USD 3,896 and USD 12,055; high-income economies are those with a GNI per capita of USD 12,056 or higher (World Bank 2019s).

Table 2. Overview of diagnostic indicators

Eco-friendly growth	Resource-efficient growth	Climate resilient growth
Coastal shelf fishing pressure	Energy intensity	CO_2 emissions trend
Change in forest cover	Transmission and distribution losses of electricity	Carbon intensity
Water stress	Material intensity	Share of renewable energy
Depletion of natural resources	Municipal solid waste intensity	Carbon stock in living biomass
Endangered species	Recycling rate of solid waste	Exposure to climate change
Water quality	Water productivity	Sensitivity to climate change
Soil health	Agricultural productivity	Adaptive capacity toward climate change
Air quality	Labor productivity	
	Logistics	
	Technology	

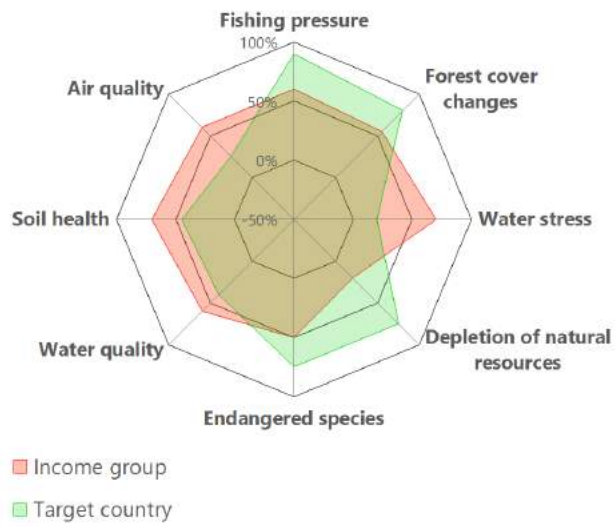
Source: Global Green Growth Institute

The results of these comparisons were illustrated in three separate radar charts—one chart of each area relevant to green growth (figure 4). The radar charts allowed for a visualization of the preliminary assessment findings and facilitated a discussion of the results with stakeholders during the consultation.

In addition to these diagnostic indicators, a set of dashboard indicators was compiled. Appendix A3 provides an overview of all 23 dashboard indicators, with information on the definition and data source of each indicator. The intended purpose of this second set of indicators was to help explain a country's performance in the diagnostic indicators. For example, energy intensity (a diagnostic indicator) was regarded as a function of the size of a country's industry sector, energy consumption in its transport sector, and energy consumption by households.

However, there was no systematic approach to establish the relationships between dashboard and diagnostic indicators, and no explanations for causality were provided or tested for. Moreover, there was no conceptual explanation for why certain indicators served as dashboard indicators while others were regarded as diagnostic indicators. Finally, the explanatory power of at least some of the selected dashboard indicators was questionable while important data that would have strengthened the analysis was missing. Generally, limiting the analysis to less than 50 indicators proved to be too superficial. Contextualization—mostly in the form of an extensive literature review—was needed in order to verify the results, understand their causes, and gain a more nuanced understanding.

Figure 4. Schematic of a radar chart for eco-friendly growth



Source: Global Green Growth Institute

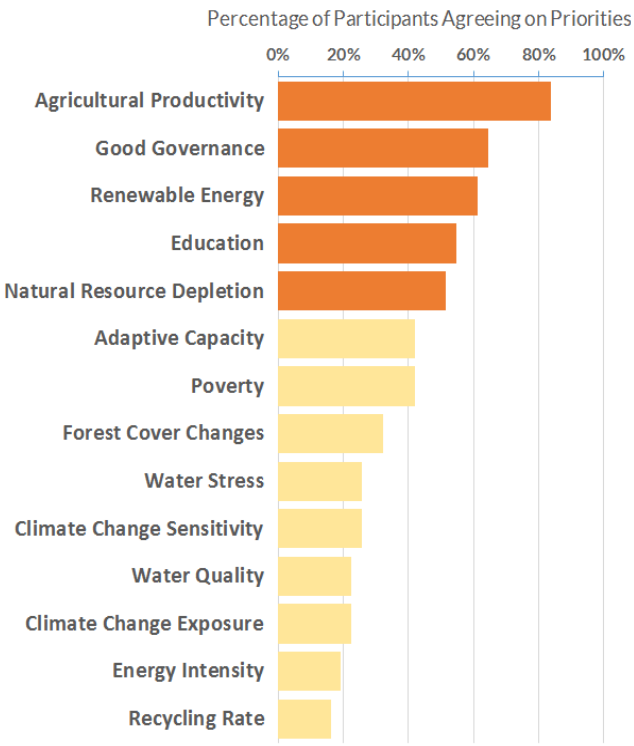
2.2 Consultation

The second step of the initial GGPA process involved engaging stakeholders to identify areas that offer the highest potential for green growth. Stakeholder consultation was regarded as crucial to ensure that the selected priorities are aligned with national plans and policies. For that purpose, a consultation workshop brought together representatives from government, academic institutions, the private sector, and development partners.

This workshop used a Delphi process to gather feedback and build consensus on the identified priorities, with the support of an electronic voting system. The voting system allowed participants to anonymously identify and prioritize areas where green growth was regarded as relevant. The results of the preliminary assessment were shared with the workshop participants to inform the discussion and validate or revise the initial findings. The consultation process was also meant to compensate for any gaps in the preliminary assessment.

The workshop proceeded in two steps. First, stakeholders were asked to identify priorities for green growth based on the results of the preliminary assessment. Stakeholders were asked multiple times to select priorities for green growth from a preselected list. This part of the consultation relied heavily on the radar charts, with a country's performance on an individual indicator representing its performance in a much wider area (figure 5).

Figure 5. Example of selected priorities



Source: Global Green Growth Institute

Each consultation round was informed by relevant results from the preliminary assessment. After each consultation round, the survey results were shared with participants to inform the discussion. The survey system allowed participants to voice their opinion anonymously, without interference of status, age, or sex of other participants. It also allowed for the gathering of feedback on politically sensitive issues that some participants might have been unwilling to openly share their views on. Discussing the results after each survey round allowed them to adjust their assessment based on additional information and feedback within the group. While the number of survey rounds was not fixed, it was suggested to conduct at least two survey rounds.

Second, after having identified priority areas, participants were asked to select sectors that were regarded as relevant for these priorities. The aim of identifying relevant sectors for individual priorities was to make the final analysis more targeted. For example, if participants had selected energy intensity as a priority, then specific sectors would identify the drivers behind a high intensity, such as transport or industry.

For that purpose, participants were divided into smaller discussion groups to inform their decision, before being asked to provide their feedback through a plenary survey. The main result of the workshop consisted of a two-dimensional matrix showing the selected priorities and corresponding sectors (table 3). This matrix served as the starting point for the final analysis.

Table 3. Example of a priority sector matrix

Priorities / Related sectors	Agricultural productivity	Depletion of natural resources	Renewable energy	Education	Good governance
Agriculture	90%	48%	14%	14%	5%
Forestry and land use	62%	71%	29%	14%	10%
Fisheries	19%	25%	0%	0%	0%
Economy and finance	10%	5%	10%	57%	90%
Industry and commerce	5%	0%	52%	0%	10%
Energy and mineral resources	10%	25%	86%	5%	10%
Public works and water resources	14%	19%	43%	5%	10%
Education and vocational training	19%	19%	19%	86%	57%
Public administration	0%	5%	10%	57%	90%
Rural development	43%	48%	29%	25%	10%

Source: Global Green Growth Institute

Note: Percentage figures indicate the share of participants that selected an individual priority sector pair.

The initial design of the consultation workshop proved to have several limitations. First, participants were asked questions whose results were not relevant for later analysis. For example, participants were asked which green growth path they thought was most relevant for their country—eco-friendly growth, resource-efficient growth, or climate resilient growth—while the results never fed into the final analysis.

Second, the results of the preliminary assessment proved insufficient to inform a detailed discussion. Focusing on the results of the benchmarking illustrated in the radar charts provided insufficient granularity and nuance to discuss complex subjects. Further analysis was needed to provide context for the results, show their relevance, and acknowledge their limitations.

Third, the identification of sectors in order to determine priorities more closely involved several inconsistencies and shortcomings. (1) There was no standardized list of sectors. Instead, sectors were compiled for each country individually. (2) Sectors were meant to represent economic sectors.[4] However, they also reflected aspects that cannot be attributed to economic sectors, such as education, public administration, health services, and urban development, among others. (3) In many countries, the

[4] Following the OECD definition, sectors were intended to represent different groups and establishments engaged in similar kinds of economic activity within the domestic economy of a country (OECD 2005).

state plays an important role in the economy. Therefore, in particular, participants representing different branches of government often regarded individual sectors through the lens of how the country's ministries were set up. This led to confusion in cases where different ministries were responsible for one of the proposed sectors or one ministry was responsible for several sectors.

Finally, there was no standardized format for sharing the workshop results with government counterparts, explaining their relevance for the final analysis, and outlining next steps.

2.3 Final Analysis

The third step of the initial GGPA process consisted of the development of a country report. Building on the results of the consultation workshop, specific opportunities and barriers to green growth were meant to be identified for each of the selected priority-sector pairs.

Initially, the emphasis rested on conducting the final analysis within a short period of time. However, the speed of the assessment contributed to the detriment of the quality and depth of the analysis. The analysis was generally too cursory to adequately understand—much less address—relevant issues as a result of insufficient consultation of existing research, publicly available data sets, case studies, project assessments, and other relevant documents.

The final assessment was intended to be built around a set of recommendations. These recommendations were principally informed by a series of expert interviews conducted in the assessment country. However, expert interviews delivered few relevant insights, as they were conducted too early in the analytical process, before important gaps and inconsistencies had been discovered by the assessment team. As a result, the assessment team was generally not in a position to ask targeted questions, with expert interviews being reduced to provide superficial insights. This was also reflected in a disconnect between the analysis and the recommendations in the early country reports, which was further aggravated by the lack of a clear underlying logic in the structure for the report.

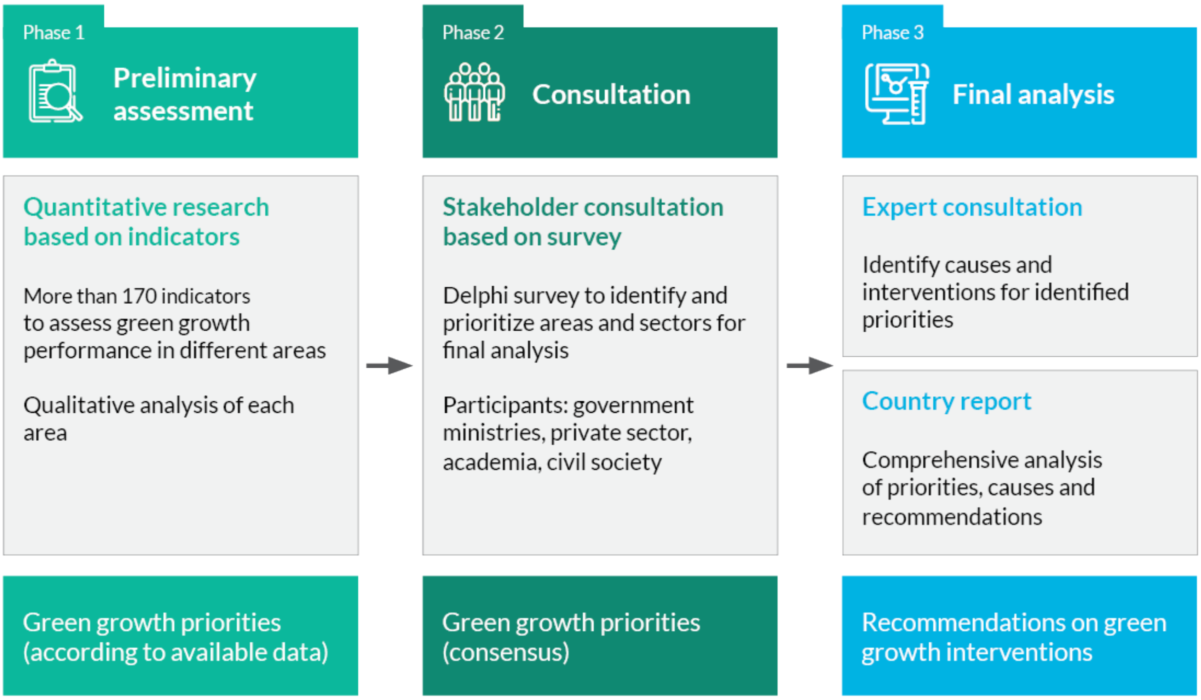
Furthermore, initially, recommendations were focused on policy options that were envisioned to fall within the four following categories: (1) national policies and strategies; (2) institutions and governance; (3) finance, technology, and capacity; and (4) market and business. However, these categories were not clearly defined, reducing their usefulness for developing recommendations. They also proved to be too limited in their scope, being geared toward high-level policy interventions, with few practical suggestions regarding existing regulation, relevant changes in infrastructure, and suitable financing mechanisms.

The results of the GGPA were generally meant to serve as an input to GGGI's Country Planning Framework (CPF). GGGI develops such a framework when starting its work with a new Member, laying out the organization's work in the country for the next five years. This follows GGGI's overarching philosophy of supporting countries with a broad range of services, from identifying priorities and formulating policies to sectoral analysis and formulating regulatory advice to designing bankable projects, developing investment plans, and facilitating access to international finance.

3. Revised Methodology

Between 2016 and 2019, the GGPA process was successfully concluded in the following nine countries: Cambodia, Colombia, the Lao PDR, Mozambique, Myanmar, Nepal, Papua New Guinea, Peru, and Qatar. During those four years, a wide range of lessons has been learned which triggered a major revision of the methodology. While the revised methodology continues to follow the three main steps of the initial concept (figure 6), much of the analytical process within each step has undergone substantial changes.

Figure 6. Overview of the revised GGPA process



Source: Global Green Growth Institute

The revisions to the methodology involve both more fundamental conceptual changes and greater detailed technical changes to the assessment process. Adjustments have been made to all three stages of the assessment process. First, for the preliminary assessment, the analytical framework has been extended to cover the dimension of social inclusion. In addition, the set of indicators has been extended considerably, from a total of less than 50 individual indicators to more than 170 indicators. Furthermore, the distinction between dashboard and diagnostic indicators has been discarded. Second, the design of the consultation workshop has been refined, and a systematic overview presenting the workshop results to all participants has been introduced. Third, the analytical process of the final report has undergone extensive revisions, which are also reflected in the structure and design of the report. Finally, an option to conduct a more rapid assessment, instead of a full-fledged GGPA, has been developed.

This chapter discusses the revisions and the rationale behind them, detailing all three stages of the assessment process. It addresses both the conceptual and technical revisions, as they are often interlinked, with conceptual changes requiring technical adjustments.

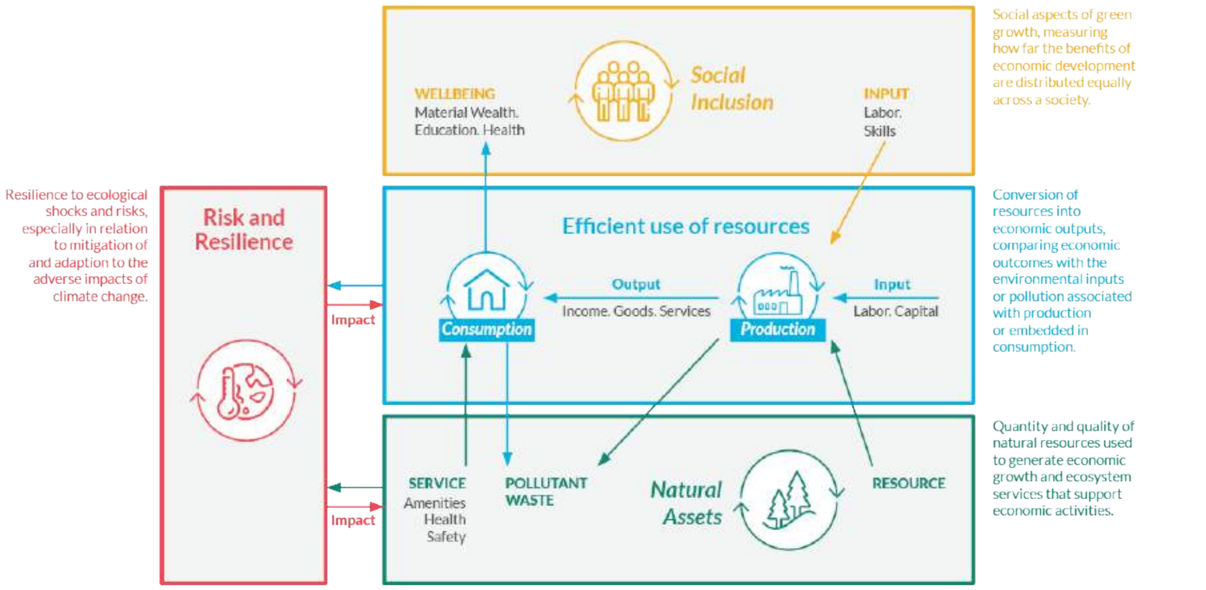
3.1 Preliminary Assessment

The preliminary analysis continues to serve as a starting point for identifying a country's priorities for green growth, causes for low performance in specific areas, and possible remedies. Emphasis rests on areas which show comparatively lower performance, as these can represent opportunities for high-impact interventions at moderate costs. Three major adjustments have been made to the preliminary assessment. First, the analytical framework has been revised to cover the dimension of social inclusion. Second, the set of indicators has been considerably extended from a total of less than 50 individual indicators to more than 170 indicators. Third, the distinction between dashboard and diagnostic indicators has been discarded.

Dimensions of green growth

GGGI defines green growth as a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive. Through the green growth model, countries seek opportunities for economic growth that reduce carbon emissions, increase resilience to the adverse impacts of climate change, prevent or remediate pollution, and maintain healthy and productive ecosystems as well as create green jobs, reduce poverty, and enhance social inclusion. Several organizations have put forward definitions and concepts of green growth, including the World Bank, OECD, and UNEP. Common to all of these definitions is that they identify three pillars of green growth: economic growth, environmental sustainability, and social inclusion. GGGI's definition recognizes the importance of all three pillars without emphasizing one over the other.

Figure 7. Framework of the preliminary assessment



Source: Global Green Growth Institute

The methodological framework to measure green growth in the GGPA is in line with GGGI's definition as well as the theoretical work undertaken by other institutions in this area. In order to measure green growth, the Green Growth Knowledge Platform proposed including indicators reflecting the following five dimensions: (1) natural assets, (2) resource efficiency and decoupling, (3) risks and resilience, (4) economic opportunities and efforts, and (5) inclusiveness (GGKP 2013; GGKP 2016; table 4).

Table 4. Dimensions for measuring green growth proposed by the GGKP

Dimension	Description
Natural assets	Natural assets relate to the natural resources used to generate economic growth and ecosystem services that support economic activities. This theme can involve issues related to land and soil, forest and timber, water, minerals and energy resources, fish stocks, and air and climate. Indicators can cover the total available biophysical stock of natural assets and changes over time, their quality and respective economic values, risks related to depletion or scarcity, or threshold limits, such as planetary boundaries.
Resource efficiency and decoupling	Resource efficiency and decoupling relate to how efficiently (or wastefully) economic outputs are produced and consumed. Efficiency indicators focus on comparisons of economic outcomes with the environmental inputs or pollution associated with production or embedded in consumption. Production-based environmental and resource productivity indicators account for environmental inputs or pollution directly linked to domestic production. Demand-based (or footprint) indicators paint a fuller picture, accounting for the environmental effects related to the full production chain for domestically consumed goods. Such indicators of decoupling show the development of environmental pressures in absolute or per capita terms.
Risks and resilience	Risks and resilience relate to how resilient the economic growth process is to ecological shocks and risks—especially those related to pollution, degradation, natural disasters, and climate change. If resilience is low, countries are more likely to experience the negative impacts (e.g., fatalities and economic damages). These impacts depend on the exposure (i.e., presence of people, livelihoods, and assets that could be adversely affected and the characteristics of those adversely affected) and vulnerability (i.e., the degree to which a system is susceptible to, or unable to cope with, the adverse effects) of people and economic systems to the climate or disaster hazard (IPCC 2014). Resilient systems are more able to respond and adapt to impacts and recover from them.
Economic opportunities and efforts	Economic opportunities and efforts relate to the adoption and implementation of policies enabling transformation toward green growth. In addition, this dimension aims to capture the opportunities created and the efforts made to facilitate such transformations.
Inclusiveness	Inclusiveness relates to the social aspects of green growth, measuring how the costs and benefits of environmental policies are distributed among different groups. This theme can include some of the measurement aspects of other themes but explicitly covers distributional aspects by measuring which households, groups, or communities have access to environmental amenities; who is exposed to environmental risks; and who can participate in environmental decision-making and incur the benefits/costs of green policies.

Source: GGKP 2016

The revised GGPA methodology largely follows the approach proposed by GGKP (2016), considering four dimensions of green growth (figure 7). The categories "natural assets" and "efficient use of resources" used in the GGPA are closely aligned with the suggestions put forward by GGKP (2016), with two exceptions. First, under the framework of the GGPA preliminary assessment, a country's contributions to climate change are included under the dimension of risk and resilience. Second, the revised methodology does not include an assessment of the available stock of minerals and fossil fuels. The connection between a country's existing mineral resources and its performance in green growth is debatable. While the quantity and quality of natural assets—such as forests, water, and air—are a direct measure for how sustainable a country's economy is operating, the quantity of its mineral resources allows for no such assessment. For example, unlike a country's forests, its mineral resource and fossil fuel reserves deliver no ecosystem services, nor—unlike soils, air, and water—is their availability essential to support human life. Furthermore, assessing the value or depletion of mineral resources and fossil fuel reservoirs carries relevant information to assess how sustainable a country's economic model is. However, it does not allow for any conclusions on how sustainably these resources are being used.

The dimension of risk and resilience, as captured within the GGPA, is somewhat narrower compared to the definition suggested by GGKP (2016) and other institutions. For example, the Intergovernmental Panel on Climate Change (2018) defines resilience as "[t]he capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning and transformation." Similarly, the latest Sendai Framework for Disaster Risk Reduction defines resilience as the "ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management" (UNDRR 2017). These definitions are rather broad, as disasters are not limited to disruptions triggered by climate change but also include other causes. While IPCC (2018) specifically refers to "hazardous physical events," the Sendai Framework merely refers to a "serious disruption of the functioning of a community or a society at any scale due to hazardous events" (UNDRR 2017).

Under the revised GGPA framework, the dimension of risk and resilience largely focuses on indicators related to climate change. Aspects such as natural disasters unrelated to climate change (volcano eruptions, earthquakes), as well as macro-economic stability and financial and fiscal risks, are excluded in the GGPA. There are two reasons for the narrower focus. First, many of these aspects go beyond GGGI's definition of green growth and, therefore, are not considered in the GGPA. Second, while GGGI assists countries in mitigating their contribution to climate change and adapting to the unavoidable adverse impacts of climate change, the organization does not focus on macro-economic stability. Other organizations with considerably more financial resources than GGGI—in particular, the International Monetary Fund—support countries regarding macro-economic and financial stability. Therefore, while the GGPA might touch upon such issues in the final analysis, these questions are generally not at the center of an assessment.

To the extent possible, indicators reflecting the dimension of economic opportunities and efforts have been included in the other four dimensions of green growth.[5] There are several reasons for not assessing this dimension separately within the framework of the GGPA's preliminary assessment. First,

[5] GGKP (2016) mentions the following examples to measure economic opportunities and efforts:

- Environmental regulation and planning: environmental action plan or strategy in place, measures of environmental policy stringency, extent of protected areas, environmental standards, renewable energy feed-in tariffs, adoption of environmental accounts, and number of international environmental treaties signed;
- Environmental taxes and government spending: environmentally related taxes, fossil fuel subsidies, and public environmental expenditure;
- Innovation and business environment: R&D expenditure and green patent counts; and
- Green transformation/opportunities: green investments, green jobs, value added of environmental goods and services sectors, adoption of certified products from sustainable value chains, and exports of environmental goods and services sectors.

availability of relevant data is very limited. Much of the required information is not or only partially available, particularly in developing countries.

Second, while there are efforts to collect such information systematically,[6] the comparability of policies and regulatory measures across countries is questionable. Indicators suggested by GGKP (2016) to measure economic opportunities largely reflect policy measures, asking whether or not these measures are in place. However, it is challenging to assess their effectiveness systematically for comparative analysis since the existence of a particular policy or regulatory measure carries little information about its effectiveness. Assessing the effectiveness of policy measures—including their implementation, their enforcement, and the extent to which they achieve the desired results—is often a subjective process with severe limitations (Botta and Koźluk 2014; Coglianese 2012). Relevant examples illustrating the limitations of comparing the effectiveness of policy measures and regulation include environmental and efficiency standards, carbon pricing, feed-in tariffs for renewable energy, and fossil fuel subsidies (Espa and Rolland 2015; Jenkins 2014; Poudineh 2016; Sorrell 2015).

Third, indicators, such as green jobs and green investment, lack agreed definitions and relevant data, which undermines the results of any peer comparisons and renders them not suitable for the purpose of the preliminary assessment. For example, major controversies include the question of how environmentally friendly nuclear power and large hydro plants are. Consensus on the sustainability of biofuels and biomass has changed. There is considerable ambiguity regarding "green" agriculture, financial services, and trade. There is also fundamental uncertainty of how to account for biodiversity and conservation (Anderson 2018; Inderst, Kaminker, and Stewart 2012). Finally, critics contend that—regardless of its exact definition—the green economy represents a small fraction of the entire economy and total employment, further undermining its relevance (Center on Education and the Workforce 2015).

Fourth, some of the proposed measurements rather fit in the context of developed countries whereas GGGI is largely working in developing countries. For example, measuring research and development (R&D) expenditure is likely of limited relevance. In a globalized economy, countries benefit from R&D investment undertaken and patents developed elsewhere, as they lack the resources to lead such innovations themselves and—under suitable conditions—technology is rapidly disseminated. Particularly for low- and middle-income countries, effectively transferring technologies might be more cost efficient than investing in R&D themselves (Comin and Mestieri 2014).

Therefore, instead of R&D expenditure, education, infrastructure, openness to international trade, and foreign direct investment, as well as a country's macroeconomic and governance conditions in general—all facilitating technology diffusion—are regarded as more relevant measures (Eaton and Kortum 1999; UN 2018; World Bank 2008b). For example, World Bank (2008b) argues that "[m]uch of the technological

[6] Examples include IEA's *Dealing with Climate Change policies and measures database,* which provides information on energy-related policies and measures taken or planned to reduce greenhouse gas emissions; IEA/IRENA's *Global Renewable Energy Policies and Measures Database,* which provides information on policies and measures taken or planned to encourage the uptake of renewable energy; the *Energy Efficiency Policies and Measures database,* which provides information on policies and measures taken or planned to improve energy efficiency; and the *Building Energy Efficiency Policies Database,* which provides a detailed breakdown of policies for energy efficiency in buildings around the world, including those supporting building codes, labels, incentive schemes, and zero-energy buildings (IEA 2019a; IEA 2019b; IEA 2019f). Further examples include OECD's Structural Policy Indicators Database for Economic Research that captures structural policies—such as institutions, framework condition policies and policies specifically related to labor markets, and drivers of productivity and investment, including trade, skills, and innovation—and the organization's Policy Instrument for the Environment Database, which provides information regarding environmental protection and natural resource management (Égert, Gal, and Wanner 2017; OECD 2019d).

progress in developing countries over the past 15 years has been associated with the increase in openness that occurred during the same period." As a result, the level of technology adopted in developing countries reflects rather the pace at which technology diffuses, depending on countries' capacities to absorb them, than on those countries' R&D budgets. Relevant indicators reflecting that capacity are considered within the dimension of social inclusion.

Finally, the initial framework of the GGPA preliminary assessment considered three aspects of green growth: efficient use of resources, conservation of natural assets, and climate change. To align the GGPA more closely with GGGI's understanding of green growth and the framework suggested by GGKP (2016), social inclusion has been added as a fourth dimension to the preliminary assessment.

In line with the suggestions put forward by GGKP (2016), social inclusion features indicators which cover questions concerning access to services (electricity, sanitation, health, education), wealth distribution and other factors of inequality, the quality of governance, and a country's business environment. Contrary to the GGKP's proposal, questions concerning representation, land tenure, and welfare schemes are not included, as data availability and the analytical insight of some of the indicators pose severe limitations. For example, the assessment of welfare schemes and land tenure provisions would largely be limited to quantitative aspects with little to no information about their quality and the degree of their implementation and effectiveness.

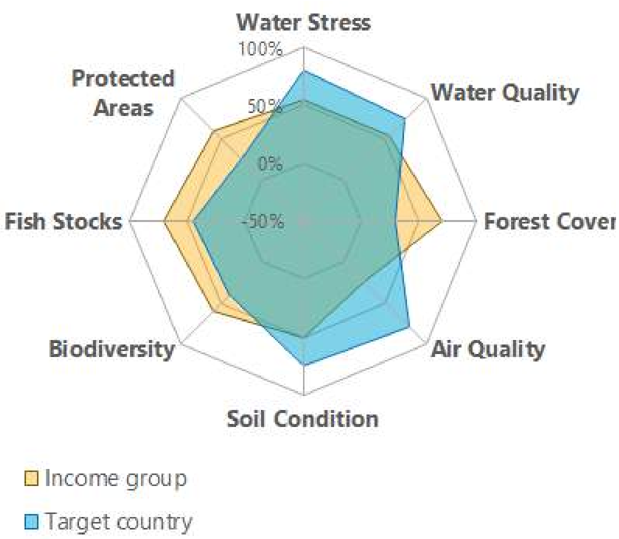
Modifications to the indicators

The purpose of the indicators as part of the preliminary assessment remains largely unchanged. They are employed to compare and benchmark a country's performance with a selected country or group of countries. The results of these peer comparisons are illustrated in four separate radar charts—one chart of each dimension of green growth. As before, these radar charts allow for the visualization of a cursory overview of the findings of the preliminary assessment. They serve to open the discussion with stakeholders during the consultation (figure 8). However, several changes have been made to the method in which the indicators are compared and used.

First, the process of normalizing the data has been changed. In this context, normalization refers to converting different indicators with different units to a common scale in order to make them comparable (GIWPS and PRIO 2017; OECD et al. 2008). There are a number of normalization methods, including ranking, z-scores, min-max, distance to a reference measure, categorical scales, indicators above or below the mean, cyclical indicators, balance of opinions, and percentage of annual differences over consecutive years (Freudenberg 2003; Jacobs, Smith, and Goddard 2004).

For the purpose of the preliminary assessment, the min-max method is applied, as it is regarded as the simplest and most transparent method. Transparency is considered as crucial to ensure that target audiences can easily understand the process behind comparing different indicators. In addition, the min-max method is widely used. For example, both the World Bank's Ease of Doing Business Index (Doing Business) and the Human

Figure 8. Schematic of a radar chart for natural assets



Source: Global Green Growth Institute

Development Index rely on the min-max method to aggregate their different constituent indicators (UNDP 2015b; World Bank 2019i).

Under the min-max method, indicators are normalized to have an identical range from 0 to 100 by subtracting the minimum value from the selected data point and dividing the difference by the range of the indicator values. The result is multiplied by 100.[7] For each indicator, 100 represents high performance while 0 depicts low performance.

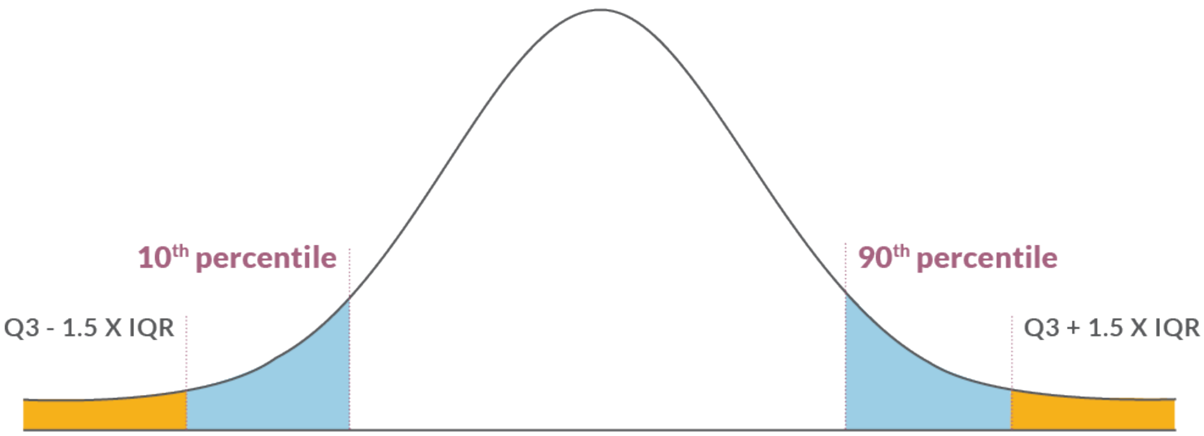
$$\frac{Data\ point - Minimum}{Maximun - Minimum}\ X\ 100$$

In the case where, for a given indicator, a lower value represents higher performance (e.g., energy intensity), the selected data point is subtracted from the maximum value and the difference is divided by the range between the minimum and maximum. The result is again multiplied by 100.

$$\frac{Maximum - Data\ point}{Maximun - Minimum}\ X\ 100$$

An important aspect of the normalization process is the treatment of outliers. Generally, an outlier is defined as "an observation which appears to be inconsistent with the remainder of that set of data" (Barnett and Lewis 1984). More specifically, the OECD (2008) defines outliers as values that could distort the data set in a way that the min-max normalization could widen the range to such an extent that the majority of datapoints are located within a small interval, obscuring the observed differences between those values.

Figure 9. Application of Tukey's fence rule compared to previous identification of outliers



Source: Global Green Growth Institute

The way that outliers are identified has been revised under the new GGPA methodology. Previously, outliers were determined by arbitrarily and indiscriminately cutting off any datapoints below the 10th

[7] Multiplying the result by 100 is not strictly necessary. However, it allows for easier visualization. Without multiplying the result by 100, values would range between 0 and 1.

percentile and above the 90th percentile. The remaining datapoints between the 10th and 90th percentile were then normalized on a scale from -50 to 100.

In contrast, the revised methodology applies Tukey's fence rule to identify outliers. Under Tukey's fence rule, the distribution of the individual data points in a given data set determines which values are treated as outliers (see box 1). Tukey's method is a widely used tool to analyze continuous univariate data (Dawson 2011; Seo 2006). Relying on Tukey's fence rule allows for a much more discriminate identification of outliers than the initial approach. As part of the preliminary assessment, it generally has the effect of reducing the number of outliers, extending the interval between the minimum and maximum boundaries (figure 9). In addition, Tukey's fence method has the advantage of being applicable to skewed or non-mound-shaped data sets (Seo 2006).

Tukey's method is not appropriate for small sample sizes, where too many datapoints could be identified as outliers (Dawson 2011; Iglewicz and Hoaglin 1993; Seo 2006). However, for all data sets that are normalized as part of the preliminary assessment, sample sizes are sufficiently large to avoid this issue, with 160 data points available on average per indicator and chosen time interval and never less than 97 data points for any individual indicator.

Box 1. Tukey's fence rule

Tukey's fence rule (1977) relies on a *boxplot* to identify outliers in a given data set. A boxplot is a widely used graphical tool to display information about continuous univariate data, such as the median, lower quartile, upper quartile, lower extreme, and upper extreme of a data set (Iglewicz and Hoaglin 1993; Seo 2006).

Following Tukey's method, the boxplot consists of several elements (Tukey 1977):

1. The median, which is the value separating the higher half of the values from the lower half of the values in a data sample. The median can also be referred to as the second quartile.
2. The first quartile Q1 (also lower quartile) splits off the lowest 25% of the values from the highest 75%. One quarter of the values in a given data set has a value lower than or equal to Q1.
3. The third quartile (also upper quartile) splits off the highest 25% of the values from the lowest 75%. One quarter of the values in a given data set has a value higher than or equal to Q3.

The boxplot consists of a box extending from the first quartile (Q1) to the third quartile (Q3), a mark at the median, and whiskers extending from the first quartile to the lower fence and from the third quartile to the upper fence (Dawson 2011).

The lower and upper fences are calculated based on the Inter Quartile Range (IQR). The IQR is the distance between the lower and upper quartiles, defined as Q3 subtracted by the Q1 (Seo 2006).

$$Interquartile\ Range: IQR = Q3 - \mathrm{Q1}$$

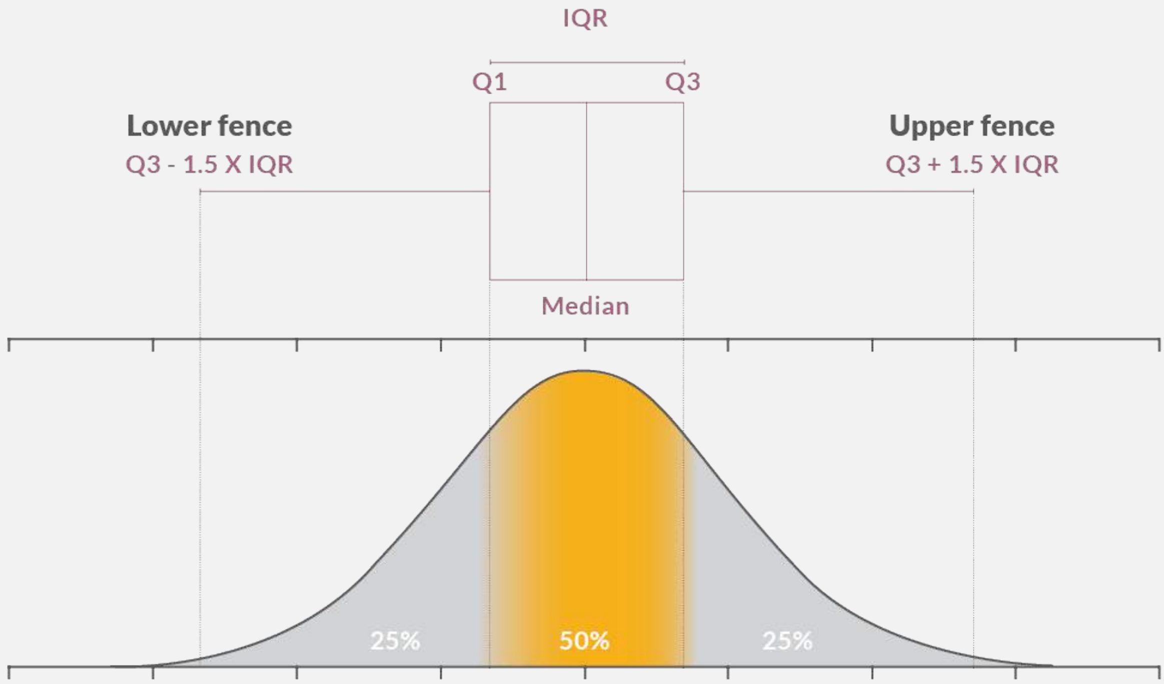
The lower and upper fences are located at a distance of 1.5 x IQR below Q1 and above Q3, respectively.

$$Upper\ Fence = Q3 + 1.5\ x\ IQR \qquad Lower\ Fence = Q1 - 1.5\ x\ IQR$$

Box 1. Tukey's fence rule (continued)

Data points located outside the fences are considered to be outliers (Dawson 2011; Seo 2006). There is no statistical basis for the reason that Tukey uses 1.5 regarding the IQR to define the lower and upper fences (Seo 2006). Therefore, other factors can be chosen, increasing or reducing the distance of the fences.

Figure 10. Schematic of a boxplot

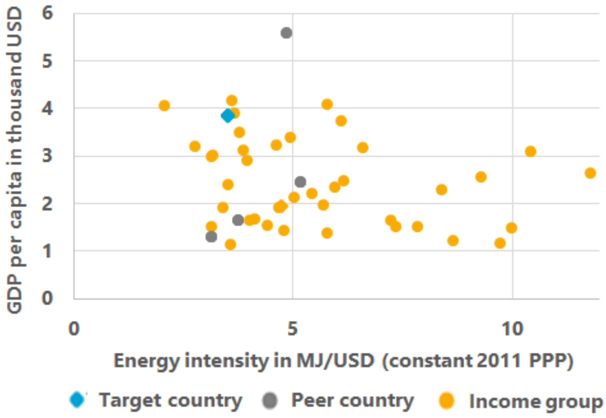


Source: Global Green Growth Institute

While, generally, values are represented on a scale from 0 to 100, in the context of the preliminary assessment, the data is rescaled to a range from -50 to 100. The reason behind this extended scale is the need to illustrate low performance. Generally, any outliers beyond the upper boundary are assigned a value of 100. Similarly, any outliers below the lower boundary would be assigned a value of 0. However, since the preliminary assessment focuses on indicators that show a low performance against a peer country or group, it is essential to capture performance at the lower spectrum in more detail—instead of showing all of them performing at the same value of 0—and be able to illustrate them in the radar charts. This is particularly relevant for low- and low-middle-income countries—which represent the majority of countries that a GGPA is conducted for—since, for several indicators, values for up to a quarter of these countries range from -50 to 0.

The second change to the indicator set consists of extending the set from a selection of a total of 48 individual indicators to 171 distinct indicators, allowing for a more detailed assessment.[8] Only a selected subset of the entire spectrum of indicators is shown in the four radar charts, based on their relevance and data availability for the country being assessed. In addition, further indicators are used to provide a more granular picture on individual aspects shown in the radar charts. For example, while the radar chart shows a country's energy intensity, additional indicators place this in context, disaggregating energy consumption by sector or account for income levels (GDP per capita). These results can be illustrated in suitable formats and inform more detailed discussions on specific questions during the stakeholder consultation (figure 11).

Figure 11. Schematic of a chart for energy intensity accounting for income levels



Source: Global Green Growth Institute

Disposing of an extended consolidated set of indicators also avoids some of the time-consuming ad-hoc data gathering that was necessary during several past assessments. Instead, data for all indicators is collected on a yearly basis from a number of centralized sources.

Box 2. Use of modeling and forecasting

The GGPA only relies on modeling and forecasting to the extent that those results are provided within the body of existing literature on a specific topic and/or for a specific country. There is no independent modeling and forecasting undertaken as part of the assessment process.

There have been requests in the past to employ modeling techniques to illustrate the impact of different scenarios and develop policy recommendations based on those scenarios. For example, it was suggested to model the impact on agricultural output of switching from traditional agriculture practices to climate resilient practices. It was also suggested to model the effect of increasing the share of renewables in a country's electricity mix on electricity tariffs.

While such modeling exercises can provide useful insights for possible developments and identify potential trade-offs, they face severe limitations. Data availability, data quality, the complexity of causal relationships, and the impact of external variables would need to be addressed. To do so, significant resources would be needed, without any guarantee that any of the challenges could be successfully addressed. Given the high complexity of the topics involved and the broadness of the current indicator set, either an exorbitant increase in the number of indicators and granularity of the data would be required, or the results would be subject to extensive uncertainty, rendering them inconclusive at best. Even with considerable resources invested into data collection, the number of intervening variables is most likely so high that they cannot be accounted for, and results would remain of limited explanatory power and usefulness.

[8] The initial indicator set consisted of 25 diagnostic and 23 dashboard indicators. Only the results of the 25 diagnostic indicators were depicted in radar charts. Under the revised methodology, the sum of all indicators used to assess the different dimensions is 185. However, several indicators are used to measure more than one aspect of green growth. Therefore, the number of distinct indicators is lower, at 171 indicators.

Third, initially, the preliminary assessment was based on two separate sets of indicators: a first set of so-called *dashboard indicators* and a second set of so-called *diagnostic indicators*. The former was meant to help explain a country's performance in the latter. For example, energy intensity—a diagnostic indicator—was seen as a function of the size of a country's industry sector, energy consumption in the transport sector, and household consumption. However, there was no systematic approach to establish the relationships between dashboard and diagnostic indicators, and no explanations for causality were provided or tested for. Moreover, there was no conceptual explanation for why certain indicators served as dashboard indicators while others were regarded as diagnostic indicators. Finally, the explanatory power of at least some of the selected dashboard indicators was questionable while important data that would have strengthened the analysis was missing.

To address these shortcomings, the distinction between dashboard and diagnostic indicators was discarded. Instead, the indicators with the most explanatory power are chosen to illustrate relevant issues for a selected country.

Overview of the extended indicator set

The set of indicators has been considerably extended, from a total of less than 50 individual indicators to more than 170 indicators. The extension was necessary as the initial indicators were inadequate to provide a sufficiently granular picture of a country's performance within areas relevant for green growth. In past assessments, a considerable amount of additional data gathering was required to strengthen the preliminary analysis. This was largely done on an ad-hoc basis, lacking a systematic approach. Increasing the number of standardized indicators to be considered in the assessment reduced the need for such ad-hoc data gathering. It also allowed for the alignment of GGPA indicators closer to GGGI's Green Growth Index as well as the indicators used to measure progress on the Sustainable Development Goals.

In addition to including more indicators, several of the initial indicators were replaced, adjusted, or discarded. Such changes were necessary as some of the initial indicators lacked relevance and analytical insight in the context of green growth, showed considerable deficiencies in their conceptual soundness, suffered from severe gaps in data availability, or were subject to a combination of those factors. Changes to the indicator set are discussed in detail in the following sections.

In line with the *OECD Handbook on Constructing Composite Indicators*, indicators used for the GGPA were selected based on the following criteria (OECD et al. 2008; figure 12):

- Relevance and analytical insight;
- Conceptual soundness;
- Data availability; and
- Data quality.

For the selection of GGPA indicators, two steps for the construction of composite indicators were considered as relevant: the theoretical framework and data selection. For these two steps, OECD et al. (2008) regard the following quality dimensions as relevant: (1) relevance, (2) accuracy, (3) credibility, (4) timeliness, and (5) interpretability. For the purpose of the GGPA, these five dimensions serve as the basis but were adapted to some degree for selecting relevant indicators.

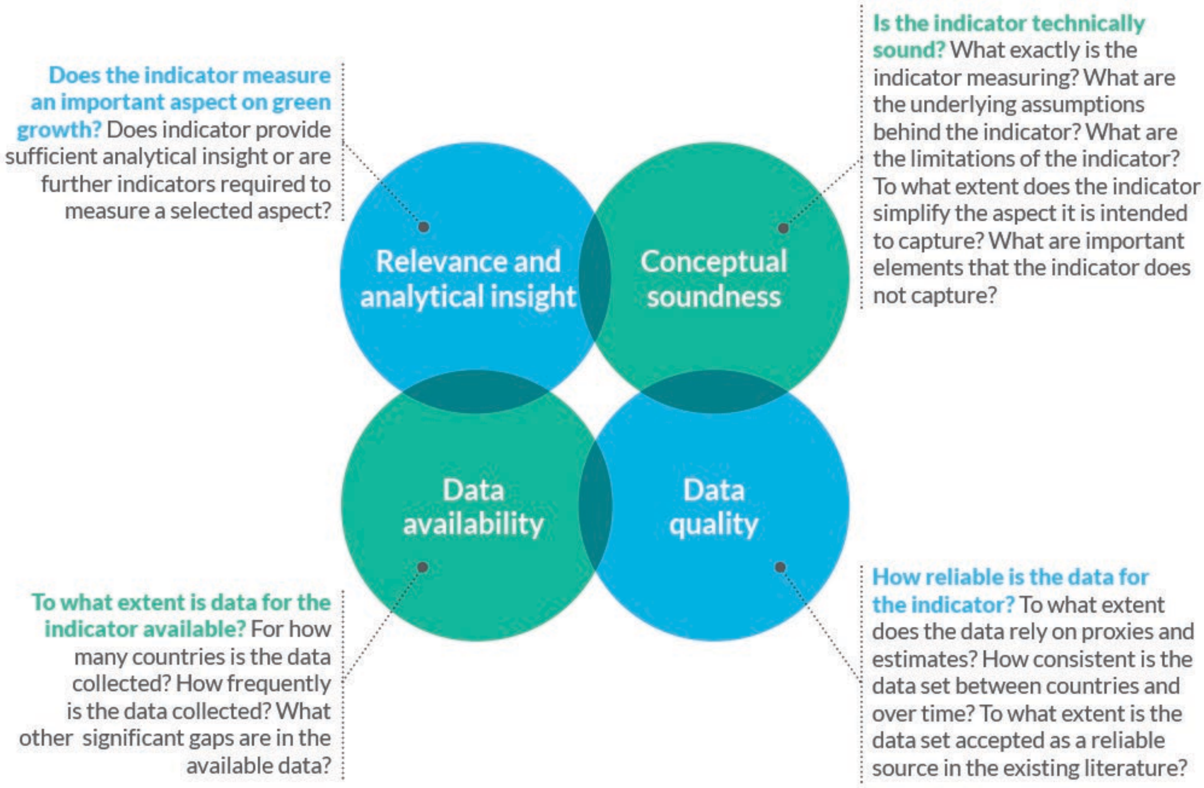
Relevance and analytical insight cover the category *relevance* under the OECD methodology. Relevance refers to the extent to which appropriate concepts are used and the degree to which they meet the needs of the user (OECD et al. 2008).

Conceptual soundness captures one element of the category *accuracy* as defined in the OECD handbook. As the handbook explains, "[a]ccuracy has many attributes, and in practical terms it has no single aggregate or overall measure." Therefore, conceptual soundness captures the element of accuracy that asks for the proximity between the measurements and phenomena they are meant to capture while data quality refers the degree to which the numerical values of these measurements are reliable. Conceptual soundness also covers the category of *interpretability,* as defined in the handbook, referring to the "adequacy of the definitions of concepts, target populations, variables and terminology underlying the data and of the information describing the limitations of the data" (OECD et al. 2008).

Data availability refers not only to *timeliness,* as defined by the OECD handbook, but also to geographical gaps in the data. In particular, geographical coverage is a major issue when working in developing countries, as relevant data is often not available on a comparable basis for a number of countries. Therefore, data coverage, in terms of time and geography, was an important selection criterion.

Data quality covers the second element the handbook ascribes to *accuracy*, asking for the degree to which the numerical values measuring a certain phenomenon can be considered reliable. It also covers the dimension of *credibility*, defined as the "confidence that users place in those products based simply on their image of the data producer." In that context, credibility refers to the objectivity of the data, including whether the data is collected and compiled professionally in accordance with appropriate statistical standards and policies, following transparent practices. It also considers whether the data is easy to access, regarding verification of the original source and gaining information on definitions, assumptions, and limitations, among others (OECD et al. 2008).

Figure 12. Criteria for selecting GGPA indicators



Source: Global Green Growth Institute

In the following sections, the indicators used as part of the preliminary assessment are discussed according to the above four criteria. A schematic—similar to that of figure 12—depicts how they are assessed for each category, based on a simple color coding, with green indicating that the indicator receives a high score for a selected criterium, yellow indicating a mediocre score, and red indicating a low score.

Under the revised methodology, the preliminary analysis is based on a total of 171 distinct indicators. This set of indicators has become too large in order to display each indicator in the radar charts. Instead, indicators are grouped into 34 categories (table 5). For each category, an indicator is chosen to illustrate the results of the preliminary assessment in the radar chart. While a large number of indicators are not visible in the radar charts, they nevertheless inform the assessment and the stakeholder consultation. See *Modifications to the indicators* in this report for more details.

Table 5. Categories of GGPA indicators

Natural assets	Efficient use of resources	Risk and resilience	Social inclusion
(1) Water stress	(9) Energy consumption	(19) Carbon intensity	(26) Poverty
(2) Water quality	(10) Conversion and distribution of electricity	(20) CO_2 emissions growth	(27) Basic services
(3) Forest cover	(11) Water productivity	(21) Carbon stock	(28) Food security
(4) Air quality	(12) Agricultural productivity	(22) Renewable energy	(29) Health
(5) Soil condition	(13) Labor productivity	(23) Fossil fuel subsidies	(30) Education
(6) Biodiversity	(14) Transport and logistics	(24) Vulnerability to climate change	(31) Material inequality
(7) Fish stocks	(15) Technology	(25) Costs of climate change	(32) Gender inequality
(8) Protected areas	(16) Solid waste management		(33) Good governance
	(17) Wastewater management		(34) Business environment
	(18) Recycling		

Source: Global Green Growth Institute

In the following sections, the indicators used for each dimension of green growth—natural assets, efficient use of resources, risk and resilience, and social inclusion—are discussed. They are assessed according to four criteria: (1) relevance and analytical insight, (2) conceptual soundness, (3) data availability, and (4) data quality.

Natural Assets

Under the revised methodology, a total of 36 indicators is considered to assess natural assets as one of a country's four dimensions of green growth. These indicators are grouped into eight different categories, namely (1) water stress, (2) water quality, (3) forest cover, (4) air quality, (5) soil conditions, (6) biodiversity, (7) fish stocks, and (8) protected areas (table 6). A list of all indicators with detailed information regarding their definitions, units of measurement, and data sources is provided in Appendix A1.

Table 6. GGPA indicators to assess natural assets

Aspect	Indicator	Change to initial methodology
Water stress	Baseline Water Stress Index	No change
	Freshwater withdrawal as a proportion of available freshwater resources (SDG 6.4.2)	Indicator added
	Long-term average annual precipitation in depth	Indicator added
	Annual freshwater withdrawal per capita	Indicator added
	Proportion of population using safely managed drinking water services (SDG 6.1.1)	Indicator added
	Degree of integrated water resources management (IWRM) implementation (SDG 6.5.1).	Indicator added
Water quality	Disability-adjusted life years (DALYs) due to unsafe water sources	Indicator added
	Water Quality Index	No change
Forest cover	Total forest cover	Indicator added
	Change in forest cover	No change
	Forest area annual net change rate (SDG 15.2.1)	Indicator added
	Total primary forest cover	Indicator added
	Change in primary forest cover	Indicator added
	Forest area as a proportion of total land area (SDG 15.1.1)	Indicator added
	Change in above-ground biomass in forest per hectare (SDG 15.2.1)	Indicator added
	Proportion of forest area certified under an independently verified certification scheme (SDG 15.2.1)	Indicator added
	Proportion of forest area with a long-term management plan (SDG 15.2.1)	Indicator added
	Proportion of forest area within legally established protected areas (SDG 15.2.1)	Indicator added

Table 6. GGPA indicators to assess natural assets (continued)

Aspect	Indicator	Change to initial methodology
Air quality	Population-weighted exposure to $PM_{2.5}$	No change
	Population weighted annual mean levels of fine particulate matter in urban areas (SDG 11.6.2)	Indicator added
	Disability-adjusted life years (DALYs) due to ambient particulate matter pollution	Indicator added
	Mortality rate attributed to household and ambient air pollution (SDG 3.9.1)	Indicator added
	Disability-adjusted life years (DALYs) due to household air pollution from solid fuels	Indicator added
	Disability-adjusted life years (DALYs) due to ambient ozone pollution	Indicator added
	Access to clean fuels and technologies for cooking	Indicator added
Soil condition	Trends in Soil Health Index	No change
	Use of inorganic fertilizers	Indicator added
	Use of pesticides	Indicator added
Biodiversity	Red List Index (SDG 15.5.1)	Indicator added
	Share of threatened species of a country's total species	Indicator added
	Change in the number of threatened species	No change
Fish stocks	Fish stocks, share of overexploited species in total catch	Indicator added
	Captured fish, total amount of nominal catch	Indicator added
	Aquaculture, total amount of farming of aquatic organisms	Indicator added
Protected areas	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas (SDG 15.1.2)	Indicator added
	Coverage of protected areas in relation to marine areas (SDG 14.5.1)	Indicator added

Source: Global Green Growth Institute

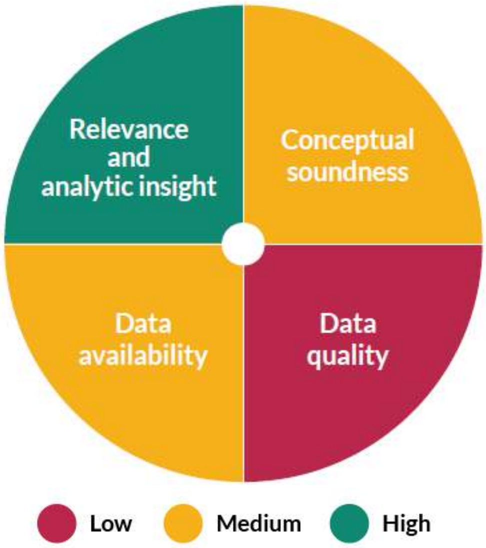
Note: Information on alignment to SDG indicators is provided where relevant.

For natural assets, changes to the initial set of indicators largely consist of extending the data set to include additional indicators in order to provide more granularity to the preliminary analysis and align the assessment closer with the SDGs. In particular, additional indicators strengthened the analysis concerning water stress, forest cover, and air quality. The only indicator that has been discarded from the preliminary assessment concerning natural assets is *depletion of natural resources*.

Water stress and water quality

First, water is an essential substance for all living organisms, delivering nutrients and oxygen and discharging metabolic wastes (Popkin, D'Anci, and Rosenberg 2010; WWAP 2012). Water sustains plant life which in turn is essential to absorb carbon dioxide, produce oxygen, and serves as a food source (Cosgrove and Rijsberman 2000; FAO 2019b; UN Water 2019). Water also plays an important role as an input for many industrial processes (Cosgrove and Rijsberman 2000; FAO 2019b). Therefore, the GGPA's preliminary assessment captures both the quantity of available water and its quality.

Figure 13. Indicator evaluation for water stress

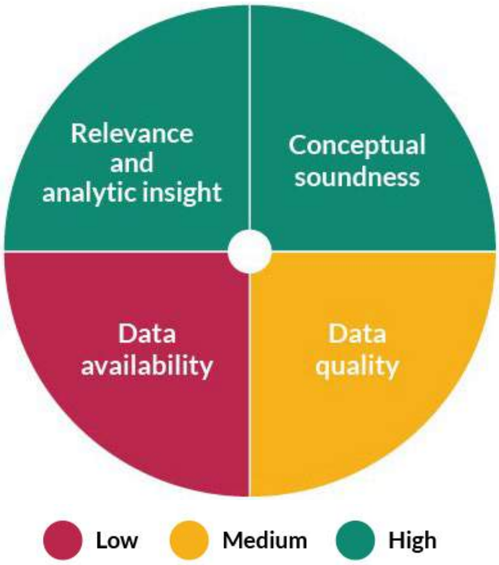


Source: Global Green Growth Institute

Water stress continues to be measured through the *Water Stress Index*, which captures the ratio between total annual water withdrawals (municipal, industrial, and agricultural) and total renewable supply. Similarly, the indicator for SDG 6.4.2 measures *freshwater withdrawal as a proportion of available freshwater resources*. The two indicators use data from different sources and, therefore, complement one another. However, both indicators capture a country's available water supply at a national level, with no information on seasonal or geographic variations.

The two indicators also do not account for the accessibility of existing water resources. Renewable water resources include all surface water and groundwater resources that are available on a yearly basis without consideration of the capacity to harvest and use these resources. However, exploitable water resources, which refer to the volume of surface water or groundwater that is available with an occurrence of 90% of the time, are considerably lower than renewable water resources, but no universally accepted method exists to assess such exploitable water resources. Furthermore, there is also no universally agreed method for determining incoming freshwater flows originating outside of a country's borders. Nor is there any standard method to account for return flows, namely the part of the water withdrawn from its source and flowing back to the river system after use. In countries where return flows represent a substantial share when compared to water withdrawal, the indicator tends to underestimate available water and therefore overestimate the level of water stress (UNSD 2019o).

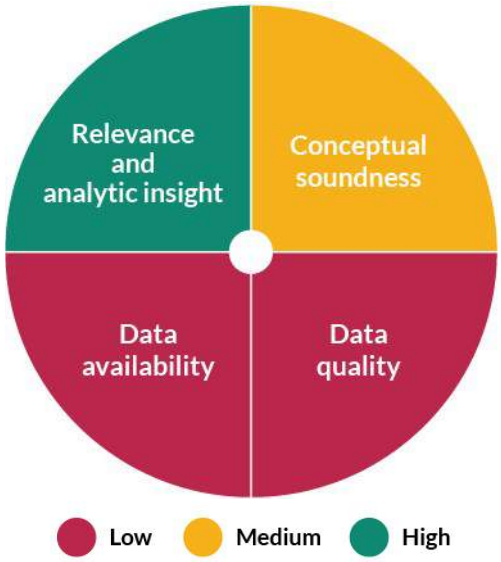
Figure 14. Indicator evaluation for annual freshwater withdrawal per capita



Source: Global Green Growth Institute

Additional indicators—such as variations in precipitation levels over time and across different locations—account reasonably well for alterations in water stress due to geography and climate. However, they have to be collected ad-hoc for specific countries and are therefore not included in the standardized data gathering. Furthermore, supplementary indicators only partially capture limitations on water access due to water management and existing infrastructure by using proxy variables, such as the freshwater withdrawal per capita, use of safely managed drinking water, and degree of integrated water resources management. Comparative data on storage capacity, quality of irrigation, and quality of the distribution system is not systematically collected on a global scale.

Figure 15. Indicator evaluation for Water Quality Index



Source: Global Green Growth Institute

Measuring water quality remains a challenge. Initially, water quality was exclusively measured through the *Water Quality Index*. The index uses three parameters measuring nutrient levels to determine the water quality of a country's freshwater bodies (dissolved oxygen, total nitrogen, and total phosphorus) and two parameters measuring water chemistry (pH and conductivity). Data quality of the indicator is considered low, as data is only available for a single year (2010) and only provides a national average with no information on individual basins (Emerson et al. 2010). However, water quality is subject to variations in location and time. Therefore, drawing conclusions on overall water quality based on the concentrations of substances measured at a specific location and time can be controversial. Furthermore, water quality can be influenced by numerous substances that are not accounted for by the current indicator.

To strengthen the analysis, a second indicator was added, capturing *disability-adjusted life years (DALYs) due to unsafe water source*. While this indicator does not directly measure water quality, it captures the impact of water quality on human health. Although the indicator also does not account for geographical variations, its main advantage is that the available data is more recent (2016) (IHME 2018).

Forest cover

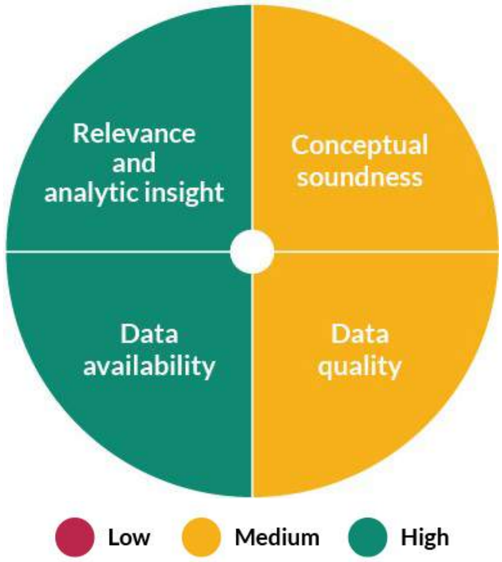
Second, forests provide essential ecosystem services, from carbon sequestration and storage, nitrogen fixation, increased soil carbon, protection against soil erosion, and improved water quality and regulation to being refugia for biodiversity and hosts to edible pollinators (HLPE 2017; Mattews et al. 2000; UNECE n.d.). Furthermore, forests play an important economic role in sustaining the livelihoods of rural populations, particularly in low-income countries (Dawson et al. 2014; World Bank 2008a). In that context, forests also play an essential role in providing fuelwood to meet households' energy needs (FAO 2010; Mattews et al. 2000).

The set of indicators related to forest cover and the forestry sector was extended considerably, adding to the granularity of the preliminary analysis. Two fundamental challenges in many developing countries are data availability and the consistency of definitions.

There are more than 800 definitions of forests worldwide. Most of them follow threshold parameters, such as minimum area, minimum tree height, and minimum percentage of crown coverage (Falcão and Noa 2016). FAO defines forests as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use (FAO 2019a). However, this definition is not applied universally across countries. For example, the government of Papua New Guinea defines forests as land spanning more than 1 hectare, with trees higher than 3 meters and a canopy cover of more than 10% (CCDA 2017). In Mozambique, forests are defined as "lands with trees with the potential to reach a height of 3 m at maturity, a canopy cover equal or greater than 30%, and that occupy at least 1 ha" (MITADER 2018).

Furthermore, assessment of forest areas is carried out at infrequent intervals in many countries. In a number of countries, the lack of national forest inventories is a severe challenge for assessing forest cover, forest types and their use, carbon storage, and deforestation and its causes (GGGI 2018c; GGGI 2019a).

Figure 16. Indicator evaluation for forest cover



Source: Global Green Growth Institute

While access to remote sensing imagery has improved in recent years, remote sensing techniques come with their own severe limitations as a result of inherent biases present within land cover models and the different but often coarse spatial resolution of satellite imagery (Pérez-Hoyos et al. 2017). Estimates based on varying land cover models and satellite imagery provide different results for the extent of forest areas as evident from discrepancies between MODIS and CCI-LC—two remote sensing models reported by FAO (2019c). In particular, there are limitations to assess land use, as remote sensing primarily evaluates land cover. Similarly, slow changes—such as forest regrowth—cannot be easily observed with remote sensing techniques and require long time periods in order to be detected. In addition, forest area with low canopy cover density (10–30%) or areas with sparse vegetation are difficult to detect and distinguish with remote sensing techniques (UNSD 2019v).

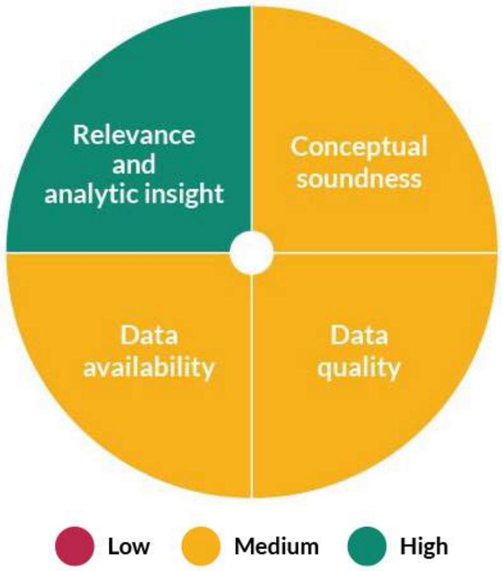
Air quality

Third, there was a distinct need to strengthen the assessment concerning air quality, given its severe health and economic impacts. The WHO (2018a) estimates that 9 out of 10 people worldwide breath air with concentrations of pollutants above the organization's guidelines. The organization further estimates that approximately 7 million premature deaths per year are caused by indoor (household) and outdoor (ambient) air pollution (WHO 2016; WHO 2018a). In addition to the health impacts, the OECD (2016) projects that the costs of ambient air pollution will amount to 1% of global GDP by 2060.

Initially, air pollution was captured by a single indicator measuring *population-weighted exposure to* $PM_{2.5}$. While $PM_{2.5}$ is an important contributor to air pollution, particularly in developing countries, it is far from the only pollutant. Therefore, it was necessary to expand the scope of the preliminary assessment to also account for other important air pollutants, including PM_{10} and ozone. Furthermore, the extended indicator set also includes measures assessing the impact of air pollution, such as the mortality rate attributed to household and ambient air pollution.

Finally, the precise mix of pollutants and the severity of their health impacts differ across geographical locations. For example, the type and level of air pollution related to energy consumption is often linked to a country's stage of economic development. At a global level, many low-income households are heavily exposed to toxic fumes when cooking, heating, and lighting their homes (IEA 2016).[9] Therefore, the additional indicators also account, to some extent, for the sources of air pollution by adding a measure for *access to clean cooking fuels and technologies*. This is of particular importance as cooking has been identified as the main source of indoor air pollution, with approximately 3 billion people—an estimated 40% of the world's population—not having access to clean cooking fuels and technologies in their homes (WHO 2018a).

Figure 17. Indicator evaluation for exposure to fine particulate matter



Source: Global Green Growth Institute

However, there are still important gaps in the assessment in accounting for the sources of air pollution, as standardized assessments for the contribution of individual sectors (transport, industry, energy) and pollutants other than particulate matter are often limited to high-income countries (OECD 2019a; Roy and Braathen 2017). In that context, it is also important to distinguish between natural causes and anthropogenic causes of air pollution, as air pollution does not exclusively originate from human activity and can be influenced substantially by dust storms, particularly in areas close to deserts (Díaz, Tobías, and Linares 2012; Mallone et al. 2011; WHO 2018b). However, there is currently no global data set that distinguishes these two sources.

Soil condition

Fourth, soils provide essential ecosystem services, from carbon sequestration and storage and nitrogen fixation to water regulation and storage and the filtration and transformation of nutrients (Adhikari and Hartemink 2016; Baveye, Baveye, and Gowdy 2016; Pereira et al. 2018). Despite their importance, systematic analyses of soil conditions on a large scale are scarce, notably in low- and middle-income countries. Soil conditions are often site-specific, thus comparing soil conditions across countries remains a challenge. In addition, while some countries have soil monitoring networks to measure soil quality, the information collected often reflects national or local priorities and standards, undermining data comparability between countries (Science Communication Unit 2013).

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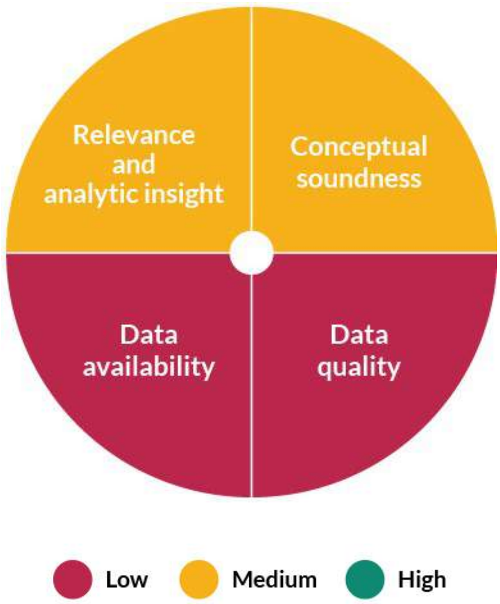
[9] At low-income levels, households tend to be heavily reliant on solid biomass (as in many low- and low-middle-income countries in Africa and Asia), the use of which usually leads to undesirable exposure to particulate matter, a leading cause of premature deaths. As economies industrialize, their use of fossil fuels in power generation and industry generally rises, as do resulting emissions of sulfur dioxide and other pollutants. Modern agricultural techniques—which include mechanization, intensified farming, and the use of chemical fertilizers and pesticides—can result in higher levels of air pollution, in addition to other negative environmental impacts. As incomes rise further, household air pollution may subside (if consumers switch to cleaner sources of energy), but energy demand is growing, including electricity for appliances and oil for transport, potentially resulting in higher emissions of sulfur oxides, nitrogen oxides, and other pollutants (IEA 2016). For example, there is evidence suggesting that the road transport sector is now the leading cause of air pollution-related deaths, both in the European Union and in the United States (Roy and Braathen 2017).

Initially, soil condition was exclusively measured through the *Trends in Soil Health Index*. The index measures the physical conditions related to loss of soil mass and structure as well as the long-term chemical conditions of soils in terms of nutrients and toxicities content (Nachtergaele et al. 2011).[10] However, data quality is considered low since the information is largely outdated (2005), and results of the index have stood in contradiction to findings from the literature review for individual countries during past assessments. Furthermore, the indicator contains no information on soil capability, namely the minimum biophysical requirements that the soil needs to meet in order to serve the existing demand in a specific location.

Figure 18. Indicator evaluation for Trends in Soil Health Index



Source: Global Green Growth Institute

While additions to the indicator set address issues of data quality, severe gaps remain. In particular, there are important questions regarding these indicators' conceptual soundness to serve as proxies to assess soil conditions in a country. For example, low use of inorganic fertilizer *can* indicate higher soil quality, and high use of fertilizer *can* indicate lower soil quality. However, equally, the intensity of inorganic fertilizer use can also be a function of its availability and affordability rather than an indication for soil quality. Furthermore, both, extensive use of inorganic fertilizer and pesticides can impact soil conditions (Nayana and Ritu 2017). In addition, there are other important sources of soil pollution that are not accounted for, such as soil and sediment eroding into and degrading surface water quality as well as heavy metal contamination from both mining and industrial activities (ELAW 2010; FAO 2011; Rodríguez-Eugenio, McLaughlin, and Pennock 2018).

Biodiversity

Fifth, biodiversity represents an important aspect of green growth. Biodiversity is essential for a functioning ecosystem and ultimately for human existence. Many contributions from the planet's biosphere cannot be replaced by alternative means. For example, loss of biodiversity—including genetic diversity—poses a serious risk to food security, as it undermines the resilience of agricultural plantations to threats such as pests, pathogens, and climate change (IPBES 2019).

While fish stocks and protected areas can be considered as subsets of biodiversity indicators, they are accounted for separately in the preliminary assessment, either because of their particular importance for food security (fish stocks) or because of their function as a proxy for political commitment to preserve a given country's natural assets (protective areas).

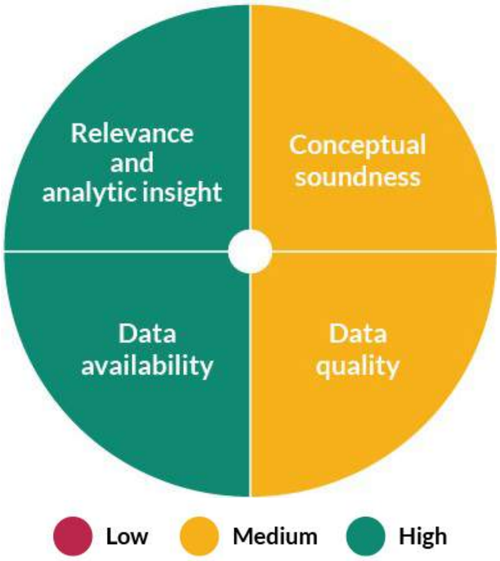
The initial indicator for biodiversity captured the *percentage change in the number of endangered species during the three most recent years* for which data was available (IUCN 2019). This indicator was

[10] Carbon is vital to soil capacity to provide ecosystem services. It impacts fertility through humus levels and microbial activity. Soil pH is a measure of the acidity or basicity (alkalinity) of a soil. It affects nutrient availability for plants by controlling the chemical forms of the different nutrients and influencing the chemical reactions they undergo (Nachtergaele et al. 2011).

considered insufficient, as it carries no information about a country's absolute level of endangered species and does not capture the relative level of endangered species.

To address this shortcoming, two indicators were added. First, the *Red List Index* measures the extinction risk of all species that have been assessed in a given country and allows for a systemic comparison of extinction risks across countries (Bubb et al. 2009). Second, an indicator measuring the *share of threatened species within a country's total species* was introduced to account for the fact that countries with a larger biodiversity are likely to also have a higher number of threatened species on their territory. Such a relative measure places the absolute number of threated species into perspective regarding a country's entire biodiversity.

Figure 19. Indicator evaluation for biodiversity

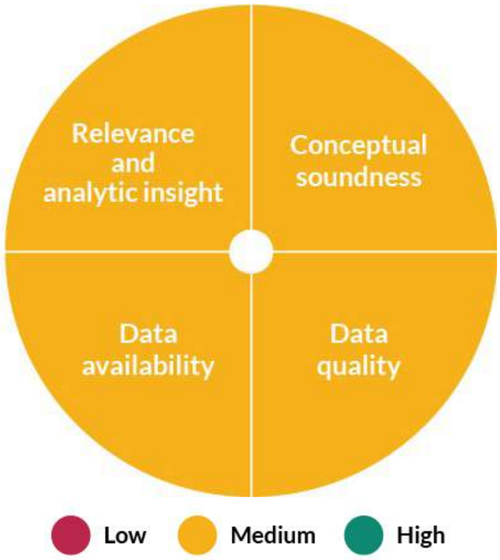


Source: Global Green Growth Institute

The initial indicator for fish stocks was replaced by several new indicators. Under the updated methodology, the *share of fish species that are overexploited or collapsed within a country's total catch within its exclusive economic zone* (EEZ) is used as a proxy to measure fishing pressure and overfishing (Hsu, Johnson, and Lloyd 2013). It replaced the initially used indicator *coastal shelf fishing pressure* that captured total catch from trawling and dredging equipment divided by the total area of a country's exclusive economic zone. In addition, the revised methodology also captures a country's *total amount of nominal catch* and the *total amount of aquatic organisms produced via aquaculture*.

The initial indicator was found to have limited explanatory power as it measured fish catch through a specific practice or technology in absolute terms with no reference to existing fish populations and their potential to regenerate in a given area. It also did not account for who is catching the fish, the coastal state, or the flag state of a vessel. Furthermore, the original indicator carried no information about fresh water fishing—an important aspect when assessing the sustainability of fisheries in many countries (Hsu et al. 2014).

Figure 20. Indicator evaluation for share of overexploited species



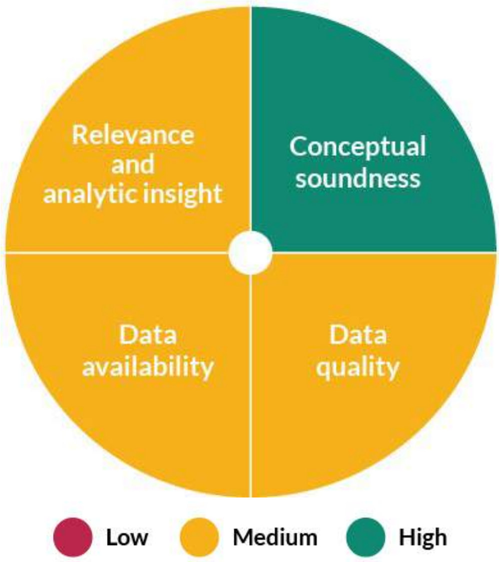
Source: Global Green Growth Institute

While the revised indicator set covers several aspects that have been omitted in the earlier iteration—such as introducing a stronger link to collapsed fish populations and considering fresh water catch—important shortcomings remain. These limitations are very much related to general gaps in global fishing data, the fact that movement of aquatic life does not abide by legal borders, and the reality that fishing activities themselves do not always follow the provisions made under international law.

First, national statistics are the principal source of fishing data. Therefore, overall data quality and coverage are largely dependent on the accuracy and reliability of the data collected nationally. However, many countries are either not reporting fishery data at all, or their statistics are incomplete, containing considerable gaps and/or inconsistencies (Anticamara et al. 2011; FAO 2018; Mazzoldi, Sambo, and Riginella 2014).[11]

Second, the GGPA indicator capturing the share of overexploited species in total catch continues to assess overfishing in reference to a country's exclusive economic zone. Under the United Nations Convention on the Law of the Sea (UNCLOS), an EEZ "shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured" (UN 2019). However, the indicator is unable to account for the transboundary movement of fish populations, either from the exclusive economic zone of one country to another or between a country's EEZ and the adjacent high seas. Due to the mobility of fish populations, fishing activities in adjacent waters have an impact on fish stocks in a given country's exclusive economic zone (Sumaila and Munro 2009). Therefore, the indicator is not suited to distinguish between the impact of a coastal states' own fishing activities within its EEZ on fish stocks and the impact of fishing activities conducted (either the coastal state or third countries) in adjacent waters on fish stocks in its EEZ.

Figure 21. Indicator evaluation for captured fish and aquaculture



Source: Global Green Growth Institute

Third, the current indicator does not properly account for fishing activities by third states—either legal or illegal—in coastal states' EEZs and the considerable contribution that these activities might have to overfishing in those waters (Cutlip 2016). According to UNCLOS, coastal states retain special rights related to exploration and the use of marine resources within the EEZs, but the water's surface remains international territory open to navigation by all types of vessels (UN 2019). Therefore, within its EEZ, a state has jurisdiction to govern the use of its marine resources, such as issuing licenses, setting catch limits, or banning a given activity altogether. As a result, whereas coastal states are concerned with vessels who are allegedly only passing through an EEZ while engaging in illegal fishing, third states have an interest in using these waters for navigation (Burke 1992). These diverging concerns are not purely academic. A number of Pacific Island nations, West African and Southeast Asian states, and coastal states bordering the Indian Ocean have voiced concerns over

[11] FAO (2018) highlights that the share of non-reporting countries grew from 20% in 2016 to 29% in 2018. As a consequence, the organization had to estimate more of the data, which diminishes the accuracy of the statistics. In particular, data availability and data quality for inland fisheries is low. According to FAO (2018), there are considerable challenges to deriving even an indication of sustainable production levels from many of the world's inland fisheries, let alone detailed assessments as to the condition of the fish stocks. Developing countries account for an estimated 95% of the world's inland fisheries' catch (Bartley et al. 2015), and approximately 90% of inland capture production is consumed in the developing world (World Bank 2012), where allocation of resources for monitoring and collection of catch data of inland fisheries is often not a priority. One effect of the limited monitoring is that statistics for inland fisheries may be under-reporting actual catch (FAO 2018).
Similarly, more than a third of producing countries do not report data for fish production from aquaculture, coupled with insufficient quality and completeness in some of the reported data (FAO 2018).

unauthorized fishing activities by vessels that are allegedly merely passing through their EEZs (Burke 1992).

In addition, while Article 61 of the UNCLOS asserts that coastal states determine allowable catch and ensure that fish stocks in their EEZs are not endangered by over-exploitation, Article 62 of the convention stipulates that coastal states have to—at the same time—promote the objective of optimum utilization of the living resources. Under that provision, coastal states have the obligation to provide third states with access to any possible surplus of the allowable catch that they are unable to harvest themselves. In turn, fishing boats of third states that are fishing in the exclusive economic zone are obligated to comply with the fishing laws and regulations of the coastal state, such as licensing, catch quotas, reporting duties, monitoring, landing of catches, and enforcement procedures (Schatz 2016; UN 2019). However, in practice, establishing regulations and enforcing them 200 miles from the shore are two different issues. In particular, low-income countries with large exclusive economic zones have limited resources to patrol their waters, rendering enforcement of existing provisions elusive (Cutlip 2016; Schatz 2016).

Finally, the indicator also does not reconcile a country's total catch data with any high sea fishing activities that might be conducted by that country. Instead, the indicator divides a country's total catch by the total area of its EEZ, independent of where the fish were actually caught.[12]

Protected areas

Sixth, three indicators measuring the coverage of protected areas in relation to wildlife habitats have been added to the assessment. Relevant habitats include terrestrial, freshwater, and marine areas. These indicators are closely aligned with SDG indicators 14.5.1 *Coverage of protected areas in relation to marine areas* and 15.1.2 *Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas*.[13]

Safeguarding relevant areas is vital for halting the decline in biodiversity and ensuring sustainable use of terrestrial, freshwater, and marine resources. The establishment of protected areas is regarded as an important mechanism for achieving this aim (UNSD 2019u; UNSD 2019w). For the purpose of the GGPA's preliminary assessment, these indicators serve as proxies for a country's political commitment to preserve its natural assets.

A critical limitation of these indicators is that they neither provide any information on the quality of the provisions related to the protected areas in question nor the degree to which these provisions are enforced. Furthermore, the indicators do not measure the effectiveness of protected areas in actually

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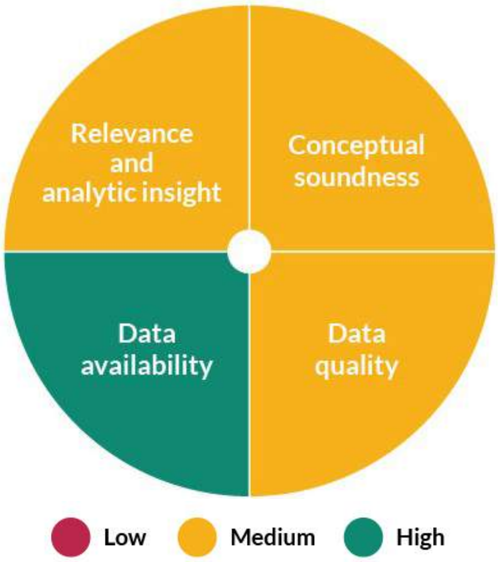
[12] For countries where artisanal fishing is the dominant practice, the more relevant geographic boundary to assess the sustainability of their fishing practice might be a country's coastal zone. However, there is no universal definition of coastal waters (Lavalle et al. 2011; UN n.d.). An option is to use territorial waters (territorial sea) as the geographic reference, defined as "up to a limit not exceeding 12 nautical miles, measured from baselines determined in accordance with [the United Nations Convention on the Law of the Seas]" (UN 2019). However, this indicator would only capture a small share of fish stocks, be unable to account for the impact of fishing activities in a country's EEZ and beyond on fish stocks in coastal areas, and ignore the often much larger share of waters that are under a country's jurisdiction. In addition, it would neither solve the issue of transboundary movement of fish populations, nor allow to distinguish between the amount of catch from different fishing activities.

[13] All three SDG indicators are calculated from data derived from a spatial overlap between digital polygons for protected areas from the World Database on Protected Areas Protected Planet (2019) and digital polygons for marine key biodiversity areas (from the World Database of Key Biodiversity Areas, including Important Bird and Biodiversity Areas, Alliance for Zero Extinction sites, and other Key Biodiversity Areas, available through the Integrated Biodiversity Assessment Tool).

reducing biodiversity loss, which ultimately depends on a range of management and enforcement factors that are not covered by the indicators. Finally, data gaps can arise due to difficulties in determining whether an individual site conforms to the IUCN definition of a protected area (UNSD 2019u; UNSD 2019w).

Figure 22. Indicator evaluation for protected areas



Source: Global Green Growth Institute

Depletion of natural resources

The initial indicator for measuring the depletion of natural resources has been discarded from the preliminary assessment. The indicator compared the monetary value of three types of natural resources (minerals, fossil fuels, and timber) to a country's gross national income. [14] It was concluded that the measure poses conceptual problems. First, it is not clear how the existence or absence of natural resources is related to green growth. Second, the existence of natural resources neither indicates whether they are exploited sustainably nor to what extent a country's economy is dependent on the extraction of natural resources. Third, the concept of a fixed stock of fossil fuels and mineral resources is in itself questionable for several reasons. Reservoirs and deposits are newly discovered on a regular basis, so reserve lifetimes are not fixed. Furthermore, the mere existence of fossil fuels and mineral resources does not mean their extraction is economically viable. Changes in fuel and mineral prices, as well as advancements in extractive technologies, render the amount of resources that can be recovered cost effectively highly variable. Finally, changes in the market value of the resource itself would have an impact on the numeric values of the data without any actual change in physical stocks.

Several new indicators capturing the share of the extractive industry in a country's GDP were introduced under the dimension of risk and resilience to account for the economic risk of a country being highly dependent on the extraction of commodities.

[14] World Bank defines natural resource depletion as the sum of net forest depletion, fossil fuel depletion, and mineral depletion, as a percentage of gross national income (GNI). Net forest depletion is calculated as unit resource rents multiplied by the excess of round wood harvest over natural growth. Fossil fuel depletion is defined as the ratio of the value of the stock of fossil fuel resources to the remaining reserve lifetime (capped at 25 years). It covers coal, crude oil, and natural gas. Mineral depletion is defined as the ratio of the value of the stock of mineral resources to the remaining reserve lifetime (capped at 25 years). It covers tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate (World Bank 2019a).

Efficient Use of Resources

Under the revised methodology, a total of 59 indicators is considered to assess how efficiently a country uses resources, as the second of four dimensions of green growth. These indicators are grouped into ten different categories, namely (1) energy consumption; (2) conversion, transmission and distribution of electricity; (3) water productivity; (4) agricultural productivity; (5) labor productivity; (6) transport and logistics; (7) technology; (8) solid waste management; (9) recycling; and (10) wastewater management (table 7). A list of all indicators with detailed information regarding their definitions, units of measurement, and data sources is provided in Appendix A1.

Table 7. GGPA indicators to assess efficient use of resources

Aspect	Indicator	Change to initial methodology
Energy consumption	Energy intensity	No change
	Energy intensity of the industry sector	Indicator added
	Energy intensity of road transport	Indicator added
	Share of primary sector in the national economy (value added)	Indicator added
	Share of secondary sector in the national economy (value added)	Indicator added
	Share of tertiary sector in the national economy (value added)	Indicator added
	Manufacturing value added per capita (SDG 9.2.1)	Indicator added
	Manufacturing value added as share of GDP (SDG 9.2.1)	Indicator added
	Manufacturing employment as a proportion of total employment (SDG 9.2.2)	Indicator added
	Energy use per capita	Indicator added
	GDP per capita	Indicator added
	Proportion of population with access to electricity (SDG 7.1.1)	Indicator added
	Total primary energy supply by fuel	Indicator added
	Total final consumption by fuel and by sector	Indicator added
	Net imports by fuel	Indicator added
Conversion, transmission and distribution of electricity	Transmission and distribution losses	No change
	Conversion efficiency of fossil-fired electricity generation	Indicator added

Table 7. GGPA indicators to assess efficient use of resources (continued)

Aspect	Indicator	Change to initial methodology
Conversion, transmission and distribution of electricity	Occurrences of electrical outages	Indicator added
	Firms experiencing electrical outages	Indicator added
	Average duration of electrical outage	Indicator added
	Electricity mix	Indicator added
Water productivity	Water productivity	No change
	Annual freshwater withdrawals, industry	Indicator added
	Annual freshwater withdrawals, agriculture	Indicator added
	Annual freshwater withdrawals, domestic	Indicator added
	Annual freshwater withdrawal per capita	Indicator added
	Baseline Water Stress Index	No change
Agricultural productivity	Agricultural productivity	No change
	Growth in agricultural productivity	Indicator added
	Agricultural production	Indicator added
	Share of agricultural land in total land area	Indicator added
	Water withdrawal for agricultural use	Indicator added
	Use of inorganic fertilizers	Indicator added
	Use of pesticides	Indicator added
	Agriculture Orientation Index for Government Expenditures (SDG 2.a.1)	Indicator added
Labor productivity	Labor productivity	No change
	GDP per capita	Indicator added
	Unemployment rate (SDG 8.5.2)	Indicator added
	Youth unemployment rate (SDG 8.6.1)	Indicator added
	Population aged 0–14 years	Indicator added
	Proportion and number of children aged 5–17 years engaged in child labor (SDG 8.7.1)	Indicator added

Table 7. GGPA indicators to assess efficient use of resources (continued)

Aspect	Indicator	Change to initial methodology
Transport and logistics	Buses per 1,000 people	Indicator added
	Passenger cars per 1,000 people	Indicator added
	Motorcycles per 1,000 people	Indicator added
	Passenger and freight km by transport mode (SDG 9.1.2)	Indicator added
	% of road network paved	Indicator added
	Road traffic death rate	Indicator added
Technology	Proportion of population covered by a 2G mobile network (SDG 9.c.1)	Indicator added
	Proportion of population covered by at least a 3G mobile network (SDG 9.c.1)	Indicator added
	Proportion of population covered by at least a 4G mobile network (SDG 9.c.1)	Indicator added
	Research and development expenditure (SDG 9.5.1)	Indicator added
	Share of medium and high-tech industry in value added of manufacturing (SDG 9.b.1)	Indicator added
Solid waste management	Municipal solid waste generation intensity	No change
	Compliance with Multilateral Environmental Agreements (SDG 12.4.1)	Indicator added
Recycling	Recycling rate of municipal solid waste	No change
Wastewater management	Share of population with access to improved sanitation	Indicator added
	Proportion of population practicing open defecation (SDG 6.2.1)	Indicator added
	Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (SDG 3.9.2)	Indicator added
	Disability-adjusted life years (DALYs) due to unsafe sanitation	Indicator added

Source: Global Green Growth Institute

Note: Information on alignment to SDG indicators is provided where relevant.

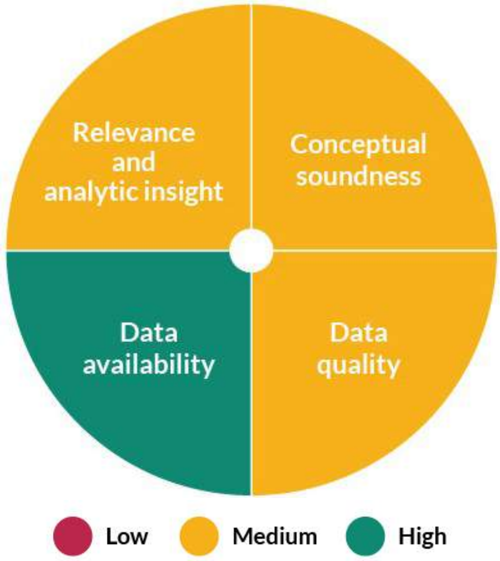
Use, conversion and distribution of energy

First, two indicator sets capture the use, conversion and distribution of energy. Efficient use of energy is considered essential for green growth, given the world's dependence on energy for artificial light, heat, refrigeration, transport, and a variety of industrial processes. At the same time, estimates suggest that the energy sector is responsible for more than 70% of global greenhouse gas (GHG) emissions (WRI 2017). OECD/IEA and IRENA (2017) estimate that approximately 90% of the global GHG emissions reduction needed to remain within the boundaries of the Paris Agreement can be met by an accelerated deployment of renewable energy and energy efficiency measures.

There is a wealth of quantitative data covering the energy sector, which was used to strengthen the preliminary analysis. For example, *total primary energy supply* (TPES) by fuel and *total final consumption* (TFC) by fuel and sector are fundamental measures to understand a country's energy use.

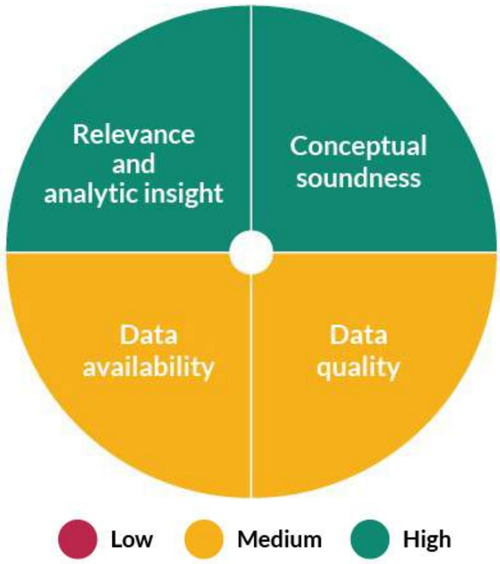
Assessing how efficiently energy is used can be a complex undertaking, with different results depending on the level of aggregation. Currently, energy efficiency is measured through *energy intensity* throughout a country's entire economy, which is an imperfect proxy. It can be affected by a number of factors—such as climate, structure of the economy, and nature of economic activities—that are not necessarily linked to actual efficiency (IEA 2014). For example, the indicator might rather reflect the structure of a country's economy—such as the size of its agricultural sector or heavy industry sector—than provide information on how efficiently energy is used. Disaggregation of energy intensity (e.g., by sector) can provide more relevant insights into energy efficiency (IEA 2014). The added indicators allow for such disaggregation to some extent, by introducing measures such as energy intensity in the transport and industry sectors. In addition, decomposition analysis can help to further filter out factors that affect energy demand—such as major structural shifts in a country's economy—from more narrowly defined energy intensity shifts (IEA 2014). Accounting for the share of the primary, secondary, and tertiary sectors in a country's economy can account for some of the structural reasons behind the level of energy intensity. However, further decomposition would be desirable.

Figure 23. Indicator evaluation for energy intensity and access to electricity



Source: Global Green Growth Institute

Figure 24. Indicator evaluation for transmission and distribution losses and conversion efficiency



Source: Global Green Growth Institute

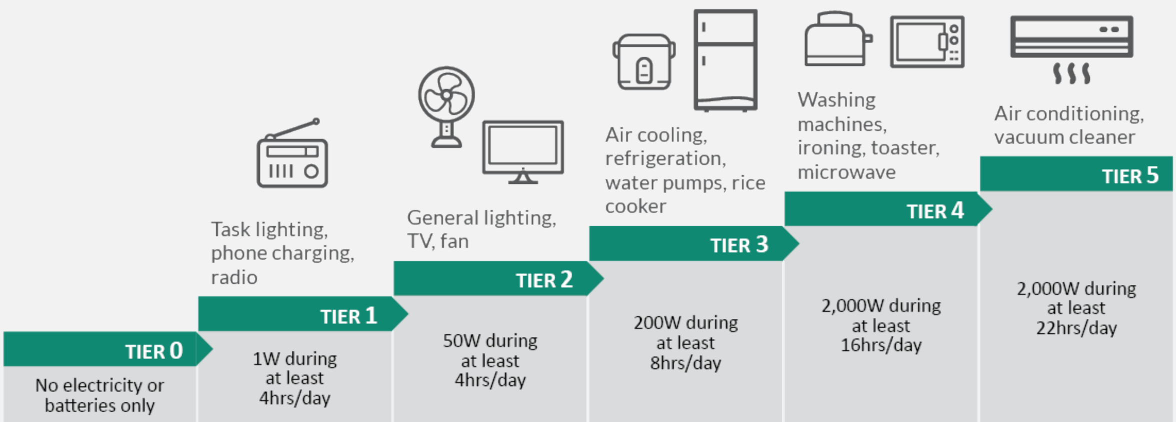
Furthermore, the preliminary analysis is strengthened by capturing the *percentage of population with access to electricity*. With approximately 1 billion people lacking access to electricity, as of 2017, and projections suggesting that more than 700 million people will remain without electricity in 2040 (IEA 2018c), this measure is highly relevant to assess a country's green growth potential; in particular, regarding the installation of off-grid electricity from renewable sources.

Box 3. Defining access to electricity

There is no universally agreed-upon definition of access to electricity. Traditionally, access to electricity has been measured on the basis of household connections to the national electricity grid. This approach limits assessing access to electricity to a binary measure (i.e., a household either has or does not have access). The measure is insufficient to capture issues such as the quantity, quality, and adequacy of service as well as questions around affordability. It is also unable to capture progress in electrification through off-grid solutions. However, lack of data—particularly in developing countries where access is an issue—often confines the analysis to a binary metric (Angelou et al. 2013; Lighting Global 2016; Lighting Global 2018).

A more accurate metric would measure the degree of access to electricity supply along various dimensions. There are examples of recent efforts to move to such a more granular metric. The IEA Energy Access Outlook 2017 includes renewable off- or mini-grid connections with sufficient capacity to provide a minimum of energy services, including several lights, phone charging, and a radio (IEA 2017a; IEA 2017b).[15] The UN's Sustainable Energy for All (SE4All) Multi-Tier Framework for electricity access seeks to capture electricity access not as a binary measure but as a continuum of service levels considering capacity, duration of supply, reliability, quality, affordability, legality, and safety. For that purpose, the Multi-Tier Framework distinguishes between six tiers of electricity access (figure 25; Angelou et al. 2013).

Figure 25. SE4All electricity access tiers



Source: Adapted from Lighting Global 2016

Transmission and distribution losses are an important measure to assess the efficiency of a country's electricity sector. However, the indicator does not capture the distinction between technical and non-technical losses. Both are fundamentally different in nature. While technical losses are caused by the

[15] For the full definition, see World Energy Outlook Methodology for Energy Access Analysis (IEA 2017b).

configuration of the electricity network, non-technical losses are the result of (illegal) consumer behavior (World Bank 2019j). Both require very different interventions in order to be addressed.

While the extended indicator set does not address this shortcoming, it provides additional measures to assess a country's electricity sector, including information on the electricity mix, conversion efficiency of fossil-fired electricity generation, and occurrences of electrical outages. However, while information on conversion efficiency and electrical outages is essential to assess the efficiency of a country's electricity sector, these indicators are subject to severe limitations regarding data availability. Comparative data for conversion efficiency is available for less than two thirds of countries, with data availability being particularly low for low-income countries. Data availability for indicators capturing the occurrence and duration of electrical outages is even lower, with recent information (2015) being available for less than half of all countries (World Bank 2019k). Finally, the latter indicators' representativeness is questionable as data is largely limited to a country's major cities, while the quality of electricity supply is generally lower in rural areas compared to urban centers (Lighting Global 2018).

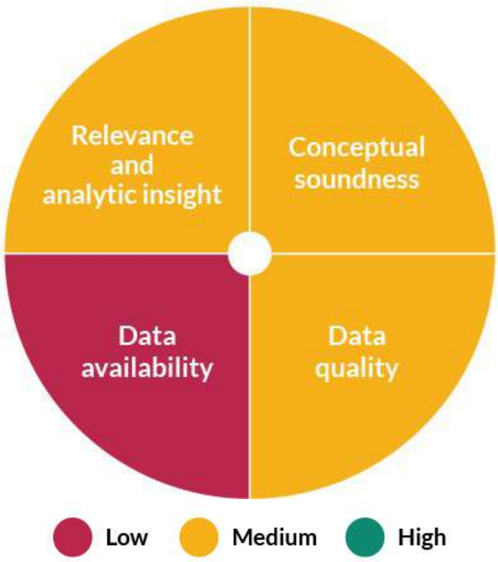
Water productivity

Second, given the importance of water for maintaining life on the planet, efficient use of water is considered as highly important for assessing green growth. The initial indicator for water productivity suffered from the same shortcomings as the indicator measuring energy intensity, in that it is an imperfect proxy for measuring efficient use of water. It can be affected by a number of factors—such as climate, structure of the economy, and nature of economic activities—that are not necessarily linked to efficiency. For example, the indicator might be strongly correlated with the structure of a country's economy—particularly the size of its agriculture sector—rather than giving an indication of how efficiently water is used for a certain activity. Therefore, disaggregation can provide more relevant insights into water efficiency. Sectoral indicators were added to allow for such disaggregation.

Decomposition analysis can help to further filter out factors that affect water demand—such as major structural shifts in a country's economy—from more narrowly defined shifts in water productivity. Accounting for the share of the primary, secondary, and tertiary sectors in a country's economy helps to capture some of the structural reasons behind the level of water productivity. Nevertheless, similar to assessing energy efficiency, further decomposition would be desirable.

None of the supplementary indicators addresses the issue that freshwater withdrawal is an imperfect approximation for water consumption. An adequate assessment of consumption levels requires taking into account the amount of return flows, specifically the share of the water withdrawn from its source that flows back to the river system after use. In countries where return flows represent a substantial part of water withdrawal, the current indicator tends to overestimate consumption and, therefore, underestimate water productivity. However, there is no universally agreed method for the computation to account for return flows (UNSD 2019o).

Figure 26. Indicator evaluation for water productivity



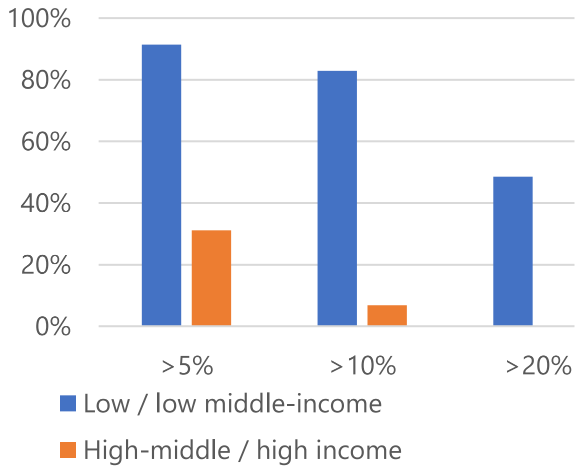
Source: Global Green Growth Institute

Finally, to assess water productivity, the revised methodology also considers water stress, since low levels of consumption can be a result of either efficient use or a result of limited availability of water.

Agricultural productivity

Third, given the detrimental effects that the agricultural sector can have on the environment,[16] the importance of agriculture for the economies of low- and middle-income countries, and the livelihoods of a considerable share of those countries' populations (FAO 2017; IFAD 2019; IFPRI 2019; ILO 2014), agricultural productivity is considered an important aspect of green growth (figure 27). For example, agricultural and related activities account for approximately 30% of employment globally and close to 40% in low- and middle-income countries (IFAD 2016). In particular, more than three quarters of the world's poor live in rural areas and depend on agriculture for their living (FAO 2017).[17]

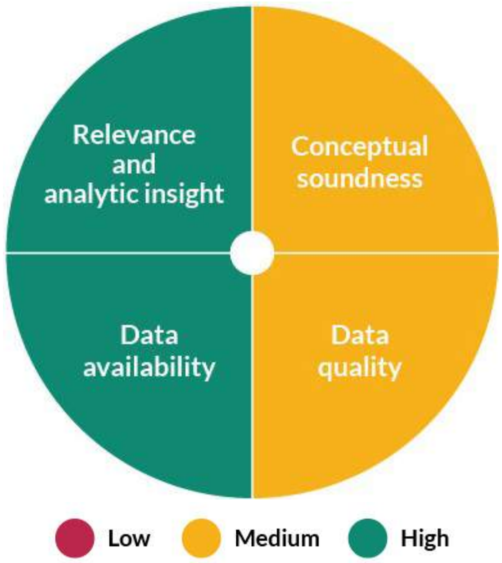
Figure 27. Share of agriculture in GDP (2018)



Source: World Bank (2019c)

As part of the preliminary assessment, agricultural productivity continues to be measured as the *value of agricultural gross production divided by a country's agricultural land area.* The indicator only includes marketable production and does not capture output from subsistence agriculture, despite its crucial importance in many low- and low-middle-income countries. Furthermore, while measuring the economic value of agricultural output allows for data comparability across different crops and livestock, it comes with severe conceptual limitations. A number of other factors can have an impact on the economic value that are unrelated to any change in physical output, such as exchange rates, inflation and local food prices, and market distortions. However, comparative data measuring the physical output is currently not available.

Figure 28. Indicator evaluation for agricultural productivity



Source: Global Green Growth Institute

Additional indicators—including total agricultural production levels, change in production over time; government expenditure; and use of inputs, such as water, fertilizer, and pesticides—allow for a more comprehensive image of the sector. Beyond the shortcomings already discussed earlier (see *soil condition* and *water productivity* in this report), assessing government expenditure—while useful—comes with severe caveats. For the purpose of the GGPA's preliminary assessment, government expenditure

[16] Negative effects of the agricultural sector on the environment include methane emissions, deforestation, salinization of irrigated lands, and the buildup of nitrate fertilizer and residues in groundwater and surface water (Bruinsma 2003; Houghton et al. 1995; Mosier and Kroeze 1998).

[17] While it is not explicitly stated in the report, it is assumed that the term "world's poor" refers to people living on less than USD 1.90/day.

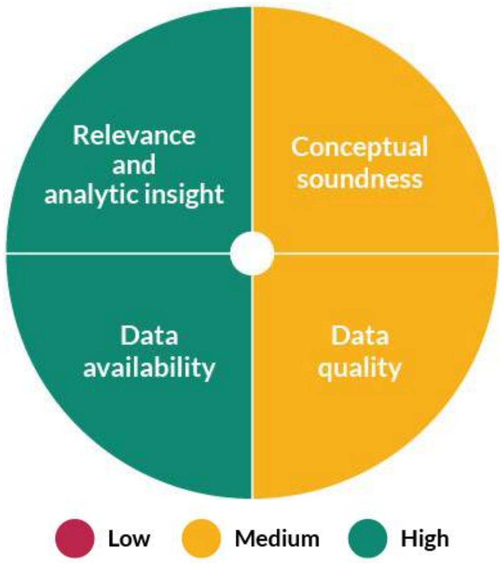
on agriculture is captured by the *Agriculture Orientation Index for Government Expenditures* (AOI). The index reflects the ratio between government expenditure on agriculture and the value added from the agriculture sector. The index only captures expenditures by the national government, with interventions by subnational governments being excluded. In addition, the index does not provide information on how effectively or for what purposes the money is spent. This makes the interpretation of the index difficult, as high expenditure does not necessarily translate into increased output. Therefore, the preliminary assessment compares the results of this index with the value of agricultural output as a share of GDP across countries as a proxy to assess how effective the expenditures are.

Labor productivity

Fourth, labor productivity is a widely used indicator to measure a country's economic performance. Productivity is one of the most important factors contributing to economic growth by reducing input costs and increasing the efficiency of production (Korkmaz and Korkmaz 2018). The level of productivity—including labor productivity—is also a key determinant of living standards, and increasing productivity is an important means toward poverty reduction (ILO 2011; OECD 2001). Growth in labor productivity can reflect greater use of capital, a decrease in the employment of low-productivity workers, and general efficiency gains and innovation (Freeman 2008; OECD 2008).

Labor productivity is generally defined as the ratio between a volume measure of economic output and a measure of input use. The volume measure of output reflects the goods and services produced by the workforce. It can be measured either by gross domestic product (GDP) or gross value added (GVA). Although there is generally a strong correlation between the two, there is a preference to use value added as taxes are excluded. The measure of input use reflects the time, effort, and skills of the workforce. It can be measured either by the total number of hours worked of all persons employed or total employment (head count) (Freeman 2008).

Figure 29. Indicator evaluation for labor productivity



Source: Global Green Growth Institute

There are both advantages and disadvantages associated with the different input measures. Total employment is simpler to measure than the total number of hours worked. Data availability and data quality are considerably higher for this information, which is why this option is used for the purpose of the preliminary assessment. However, total employment as a measure of labor productivity suffers from several conceptual drawbacks, as it reflects neither changes in the average work time per employee nor changes in multiple job holdings, the role of self-employed persons, and in the quality of labor (Freeman 2008).

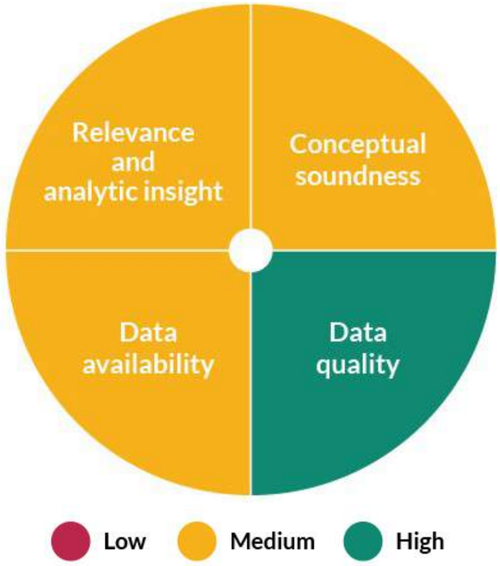
In contrast, the total number of hours worked is generally considered the conceptually more appropriate measure of labor input. However, data availability is mostly limited to OECD countries, and the quality of estimates for hours worked is an important concern. In particular, the quality of statistical methods and household surveys to estimate hours worked varies across countries, undermining the international comparability of the results (Freeman 2008).

Additional indicators consider GDP per capita, unemployment rates, and demography to provide context and identify potential variables influencing labor productivity. While not relevant for assessing labor productivity, child labor is considered in this context as an important indicator for labor conditions.

Transport and logistics

Fifth, the indicator set capturing transport and logistics was revised completely. The new indicators capture the availability of public transportation (number of buses per 1,000 people), compared to utilization of individual forms of transportation (passenger cars and motorcycles). Ideally, the assessment should be based on a more complex measure, such as passenger and freight kilometers by mode of transportation. While such information is considered as part of the preliminary assessment, limited data availability and low data quality reduce their analytical value. The level of road congestion (and associated productivity loss), share of non-motorized transport, rail system length per capita, and bus kilometers per capita are other indicators that were considered as additions. However, paucity of available data and limited explanatory power of individual indicators led to the decision to presently exclude them from the assessment.

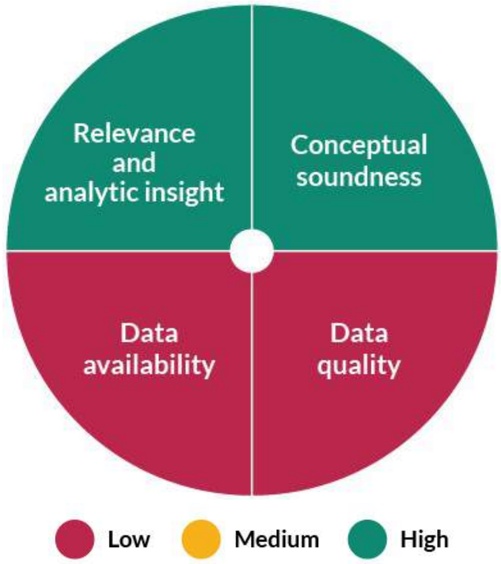
Figure 30. Indicator evaluation for number of buses per 1,000 people



Source: Global Green Growth Institute

Despite its limitations, the revised indicator—number of buses per 1,000 people—represents a significant improvement compared to the initial measurement (*Logistic Performance Index*) for two reasons. The current indicator is considered more relevant to assessing green growth in the transport sector than the Logistic Performance Index. The index is dominated by indicators assessing the efficiency of customs and shipment arrangements (World Bank 2019n),[18] with no clear contribution that green growth initiatives could make to improve performance. Furthermore, using an index to measure individual aspects of green growth renders the assessment methodology less transparent. Therefore, to the extent possible, relying on composite indices is avoided within the preliminary assessment.

Figure 31. Indicator evaluation for passenger and freight km by transport mode



Source: Global Green Growth Institute

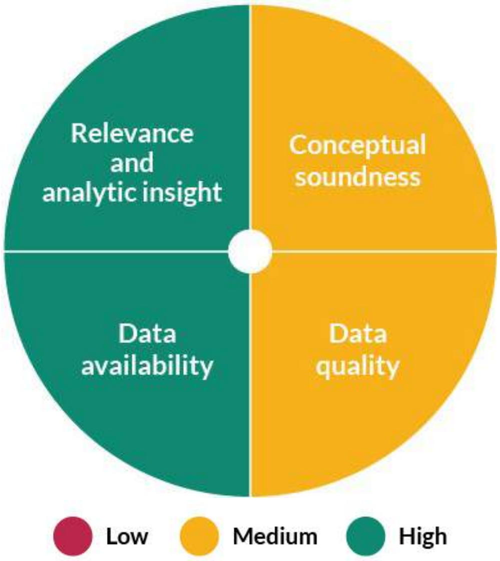
The assessment considers two further indicators: the percentage of road network paved and the road traffic death rate. With their focus on road transport, both indicators somewhat lack specific relevance for green growth. However, given the dominance of road transport in many low- and middle-income countries (IEA 2019d; ITF 2019; Jeschke 2011), they are considered relevant for the assessment.

[18] World Bank's Logistics Performance Index measures countries' performance in six areas: efficiency of the customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time (World Bank 2019n).

Technology

Sixth, the indicator set capturing technology was revised completely. *Mobile network coverage* serves as an indicator capturing access to modern means of communication. Over the past decade, the possibility to use mobile-cellular services to communicate and access information has become an important means to overcome basic infrastructure and service barriers, particularly in low- and low middle-income countries. For example, mobile phones can be essential for farmers and vendors to determine prices and sell their goods among others (Baumüller 2015; GSMA 2019; Trendov, Varas, and Zeng 2019), while mobile money transfer has become an important means to facilitate financial transactions (GSMA 2019; Jack and Suri 2011), particularly in countries where physical access to banks or other financial institutions is limited. Mobile technology is also tackling the limitations in many other sectors, including health, education, water, and sanitation (GSMA 2019; USAID 2014).

Figure 32. Indicator evaluation for mobile network coverage



Source: Global Green Growth Institute

The indicator set is able to capture different technologies offering different ranges of service. While narrowband (2G) mobile-cellular networks offer limited (and mainly voice-based) services, higher-speed networks (3G and LTE) provide access to the Internet and its increasing amount of information, services, and applications.

Mobile network coverage becomes less relevant as an indicator for higher-income countries, where access rates are generally high and increasingly considered a basic service (ITU 2017). For those countries, *expenditure on research and development* and the *share of medium and high-tech industry in manufacturing* are considered to be more relevant indicators. Both are regarded as proxies for technological innovation and higher value-adding activities.

This indicator set replaced the *Technological Readiness Index*. The index was initially meant to serve as a proxy to measure the agility with which an economy adopts existing technologies to enhance the productivity of its industries. Its intended purpose was to reflect an economy's capacity to leverage information and communication technologies in daily activities and production processes to increase efficiency, enable innovation, and strengthen competitiveness.[19] However, mobile network coverage, R&D expenditure, and high-tech manufacturing offer simpler and more transparent measures. Furthermore, the index's underlying assumptions can be questioned, and—similar to the initially used transport and logistics indicator (Logistic Performance Index)— its link to green growth is unclear. Efficiently adopting new technologies is not a characteristic of green growth in itself, nor are new technologies inherently less environmentally harmful than older technologies—a caveat that also applies to some of the currently used indicators.

[19] The Technological Readiness Index covers the following areas: (1) technological adoption—including the availability of latest technologies, firm-level technology absorption, foreign direct investment, and technology transfer—and (2) use of information and telecommunication technologies, including the number of Internet users, broadband Internet and mobile broadband subscriptions, Internet bandwidth, mobile telephone subscriptions, and fixed telephone lines (Schwab and Sala-i-Martín 2014).

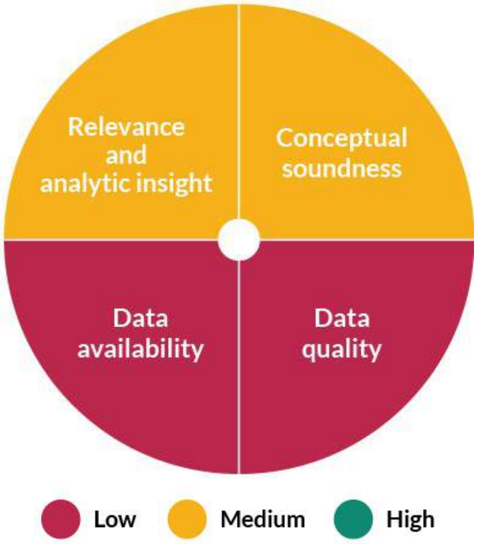
Waste management

Seventh, the final indicator set for assessing the efficient use of resources considers three aspects of waste management, including solid waste management, wastewater management, and recycling. Indicators for all three aspects face substantial limitations regarding their conceptual soundness and data quality. However, waste management represents an important aspect of green growth, given the detrimental effects of poorly disposed waste on public health and the environment, including GHG emissions, pollution, and poisoning (Alam and Ahmade 2013; Kaza et al. 2018).[20] Furthermore, the amount of generated waste and its associated negative impacts are expected to increase with economic development and population growth (Kaza et al. 2018). Therefore, it was decided that available information would be included while acknowledging its severe limitations, with considerable time dedicated to gathering data from other sources for the country being assessed.

There is little comparative data available covering solid waste management, and the data quality of the current indicator is considered as low. The current indicator captures the amount of municipal solid waste (MSW) collected by or on behalf of municipal authorities and disposed of through the waste management system. The indicator neither captures actual amounts of waste produced nor any amounts gathered through informal waste collection. Furthermore, the available information is largely outdated (D-Waste 2012).

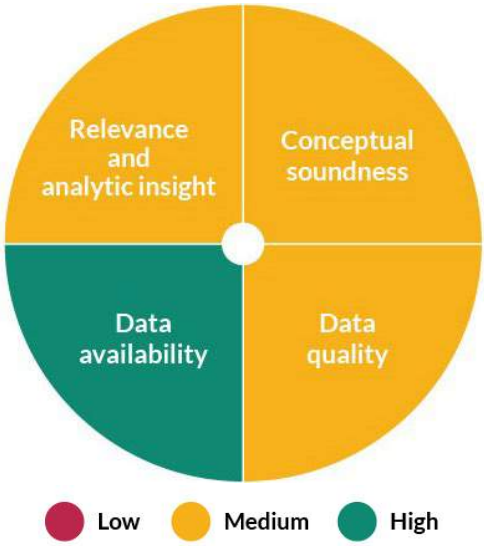
In addition, a second indicator considers the share of multilateral environmental agreements (MEAs) to which a country is an official party—where the country has ratified, accepted, approved, or accessed the agreement—and has submitted the required reporting to the secretariat of the relevant MEA (UNSD 2019t).[21] However, the

Figure 34. Indicator evaluation for municipal solid waste collection and recycling



Source: Global Green Growth Institute

Figure 33. Indicator evaluation for access to improved sanitation



Source: Global Green Growth Institute

[20] Food waste and improper waste management account for an estimated 5% of global greenhouse gas emissions (Kaza et al. 2018).

[21] The indicator captures the following five MEAs: (1) the Basel Convention on the control of transboundary movements of hazardous wastes and their disposal (Basel Convention), (2) the Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade (Rotterdam Convention), (3) the Stockholm Convention on persistent organic pollutants (Stockholm Convention), (4) the Montreal Protocol on substances that deplete the ozone layer (Montreal Protocol), and (5) the Minamata Convention on mercury (Minamata Convention).

indicator neither reflects compliance with those agreements nor provides information on the quantity of hazardous waste and toxins produced.

Similarly, the indicator reflecting countries' recycling rates only captures the amount of municipal solid waste recycled as a proportion of total MSW collected within the formal waste sector (D-Waste 2012). Due to a lack of alternative data sources and the desire to include recycling as an important aspect of waste management, it was decided to keep the indicator as part of the assessment.

Two indicators measuring the share of population with access to improved sanitation serve as proxies to assess wastewater management. Conceptually, these indicators are regarded as sound, but they only allow for a very cursory assessment, with no information on the capacity and reliability of the system, the extent of wastewater treatment, and the economic viability of the system. Furthermore, data quality for this indicator is uncertain, as definitions of *improved sanitation* suffer from differences in minimum standards between countries and regions. This is partly compensated by two additional indicators reflecting the health impact from unsafe sanitation—in terms of mortality rate and disability-adjusted life years. They allow for the corroboration of the results for the access indicators.

Material intensity

Finally, the initial indicator attempting to capture domestic material consumption—or material intensity—was discarded from the preliminary assessment. Both the SDG indicators and OECD green growth indicators aim to measure this aspect of a country's economy (OECD 2019b; UN 2017).[22] In the context of the GGPA, material intensity referred to the quantity of material used to produce goods and services, defined as the ratio between GDP and the total amount of domestically consumed materials (construction and industrial minerals, metal, ores, fossil fuels, and biomass) (Materialflows 2018).

However, the indicator has been discarded from the preliminary assessment for several reasons. First, conceptually, material intensity rather reflects the structure of an economy—such as the size of the industry sector, particularly heavy industry and the processing of natural resources—than indicating the efficiency with which materials and resources are used. Second, there are concerns about data quality, as consumption is defined as the sum of domestic production/extraction and net trade. However, there is uncertainty about how trade is accounted for in the available data. Furthermore, trade data is notoriously unreliable. For example, bilateral trade data rarely matches between two countries. Discrepancies arise from differences in the classification of goods, the time of recording, and estimation methods (Garber, Peck, and Howell 2018; Javorsek 2016). There are also considerable discrepancies between data based on consignment and data based on the country of origin (UNSD 2004).[23] These issues have only become more pronounced and accounting more complicated, with increasingly globalized supply chains where different components of a product have varying origins and cross borders multiple times (Sénat and WTO 2010). Third, data availability from alternative sources—such as the UN and OECD—is severely limited, thus the results cannot be confirmed.

[22] SDG indicators 8.4.1 (also 12.2.1) Material footprint, material footprint per capita, and material footprint per GDP and 8.4.2 (also 12.2.2) Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP capture the notion of material intensity (UN 2017).

[23] Data based on consignment attributes the amount or the value of a transaction to a country that may only be the location of a distribution warehouse, a middleman, or a trade, while for quota and tariff purposes, the country of origin is required. Furthermore, exporting companies face considerable uncertainty regarding the final destination of their products, as goods can be redirected while at sea or be trans-shipped from the original country of destination (UNSD 2004).

Risk and Resilience

Under the revised methodology, a total of 42 indicators is considered to assess risk and resilience as the third dimension of green growth. Under this dimension, the preliminary assessment largely focuses on indicators related to climate change. Aspects such as natural disasters unrelated to climate change (volcano eruptions, earthquakes) and economic vulnerability (macro-economic stability, financial and fiscal risks) are not considered. The indicators are grouped into seven different categories, namely (1) greenhouse gas emissions, (2) emission trends, (3) carbon stock, (4) mitigation of contributing to climate change, (5) vulnerability to climate change, (6) costs of climate change, and (7) dependence on resource extraction (table 8). A list of all indicators with detailed information regarding their definitions, units of measurement, and data sources is provided in Appendix A1.

Table 8. GGPA indicators to assess risk and resilience

Aspect	Indicator	Change to initial methodology
Greenhouse gas emissions	Carbon intensity	No change
	CO_2 emissions per capita	Indicator added
	Total CO_2 emissions	Indicator added
	CO_2 emissions from manufacturing industries and construction	Indicator added
	CO_2 emissions from transport	Indicator added
	CO_2 emissions from electricity and heat production	Indicator added
	CO_2 emissions from residential buildings and commercial and public services	Indicator added
	CO_2 emissions from 'other' sectors	Indicator added
	Total methane emissions	Indicator added
	Methane emissions from agriculture	Indicator added
	Energy-related methane emissions	Indicator added
Emission trends	Change in carbon intensity	Indicator added
	Change in CO_2 emissions per capita	Indicator added
	Change in total CO_2 emissions	No change
	Change in CO_2 emissions from manufacturing and construction	Indicator added
	Change in CO_2 emissions from transport	Indicator added
	Change in CO_2 emissions from electricity and heat production	Indicator added
	Change in CO_2 emissions from residential and commercial and public services	Indicator added

Table 8. GGPA indicators to assess risk and resilience (continued)

Aspect	Indicator	Change to initial methodology
Emission trends	Change in CO_2 emissions from 'other' sectors	No change
	Change in total methane emissions	Indicator added
Carbon stock	Carbon stock in living biomass	No change
	Forest cover	Indicator added
	Change in forest cover	Indicator added
Mitigation of contributing to climate change	Electricity generation from renewable sources	Indicator added
	Change in electricity generation from renewable sources	Indicator added
	Electricity mix	No change
	Access to clean fuels and technologies for cooking	Indicator added
	Fossil fuel subsidies	Indicator added
Vulnerability to climate change	Notre Dame Global Adaptation Initiative (ND-Gain) Index	Indicator added
	Exposure to climate change	No change
	Sensitivity to climate change	No change
	Adaptive capacity to climate change	No change
	Share of population made homeless by natural disasters	Indicator added
	Disaster Risk Reduction (SDG 1.5.3)	Indicator added
	Share of local governments that adopted and implemented local disaster risk reduction strategies (SDG 1.5.4)	Indicator added
Cost of climate change	Financial losses from relevant natural loss events	Indicator added
	Climate Risk Index	Indicator added
	Damage from natural disasters	Indicator added
Dependence on resource extraction	Share of exports of extractive industry in total exports	Indicator added
	Share of extractive industry in total GDP	Indicator added

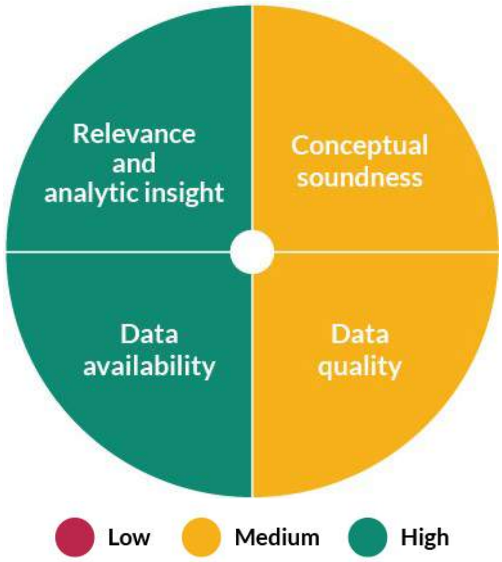
Source: Global Green Growth Institute

Note: Information on alignment to SDG indicators is provided where relevant.

Greenhouse gas emissions

First, under the revised methodology, the indicator set capturing greenhouse gas emissions and emission trends has been extended considerably. In addition to carbon intensity, carbon dioxide (CO_2) emission trends and carbon stocks in living forest biomass, time series for CO_2 emissions per capita, and a sectoral breakdown of CO_2 emissions are now considered. Furthermore, while CO_2 is the single most important greenhouse gas, the preliminary assessment initially omitted nearly a quarter of global GHG emissions.[24] In particular, emissions of methane (CH_4) were not captured. The revised assessment includes data on methane, reducing the share of global GHG emissions that are not considered to less than 10%.

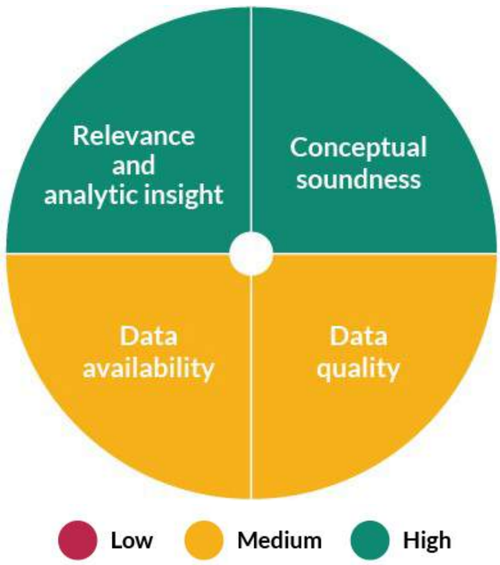
Figure 35. Indicator evaluation for CO_2 emissions



Source: Global Green Growth Institute

The initial indicators—carbon intensity and CO_2 emissions trend—examined a country's entire economy. A newly introduced sectoral breakdown allows for the disaggregation of emission figures to avoid merely capturing a country's economic structure (for example, size of the industry sector). However, the potential for disaggregation is limited as governments might use UNFCCC default conversion factors to calculate the sectoral breakdown in their official reporting. Further analysis is needed to evaluate the extent of this practice. In addition, while measuring carbon intensity accounts for the effect of material wealth on a country's CO_2 emissions (low income versus high income), adding a per capita measurement also takes into consideration population size.

Figure 36. Indicator evaluation for CH_4 emissions



Source: Global Green Growth Institute

Conceptually, the current CO_2 indicators have one principal drawback. They only capture CO_2 emissions from burning fossil fuels and producing cement. CO_2 emissions released from land use—for example, as a result of deforestation—are not accounted for (World Bank 2019d).

After carbon dioxide, methane represents the second most prominent contributor to global GHG emissions, accounting for approximately a sixth of total emissions. Methane emissions result largely from agricultural activities; industrial production; landfills and wastewater treatment; and other sources, such as tropical forest and other vegetation fires (World Bank 2019o).

[24] In 2010, CO_2 emissions from fossil fuel combustion and industrial processes represented 65% of total GHG emissions, while CO_2 emissions from forestry and other land use accounted for 11% of total GHG emissions (IPCC 2014). In 2010, emissions of CH_4 accounted for 16%, emissions of N_2O for 6.2%, and emissions of fluorinated gases for 2% of global GHG emissions (IPCC 2014).

Therefore, given the prominence of the agricultural sector in many developing countries, methane represents a much higher share of GHG emissions in individual countries (Smith et al. 2007; World Bank 2019b; Yusuf et al. 2012).

The current data set allows for the disaggregation of a country's total methane emissions into emissions from agriculture and energy-related emissions. Methane emissions are expressed in carbon dioxide equivalents using the global warming potential (GWP). This permits the comparison of effective contributions of CO_2 and CH_4. The GWP100 metric of the IPCC Second Assessment Report for methane amounts to 21; more precisely, a kilogram of methane is 21 times as effective at trapping heat in the earth's atmosphere as a kilogram of carbon dioxide over a period of 100 years (World Bank 2019o).

While data availability for both CO_2 and CH_4 emissions is high (World Bank 2019d; World Bank 2019o), data quality for many low- and low-middle-income countries is considered questionable. Furthermore, in the case of methane emissions, the most recent information dates from 2010, undermining its relevance (World Bank 2019o).

Carbon sequestration

Second, carbon sequestration plays an important role in absorbing CO_2 emissions and regulating the earth's climate. IPCC (2019) calls attention to the decisive role played by forests as carbon stocks and the need to reverse the trend of deforestation and increase the amount of forests worldwide. Therefore, the preliminary assessment includes several indicators to capture carbon stocks in forests, most prominently FAO estimates for individual countries' *carbon stock in living forest biomass* (FAO 2014).

Figure 37. Indicator evaluation for carbon stock in living forest biomass

Source: Global Green Growth Institute

The relevance and data quality of the indicator face two severe limitations. First, forests do not represent the most important reservoirs for storing carbon, with the world's oceans playing a more important role for carbon storage (Bollmann et al. 2010; Brack 2019; Goudriaan 1990; IPCC 2005).[25] However, carbon sequestration by the vast majority of sea organisms cannot be attributed to individual countries and, therefore, is not considered as part of the preliminary assessment. Nevertheless, even within the terrestrial biosphere, recent estimates suggest that forests do not represent the most important carbon reservoirs either, with soils—in particular peatlands—accounting for considerably higher amounts of stored carbon (Nichols and Peteet 2019). Second, data quality of the FAO estimates is uncertain, given that different trees—and, ultimately, different forests—can have largely divergent potentials for carbon sequestration (Babor 2011; GGGI 2019a) and that estimates often rely on remote sensing technologies, with large margins of error (FAO 2019c; GGGI 2019a; Pérez-Hoyos et al. 2017).

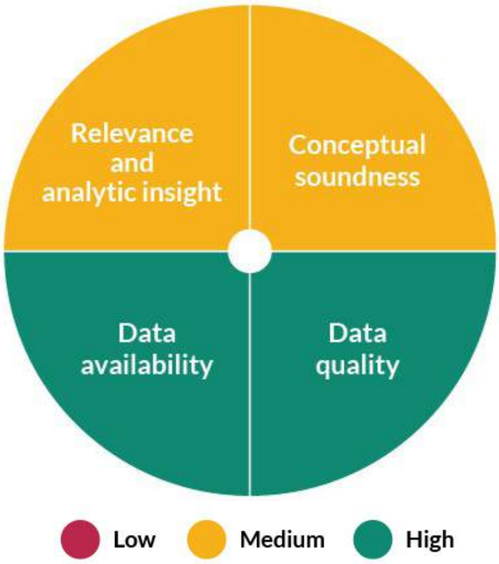
[25] Estimates for carbon sequestration show large variations depending on time horizons and whether all or only anthropogenic emissions are considered. For example, Bollmann et al. (2010) suggest that oceans contain 16 times as much carbon as the terrestrial biosphere. In contrast, according to IPCC (2005), over the past 200 years, oceans have stored 500 Gt of CO_2 from the atmosphere out of 1,300 Gt of total anthropogenic CO_2 emissions.

Mitigation of contribution to climate change

Third, to assess a country's potential toward mitigating its contribution to climate change, the preliminary assessment considers its electricity mix, its population's access to clean fuels and technologies for cooking, and spending on fossil fuel subsidies.

Electricity generation from renewable sources reduces greenhouse gas emissions by displacing the combustion of fossil fuels with cleaner alternatives. Electricity generation from burning fossil fuels is one of the principal sources of anthropogenic GHG emissions, with electricity and heat production accounting for approximately 40% of the global emissions from fuel combustions in 2016 (IEA 2018a). OECD/IEA and IRENA (2017) estimate that almost 60% of the global GHG emissions reduction needed to remain with the boundaries of the Paris Agreement can be achieved by the accelerated deployment of renewable energy.[26]

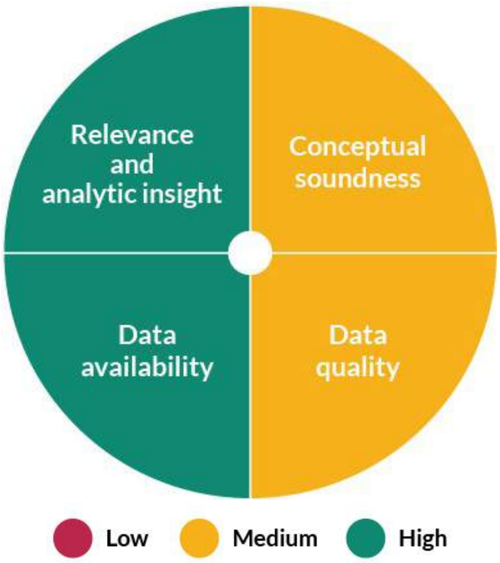
Figure 38. Indicator evaluation for electricity generation from renewable sources



Source: Global Green Growth Institute

The indicator faces a number of conceptual limitations. First, it does not capture electricity generated from off-grid renewable sources. However, the IEA (2017a) estimates that off-grid renewables will account for a growing share of the electricity sector over the next decade, from less than 10% of all new connections in the period from 2012 to 2016 to accounting for more than half of the households gaining access by 2030, and for more than two-thirds of households gaining access in rural areas. Second, the share of electricity generation from renewables is often different from its share in consumption, as transmission and distribution losses can differ between technologies while imports and exports of electricity do not necessarily show the same share of renewables as generation (Angelou et al. 2013).[27]

Figure 39. Indicator evaluation for access to clean fuels and technologies for cooking



Source: Global Green Growth Institute

A newly introduced indicator captures access to *clean fuels and technologies for cooking*, which refers to either using biomass and charcoal more efficiently or replacing them entirely with other fuels, such as LPG and biogas (USAID and Winrock 2017). Access to clean fuels and technologies for cooking is relevant to green growth for several reasons. First, it reduces deforestation and associated soil erosion (World

[26] Energy efficiency measures would contribute approximately another third (OECD/IEA and IRENA 2017).

[27] For a more detailed description of the methodological challenges associated with defining and measuring renewable energy, refer to Angelou et al. (2013), Chapter 4, Section 1, pages 194–200.

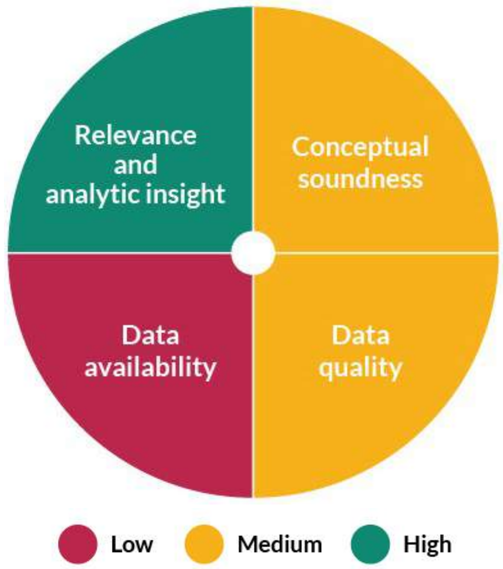
Bank 2010). Second, emissions of methane, carbon monoxide, nitrous oxides, and black carbon from traditional cookstoves contribute to global climate change (Alliance 2011; Alliance 2016; Alliance 2019; UNEP 2011). Third, use of clean cooking fuels and technologies reduces indoor air pollution with a direct effect on health and life expectancy, particularly for women. Traditional cookstoves emit a range of pollutants, such as fine particulate matter (black carbon, $PM_{2.5}$) and carbon monoxide (CO), that are damaging to human health (Clougherty 2010; Khushk et al. 2005; McCracken et al. 2007; UNEP 2011).[28] Exposure to indoor air pollutants has been proven to be linked to acute lower respiratory infections,[29] chronic obstructive pulmonary disease, stroke, ischemic heart disease, cataracts, and lung cancer (USAID and Winrock 2017).

Estimates suggest that approximately 3.8 to 4.3 million people die prematurely per year from illnesses attributable to indoor (household) air pollution caused by the inefficient use of solid fuels and kerosene for cooking (Prüss-Ustün et al. 2016; WHO 2018d). Traditional cooking methods that use wood, charcoal, animal dung, crop residues, and coal as fuel for fire lead to more early deaths worldwide than AIDS, tuberculosis, and malaria combined (Rosenthal 2015). In addition to the health impacts, the OECD (2016) projects that the costs of ambient air pollution will amount to 1% of global GDP by 2060. A systematic review of improved cookstoves confirmed that their installation significantly reduces indoor air pollution, although not to the point of meeting WHO air quality guidelines (Pope et al. 2017).

There is a limited amount of available data capturing the type of fuel and devices used by households for cooking. In its current form, the indicator is modeled with household survey data compiled by the World Health Organization. While more targeted household surveys to gather the necessary information are being piloted, data availability and data quality will remain an issue for the foreseeable future (UNSD 2019p).

The revised methodology also considers fossil fuel subsidies. Fossil fuel subsidies are relevant for green growth due to their detrimental environmental, social, and economic impacts (Rentschler and Bazilian 2018). They are also pertinent due to their widespread use. The International Energy Agency (2019c) estimates that in 2018, more than USD 400 billion was spent worldwide on subsidies for fossil fuels that are consumed directly by end-users or as inputs to electricity generation. However, this indicator faces several challenges, including controversy around what measures constitute subsidies, methods to calculate subsidies, data quality, and comparability (IEA 2019c; OECD/IEA 2019). The United Nations Environment Programme (UNEP)—together with the International Institute for Sustainable Development (IISD), Global Subsidies Initiative (GSI), and the Organisation for Economic Cooperation and Development (OECD)—has proposed a methodology for measuring fossil fuel subsidies in the context of the Sustainable Development Goals (UNEP, OECD, and IISD 2019). However, as of December 2019, the suggested methodology has not been adopted, and data is not available.

Figure 40. Indicator evaluation for fossil fuel subsidies



Source: Global Green Growth Institute

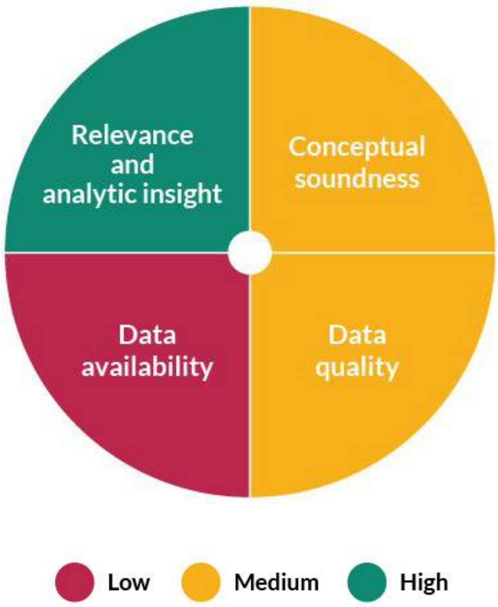
[28] For example, residential sources, mainly from cookstoves, account for more than 25% of global black carbon emissions (Bond et al. 2004).

[29] Acute lower respiratory infections include pneumonia, which is the single leading cause of death for children under five years (USAID and Winrock 2017).

Vulnerability to climate change

Fourth, the preliminary assessment captures vulnerability to climate change through several indicators reflecting different aspects of vulnerability—such as exposure, sensitivity, adaptive capacity, and impact. However, climate change is an inherently complex topic manifesting itself in a wide spectrum of impacts and affecting multiple sectors (Arent et al. 2014; UNFCCC 2007). Therefore, systematically assessing and comparing the extent to which different countries are affected by climate change is a challenge. As a result, the preliminary assessment relies heavily on composite indices to measure countries' vulnerability to climate change. However, while composite indices are able to capture the multiple aspects of climate change in a single measurement, making the results comparable, they reduce transparency and increase the subjectivity of the results because of the way that individual indicators are selected and weighted (GGKP 2016; OECD et al. 2008).[30]

Figure 41. Indicator evaluation for ND-GAIN indices



Source: Global Green Growth Institute

The preliminary assessment refers to the Notre Dame Global Adaptation Initiative (ND-GAIN) index, which is composed of a vulnerability score and a readiness score. While vulnerability measures a country's exposure, sensitivity, and capacity to adapt to the adverse impacts of climate change, readiness measures a country's ability to leverage investments to adapt to climate change (Chen et al. 2015). In addition, the assessment includes three ND-Gain sub-indices separately capturing exposure, sensitivity, and adaptive capacity.[31] The initial methodology was limited to these three indicators. There are two main reasons for extending the indicator set. First, following the methodology of the ND GAIN index, vulnerability to climate change does not equate to the simple sum of exposure, sensitivity, and adaptive capacity. Second, disaggregating climate change into several indicators proved to be problematic during the consultation workshop. Participant votes reflecting concerns about the adverse impacts of climate change were often distributed across the three aspects. This disaggregation might have contributed to the result that, often, stakeholders did not select climate change as a top priority for green growth in their country.

Further indicators include measures to capture the impact of climate change—the share of population made homeless by natural disasters—and a country's emergency preparedness—reflecting to what

[30] Ravallion (2012) argues that the meaning, interpretation, and robustness of composite indices is often unclear, while Stiglitz, Sen, and Fitoussi (n.d.) suggest that composite indices are rather a suitable tool to draw attention to the constituent components of an index than a means to measure performance.

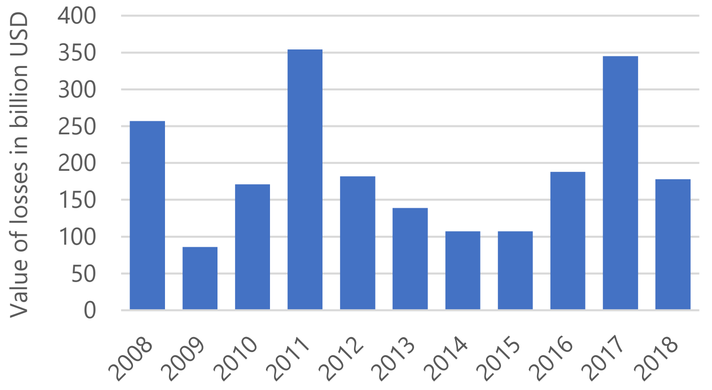
[31] A country is exposed to climate change when it is subject to major changes in extreme climate events and weather patterns. It is sensitive to this exposure when the economy relies on sectors where output depends on the climate, such as agriculture. A country also has adaptive capacity, which is defined as its ability to reduce the adverse impacts of climate change, despite its level of exposure and sensitivity. Exposure and sensitivity increase a country's overall vulnerability to climate change, while adaptive capacity reduces overall vulnerability.

extent countries have adopted legislative and regulatory provisions for managing disaster risk.[32] All three indicators were included to support the assessment of a country's vulnerability to climate change. Given the problematic nature of many of the existing climate change-related indicators, they serve to verify whether or not a country's scores are consistent when applying different measures.

Costs of climate change

Fifth, the preliminary assessment includes several indicators aiming to estimate the costs of climate change. There is a large spectrum of adverse impacts of climate change that can inflict considerable losses. However, estimating the damage caused by climate change is complex and accompanied by considerable uncertainties (Tol 2008). For example, the 2008–2018 period estimates suggest that, on average, damages related to climate change amounted to more than USD 190 billion per year worldwide. However, for individual years, estimated damages range between USD 86 billion in 2009 and the record sum of USD 354 billion in 2011 (figure 42). In addition, estimating the extent of these losses is a challenge due to the multiple causes of natural disasters—which can but do not have to be related to climate change—as well as low data availability. Phenomena as diverse as changes in temperatures, shifts in precipitation patterns, a rise in sea levels, ocean acidification, and the occurrence of tropical cyclones are related to climate change (OECD 2015). However, estimating the degree to which climate change is responsible for an individual event is subject to considerable uncertainty and, therefore, so is estimating the costs associated with climate change.

Figure 42. Estimated global losses from climate change-related events



Source: Munich RE 2018

Furthermore, the term *financial loss* does not have a uniform definition. Generally, financial losses can be divided into two categories: (1) insured losses and (2) overall losses. Data for insured losses is relatively reliable as it reflects claims actually paid by insurance companies. Assessing overall losses is more complex. They are often extrapolated from data on insured losses. The greater the insurance penetration, the more accurate the extrapolation results. Financial losses can also be assessed in terms of direct, indirect, and consequential losses, cutting across the former two categories. Direct losses are immediately visible and countable, such as loss of homes, household property, schools, vehicles, machinery, and livestock. They are always calculated on the basis of replacement and repair costs.[33]

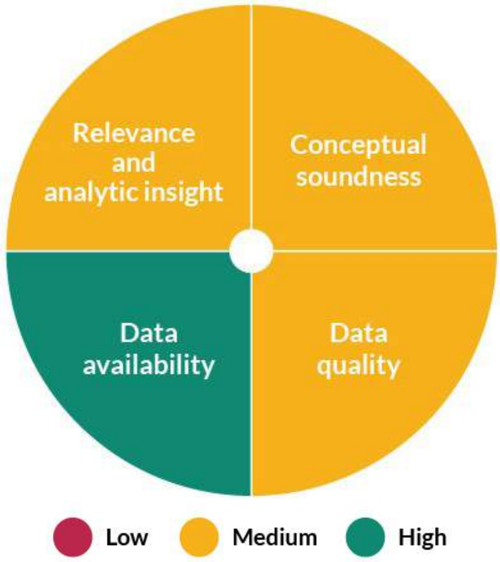
[32] Indicators reflecting emergency preparedness are aligned with SDG indicator 1.5.3 *Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030* and SDG indicator 1.5.3 *Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies* (UNSD 2019c; UNSD 2019d).

[33] Direct losses are calculated on the basis of replacement and repair costs. However, damaged structures (for example, dykes) are upgraded, while being repaired or replaced, to a higher safety and, therefore, higher value level. While actual losses should refer to damaged items, the figures, in fact,

Indirect losses include—among others—increased transport costs due to infrastructure damage, loss of jobs, and loss of rental income.[34] Consequential losses refer to the economic impact of a natural disaster, such as reduced tax revenues, lower economic output, reduced GDP, or a weaker currency. The quantification and attribution of indirect and consequential losses are generally challenging (Munich RE 2001).

An alternative to gauging financial losses is the measurement of harm to humans, including the death toll and number of missing, injured, homeless, and evacuated people. However, those measures are subject to the same uncertainty as described above regarding attribution and data availability.

Figure 43. Indicator evaluation for cost of climate change



Source: Global Green Growth Institute

Based on data published by the Munich Reinsurance Company (Munich Re), the indicator *financial losses from relevant natural loss events* captures direct losses calculated on the basis of replacement and repair costs. It neither captures indirect losses nor consequential losses (Munich RE 2018). Similarly, the indicator *damage from natural disasters* reflects the amount of damage to property, crops, and livestock, based on data published by the Centre for Research on the Epidemiology of Disasters (CRED n.d.). While the database allows a more granular distinction between different loss events—the preliminary assessment considers losses from biological, climatological, and hydrological events and excludes geophysical and extraterrestrial events—the center's underlying methodology for estimating the losses is not available (CRED n.d.).[35] The Climate Risk Index represents a combination of the financial losses and harm to humans but also only reflects direct losses (Eckstein, Hutfils, and Winges 2018).

Dependence on the extraction of natural resources

Finally, under the revised methodology, two indicators for measuring an economy's dependence on the extraction of natural resources have been included. The indicators capture the share of a country's extractive industry in total GDP and the share of exports of goods from the extractive industry in total exports. It is assumed that the higher the contribution of the extractive industry to a country's GDP and

usually refer to costs. Quantifying direct losses is also problematic when it comes to estimating the value of historical quarters and cultural heritage that have been destroyed (Munich RE 2001).

[34] Two types of insured indirect losses are business interruption—for example, in case production is halted because the insured plant is flooded—and contingent business interruption—where production is halted because a supplier's plant is flooded or where finished products or parts cannot be delivered because the recipient company is not operational. Insurance cover for such cases is not widespread. Therefore, estimating these kinds of indirect losses is challenging (Munich RE 2001).

[35] It is only specified that the database contains disasters that meet at least one of the following criteria: (1) 10 or more people reported killed, (2) 100 or more people reported affected, (3) a state of emergency declared, or (4) international assistance called upon (CRED n.d.).

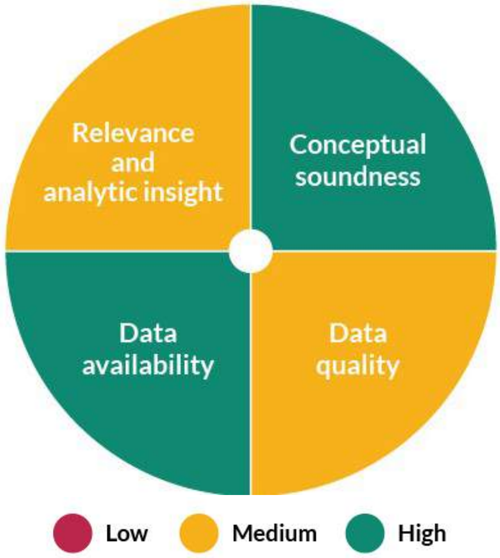
the higher their share in exports, the less sustainable the economic model of the country is.[36] Sachs and Warner (2001) found that an abundance of natural resource wealth can have a strong negative impact on a country's economic growth, the so-called "resource curse" or "Dutch disease."

While the impact is not identical across countries, the negative consequences are generally linked to structural changes in a country's economy in the wake of discovering large natural resource deposits. The possible effects ultimately undermining economic growth include large foreign exchange earnings from the export of newly discovered resources, leading to an appreciation of the exchange rate and rendering other goods less competitive internationally. This can cause a concentration of the economy with a stagnation in non-extractive sectors (particularly manufacturing). Such concentration of export earnings can be a risk to a county's balance of payments and fiscal health, given the high price volatility and often low short-term supply elasticities of natural resources. The expected windfall from newly discovered resources can also lead to overborrowing and unsustainable debts (Barder 2006; Brahmbhatt, Canuto, and Vostroknutova 2010; Sachs and Warner 2001).

Data on exports of extractive goods is widely available (UNCAD 2019). However, there is no reliable data for the value added in extractive industries. The current indicator only covers value added in mining and quarrying but excludes the extraction of fossil fuels. Furthermore, data is only available for African countries for the period 2000–2011 (World Bank 2013).

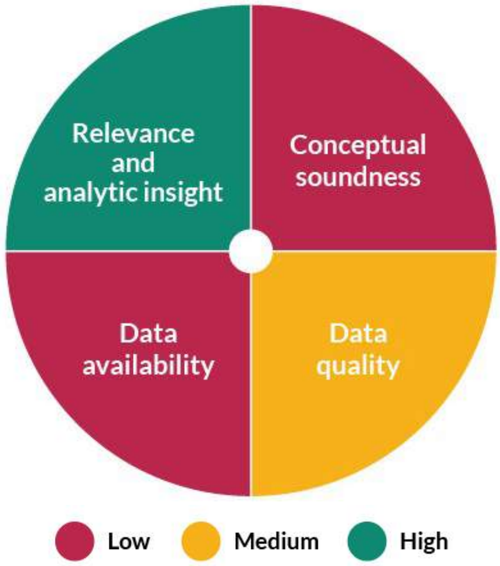
An additional indicator has been considered but discarded, due to its conceptual shortcomings. The World Bank (2019q) attempts to measure natural resources rents—including oil, natural gas, coal (hard and soft), mineral, and forest rents—as a share of GPD. However, measuring the income from resources over GDP seems questionable, since GDP

Figure 44. Indicator evaluation for share of exports from extractive industry



Source: Global Green Growth Institute

Figure 45. Indicator evaluation for share of extractive industry in GDP



Source: Global Green Growth Institute

[36] It is acknowledged that this is an imperfect measure, as sustainability ultimately depends on how environmentally damaging the process of resource extraction is as well as how resource revenues are managed and reinvested. Norway is generally regarded as an example for a country that has found a sustainable model for the country's large share of revenues from natural resources. Nevertheless, countries such as Norway are rather regarded as the exception, with countries dependent on resource wealth often struggling to establish a sustainable economic model.

is defined as the gross value added by all resident producers in an economy and not the return from their economic activity (World Bank 2019e).

Furthermore, the World Bank (2019q) uses average production costs and world prices to determine the rent a country receives from extracting natural resources. However, both production costs and prices for the same resource show considerable differences between countries. Production costs are dependent on labor, land, financing, and other costs—such as taxes that differ across locations (IEA 2018b; King, Deng, and Metz 2012; Sigam and Garcia 2012)—while prices differ according to the quality, specifications, and—sometimes—location, among others (Deutsche Bank Markets Research 2013). For example, in 2018, crude oil prices witnessed price differentials of 2% between North Sea Brent crude and Russian Urals crude but more than a 12% difference between Brent and Mexican Maya crude (CEIC 2019; EIA 2019; Macrotrends 2019). Similarly, Western Canadian Select was trading at a nearly 70% lower price than US WTI, amounting to a differential of more than 25 USD/bbl on average in 2018 (Regulator 2019).[37] Moreover, there are no global prices for natural gas. Prices for gas transported through pipelines are determined through long-term contracts between the parties, while prices for seaborn liquified natural gas (LNG) differ between world regions and are oriented along a number of import hub prices, with sharp differences between historical prices in East Asia and North America (Deutsche Bank Markets Research 2013; Hulshof, van der Maat, and Mulder 2016; IEA 2019e).

Social Inclusion

Systematically measuring and benchmarking indicators reflecting social inclusion is a new element in the GGPA. Social inclusion represents a fundamental facet in the concept of green growth and, therefore, was decided to be given the same prominence in the analysis as other aspects. A set of indicators reflecting the social dimension of green growth has been included during the assessments of Cambodia, Mozambique, Myanmar, Papua New Guinea, and Qatar. However, since then—and in line with the other dimensions of green growth—the indicator set has been extended considerably.

Under the revised methodology, a total of 48 indicators is considered to assess social inclusion as the fourth dimension of green growth. The indicators are grouped into eight different categories, namely (1) poverty, (2) food security, (3) health, (4) education, (5) inequality, (6) good governance, (7) business environment, and (8) access to formal finance (table 9). A list of all indicators with detailed information regarding their definitions, units of measurement, and data sources is provided in Appendix A1.

Table 9. GGPA indicators to assess social inclusion

Aspect	Indicator	Change to initial methodology
Poverty	Poverty headcount ratio at USD 1.90 a day (SDG 1.1.1)	Indicator added
	Proportion of population living below the national poverty line (SDG 1.2.1)	Indicator added
	Share of population with access to electricity (SDG 7.1.1)	Indicator added
	Access to clean fuels and technologies for cooking	Indicator added

[37] There is considerable downward pressure on prices for Canadian heavy crudes due to restricted transport capacity, with both pipeline and rail capacity unable to meet demand (IEA 2019g).

Table 9. GGPA indicators to assess social inclusion (continued)

Aspect	Indicator	Change to initial methodology
Poverty	Percentage of population with access to improved drinking water	Indicator added
	Water Quality Index	Indicator added
	Share of population with access to improved sanitation	Indicator added
	Proportion of population using safely managed sanitation services (SDG 6.2.1)	Indicator added
	Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (SDG 3.9.2)	Indicator added
	Disability-adjusted life years (DALYs) due to unsafe water source	Indicator added
	Disability-adjusted life years (DALYs) due to no access to handwashing facility	Indicator added
Food security	Prevalence of undernourishment (SDG 2.1.1)	Indicator added
	Prevalence of stunting among children under 5 years of age (SDG 2.2.1)	Indicator added
	Prevalence of moderate or severe food insecurity in the population (SDG 2.1.2)	Indicator added
Health	Healthy life expectancy at birth	Indicator added
	Maternal mortality ratio (SDG 3.1.1)	Indicator added
	Under-five mortality rate (SDG 3.2.1)	Indicator added
	Neonatal mortality rate (SDG 3.2.2)	Indicator added
	Government health expenditure	Indicator added
	Government health expenditure per capita	Indicator added
	Current health expenditure	Indicator added
	Health worker density (SDG 3.c.1)	Indicator added
Education	Primary education completion rate	Indicator added
	Lower secondary education completion rate	Indicator added
	Share of population having attained upper secondary	Indicator added
	Share of population having attained a bachelor's degree	Indicator added
	Gender parity index for achievement in reading (SDG 4.5.1)	Indicator added

Table 9. GGPA indicators to assess social inclusion (continued)

Aspect	Indicator	Change to initial methodology
Education	Socio-economic parity status index for achievement in reading (SDG 4.5.1)	Indicator added
	Government expenditure on education	Indicator added
	Government expenditure per student	Indicator added
	Government expenditure on primary education per student	Indicator added
	Government expenditure on secondary education per student	Indicator added
	Government expenditure on tertiary education per student	Indicator added
	Research and development expenditure as a proportion of GDP (SDG 9.5.1)	Indicator added
Inequality	Gini coefficient	Indicator added
	Gender Inequality Index (GII)	Indicator added
	Proportion of women in managerial positions (SDG 5.5.2)	Indicator added
	Proportion of seats held by women in national parliaments (SDG 5.5.1)	Indicator added
Good governance	Corruption Perception Index (CPI)	Indicator added
	Bribery incidences (SDG 16.5.2)	Indicator added
	ITUC Global Rights Index	Indicator added
	The Fragile States Index	Indicator added
Business environment	Ease of Doing Business ranking	Indicator added
	Ease of Doing Business scores	Indicator added
	Index of Economic Freedom	Indicator added
Access to formal finance	Proportion of adults with an account at a bank or other financial institution or with a mobile-money-service provider (SDG 8.10.2)	Indicator added
	Number of commercial bank branches (SDG 8.10.1a)	Indicator added
	Number of automated teller machines (ATMs) (SDG 8.10.1b)	Indicator added

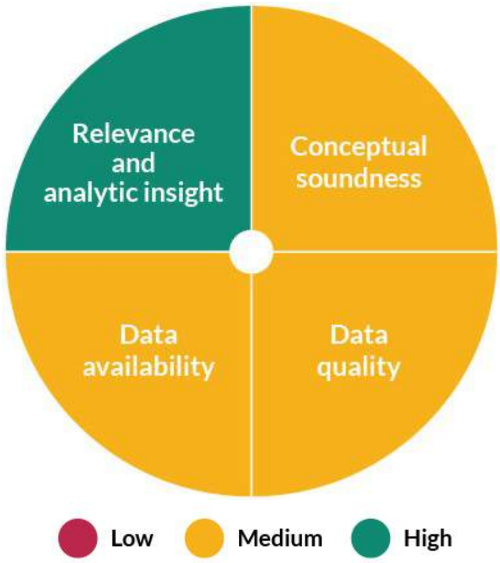
Source: Global Green Growth Institute

Note: Information on alignment to SDG indicators is provided where relevant.

Poverty

First, reducing poverty is an important goal on the global agenda, as well as on the national development agenda, of many low- and middle-income countries. The preliminary assessment considers poverty as defined for an individual country—with countries with higher per capita income generally adopting higher standards of living for defining poverty (UNSD 2019a)—and as established by the international poverty line, which is currently set at USD 1.90 a day at 2011 international prices (World Bank 2019p). The relevance and rationale of both indicators are well established (Jolliffe and Prydz 2016). Nevertheless, there is an ongoing debate about how to define a common threshold across countries and over time, which represents a standard of living below which a person is considered as poor—particularly in light of comparing vastly different people consuming very different goods and services all priced in different currencies (Ferreira et al. (2015). In addition, data quality is a challenge as a result of issues related to timeliness, frequency, quality, and comparability of household surveys used to collect the relevant data. In addition, accounting for nonmarket goods can pose a conceptual challenge (UNSD 2019a).

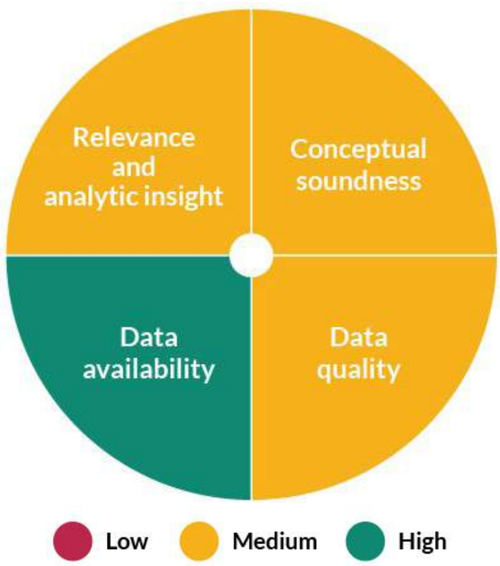
Figure 46. Indicator evaluation for poverty lines



Source: Global Green Growth Institute

Furthermore, the preliminary assessment considers access to basic services—such as electricity, drinking water, and sanitation—and the associated health impact due to lack of access. While these indicators provide a broader picture to gauge a country's poverty level, they are subject to significant conceptual limitations and a paucity in available data. For example, access to electricity is measured on the basis of household connections to the national electricity grid, with no information on quantity, quality, and affordability of service as well as the inability to capture electrification through off-grid solutions (Lighting Global 2016 ; Lighting Global 2018; Angelou et al. 2013; See Box 3. Defining access to electricity). Similarly, the presence of sanitation and handwashing facilities does not translate into their capacity being adequate, nor does it guarantee that household members wash hands when recommended (UNSD 2019n). Finally, the attribution of health impacts from the lack of access to basic services follows statistical models which have inherent uncertainties. So, the quality of such indicators is only as good as the underlying model is able to approximate reality (Prüss-Ustün et al. 2014; WHO 2014b).

Figure 47. Indicator evaluation for access to services



Source: Global Green Growth Institute

Including the availability of public social security programs was also considered when assessing poverty as part of the preliminary assessment, such as SDG indicator 1.3.1 *Proportion of population covered by social protection floors/systems* (UNSD 2019b). However, given the many conceptual challenges—

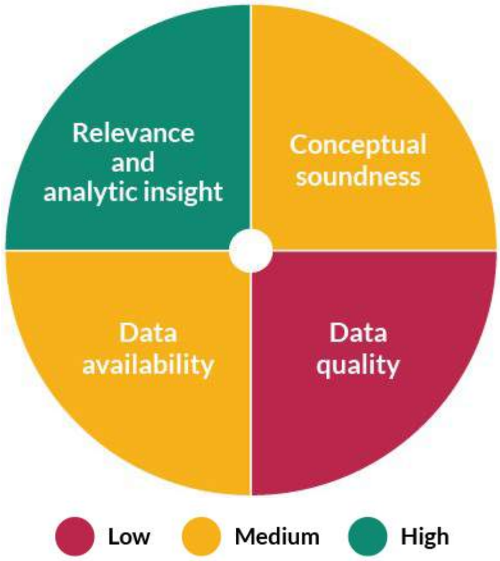
including the generally partial nature of the information collected and the lack of a qualitative dimension, with no information on whether the services provided are sufficient to address the needs of the beneficiaries (UNSD 2019b)—as well as limitations in data availability and data quality, it was decided to not include any such measurements.

Food security

Second, food security remains an important global challenge, with more than 800 million undernourished people worldwide in 2017, representing approximately 10% of the world's total population. Counting the number of people suffering from moderate and severe levels of food insecurity, these figures rise to approximately 2 billion people, or more than a quarter of the world's population. Current progress to improve food security is too slow to achieve the 2025 and 2030 Global Nutrition Targets (Food and Agriculture Organization et al. 2019).

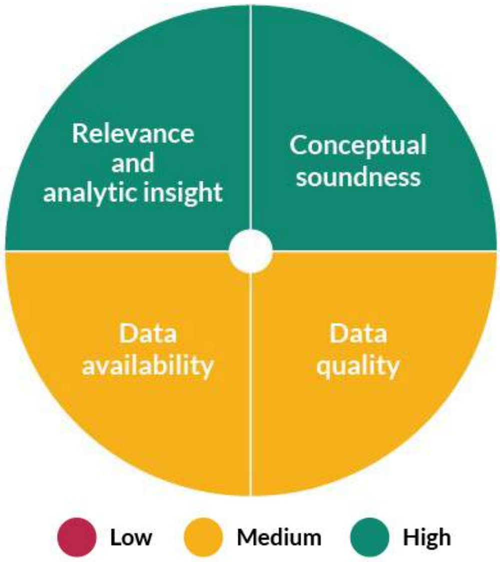
Prevalence of undernourishment has been used by the FAO to monitor the World Food Summit Target and the Millennium Development Goals Target 1C since 1999. The organization defines undernourishment as the condition in which a person does not have access, on a regular basis, to amounts of food that are sufficient to provide the energy required for conducting a normal, healthy, and active life, given their own dietary energy requirements. The indicator is an estimate of the percentage of individuals in a given group—usually a country's population—that are in the condition of undernourishment, but it does not allow for the identification of which individuals in the group are undernourished (UNSD 2019e). Data quality of estimates for the prevalence of undernourishment is generally low, due to the probabilistic nature of the estimate and the margins of uncertainty associated with each of the parameters. While the margins of error in the estimates are unknown, they likely exceed 5% in most cases. Therefore, FAO publishes national-level estimates for prevalence of undernourishment only when they exceed 5% (UNSD 2019e).

Figure 48. Indicator evaluation for prevalence of undernourishment



Source: Global Green Growth Institute

Figure 49. Indicator evaluation for the FAO Food Insecurity Experience Scale



Source: Global Green Growth Institute

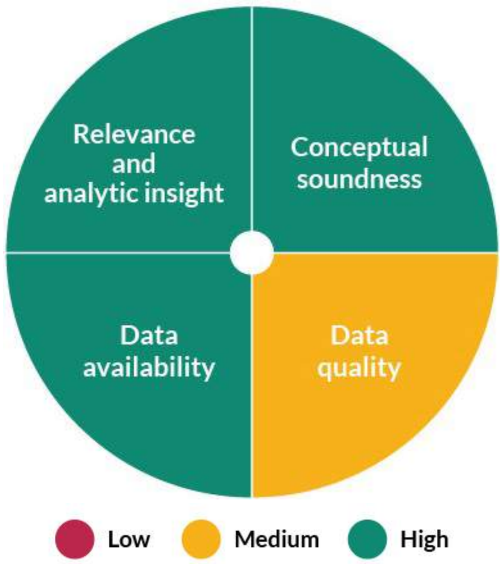
To add granularity, the impact of undernourishment on children is captured in a separate indicator, with child growth being widely accepted as reflecting a child's nutritional status. The indicator carries a high relevance since child stunting—specifically, children who are too short for their age as the result of chronic or recurrent malnutrition—is a risk factor contributing to child mortality, and stunted children fail to reach their physical and cognitive potential (UNSD 2019g). Its relevance is further highlighted by the scale of the issues related to malnutrition, given that worldwide, approximately 149 million children are stunted, 50 million children are wasted (i.e., too thin for their height), 340 million children suffer from deficiencies in essential vitamins and nutrients, and 40 million children are overweight or obese (UNICEF 2019).[38] Since estimates for this indicator are based on surveys, data quality is subject to sampling, measurement, recording, and other errors generally associated with surveys (UNSD 2019g).

In addition, the prevalence of moderate or severe food insecurity is assessed based on the FAO *Food Insecurity Experience Scale*. In line with the other indicators measuring food security as part of the preliminary assessment, data for the Food Insecurity Experience Scale is collected through surveys. Based on their answers, respondents are assigned to different degrees of food insecurity and the results extrapolated to the whole population. As with any statistical assessment, reliability and accuracy crucially depend on the quality of the survey design and the survey's implementation. One major advantage of the methodology behind the Food Insecurity Experience Scale is that it permits testing the quality of the collected data and estimating the likely margin of uncertainty around the observed prevalence rates. In addition, comparability of the results across countries is high. However, confidence intervals are relatively wide at approximately 20% (UNSD 2019f).

Health

Third, public health is an important aspect of social inclusion. According to WHO (2002), health patterns almost always indicate disadvantages toward the poor, who die earlier and are subject to higher levels of morbidity. In low- and low-middle-income countries, poverty is often connected to poor sanitation, unhealthy working and living environments, poor nutrition, and higher exposure to infectious diseases. Nevertheless, in higher-income countries, there is also a clear correlation between mortality and levels of income due to factors such as stress and nutrition, among others (WHO 2002).

Figure 50. Indicator evaluation for life expectancy and mortality ratios



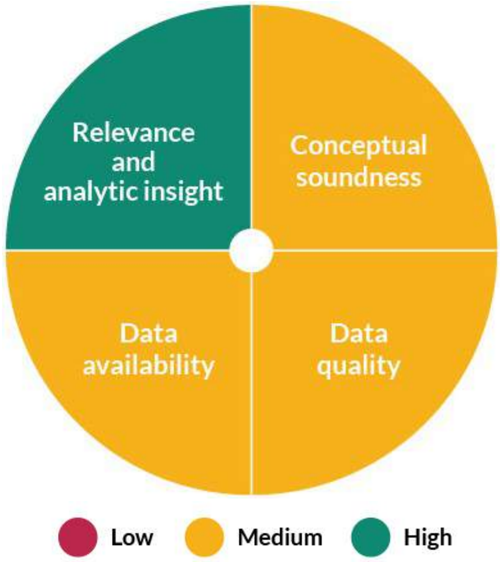
Source: Global Green Growth Institute

Life expectancy at birth and mortality ratios are well-established indicators to assess public health, well-being and—more broadly—social and economic development. The indicators reflect the access of individuals and communities to basic health interventions, such as vaccination, medical treatment of infectious diseases, and adequate nutrition (Fogel 1999; UNSD 2019i; UNSD 2019j; WHO 2002; WHO 2014a; WHO Health Assembly 2018). To be precise, life expectancy and mortality ratios are not rates but either the probability of the average number of years a person can expect to live or the probability of a person's death during a certain period (e.g., under the age of five) or in a given situation (e.g., giving birth), respectively (UNSD 2019h; UNSD 2019i; UNSD 2019j; WHO 2018c).

[38] Though not all of these aspects of malnutrition are captured by the current indicator, future versions of the assessment aim to consider these forms as well.

In addition, information on health expenditure gauges how well the health system is funded. More importantly, correlating expenditure and life expectancy—or other relevant indicators—provides some deduction regarding how effectively health budgets are spent and whether the level of funding influences the level of public health and performance of the health system observed in a specific country. While data on public spending on health can be gathered from government budgets, estimating private spending on health is more challenging and a main source of uncertainty (World Bank 2019e; World Bank 2019g; World Bank 2019h).

Figure 51. Indicator evaluation for the density of health workers



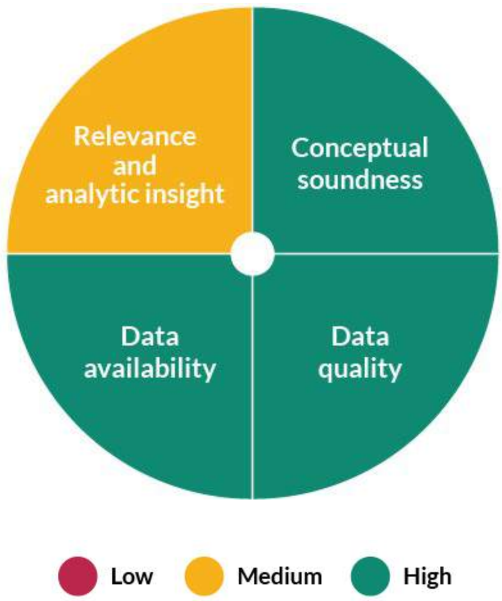
Source: Global Green Growth Institute

Similarly, data on health worker density permits to assess another aspect driving public health. Testing for correlations between health worker density and life expectancy, mortality rates, or expenditure provides a more granular image and allows insights regarding possible causalities. Data on health workers tends to be more complete for the public sector and may underestimate the active workforce in private, military, non-governmental, and faith-based health organizations. Due to the differences in data sources, there is considerable variability across countries in the coverage, frequency, quality, and completeness of the data (UNSD 2019k).

Education

Fourth, education is an important measure for social inclusion and economic growth. The level of education is a critical determinant for an individual's income, while skill levels across the workforce are a defining feature for a country's level of economic development (UNESCO 2004).

Figure 52. Indicator evaluation for attainment levels

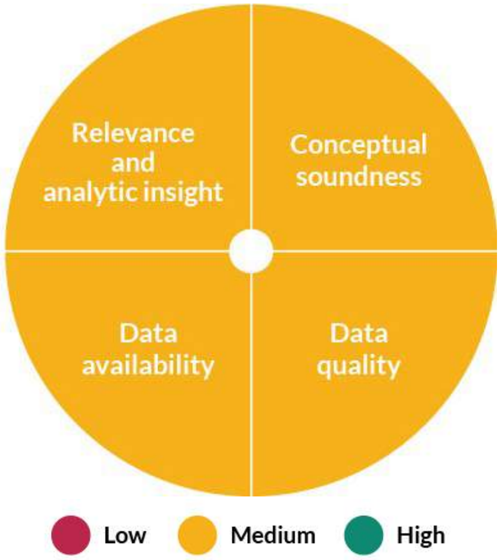


Source: Global Green Growth Institute

Attainment and completion rates for different levels of education provide widely used estimates to assess skill levels within a country's population (OECD 2012; OECD 2018a). However, these indicators provide no information about the quality of the education attained, which undermines comparability of the results across countries. The OECD Programme for International Student Assessment (PISA) is a periodic comprehensive test to assess students' academic performance in reading, mathematics, and science across countries (OECD 2019c). However, data availability is limited, with the most recent tests in 2018 only including 79 participating countries and economies, mostly comprising of high- and high-middle-income countries (OECD 2018b). No such assessment exists on a larger scale. In addition, similar to measuring attainment and completion rates, PISA has been criticized for methodological issues, and the comparability of the results across countries has been repeatedly questioned (Fernandez-Cano 2016).

Similar to public health, information on expenditure levels on education allows for correlating expenditure with performance, permitting deductions regarding how effectively education budgets are spent, and the impact of funding levels on performance. An important caveat is that while data on public spending on education can be gathered from government budgets, private spending on education is not reflected in the current indicators (UNSD 2019s; World Bank 2019m). However, private spending accounts for a considerable share in spending on education in many countries. For example, in OECD countries, private spending plays a crucial role in financing tertiary education, accounting, on average, for approximately one third of the total expenditure on educational institutions in 2016. At non-tertiary levels, private spending on education represented approximately one tenth of the total expenditure on education in the same year (UNESCO 2018).

Figure 53. Indicator evaluation for expenditure on education



Source: Global Green Growth Institute

Within the preliminary assessment, gender parity and socio-economic parity status indices for achievement in reading are used to gauge two important sources of inequality regarding education (Pfeffer 2018; UNESCO 2018; UNSD 2019x).

Inequality

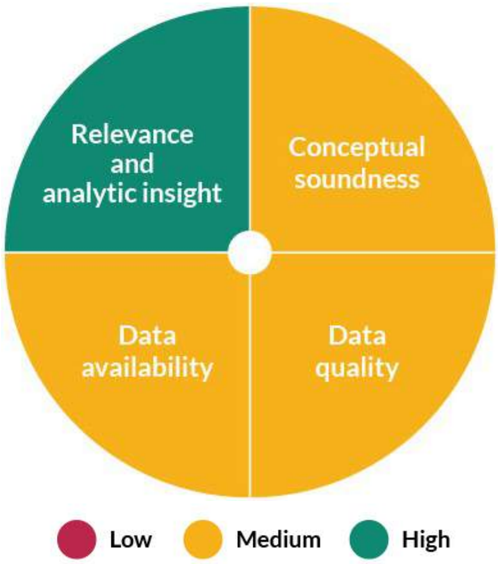
Fifth, reducing inequality remains high on the political agenda of many countries. Inequality reduces social cohesion and can trigger macro-economic and political instability (Dabla-Norris et al. 2015). Inequality can manifest itself in different shapes, such as unequal distribution of wealth, unequal participation and representation in decision-making, and unequal access to services—such as health, education, and transportation. Inequality can lead to the marginalization of specific groups within a society because of race, gender, faith, and language, among others (Carter and Reardon 2014). Policies to Redistribution of wealth, creation of equal opportunities in education and professional life, and provision of access to health and other services, and programs against discrimination are popular policy measures to enhance equality (UNDP 2015a).

In this context, the indicators drawn on as part of the preliminary assessment focus on material and gender inequality. While other aspects of inequality are important, there is often little comparative data across countries. Nevertheless, other forms of inequality are considered during the assessment, though not reflected in the standard set of indicators.

The *GINI coefficient* measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. The GINI coefficient measures the area between the Lorenz curve and the hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Its main advantage is that it is a measure of inequality by means of a ratio analysis, rather than a variable unrepresentative of most of the population, such as per capita income or gross domestic product (World Bank 2019l).

There are a number of limitations in the GINI coefficient's explanatory power. Economies with similar incomes and GINI coefficients can still have very different income distributions. This is because the Lorenz curves can have different shapes and yet still yield the same GINI coefficient. As an extreme example, an economy where half the households have no income and the other half share income equally has a GINI coefficient of 0.5. An economy with complete income equality, except for one household that has half the total income, also has a GINI coefficient of 0.5. Furthermore, the Lorenz curve may understate the actual amount of inequality if wealthier households are able to use income more efficiently than lower-income households (Buhmann et al. 1988; Cowell 2011; De Maio 2007; Dutta and Mandal 2011; UNECE 2011; World Bank 2019l) .

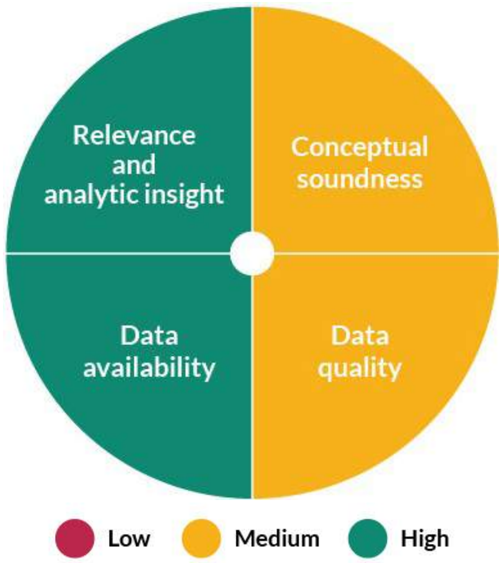
Figure 54. Indicator evaluation for the GINI coefficient



Source: Global Green Growth Institute

The data used for calculating the GINI coefficient is generally a sample. In this sample, the population that works in the informal sector and other socially marginalized parts of the population (e.g., homeless people) are often not included. Numbers for marginalized groups within the population usually have to be estimated. Depending on the estimates, different GINI coefficients can be calculated for the same country for the same year. In addition, the GINI coefficient is generally calculated at the national level. That means, little can be said about income distribution between different regions within one country (Deininger et al. 1996; Deltas 2003; World Bank 2019l).

Figure 55. Indicator evaluation for the Gender Inequality Index



Source: Global Green Growth Institute

Gender inequality is captured through the *Gender Inequality Index*. It is a composite index measuring the following three dimensions: (1) health measured using the maternal mortality ratio and adolescent birth rate; (2) empowerment measured in female and male populations aged 25 years and older with at least secondary education as well as female and male shares of parliamentary seats; and (3) the labor market (economic status), measured using labor force participation rates of female and male populations aged 15 years and older. The index is based on the general mean of general means of different orders. The first level of aggregation occurs via a geometric mean within one dimension, calculated separately for women and men. The second level of aggregation combines the gender-specific indices across dimensions into a female gender index and male gender index. Finally, these two gender indices are combined using a harmonic mean (UNDP 2018a; UNDP 2018b).

Conceptually, the Gender Inequality Index is criticized for the limited number of indicators it is based on, not capturing the entire spectrum of gender inequality. For example, the use of national parliamentary representation excludes participation at the local government level and elsewhere in community and public life. The labor market dimension lacks information on employment, such as the quality of jobs or unpaid work that is mostly done by women. The index misses other important aspects, such as asset ownership, childcare support, gender-based violence, and participation in community decision-making, mainly due to limited data availability (Gaye et al. 2010). Methodologically, the Gender Inequality Index has been criticized for being overly complicated, due to its functional form and combination of indicators that compare the relative performance of women and men with absolute women-specific indicators (Permanyer 2013).

Gender inequality is captured by two additional indicators: the *share of women in managerial positions* and the *share of seats held by women in national parliaments*. While providing some insight into the representation of women in political and economic decision-making, both indicators have severe limitations. They do not reflect differences in the levels of responsibility of women in these high- and middle-level positions or the importance of the enterprises and legislative body in which they are employed. Furthermore, data quality to assess the share of women in managerial positions is highly dependent on the reliability of a country's employment statistics by occupation (UNSD 2019l; UNSD 2019m).

Good governance

Sixth, good governance is often regarded as a fundamental precondition for sustainable economic growth and the effective functioning of public administration. The OECD (2014) estimates that the cost of corruption amounts to more than 5% of global GDP. Corruption increases the cost of doing business, leads to the waste or inefficient use of public resources, and excludes poor segments of a society from public services and perpetuates poverty. Corruption corrodes public confidence in a country's institutions, undermines the rule of law, and ultimately delegitimizes the state (OECD 2014). Therefore, promoting the rule of law, accountability, transparency, and an inclusive decision-making process are at the center of good governance.

As part of the preliminary assessment, information on good governance is largely gathered in the form of composite indices. Composite indices capture the multiple aspects of an issue in a single measurement, making the results comparable. However, they also reduce transparency as they aggregate complex, multifaceted, nuanced issues—such as good governance—into a single number. At the same time, composite indices increase the subjectivity of the results because of the way that individual indicators are selected and weighted (Hough 2017; OECD et al. 2008; Ravallion 2012; Stiglitz, Sen, and Fitoussi).[39] However, assessing a country's governance situation in all its nuances would extend beyond the scope of the preliminary assessment. Therefore, the assessment relies on composite indices that—despite the legitimate criticism toward them—are widely used.

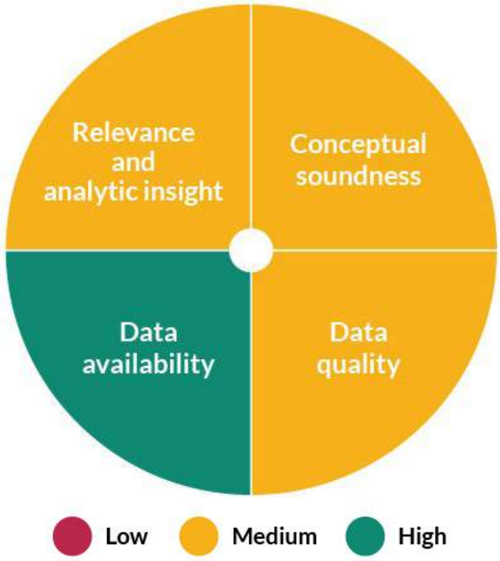
Transparency International's *Corruption Perception Index* (CPI) is a widely used measure for good governance (Razafindrakoto and Roubaud 2010). The composite index is based on a combination of surveys and assessments of corruption, collected by various institutions. Since its inception in 1995, both the sources used to compile the index and the methodology to aggregate results have been adjusted and refined. Important for the purpose of the GGPA is that methodological changes adopted in 2012 allow for comparing scores over time, which was not possible prior to 2012 (Transparency International 2018). Despite this and other improvements, the Corruption Perception Index continues to be criticized on the grounds of definition problems, perception bias, false accuracy, and a flawed statistical model (Andersson and Heywood 2009; Cobham 2013; Hough 2017; *The Economist* 2010).

Most importantly, the CPI does not measure—and does not claim to measure—corruption. Instead, it captures perceptions of corruption. The two are not synonymous. Corruption perception is, by definition, subjective. The answer to the question of whose perceptions are being tracked matters.

[39] For example, Ravallion (2012) argues that the meaning, interpretation, and robustness of composite indices are often unclear, while Stiglitz, Sen, and Fitoussi (n.d.) suggest that composite indices are rather a suitable tool to draw attention to the different components that underlie an index than a means to measure performance.

Survey results considered by the CPI largely originate from "country experts" and business executives, with a focus on bribery. However, corruption involves much more than paying bribes, and critics contend that the CPI neither distinguishes between different forms of corruption nor their impact and severity (Andersson and Heywood 2009).

Figure 56. Indicator evaluation for the Corruption Perception Index



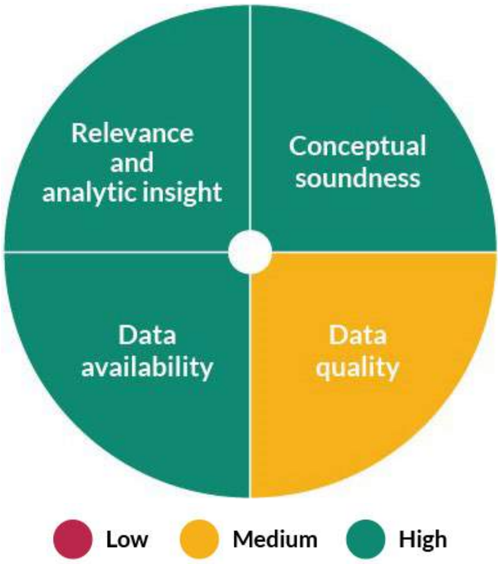
Source: Global Green Growth Institute

Some of this criticism also applies to the indicator tracking *bribery incidences experienced by businesses* that is used as a supplementary indicator as part of the preliminary assessment. The *Global Rights Index* published by the International Trade Union Confederation (ITUC) and the *Fragile States Index* produced by the Fund for Peace both take a broader view on good governance. While the ITUC index focuses on violations of human and worker rights, the Fragile State Index considers violence and organized crime, human rights and rule of law, demographic pressures, refugees and internally displaced persons, fragmentation of state institutions along ethnical lines, and external intervention (FFP 2017; ITUC 2018). However, their broader approach also renders the results less transparent and open to multiple criticisms regarding conceptual questions and the individual indicators that are considered (Hukil 2013; IPCS 2016).

Business environment

Seventh, complementary to good governance, the preliminary assessment also considers a country's business environment. The rationale behind including this aspect is that regulatory quality and efficiency are needed to foster economic growth, innovation, and—where applicable—a shift from the informal to the formal sector of an economy. When local businesses flourish, they create employment and generate income that can be spent and invested domestically (World Bank 2019f).

Figure 57. Indicator evaluation for Doing Business



Source: Global Green Growth Institute

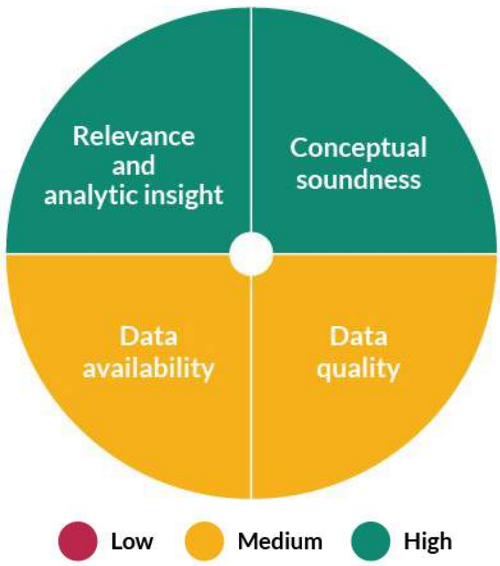
The World Bank's *Ease of Doing Business Index* (Doing Business) is used to assess the business environment, supported by the Heritage Foundation's *Index of Economic Freedom*. Doing Business includes 11 sets of indicators that measure aspects of business regulation relevant for (private) entrepreneurs (World Bank 2019f). Doing Business does not claim to cover all the areas pertinent to private sector development and growth. Its indicators offer insights to identify areas for reform that could improve the local business environment. However, the index acknowledges several clear caveats. The underlying data in itself is not sufficient to assess the overall competitiveness or foreign investment prospects of an economy. The index does not assess market size, the soundness and depth of financial markets, macroeconomic conditions, foreign investment, security, and political stability (World Bank 2019f). Despite recent critique toward the methodology behind the index, it is still one of the most widely used and accepted measures for whether a county's regulatory environment is conducive to starting and operating a local firm (Brunswijck 2018; Devarajan 2018; McCormack 2018; *The Economist* 2018).

The Heritage Foundation's Index of Economic Freedom is somewhat broader in scope, including 70 indicators across four categories: rule of law, government size (referring to tax burden and fiscal health), regulatory efficiency, and the openness of markets (The Heritage Foundation 2019). As part of the preliminary assessment, the Index of Economic Freedom is mainly used to corroborate the results of Doing Business and to help pinpoint individual areas or indicators, for which the results show large discrepancies.

Access to formal financial services

Finally, access to formal financial services is a basic requirement for people to be able to gain access to credit, receive or send remittances, make payments other than cash payments, and benefit from insurance services (UNSD 2019q; UNSD 2019r). As part of the preliminary assessment, three indicators capture access to formal financial services: (1) the share of adults—15 years and older—with an account at a bank or other financial institution or with a mobile-money-service provider, (2) the number of commercial bank branches per 100,000 adults, and (3) the number of automated teller machines (ATMs) per 100,000 adults.

Figure 58. Indicator evaluation for access to formal finance



Source: Global Green Growth Institute

Having access to a bank account is an important prerequisite for people to access a range of financial services. Data for this indicator is collected by the World Bank through surveys and subject to the biases and errors generally associated with surveys (UNSD 2019r). Similarly, as banks remain one of the key institutions for access to formal financial services, having an accessible bank branch is an important precondition for access to a wider range of financial services. The number of bank branches is complemented by access to automated teller machines of all formal financial institutions as another important point of access, since ATMs can extend a minimum of financial services to remote locations. The International Monetary Fund (IMF) collects data for these two indicators from central banks and a country's financial regulators (IMF 2019; UNSD 2019q).

3.2 Consultation

As part of the GGPA process, stakeholders are given a leading role in determining the content and scope of the assessment, making it relevant to their needs. Stakeholders consist of representatives from government, academic institutions, the private sector, civil society, and development partners. Their input is essential in order to identify priorities for green growth and to develop recommendations considering local conditions.

While stakeholder engagement occurs throughout the entire assessment process, a concerted effort to systematically gather feedback from a broad range of constituents is made following the preliminary assessment through an interactive workshop. This workshop serves for approximately 50–100 stakeholders to select priorities for green growth, confirming or adjusting the results of the preliminary assessment. The selected priorities determine the scope of the final analysis and provide guidance on the issues that recommendations are required for. Given the importance of stakeholder input for shaping the assessment, a systematic participatory process is essential to ensure broad consensus on green growth priorities that are to be addressed in the final analysis.

Multi-criteria decision-making

The GGPA's stakeholder consultation relies on the Delphi method in order to identify priorities. The Delphi method is a systematic, interactive, and multiple-stage survey methodology, relying on a panel of experts. It was originally developed to systematically gather expert opinions and evaluate events and trends, based on consent or dissent among participants (Okoli and Pawlowski 2004; Turoff and Linstone 1975; Vorgrimler 2003).

There is a large spectrum of weighting or prioritization techniques in the context of multi-criteria decision-making (MCDM) methods.[40] While a comprehensive literature review would go beyond the scope of this report, a few general observations are relevant in the context of the GGPA.

There is no *objective* or *correct* way to determine priorities or assign weights. Whether or not a methodology is suitable depends on which multi-criteria problem it is meant to solve and for which purpose it is employed (Ananda and Herath 2009; Roszkowska 2013; Zardari et al. 2015).[41] Therefore, characteristics—such as an individual methodology's transparency, the complexity of calculating the results, and the involved costs—are, in many cases, just as important as technical soundness. There are a number of frequently used methodologies to assign weights to different options. Each has different advantages and disadvantages, along with the criteria mentioned above. These popular techniques include pairwise comparisons as the basis for the analytic hierarchy process (AHP) as well as the budget allocation method, trade-off weighting method, rank ordering centroid, and Delphi method (which is used as part of the GGPA) (OECD et al. 2008; Zardari et al. 2015).

Conceptually, the GGPA came with certain basic requirements that any weighting methodology had to align with. This includes (1) the need to engage stakeholders and reflect their opinions in the identified

[40] The spectrum of existing approaches is so vast that experts do not even agree on common categories to distinguish and group different approaches. It is also reflected in the fact that there is no agreement on terminology, with multi-criteria decision-making, multi-criteria decision analysis, multi-objective decision-making, multi-attributes decision-making, and multi-dimensions decision-making being used synonymously (Zardari et al. 2015).

[41] Abrishamchi et al. (2005) state that selecting an appropriate MCDM from a wide range of available MCDM methods is a multi-criteria problem itself.

priorities, (2) a strong preference for a simple and transparent methodology that stakeholders could easily comprehend, (3) the need to share the results among all participants instantaneously, (4) the possibility of immediate feedback and repetition of the survey, and (5) a process that requires the least time possible.

First, the GGPA methodology is aimed to consult stakeholders on their priorities. Given this requirement, all methodologies that exclusively rely on the structure of the data to determine the weights of different aspects were deemed unsuitable (e.g., principal component analysis, factor analysis).

Second, the GGPA required a simple and transparent method for identifying stakeholder preferences, with all participants being able to easily understand and interpret the results. This disqualified the more complex approaches, such as outranking, regime, permutation, and evamix methods (compare Zardari et al. 2015). For example, Chang et al. (2010) considered the trade-off method as too complicated, stating that some participants had severe difficulties understanding the underlying logic behind it.[42]

Third, the GGPA stakeholder consultation is designed to bring 50 to 100 participants together in a one-day setting. This is to ensure that stakeholders have the opportunity to interact and discuss the results among themselves. It was deemed unrealistic to expect longer or multiple engagements with numerous senior-level administrators while a remote survey would lack the element of interaction and feedback within the group.[43] This comes with the need to gather input and share results quickly, avoiding time-intensive methods and complex computations of results. Both AHP and the budget allocation method were discounted for that matter.[44]

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[42] Fattahi and Fayyaz (2010), Morais and Almeida (2010), and Delgado-Galván et al. (2010) agree with that assessment.

[43] Remote surveys were also assumed to likely result in lower response rates.

[44] AHP is a weighting method based on pairwise comparisons. For a given objective, the comparisons are made between pairs of individual attributes, asking which of the two is more important and by how much. If *(n)* is the number of attributes, then the number of needed comparisons is $n*(n-1)/2$. There are two main reasons why AHP was deemed unsuitable for the purpose of the GGPA. First, as the number *(n)* of attributes increases, the number of pairwise comparisons increases quadratically. As a result, the completion of comparisons can become a very difficult and time-consuming task for a participant when the number of attributes is high. For example, as part of the GGPA consultation process, participants are asked to choose priorities from among 34 options. This would imply 561 pairwise comparisons—hardly a task anyone would want to perform several times in a single day. Second, the relative weights of the individual attributes are calculated using an eigenvector. This method makes it possible to check the consistency of comparisons through the calculation of the eigenvalues. While this has the advantage of providing a measure of the inconsistency in respondents' replies, the high number of comparisons makes such inconsistencies inevitable and increasingly difficult to reconcile. Once these inconsistencies become too high, the value of the results can be questioned (Deng, Yeh, and Willis 2000; Karlsson 1998; OECD et al. 2008; Zardari et al. 2015).

In the budget allocation method (also called the point allocation method), participants are given a limited number of points (budget) to be distributed over a number of individual attributes, allocating more points to those attributes they consider important. Weights are calculated as the average number of points assigned to an individual attribute. While this method is simple and transparent, it is generally deemed unsuitable for a range of attributes higher than ten (OECD et al. 2008; Zardari et al. 2015). Deng, Yeh, and Willis (2000) found that it is a difficult task for the respondents to ascribe higher importance to one criterion by lowering the importance of another, as it requires careful consideration of the relative importance of each criterion. If too large a number of attributes are involved, this method becomes time-consuming and can induce serious cognitive stress in the participants who are asked to allocate the budget (OECD et al. 2008; Zardari et al. 2015).

Fourth, a modified Delphi method, asking a limited number of questions in multiple rounds was judged to be the most suitable approach given the requirements of the GGPA. The Delphi method comes with its own restraints, such as a bandwagon effect as a result of dominant personalities unduly influencing the group (Anagnostopoulos and Petalas 2011) and fatigue among respondents in cases where there is a large number of complex questions (Peng and Zhou 2011). However, some of the general drawbacks of the Delphi method have been addressed in the GGPA's setup, with its simple questions and execution through an anonymous electronic survey. Furthermore, by asking participants for the highest priorities (top eight ranks) and not assigning weights to each of the 34 options, the GGPA captures the advantages of the rank ordering centroid, including the approach's simplicity and accuracy in determining the attributes with the highest importance (Chang et al. 2010; Morais and Almeida 2010).

Finally, a general critique brought forward against the Delphi method is that survey participants are often chosen poorly (Zardari et al. 2015). Ensuring the representativeness of workshop participants is a persistent challenge. The validity of the Delphi method relies on a careful selection of participants and balanced representation of different views and interests.

Since GGGI is working in close cooperation with counterparts within national governments, the organization is not free to choose participants and is dependent on official agreement. However, the relevance and acceptance of the workshop results depend on how representative the composition of participants reflecting different government branches is as well as the views from academia, civil society, the private sector, and development partners.

During several consultations, there was a high representation of the government counterpart directly working with GGGI, to the detriment of representatives from other government branches as well as participation of civil society and the private sector. While quotas to determine participants are regarded as unrealistic and should be avoided, continuous efforts will be made to engage with the government counterpart earlier in the process, explaining the benefit of bringing together a diverse set of stakeholders.

While the choice of participants—particularly ensuring representativeness—remains a constant concern when conducting a GGPA, this is the case for whichever methodology is chosen for stakeholder consultation.

Consultation process

During the GGPA workshop, stakeholders are asked multiple times via an electronic survey system to select priorities for green growth, based on a list of preselected areas represented by the indicators used during the preliminary assessment. Each consultation round is informed by relevant findings from the preliminary assessment. After each consultation round, the survey results are shared with participants to direct the discussion. The survey system allows participants to voice their opinion anonymously, without interference of status, age, or sex of other participants. This also allows for the gathering of feedback on politically sensitive issues that some participants might be unwilling to openly share their views on. Discussing the results after each survey round allows them to adjust their assessment based on additional information and feedback within the group.

The experiences made during past consultations have largely been positive, with stakeholders welcoming the participatory nature of the process. Using an electronic voting system to quickly and anonymously gather feedback has proven to be an efficient way for creating an interactive and participatory atmosphere and engaging a diverse group of representatives to select priorities for green growth. Nevertheless, the experiences made during individual assessments showed that several aspects of the initial consultation process warranted improvement. In particular, the consultation process needed to become more flexible.

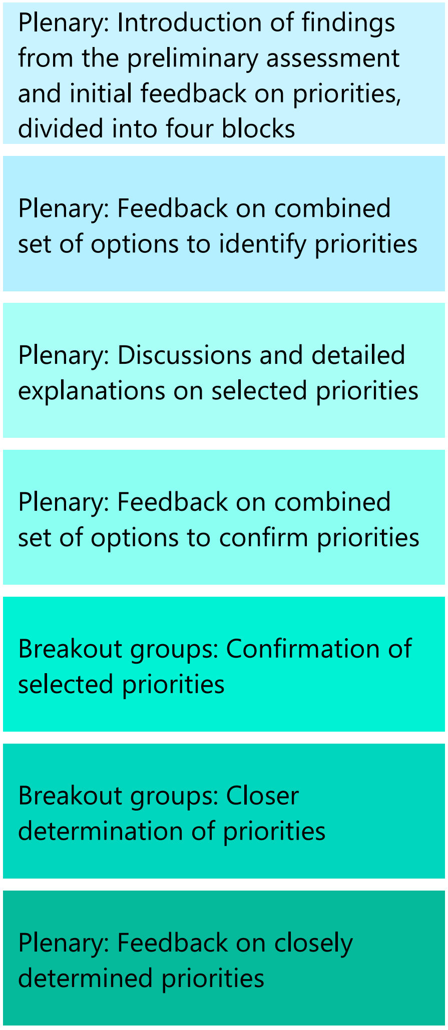
For that purpose, several questions needed to be addressed as part of the revised methodology. How can presenting the results of the preliminary assessment be better integrated with gathering relevant feedback from stakeholders? How many rounds of gathering feedback are required before the results can be regarded as consolidated? Is there a more practical way to determine priorities more closely, other than asking for the economic sectors related to the selected areas?[45]

Experiences from past consultation workshops allowed for refinement of the application of the Delphi survey technique, such as the number of survey rounds, combination of presenting the results of the preliminary assessment and gathering participants' feedback, and design of the group discussions. For example, participants are asked for their feedback at a much earlier point by introducing the results of the preliminary assessment in four separate blocks, with participants asked for their initial feedback after each block.

Furthermore, in Nepal and Laos, stakeholders challenged the validity and representativeness of some of the indicators, including energy consumption (energy intensity) being measured as energy consumption per GDP. In response to these early experiences, the preliminary analysis has been strengthened by widening the base of indicators. As a result, individual areas of green growth are being represented by more than a single indicator. This has strengthened the credibility of the preliminary assessment in the eyes of stakeholders. For example, when discussing the results for energy consumption in Mozambique, the assessment team was able to draw on a much wider range of indicators than merely referring to energy consumption per GDP.[46]

As a result of these and other adjustments, the consultation workshop generally takes participants through the following steps (figure 59): First, the results of the preliminary assessment are introduced separately for each of the four green growth dimensions (see figure 7 on page 22 in this report). Participants are asked for their initial feedback on the results of the preliminary assessment, presented in the form of radar charts, and to select the two highest priorities separately for each dimension.

Figure 59. Consultation process



Source: Global Green Growth Institute

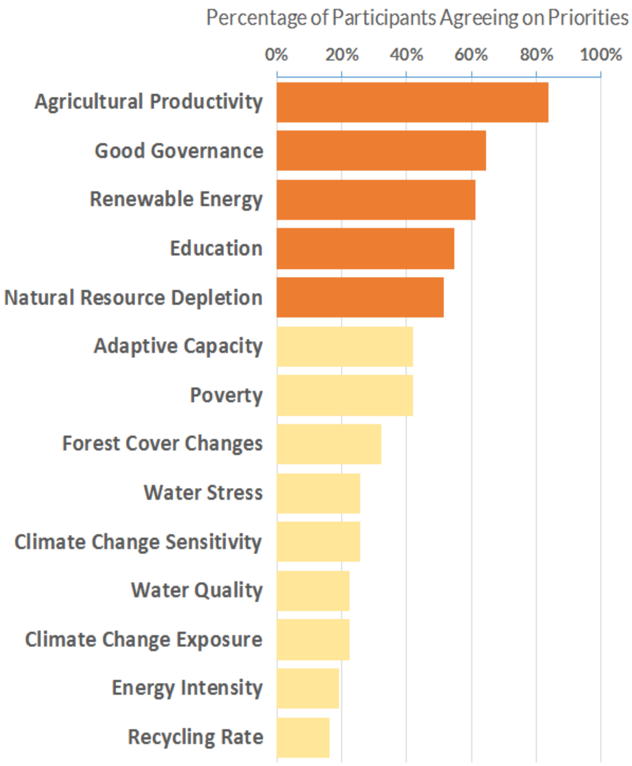
[45] Initially, after having chosen a number of priorities for green growth, stakeholders were given a list of 14 sectors to narrow down these priorities. For example, having chosen energy intensity as a priority, stakeholders would be asked in which particular sector energy intensity is an issue, such as industry, agriculture, etc.

[46] The additional indicators include energy intensity in the industry sector; energy intensity of road passenger transport; the share of primary, secondary, and tertiary sectors in the national economy; manufacturing value added per capita; manufacturing value added as a share of GDP; manufacturing employment as a proportion of total employment; energy use per capita; GDP per capita; the share of population with access to electricity; total primary energy supply by fuel; total final consumption by fuel and by sector; and net imports share by fuel.

Second, this is followed by a second round of feedback in which participants can select a total of eight priorities across all four dimensions.

Third, the plenary discusses the selected priorities as well as results that figured prominently in the preliminary assessment. This discussion is supported by presenting the audience with a more detailed analysis on the selected areas, based on the indicators and results of the literature review, going beyond the set of indicators illustrated in the radar charts. Participants are then asked for a third time to select eight priorities in order to confirm or revise the earlier results (figure 60).

Figure 60. Example of selected priorities



Source: Global Green Growth Institute

Three consultation rounds have proven to be sufficient to build consensus around priorities. This is based on two observations from past workshops. First, the concentration of votes captured by the top five priorities increased throughout the feedback rounds in seven of eight cases.[47] Second, changes in the top five priorities selected by participants were considerably larger between the first and second feedback rounds than between the second and third feedback rounds.[48]

In the second part of the workshop, participants are divided into smaller groups. The aim of these breakout groups is to consolidate the results of the plenary survey and define the identified priorities more closely. Past experiences have shown that participants appreciate this interactive session of small group discussions, while the results provide additional insights to determine the direction of the final analysis (country

[47] The only case where the concentration of votes decreased in the course of the workshop was in Mozambique. This was largely due to a very high concentration of votes in the first feedback round, where participants were given a total of four instead of eight votes. This was done to accustom participants with using the electronic voting system used to gather their feedback. However, this made the methodology less reliable and was therefore not repeated in the following workshops.

[48] Countries where three feedback rounds were recorded included Cambodia, Mozambique, Myanmar, Nepal, Papua New Guinea, and Qatar.
In Nepal, two of the initial top five priorities were replaced in the second feedback round while no changes occurred during the third feedback round. In Myanmar, three of the initial top five priorities were replaced in the second round, with only one of the top five priorities replaced in the third round. In Cambodia, one of the initial top five priorities was replaced in the second round while an additional priority was added in the third round, due to the fifth and sixth highest priorities receiving the same number of participants' votes. In Mozambique, one priority was added in the second round due to a tie of votes. A different priority was discarded in the third round. In Papua New Guinea, only four priorities were selected. These priorities remained the same throughout the workshop; merely their order changed. In Qatar, one of the initial priorities was replaced in the second feedback round. In the third feedback round, a different priority was replaced.

report). To make these sessions more relevant, the amount of time dedicated to the group discussions has increased considerably over the course of the past assessments.

To guide the discussions, breakout groups are given two specific tasks. First, they are asked to verify whether the group agrees with the priorities selected by the plenary and to choose alternative priorities in case they do not agree. Second, in order to narrow down priorities, each group is asked to define the priorities more closely. For that purpose, participants are given a list of choices for each priority and asked to identify (1) causes that make the chosen priority a challenge and (2) options than can help to address the challenge. The list of choices is based on the results of the preliminary assessment, a literature review, and input from GGGI thematic experts. Beyond these preselected options, participants are encouraged to suggest further issues (table 10).

Table 10. Selected priorities and related issues by share of participants

Priority / Related Issues	Water stress	Energy consumption	Vulnerability to climate change	Food security	Air quality
Infrastructure	82%	59%	50%	64%	23%
Technical capacity	32%	23%	9%	64%	14%
Data and analysis	18%	14%	82%	-	82%
Private sector and competition	5%	5%	5%	55%	5%
Awareness	45%	73%	9%	5%	5%
Political will	-	5%	18%	45%	-
Governance and institutions	5%	9%	32%	18%	-
Regulation	14%	32%	14%	-	59%
Monitoring and enforcement	18%	27%	50%	-	59%
Subsidies	23%	50%	-	14%	-
Energy consumption[1]	41%	-	-	-	-
Health and economic costs[2]	-	-	-	-	59%

Source: Global Green Growth Institute

- Selected by more than 60% of participants
- Selected by between 40% and 59% of participants
- Selected by between 20% and 39% of participants
- Selected by between 10% and 19% of participants

[1] Category introduced by participants for water stress only.
[2] Category introduced by participants for air quality only.

The setup of the group discussion has been refined, with the way the deliberations are structured gradually having become more flexible. Particular improvements have been applied to the method of determining priorities more closely. Initially, for each priority, the same preselected set of sectors was used to define the challenges and possible solutions. Experiences in Nepal and Laos showed that this approach was too broad and delivered little additional insight.

Since then, several alternatives for determining priorities more closely have been tested. Across these alternatives, there is a general trade-off between relying on more open questions leading to a less structured discussion—with the challenge of consolidating the results and determining consensus among participants—and relying on a set of targeted questions—with the risk of being too rigorous, limiting the options for partisans to answer, and missing important aspects.

The current approach offers a reasonable balance between these trade-offs. In recent consultations, a tailored list of specific aspects related to each of the potential priorities has proven to offer more flexibility than the previous approach. That way, the group discussions provide more useful granularity to the identified priorities than relying on the same set of sectors across all priorities. At the same time, it helps to maintain a structured approach by providing a list of choices to participants, instead of relying on the format of an open discussion with the risk of the results being less useful to guide the final analysis.

Figure 61. Photos from GGPA workshops

To conclude the consultation, the results from the breakout groups are discussed in the plenary and confirmed through a final survey round. It has proven useful to close the final survey round by asking participants to what extent they agree with the workshop results. This serves as a final check of the validity and representativeness of the results and provides an opportunity for dissenting voices and potential critique toward the methodology to be heard and addressed.

Consultation results

The consultation workshop is an essential part of the GGPA. The priorities identified by stakeholders determine the scope and direction of the country report, with the report's analysis and recommendations addressing the priorities selected during the workshop.

The usefulness of the workshop and the validity of its results have been supported by participants' high agreement with the results recorded in past consultation workshops. For instance, in Cambodia, Qatar, and Papua New Guinea, nearly all participants (>95%) agreed or somewhat agreed that the final analysis should focus on the selected priorities. Similarly, in Mozambique, nearly 70% of participants agreed with the results, more than 20% somewhat agreed, and only 10% disagreed with the identified priorities.[49]

A workshop report presents and interprets the results of the workshop. It serves two purposes. First, the workshop report—usually shared within a week after the consultation workshop—provides participants with a final opportunity to comment on and voice disagreement with the results of the consultation and

[49] In prior GGPAs, participants had not been asked to explicitly provide feedback on this question. However, when discussing the workshop results in Lao PDR, participants only asked for one change to be made in the summary while no changes were asked for in Myanmar.

thereby determine the scope and direction of the final analysis. Second, the report allows external audiences to understand the process and results of the workshop. In addition, the workshop report is particularly relevant for the reduced version of the GGPA, where the assessment potentially ends with the interpretation of workshop results and outlining options on how to build on those results (see Box 5. GGPA Light).

The workshop report is an entirely new feature that did not exist under the initial GGPA process. The report largely follows a standardized template for presenting the results, while the depth of interpreting the outcomes is flexible and dependent on the requests made toward the assessment team (figure 62).

Figure 62. Example of a GGPA workshop report

Source: Global Green Growth Institute

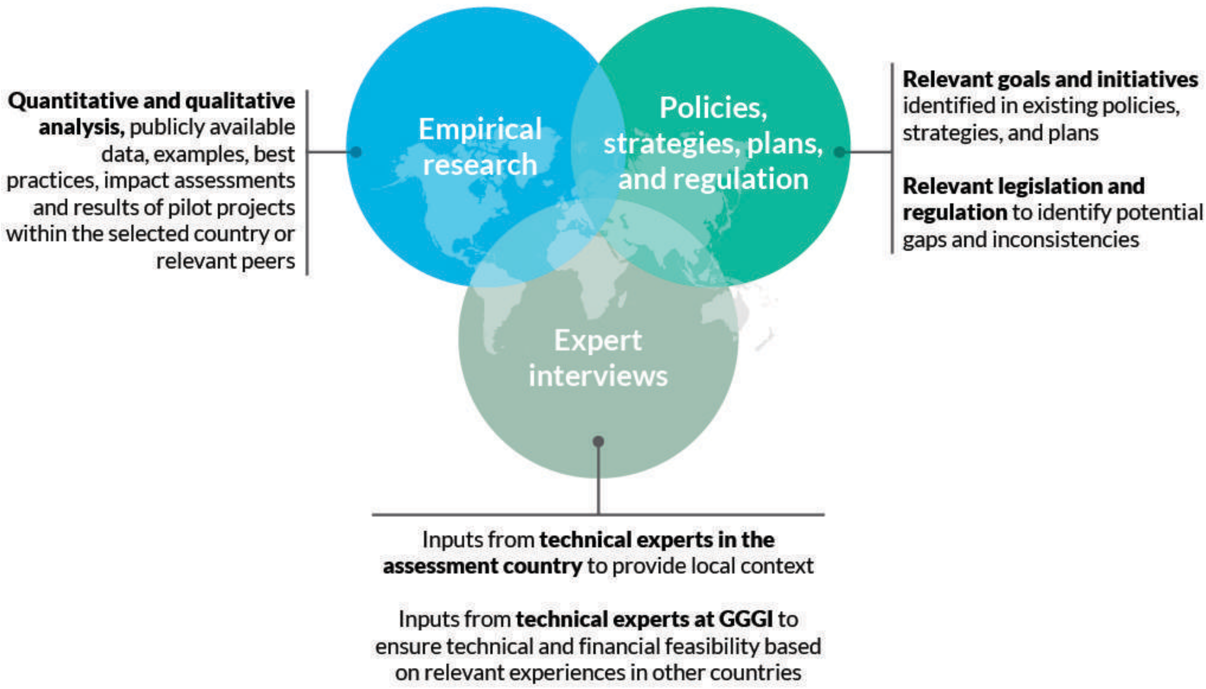
3.3 Final Analysis

Point of departure for the final analysis

Building on the results of the consultation workshop, the final analysis identifies specific opportunities and barriers to green growth for each of the selected priorities. The final analysis is built around a set of recommendations, ranging from changes in policy to strengthening regulation and enforcement to technical interventions and specific pilot projects.

In the course of the past four years, the process of developing the recommendations has been continuously strengthened. Initially, the development of recommendations relied heavily on inputs gathered through expert interviews. As a result, recommendations were subject to individual bias and repeatedly in dissonance with the larger body of literature about the issues they were meant to address. Under the revised method, recommendations are developed based on three different kinds of inputs (figure 63):

Figure 63. Schematic of inputs to the final analysis



Source: Global Green Growth Institute

First, the recommendations are informed by quantitative and qualitative analysis drawn from existing research and based on publicly available data sets. Furthermore, they rest on inference from examples, best practices, impact assessments, and results of pilot projects within the selected country or relevant peers.

Second, policies, plans, strategies, and existing regulation are reviewed to assess the current policy and regulatory framework. This allows for the identification of relevant goals and initiatives and determine potential gaps, inconsistencies, or obstacles within the current legislation, regulation, and institutional setup.

Third, a crucial input to developing the recommendations is a series of expert interviews conducted in the assessment country. For that purpose, for two to three weeks, approximately 20–30 technical experts from government, academia, the private sector, and civil society are consulted on specific issues within their area of expertise. While such expert interviews were part of the initial methodology, the manner in which these interviews contribute to the analysis has evolved considerably. Initially, expert interviews were meant to identify relevant recommendations. Interviews were conducted immediately after priorities had been selected, with insufficient preparation to ask targeted questions. As a consequence, the interview results were often too generic and contributed little—or even contradicted—the final analysis that also considered information from other sources.

Under the revised methodology, expert interviews are conducted at a later stage. Instead of developing recommendations based on the interviews, they serve to address gaps that remain after reviewing the literature, legislation, and regulation, to clarify issues where the information gathered from documents is ambiguous and verify the recommendations that the assessment team is proposing. They also provide additional context and reflect the most recent developments in the assessment country that might not be available in written documents yet. In addition to local experts, technical experts from within GGGI provide their input to ensure that important aspects and trade-offs have not been overlooked, verify that the recommendations are technically feasible and cost-effective, and share relevant experiences from other countries.

As part of this process, the linkages and trade-offs between the selected priorities are analyzed. Examples from past assessments include governments' desire to increase agricultural output and generate income for rural populations without causing further deforestation (GGGI 2018c; GGGI 2019a). Similarly, the GGPA of Papua New Guinea discussed the trade-off between attracting investment to ensure a reliable electricity supply via the national grid and affordability of electricity tariffs for low-income households. Such trade-offs need to be reflected in the recommendations (GGGI 2019a).

Box 4. From outsourcing to in-house analysis

An important change to the way a GGPA is conducted goes beyond a revision of the methodology itself. It concerns the question of who conducts an assessment. Initially, assessments were led by GGGI, but data analysis, stakeholder consultation, the literature review, and expert interviews were all carried out by external consultants. Even the final analysis was drafted by external consultants. In theory, this had the advantage of acquiring an assessment team who would be familiar with the country under review, the political context, and the local languages. In practice, the large extent of outsourcing rendered quality control difficult. Since the GGGI team was not necessarily aware of what sources had been consulted, how thoroughly data had been checked, how ambiguous results had been interpreted, and how expert interviews had unfolded, the assessment process lacked transparency. There was little information on the strengths and weaknesses within the analysis, as the GGGI team was not always aware of how certain results had been arrived at. It also made it difficult to improve a process that was not understood in all of its details.

Therefore, the involvement of external consultants in the assessment process was gradually reduced. Ultimately, it became an in-house process, with minimal external support, that is largely limited to support logistics during stakeholder consultation and expert interviews. The entire analytical work—including data gathering, the literature review, stakeholder consultation, and development of recommendations—is undertaken by an in-house assessment team. This approach was successfully applied during the two most recent GGPAs—covering Papua New Guinea and Qatar—to the satisfaction of both GGGI and its Partners. Going forward, some external support might be required for gathering literature, particularly in countries where soft copies of essential documents are not widely available, or the language barrier inhibits the assessment team to gather crucial information.

A particular advantage of relying on an in-house process is that it ensures quality control, which is essential given the low quality of some of the available analyses the team has encountered during past assessments. The limitations in the existing literature have two principal causes.

Box 4. From outsourcing to in-house analysis (continued)

First, in many countries, the necessary data is either not available or not reliable. This translates into analyses often having to rely on estimates, imposing severe caveats or rendering the results inconclusive. The paucity of reliable data is a severe impediment across all sectors, from electricity to transportation to GHG emission inventories and from agriculture and forestry to sanitation and waste management. For example, in several countries, basic data for the energy sector—such as total primary energy supply and total final demand—were not available or considered unreliable (GGGI 2017a; GGGI 2019a). Similarly, FAO (2014) indicates that different initiatives to estimate forest areas in Mozambique resulted in inconsistent data, misleading discussions on forest changes. Due to the different forest definitions used in subsequent forest inventories, the extent of forest cover has been reported differently in various sources. It is not possible to identify whether this discrepancy is due to real changes or classification errors. Forest cover was estimated at approximately 20 million hectares in 1990 (Saket 1994). However, more recent estimates suggest a forest cover of approximately 40 million hectares (Marzoli 2007). Such large discrepancies allow for little solid analysis. When the extent of deforestation is unclear, identifying the drivers behind it and how to address them is subject to considerable uncertainty (GGGI 2018c).

Second, past experiences have shown that for a substantial share of the existing literature, the lack of reliable data is compounded by questionable assumptions, leading to conclusions and recommendations that are ineffective at best and counterproductive at worst. Assumptions and underlying methodologies are often not (sufficiently) explained to make analyses transparent and results comparable. Too often, analyses conclude with overly general statements that provide little practical insight and are open to interpretation. In different countries where GGPAs have been conducted, various reports showed severe technical errors or a limited technical understanding. For example, numerous reports did not make the fundamental distinctions between energy and electricity, while others conflated distinct terms, such as renewable energy, clean energy, and clean cooking. In some cases, documents are not even internally consistent, with different figures for basic data, such as GDP, being used in one and the same document.

Conducting GGPAs in-house ensures that the assessment team is fully aware of the weaknesses and assumptions within the conclusions of the analysis, stipulating adequate caveats and adjusting recommendations accordingly.

Design of the analysis

Beyond changes in the process of how recommendations are developed, the format to present those recommendations has also evolved. Initial assessments showed a substantial disconnect between the analysis contained in the report and the recommendations brought forward. The upfront analysis did not always lead logically to the recommendations attached to it. In consequence, the assessment team has experimented with different formats of how to make the report more coherent and easily accessible to readers. As a result, the connection between the recommendations and the underlying analysis has been strengthened and made more explicit.

Under the revised methodology, the final report is designed around a set of recommendations. For each of the 4–6 identified priorities, between 5 and 10 recommendations are developed, each undergirded by a rationale and relevant analysis to support its relevance. Each recommendation is introduced upfront in its own section, followed by the related analysis outlining its relevance and providing evidence for its effectiveness. The analysis generally aims to demonstrate why and how the recommendation can bring about a desired result, building on a combination of existing research, case studies, and successful initiatives within the country itself or relevant peer countries as well as expert interviews.

This format also makes it easier for the reader to navigate the report and identify the sections that they are interested in. The Global Reports published by the New Climate Economy served as a template for how to present the recommendations and the related analysis (compare NCE 2016, NCE 2017).[50] The GGPA reports covering Cambodia, Mozambique, and Papua New Guinea follow this design (GGGI 2018a; GGGI 2018c; GGGI 2019a).

Scope of the analysis

Under the new methodology, the scope of the recommendations varies, depending on the purpose for which a government or GGGI itself wants the assessment to be conducted. This is a major change from the initial setup of the final analysis, with its narrow focus on policy options. These options were envisioned to fall within the four following categories: (1) national policies and strategies; (2) institutions and governance; (3) finance, technology, and capacity; and (4) market and business. However, this structure was of little help to develop specific recommendations. Its limited focus left out important aspects that government counterparts wanted to be covered by the analysis. It also proved to be of little practical use, as it was not always possible to distinguish recommendations along these four categories. As a result, the process of determining the scope of the analysis has been strengthened over the course of the last four years.

Broadly, under the new approach, all assessments serve the purpose of identifying priorities for green growth and presenting recommendations on how to address those priorities. However, in practice, the way in which the assessment results are being used often differs between countries. Past assessments have proven that it is essential to tailor the nature, scope, and depth of the analysis to the needs of Partners and align the recommendations with local requirements. Therefore, the level and scope of the recommendations—and the analysis behind those recommendations—is agreed on early in the assessment process; either at the outset, when officially launching a GGPA, or directly after the priorities for green growth have been identified with stakeholders.

Such a tailored approach allows for the development of more targeted recommendations. The more the analysis is customized to address their specific requirements, the more useful the results are of the assessment for government counterparts and GGGI. Such a flexible approach is also further aligned with GGGI's overarching philosophy to support countries with a comprehensive service, from diagnosing impediments and formulating policies to designing bankable projects and facilitating access to international finance.

Past assessments have shown a number of possible motivations behind conducting an assessment, which were then reflected in the nature and scope of the recommendations, ranging from the development of policies to advice on specific regulations to suggestions for specific infrastructure projects (table 11).

First, in several countries, the results of the GGPA were used as an input to the development of policies and strategies. For instance, in Colombia and Peru, the assessment mainly served as an input to developing the countries' green growth strategy. In Laos, the GGPA identified tourism, transport, renewable energy, energy efficiency, and waste management as priorities for green growth. Consequently, the government decided to mirror these priorities in its country's National Green Growth Strategy. In Myanmar, the GGPA analysis has served as the basis for GGGI's input into the drafting or implementation of the Myanmar Climate Change Strategy and Masterplan (draft), Myanmar Agriculture

[50] The most recent NCE report follows a different format (NCE 2019).

Development Strategy (2018), National Land Use Policy (2016), National Sustainable Development Plan (2018), and National Green Economy Policy Framework (draft). For example, the land use policy was strengthened by incorporating emissions targets. In the case of Cambodia, the GGPA provided the analysis and rationale for specific interventions to achieve targets set out in the national development plan.

Table 11. Scope of GGPA recommendations

	Input to green growth strategy	Input to national development plan	Input to sector strategies	Input to regulation	Input to Country Planning Framework	Identification of pilot projects
Cambodia		X		X		X
Colombia	X					
Lao PDR	X				X	X
Mozambique		X	X	X	X	X
Myanmar	X			X	X	
Nepal	X				X	
Papua New Guinea				X	X	X
Peru	X					

Source: Global Green Growth Institute

Note: The GGPA conducted in Qatar followed a different approach and did not include the development of a country report (see Box 5. GGPA Light).

Second, in four countries—Cambodia, Mozambique, Myanmar, and Papua New Guinea—the assessment team was asked to develop recommendations addressing regulatory gaps. For example, in Cambodia, numerous recommendations provided advice on how to strengthen specific regulations, including monitoring of industrial waste, licensing of solar power equipment for mini-grid operators and commercial end-users, and enhancing the independence of the electricity sector regulator (GGGI 2018a). Similarly, the report covering Papua New Guinea included a broad assessment regarding regulatory gaps in the electricity sector, with specific recommendations on data collection, the setting of electricity tariffs, and quality control of off-grid solar equipment, among others (GGGI 2019a).

Third, several recommendations in the assessments of Laos, Myanmar, and Mozambique suggested specific infrastructure projects. For example, in Laos, the report referred to a pilot scheme on low-carbon transport options that included electric buses, motorcycles, and tuk-tuks (GGGI 2017a). In Myanmar, the report recommended the construction of a model wastewater treatment plant to demonstrate the benefits of existing best practices in industrial wastewater treatment (GGGI 2017c). In Mozambique, the analysis made a number of suggestions concerning possible pilot projects using off-grid solar systems for productive use (GGGI 2018c). Finally, in Papua New Guinea, the assessment's two main purposes were to inform the GCF readiness program and provide relevant analysis to support the development of project applications, particularly in the areas of renewable energy, agriculture, and forestry (GGGI 2019a).

Fourth, beyond supporting partner governments, the results of the GGPA often served as an important input to GGGI's Country Planning Frameworks (CPFs). The organization develops a CPF when starting its work in the country of a new Member. In that process, the GGPA provides the organization with options for interventions and projects to work on within specific countries. The relevance of the suggested initiatives is supported by the report's technical analysis and the political support they enjoy, confirmed through consulting stakeholders.

Box 5. GGPA Light

An important lesson after having successfully conducted nine GGPAs is that, to ensure quality, the assessment process is more time-consuming and work-intensive than GGGI had initially anticipated. First, given the paucity of reliable data in many review countries, the preliminary assessment requires considerably more gathering, cross-checking, and triangulation of individual data points than initially expected. Second, the process of drafting the final report—including the literature review, expert interviews, and peer review—exceeds the time allocated in the initial assessment schedule considerably.

Given the occasional urgency for both national governments and GGGI to conduct an assessment, there was a need for a reduced version of the GGPA, short of a full-fledged assessment. While the scope and format of any such limited GGPA will depend on the requirements that individual government partners and GGGI have in a given country, there are two broad options for conducting such a *GGPA light*.

First, the assessment could focus on the results of stakeholder consultation—namely identifying priorities for green growth—providing an overview for the issues and questions that require further assessment in order to identify specific interventions.

Second, from its outset, the fast-track assessment could focus on one specific sector or issue. This would reduce the scope of both the preliminary assessment and final assessment while giving the consultation workshop a new role. The consultation could be geared toward prioritizing individual interventions in a given area—for example, whether to focus on clean cooking solutions or off-grid electricity from renewable sources in the energy sector—than selecting high-level priorities, such as whether to focus on deforestation or renewable energy.

As of January 2020, only one such GGPA light has been conducted. In the case of Qatar, the scope and format of the GGPA was adjusted to allow for a fast-track assessment. In that context, the assessment focused on identifying priorities for green growth. The analysis was reduced to providing a rationale for the chosen priorities. Furthermore, the assessment document outlined the relevance of those priorities for the preparation of the country's next NDCs as well as a potential green growth strategy. As a prospective starting point for both documents, it suggested a range of measures that could be considered and highlighted a number of avenues for further analysis.

In both cases, the prescribed approach involved (1) establishing relevant targets and (2) identifying relevant means to achieve those targets. For example, in the context of revising its NDCs, the report suggested measures that the government of Qatar could consider regarding electricity generation from renewable sources, energy efficiency measures, and public transport. Among the measures to be considered, the report elaborated on the relevance of mandatory efficiency standards for buildings, vehicles, and appliances as well as economic and fiscal incentives to change consumer behavior (GGGI 2019b).

4. Conclusion

GGGI defines green growth as a development approach that seeks to deliver economic growth that is both environmentally sustainable and socially inclusive. Through the green growth model, countries seek opportunities for economic growth that are low-carbon and climate resilient, prevent or remediate pollution, and maintain healthy and productive ecosystems as well as create green jobs, reduce poverty, and enhance social inclusion. Several definitions and concepts of green growth exist in different development organizations, such as the OECD, UNEP, and World Bank. Common to all these definitions is that green growth balances economic growth, environmental sustainability, and social inclusion, aiming to minimize the trade-offs and maximize the synergies between them.

While the awareness of and commitment to green growth are rising worldwide, green growth is a broad concept, encompassing not only different economic sectors but also different levels of intervention. Furthermore, the definition of green growth in individual countries and how it can be translated into specific actions depends on a wide range of factors, such as a given economy's stage of development, its endowment with natural assets, and its social characteristics. Therefore, given the concept's broad nature, there is a need to clarify the meaning of green growth in a specific country's context, identify priorities, and assess those priorities systematically.

During the past four years, GGPAs have been successfully concluded in nine countries: Cambodia, Colombia, the Lao PDR, Mozambique, Myanmar, Nepal, Papua New Guinea, Peru, and Qatar. The assessment has proven to be a useful tool, providing policymakers with empirically founded advice and helping them to determine areas where green growth interventions can have the highest impact. Furthermore, the GGPA gives recommendations regarding the means and actions to address those priorities, which are tailored to an individual country's context.

Several organizations conduct assessments similar to the GGPA. For example, the IEA, OECD, and World Bank conduct country assessments, with the difference being that the scope of these assessments—specifically the sectors, areas, and topics to be examined—is the same for each country, and stakeholder consultation is limited to inform the technical analysis. The GGPA is comparable to IRENA's *Renewables Readiness Assessment* in how it combines data analysis with stakeholder consultation and in-depth analysis. An important distinction between the two assessment methodologies lies in the sequence of the different activities. The GGPA consults with stakeholders in order to identify the direction and scope of the final analysis prior to its drafting, while stakeholder consultation, as part of IRENA's assessment process, serves to validate and revise the findings of the final report after it has been drafted (IRENA 2013).

Similarly, the GGPA shares a number of features with the FAO's Rapid Rural Appraisal. Both combine a range of analytical procedures, including semi-structured expert and group interviews, methods of cross-checking information from different sources, sampling techniques that can be adapted to a particular objective, methods of obtaining quantitative data in a short time frame, methods of direct observation at site level, and use of secondary data sources. Both approaches reflect an attempt to gain relevant research insights within a short period of time for the purpose of project planning, and both can be conducted at comparatively low costs. In essence, the two methodologies represent a bridge between formal surveys and unstructured research methods (Crawford 1997).

Finally, the GGPA's preliminary assessment, with its reliance on standardized data analysis, is comparable to a number of tools that focus on the quantitative analysis of green growth with the aim to benchmark countries. Examples include the use of dashboard indicators (e.g., OECD Green Growth Indicators, Eurostat's Sustainable Development Indicators), composite indices (e.g., Yale University's Environmental Performance Index, GGGI's Green Growth Index), environmental footprints (e.g., UNEP's Carbon

Footprint, Global Resource Footprint of Nations), and adjusted economic indicators (e.g., the World Bank's adjusted net savings, the OECD's environmentally adjusted multifactor productivity). The GGPA shares the element of comparing countries' performances based on data analysis. However, since the GGPA focuses on a single country at a time, the standardized benchmarking process is supported by a more qualitative assessment, verifying the results through an extensive literature review and placing each indicator in the specific national context. Furthermore, the assessment is unique in combining this data analysis with stakeholder consultation.

While the past four years have demonstrated the GGPA's usefulness, experiences made during that period have also triggered a wide range of revisions to the initial assessment process. This report provides a detailed overview of the assessment methodology in its current form and the extensive changes made to it since the first GGPA was conducted in 2016. These revisions encompass all three stages of the assessment process: the preliminary assessment, consultation process, and final analysis. This report provides a detailed rationale for the revisions, explaining how they contributed to the GGPA becoming a more useful tool for GGGI and the organization's Partners. Finally, the report highlights aspects where further improvements are desirable, because—as with any methodology—the refinement of the GGPA methodology is an open-ended process. Future adjustments will be needed when additional globally comparative data becomes available, and another round of assessments will provide further insights into the potential and limitations of the current methodology.

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Appendix

A1. GGPA Indicators

	Indicator	Unit	Description	Source
A.	**Natural assets**			
A.1	**Water stress**			
A.1.1	Baseline Water Stress Index	0–5 (higher score = greater competition among users)	The ratio of total annual water withdrawals (domestic, industrial, irrigation, and livestock) to available renewable supplies. The values are normalized on a scale from 0 to 5. Renewable water resources include all surface water and groundwater resources that are available on a yearly basis without consideration of the capacity to harvest and use this resource. Exploitable water resources, which refer to the volume of surface water or groundwater that is available with an occurrence of 90% of the time, are considerably less than renewable water resources, but no universal method exists to assess such exploitable water resources. https://www.wri.org/applications/aqueduct/country-rankings/	WRI
A.1.2	Freshwater withdrawal as a proportion of available freshwater resources (SDG 6.4.2)	% of available freshwater resources	The ratio between total freshwater withdrawn by all major sectors and total renewable freshwater resources, after taking into account environmental water requirements. Main sectors, as defined by ISIC standards, include agriculture, forestry and fishing, manufacturing, the electricity industry, and services. This indicator is also known as water withdrawal intensity. Data is available for a single year (2014). This indicator is aligned with the definitions of SDG indicator 6.4.2 Freshwater withdrawal as a proportion of available freshwater resources. https://unstats.un.org/sdgs/indicators/database/	FAO
A.1.3	Long-term average annual precipitation in depth	mm per year	Long-term average (over space and time) of annual endogenous precipitation (produced in the country) in depth. Precipitation refers to any kind of water that falls from clouds, both liquid and solid. http://www.fao.org/nr/water/aquastat/data/query/index.html	FAO
A.1.4	Annual freshwater withdrawal per capita	m^3 per capita	Annual freshwater withdrawals are total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100 percent of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where water reuse is significant. Withdrawals for agriculture and industry are total withdrawals for irrigation and livestock production and for direct industrial use (including for cooling thermoelectric plants). Withdrawals for domestic uses include drinking water, municipal use or supply, and use for public services, commercial establishments, and homes. Data is collected at irregular intervals for some countries. The GGPA is using the most recent information available for any country. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Freshwater withdrawal: http://databank.worldbank.org/data/reports.aspx?source=2&series=ER.H2O.FWTL.K3 Population: http://databank.worldbank.org/data/reports.aspx?source=2&series=SP.POP.TOTL	World Bank

A.1.5	Proportion of population using safely managed drinking water services (SDG 6.1.1)	% of population	The percentage of population using safely managed drinking water services is measured by the share of population using an improved basic drinking water source which is located on premises, available when needed, and free of fecal (and priority chemical) contamination. Improved drinking water sources include the following: piped water into a dwelling, yard, or plot; public taps or standpipes; boreholes or tube wells; protected dug wells; protected springs; packaged water; delivered water; and rainwater. The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) developed the concept of "improved" water sources, which was used as a proxy for "safe water," as such sources are likely to be protected against fecal contamination. This metric has been used since 2000 to track progress toward the Millennium Development Goals target 7c. A water source is considered to be located on premises if the point of collection is within the dwelling, yard, or plot. Available when needed means that households are able to access sufficient quantities of water. Free from fecal and priority chemical contamination means that the water quality complies with relevant national or local standards. In the absence of such standards, reference is made to the WHO Guidelines for Drinking Water Quality (http://www.who.int/water_sanitation_health/dwq/guidelines/en/). E. coli or thermotolerant coliforms are the preferred indicator for microbiological quality, and arsenic and fluoride are the priority chemicals for global reporting. This indicator is aligned with the definitions of SDG indicator 6.1.1 Proportion of population using safely managed drinking water services. https://unstats.un.org/sdgs/indicators/database/	WHO, UNICEF
A.1.6	Degree of integrated water resources management (IWRM) implementation (SDG 6.5.1).	score 0–100 (100, indicating full implementation of IWRM)	The score is determined based on the results of a questionnaire on integrated water resources management (IWRM) comprising of four sections. The information required to complete the survey is expected to be held by government officials responsible for water resources management in the country, supported by official documentation. The four sections are: (1) Enabling environment: Creating the conditions that help to support the implementation of IWRM, which includes the most typical policy, legal, and strategic planning tools for IWRM. (2) Institutions and participation: The range and roles of political, social, economic, and administrative institutions and other stakeholders that help to support the implementation of IWRM. (3) Management instruments: The tools and activities that enable decision-makers and users to make rational and informed choices between alternative actions. (4) Financing: Budgeting and financing made available and used for water resources development and management from various sources. Each section contains two subsections: the first covering the national level and the second covering subnational, basin/aquifer, and transboundary levels as appropriate. The question scores in each section are averaged to provide a section score. The four section scores are then averaged to create the indicator score on a scale of 0–100. This indicator is aligned with the definitions of SDG indicator 6.5.1 Degree of integrated water resources management (IWRM) implementation. Data is available for a single year (2017). https://unstats.un.org/sdgs/indicators/database/	IWRM
A.2	**Water quality**			
A.2.1	Disability-adjusted life years (DALYs) due to unsafe water source	years	Disability-adjusted life years (DALYs) are the sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost. The definition of an unsafe water source considers the share of households with access to different water sources (safely managed, basic, limited, unimproved, surface water) and reported use of household water treatment methods (boiling or filtering, chlorinating or solar filtering, no treatment). Unsafe water sources refer to water from limited, unimproved, and surface water sources without any treatment. A limited water source refers to drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip including queuing. An unimproved water source refers to drinking water from an unprotected dug well or unprotected spring. Surface water refers to drinking water directly from a river, dam, lake, pond, stream, canal, or irrigation canal. Data is available for a single year (2016). http://ghdx.healthdata.org/gbd-results-tool	IHME

A.2.2	Water Quality Index	0–100 (higher scores indicate higher quality)	The Water Quality Index (WQI) uses three parameters to determine the water quality of a country's freshwater bodies, measuring nutrient levels (dissolved oxygen, total nitrogen, and total phosphorus), and two parameters measuring water chemistry (pH and conductivity). The WQI is a proximity-to-target composite of water quality, adjusted for monitoring station density in each country, with a maximum score of 100. Higher scores indicate higher water quality. Data is available for a single year (2010). https://epi.envirocenter.yale.edu/epi-downloads	EPI
A.3	**Forest cover**			
A.3.1	Total forest cover	1,000 ha	Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. http://www.fao.org/faostat/en/#data/RL	FAO
A.3.2	Change in forest cover	annual change in total forest cover (%)	The annual percent change in forest cover between 2005 and 2015. Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. http://www.fao.org/faostat/en/#data/RL	FAO
A.3.3	Forest area annual net change rate (SDG 15.2.1)	annual change (%)	The annual percent change in forest area between 2010 and 2015. Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. This indicator is aligned with the definitions of SDG indicator 15.2.1 Forest area annual net change rate. Under SDG 15.2.1, this indicator is used as a measure for sustainable forest management. The sub-indicator focuses on both (1) the direction of change (whether there is a loss or gain in forest area), and (2) how the change rate varies over time (to capture progress among countries that are losing forest area but have managed to reduce the rate of annual forest area loss). https://unstats.un.org/sdgs/indicators/database/	FAO
A.3.4	Total primary forest cover	1,000 ha	Primary forests are defined as naturally regenerated forests of native species, where there are no clearly visible indications of human activities, and the ecological processes are not significantly disturbed. Some key characteristics of primary forests include the following: they show natural forest dynamics, such as natural tree species composition, occurrence of dead wood, natural age structure, and natural regeneration processes; the area is large enough to maintain its natural characteristics; and there has been no known significant human intervention or the last significant human intervention was long enough ago for the natural species composition and processes to reestablish. http://www.fao.org/faostat/en/#data/RL	FAO
A.3.5	Change in primary forest cover	annual change in primary forest cover (%)	The annual percent change in primary forest cover between 2005 and 2015. Primary forests are defined as naturally regenerated forests of native species, where there are no clearly visible indications of human activities, and the ecological processes are not significantly disturbed. Some key characteristics of primary forests include the following: they show natural forest dynamics, such as natural tree species composition, occurrence of dead wood, natural age structure, and natural regeneration processes; the area is large enough to maintain its natural characteristics; and there has been no known significant human intervention or the last significant human intervention was long enough ago for the natural species composition and processes to reestablish. http://www.fao.org/faostat/en/#data/RL	FAO
A.3.6.	Forest area as a proportion of total land area (SDG 15.1.1)	% of total land area	Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. Total land area is defined as the total surface area of a country less the area covered by inland waters (e.g., major rivers and lakes). This indicator is aligned with the definitions of SDG indicator 15.1.1 Forest area as a proportion of total land area. https://unstats.un.org/sdgs/indicators/database/	FAO

A.3.7	Change in above-ground biomass in forest per hectare (SDG 15.2.1)	annual change (%)	The annual percent change in biomass in forests between 2010 and 2015. Biomass in forest is defined as all living biomass above the soil, including stem, stump, branches, bark, seeds, and foliage. The changes in the above-ground biomass stock in forest indicate the balance between gains in biomass stock due to forest growth and losses due to wood removals, natural losses, fire, wind, pests, and diseases. This indicator is aligned with the definitions of SDG indicator 15.2.1 Change in above-ground biomass in forest per hectare. Under SDG 15.2.1, the indicator is used as a measure for sustainable forest management. At the country level and over a longer period, sustainable forest management would imply a stable or increasing biomass stock per hectare. https://unstats.un.org/sdgs/indicators/database/	FAO
A.3.8	Proportion of forest area certified under an independently verified certification scheme (SDG 15.2.1)	annual change (%)	The annual percent change between 2010 and 2015 in forest area certified under a forest management certification scheme, with published standards and independently verified by a third party. Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. This indicator is aligned with the definitions of SDG indicator 15.2.1. Proportion of forest area certified under an independently verified certification scheme. Under SDG 15.2.1, this indicator is used as a measure for sustainable forest management. The certification schemes apply standards that generally are higher than those established by the countries' own normative frameworks, and compliance is verified by an independent and accredited certifier. It should be noted that there are significant areas of sustainably managed forest which are not certified, either because their owners have chosen not to seek certification (which is voluntary and market-based) or because no credible or affordable certification scheme is in place for that area. https://unstats.un.org/sdgs/indicators/database/	FAO
A.3.9	Proportion of forest area with a long-term management plan (SDG 15.2.1)	annual change (%)	The annual percent change between 2005 and 2010 in forest area that has a long-term documented management plan, aiming at defined management goals, which is periodically revised. Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. This indicator is aligned with the definitions of SDG indicator 15.2.1 Proportion of forest area with a long-term management plan. Under SDG 15.2.1, this indicator is used as a measure for sustainable forest management. The existence of a documented forest management plan is regarded as the basis for long-term and sustainable management of the forest resources for a variety of management objectives, such as for wood and non-wood forest products, protection of soil and water, biodiversity conservation, social and cultural use, and a combination of two or several of these. https://unstats.un.org/sdgs/indicators/database/	FAO
A.3.10	Proportion of forest area within legally established protected areas (SDG 15.2.1)	annual change (%)	The annual percent change between 2010 and 2015 in forest area within formally established protected areas independent of the purpose for which the protected areas were established. Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. This indicator is aligned with the definitions of SDG indicator 15.2.1 Proportion of forest area within legally established protected areas. Under SDG 15.2.1, this indicator is used as a measure for sustainable forest management. The change in forest area within legally protected areas is regarded as a proxy for trends in forest biodiversity conservation and an indication of the political will to protect and conserve forest biodiversity. https://unstats.un.org/sdgs/indicators/database/	FAO

A.4	Air quality			
A.4.1	Population-weighted exposure to $PM_{2.5}$ (three-year average)	% of population	The indicator measures the weighted percentage of a country's population exposed to annual concentrations of $PM_{2.5}$ that exceed WHO guidelines at four different levels, with (1) PM1 defined as the share of population exposed to annual surface concentration levels of $PM_{2.5}$ beyond 10 µg/m³, (2) PM2 defined as the share of population exposed to annual surface concentration levels of $PM_{2.5}$ beyond 15 µg/m³, (3) PM3 defined as the share of population exposed to annual surface concentration levels of $PM_{2.5}$ beyond 25 µg/m³, and (4) PM4 defined as the share of population exposed to annual surface concentration levels of $PM_{2.5}$ beyond 35 µg/m³. Higher concentration levels are given higher weights in the averaging process, with PMW = 0.1 x PM1 + 0.2 x PM2 + 0.3 x PM3 + 0.4 x PM4. Population distribution (PDS) was intersected with spatial masks representing the four different global surface levels of $PM_{2.5}$ concentrations, and the population within the areas above the respective thresholds was summed for each country. The population within the areas of exceedance was then divided by the country population to arrive at the percentage of population in areas exceeding each threshold. https://epi.envirocenter.yale.edu/epi-downloads	EPI
A.4.2	Population-weighted annual mean levels of fine particulate matter in urban areas (SDG 11.6.2)	µg / m³	The mean annual concentration of fine suspended particles of less than 2.5 micrometers in diameters ($PM_{2.5}$) is a common measure of air pollution. The mean is a population-weighted average for urban population in a country and is expressed in micrograms per cubic meter. This indicator is aligned with the definitions of SDG indicator 11.6.2 Annual mean levels of fine particulate matter (e.g., $PM_{2.5}$ and PM_{10}) in cities (population weighted). Data is available for a single year (2016). https://unstats.un.org/sdgs/indicators/database/	WHO
A.4.3	Disability-adjusted life years (DALYs) due to ambient particulate matter pollution	life years	Disability-adjusted life years (DALYs) are the sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost. Ambient particulate matter pollution refers to the annual average daily exposure to outdoor air concentrations of fine suspended particles of less than 2.5 micrometers in diameter ($PM_{2.5}$), measured in micrograms per cubic meter. http://ghdx.healthdata.org/gbd-results-tool	IHME
A.4.4	Mortality rate attributed to household and ambient air pollution (SDG 3.9.1)	number per 100,000 population	Death rates are calculated by dividing the number of deaths by the total population. The mortality associated with household and ambient air pollution was estimated based on the calculation of the joint population attributable fractions (PAF), assuming independently distributed exposures and independent hazards. PAF is the fraction of disease seen in a population that can be attributed to the exposure (household and ambient air pollution). It was applied to the total burden of disease (e.g., cardiopulmonary disease expressed as deaths). Evidence from epidemiological studies have shown that exposure to air pollution is linked, among others, to the diseases taken into account in this estimate, including acute respiratory infections (estimated for all ages); cerebrovascular diseases in adults (estimated above 25 years); ischemic heart diseases in adults (estimated above 25 years); chronic obstructive pulmonary disease in adults (estimated above 25 years); and lung cancer in adults (estimated above 25 years). This indicator is aligned with the definitions of SDG indicator 3.9.1 Age-standardized mortality rate attributed to ambient air pollution (deaths per 100,000 population). Data is available for a single year (2016). https://unstats.un.org/sdgs/indicators/database/	WHO
A.4.5	Disability-adjusted life years (DALYs) due to household air pollution from solid fuels	years	Disability-adjusted life years (DALYs) are the sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost. Household air pollution from solid fuels is defined as individual exposure to fine suspended particles of less than 2.5 micrometers in diameter ($PM_{2.5}$) due to the use of solid cooking fuels. http://ghdx.healthdata.org/gbd-results-tool	IHME
A.4.6	Disability-adjusted life years (DALYs) due to ambient ozone pollution	years	Disability-adjusted life years (DALYs) are the sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost. Ambient ozone pollution refers to seasonal (3 months) hourly maximum ozone concentrations, measured in parts per billion (ppb). http://ghdx.healthdata.org/gbd-results-tool	IHME

A.4.7	Access to clean fuels and technologies for cooking	% of population	Access to clean fuels and technologies for cooking is defined as the share of a country's total population primarily using clean cooking fuels and technologies for cooking. Following WHO guidelines, kerosene is excluded from clean cooking fuels. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.CFT.ACCS.ZS	World Bank
A.5	**Soil conditions**			
A.5.1	Trends in Soil Health Index	0–50 (higher score = better soil condition)	The Trends in Soil Health Index measures the physical part related to loss of soil mass and structure and the long-term chemical conditions of the soil in terms of nutrients and absence of toxicities built up. Data is available for a single year (2005). Unpublished document.	FAO
A.5.2	Use of inorganic fertilizers	kg/ha	The data describes the use of chemical and mineral fertilizers per area of cropland (which corresponds to the sum of arable land and permanent crops) at national, regional, and global level in a time series from 2002 to 2016. The fertilizers include nutrient nitrogen N, nutrient phosphate P2O5, and nutrient potash K2O. http://www.fao.org/faostat/en/?#data/EF	FAO
A.5.3	Use of pesticides	kg/ha	The indicator is defined as the annual agricultural use of total pesticides in active ingredients for the following categories of pesticides: fungicides, bactericides, herbicides, insecticides, plant growth regulators, seed treatment fungicides, seed treatment insecticides, mineral oils, rodenticides, disinfectants, and other pesticides NES (not elsewhere specified). The sum of active ingredients is divided by the area of cropland (which is the sum of arable land and land under permanent crops). http://www.fao.org/faostat/en/#data/EP	FAO
A.6	**Biodiversity**			
A.6.1	Red List Index (SDG 15.5.1)	0 (extinct) –1 (least concern)	The Red List Index measures change in aggregate extinction risk across groups of species. It is based on genuine changes in the number of species in each category of extinction risk on the IUCN Red List of Threatened Species (IUCN 2015). The Red List Index value ranges from 1 (all species are categorized as "least concern") to 0 (all species are categorized as "extinct") and indicates how far a county's set of species has moved overall toward extinction. This indicator is aligned with the definitions of SDG indicator 15.5.1 Red List Index. https://unstats.un.org/sdgs/indicators/database/	IUCN, BLI
A.6.2	Share of threatened species of a country's total species	% of total species	Number of threatened animal species and plant species divided by total number of species in each IUCN Red List Category within a given country. Threatened species are defined as the sum of "Critically Endangered," "Endangered," and "Vulnerable" categories in the IUCN Red List. https://www.iucnredlist.org/resources/summary-statistics	IUCN
A.6.3	Change in the number of threatened species	% change	Changes in the number of endangered species in a country, based on the IUCN Red List of Threatened Species between 2013 and 2015. Endangered species are defined as the sum of "Critically Endangered," "Endangered," and "Vulnerable" categories in the IUCN Red List. http://cmsdocs.s3.amazonaws.com/summarystats/2015-4_Summary_Stats_Page_Documents/2015_4_RL_Stats_Table_5.pdf	

A.7	Fish stocks			
A.7.1	Fish stocks, share of overexploited species in total catch	% of overexploited species in total catch	Fish stocks measures the percentage of a country's total catch—within its exclusive economic zone (EEZ)—that is comprised of species that are overexploited or collapsed. The data for the indicator was published as part of Yale University's Environmental Protection Index but has been discontinued. The latest data available covers the year 2010. http://epi2016.yale.edu/sites/default/files/2016EPI_Full_Report_opt.pdf	EPI
A.7.2	Captured fish, total amount of nominal catch	thousand tons	Total amount of nominal catches of freshwater, brackish water, and marine species of fish, crustaceans, mollusks and other aquatic animals and plants, killed, caught, trapped, or collected for all commercial, industrial, recreational, and subsistence purposes. The nominal catch concept refers to the landings converted to a live weight basis. Landings refers to the quantities on a landed weight basis. In many fisheries, the landed quantities (landings) are identical to the quantities caught (nominal catches). http://www.fao.org/fishery/statistics/global-capture-production/query/en	FAO
A.7.3	Aquaculture, total amount of farming of aquatic organisms	thousand tons	Total amount of farming of aquatic organisms, including fish, mollusks, crustaceans, and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, and protection from predators. Farming also implies individual or corporate ownership of the stock being cultivated. http://www.fao.org/fishery/statistics/global-aquaculture-production/query/en	FAO
A.8	**Protected areas**			
A.8.1	Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas (SDG 15.1.2)	% of terrestrial biodiversity sites covered by protected areas	This indicator captures the share of important sites for terrestrial and freshwater biodiversity that are covered by designated protected areas. Important sites are defined as areas that contribute significantly to the global persistence of biodiversity. They include 10,993 Important Bird Areas and 588 Alliance for Zero Extinction sites. This indicator is aligned with the definitions of SDG indicator 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type. https://unstats.un.org/sdgs/indicators/database/	UNEP-WCMC, BLI, IUCN
A.8.2	Coverage of protected areas in relation to marine areas (SDG 14.5.1)	% of marine biodiversity sites covered by protected areas	The indicator captures the share of important sites for marine biodiversity that is covered by designated protected areas. Important sites are defined as areas that contribute significantly to the global persistence of biodiversity. They include 10,993 Important Bird Areas and 588 Alliance for Zero Extinction sites. This indicator is aligned with the definitions of SDG indicator 14.5.1 Coverage of protected areas in relation to marine areas (exclusive economic zones). Data is available for a single year (2017). https://unstats.un.org/sdgs/indicators/database/	UNEP-WCMC, BLI, IUCN

	Indicator	Unit	Description	Source
B.	**Efficient use of resources**			
B.1	**Energy consumption**			
B.1.1	Energy intensity (SDG 7.3.1)	MJ/USD (constant 2011 PPP)	Energy intensity is defined at total primary energy supply (TPES) divided by GDP measured at purchasing power parity in constant 2011 US dollars. TPES, as defined by the International Recommendations for Energy Statistics (IRES), is measured as indigenous production plus imports, minus exports, stock changes, and fuels supplied to international marine and aviation. Primary energy is any energy commodity that can be captured directly from natural resources without transformation. Gross domestic product (GDP) is the measure of economic output. For comparisons over time, GDP is measured in constant terms. This indicator is aligned with the definitions of SDG indicator 7.3.1 Energy intensity measured in terms of primary energy and GDP. http://data.worldbank.org/indicator/EG.EGY.PRIM.PP.KD https://unstats.un.org/sdgs/indicators/database/	World Bank (IEA, UNSD, UN Energy)
B.1.2	Energy intensity of the industry sector	MJ/USD (current)	Energy intensity of the industry sector is defined as total final consumption (TFC) of energy in the industry sector divided by value added of the industry sector. TFC of energy in the industry sector includes fuel used within the manufacturing and construction industries, iron and steel, chemicals and petrochemicals, non-metallic minerals, and pulp and paper. Transformation of energy into another form or for the production of fuels is excluded. Consumption of fuels for the transport of goods is included in the transport sector. Value added in the industry sector is the net output of the industry sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. Industry corresponds to ISIC divisions 10–45 and includes manufacturing (ISIC divisions 15–37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Data is in current USD. Total final consumption: IEA 2018, World Energy Balances, proprietary data Value added: https://data.worldbank.org/indicator/NV.IND.TOTL.CD	IEA, World Bank
B.1.3	Energy intensity of road transport	million vehicle-km/toe	Energy intensity of road passenger transport is defined as annual traffic volume divided by road transport energy consumption. Annual traffic volume includes the following vehicle categories: passenger cars, buses and motor coaches, and motorcycles. Annual traffic volume: IRF 2017, World Road Statistics, proprietary data Road energy consumption: IEA 2018, proprietary data	IEA, IRF
B.1.4	Share of primary sector in the national economy (value added)	% of GDP	The primary sector corresponds to ISIC divisions 1–5 and includes forestry, hunting, and fishing as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4. The United Nations System of National Accounts calls for value added to be valued at either basic prices (excluding net taxes on products) or producer prices (including net taxes on products paid by producers but excluding sales or value added taxes). Both valuations exclude transport charges that are invoiced separately by producers. Total GDP is measured at purchaser prices. Value added by industry is normally measured at basic prices. http://databank.worldbank.org/data/reports.aspx?source=2&series=NV.AGR.TOTL.ZS	World Bank
B.1.5	Share of secondary sector in the national economy (value added)	% of GDP	The secondary sector corresponds to ISIC divisions 10–45 and includes manufacturing (ISIC divisions 15–37). It comprises value added in mining, manufacturing, construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4. The United Nations System of National Accounts calls for value added to be valued at either basic prices (excluding net taxes on products) or producer prices (including net taxes on products paid by producers but excluding sales or value added taxes). Both valuations exclude transport charges that are invoiced separately by producers. Total GDP is measured at purchaser prices. Value added by industry is normally measured at basic prices. http://databank.worldbank.org/data/reports.aspx?source=2&series=NV.IND.TOTL.ZS	World Bank

B.1.6	Share of tertiary sector in the national economy (value added)	% of GDP	The tertiary sector corresponds to ISIC divisions 50–99, and they include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3 or 4. The United Nations System of National Accounts calls for value added to be valued at either basic prices (excluding net taxes on products) or producer prices (including net taxes on products paid by producers but excluding sales or value added taxes). Both valuations exclude transport charges that are invoiced separately by producers. Total GDP is measured at purchaser prices. Value added by industry is normally measured at basic prices. Financial intermediation services indirectly measured (FISIM) is an indirect measure of the value of financial intermediation services (i.e., output) provided, but for which financial institutions do not charge explicitly as compared to explicit bank charges. Although the 1993 SNA recommends that the FISIM are allocated as intermediate and final consumption to the users, many countries still make a global (negative) adjustment to the sum of gross value added. https://data.worldbank.org/indicator/NV.SRV.TOTL.ZS	World Bank
B.1.7	Manufacturing value added per capita (SDG 9.2.1)	USD (constant 2010)	Manufacturing value added (MVA) per capita is defined as MVA in constant 2010 US dollars divided by the total population of a country or area. Gross value added is defined as output minus intermediate consumption and equals the sum of employee compensation, gross operating surplus of government and corporations, gross mixed income of unincorporated enterprises, and taxes less subsidies on production and imports, except for net taxes on products (System of National Accounts 2008). Manufacturing refers to industries belonging to sector C defined by International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4, or sector D (ISIC divisions 15-37) defined by ISIC Revision 3. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 9.2.1 Manufacturing value added per capita at constant 2010 US dollars. https://unstats.un.org/sdgs/indicators/database/	UNIDO
B.1.8	Manufacturing value added as share of GDP (SDG 9.2.1)	% of GDP (constant 2010 USD)	Manufacturing value added (MVA) as a proportion of gross domestic product (GDP) is the ratio between MVA and GDP, both reported in constant 2010 US dollars. Gross value added is defined as output minus intermediate consumption and equals the sum of employee compensation, gross operating surplus of government and corporations, gross mixed income of unincorporated enterprises and taxes less subsidies on production and imports, except for net taxes on products (System of National Accounts 2008). Manufacturing refers to industries belonging to sector C defined by International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4, or sector D (ISIC divisions 15-37) defined by ISIC Revision 3. This indicator is aligned with the definitions of SDG indicator 9.2.1 Manufacturing value added share in GDP. https://unstats.un.org/sdgs/indicators/database/	UNIDO
B.1.9	Manufacturing employment as a proportion of total employment (SDG 9.2.2)	% of total employment	The indicator is defined as employment in manufacturing divided by total employment. Employment is defined as comprising all persons of working age who, during a specified period, were in the following categories: (1) paid employment (whether at work or with a job but not at work) or (2) self-employment (whether at work or with an enterprise but not at work). No distinction is made between persons employed full time and those working less than full time. Manufacturing refers to industries belonging to sector C defined by International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4, or sector D (ISIC divisions 15-37) defined by ISIC Revision 3. This indicator is aligned with the definitions of SDG indicator 9.2.2 Manufacturing employment as a proportion of total employment. https://unstats.un.org/sdgs/indicators/database/	UNIDO

B.1.10	Energy use per capita	kg of oil equivalent per capita	Energy use per capita is defined as TPES divided by the total population of a country or area. TPES is defined as indigenous production plus imports, minus exports, stock changes, and fuels supplied to ships and aircraft engaged in international transport. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.USE.PCAP.KG.OE	World Bank
B.1.11	GDP per capita	USD (current)	GDP per capita is gross domestic product divided by the total population of a country or area. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://databank.worldbank.org/data/reports.aspx?source=2&series=NY.GDP.PCAP.CD	World Bank
B.1.12	Proportion of population with access to electricity (SDG 7.1.1)	% of population	Following the definitions put forward by the IEA and UN, the indicator captures the number of households with an electricity connection divided by the total number of households within the country. In its current form, this indicator is aligned with the definitions of SDG indicator 7.1.1 Proportion of population with access to electricity. https://datacatalog.worldbank.org/search?search_api_views_fulltext_op=AND&query=access+to+electricity&nid=&=Apply&sort_by=search_api_relevance&sort_by=search_api_relevance	World Bank
B.1.13	Total primary energy supply by fuel	ktoe	Total primary energy supply (TPES), as defined by the International Recommendations for Energy Statistics (IRES), is measured as indigenous production plus imports, minus exports, stock changes, and fuels supplied to international marine and aviation. Primary energy is any energy commodity that can be captured directly from natural resources without transformation. IEA 2018, World Energy Balances, proprietary data	IEA
B.1.14	Total final consumption by fuel and by sector	ktoe	Total final consumption (TFC) is the sum of energy consumption by the different end-use sectors. TFC is broken down into energy demand in the following sectors: industry, transport, buildings (including residential and services), and other (including agriculture and non-energy use). It excludes international marine and aviation bunkers, except at the world level where it is included in the transport sector. IEA 2018, World Energy Balances, proprietary data	IEA
B.1.15	Net imports by fuel	ktoe	Net imports are defined as the difference of imports minus exports. Imports and exports comprise amounts having crossed the national territorial boundaries of a country, whether or not customs clearance has taken place. IEA 2018, World Energy Balances, proprietary data	IEA
B.2	**Conversion, transmission, and distribution of electricity**			
B.2.1	Transmission and distribution losses	% of output	Transmission and distribution losses include both technical and non-technical electricity losses. Technical losses are caused by physical characteristics of the grid and the electricity-generating system. The amount of losses is mainly dependent on the length of power lines, voltage of transmission and distribution, and quality of network. Transmission and distribution losses comprise all losses due to the transport and distribution of electrical energy, including losses in overhead transmission lines and distribution networks as well as losses in transformers which are not considered as integral parts of the power plants. Non-technical losses mainly refer to inaccurate metering and electricity theft. http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS	World Bank
B.2.2	Conversion efficiency of fossil-fired electricity generation	toe/GWh	The amount to fossil fuel consumed for electricity generation divided by the amount of generated electricity. Electricity generated by combined heat and power (CHP) plants is excluded. Data is available for a single year (2016). IEA 2018, World Energy Balances, proprietary data	IEA

B.2.3	Occurrences of electrical outages	% of companies experiencing electrical outages	The indicator reflects the share of companies having experienced electrical outages during the previous fiscal year. Data is collected through surveys conducted by private contractors on behalf of the World Bank, with generally 1,200–1,800 interviews being conducted in larger economies, 360 interviews in medium-sized economies, and 150 interviews in smaller economies. The manufacturing and services sectors are the primary business sectors of interest. Formal (registered) companies with five or more employees are targeted for interview. Service companies include construction, retail, wholesale, hotels, restaurants, transport, storage, communications, and IT. Firms with 100% government/state ownership are not eligible for the survey. Occasionally, for a few surveyed countries, companies from other sectors are included in the survey, such as education or health-related businesses. In each country, businesses in the cities/regions of major economic activity are interviewed following the Manufacturing Questionnaire and the Services Questionnaire. In some countries, other surveys, which depart from the usual Enterprise Survey methodology, are conducted. Examples include (1) surveys of informal (unregistered) enterprises, (2) micro-surveys covering registered firms with less than five employees, and (3) financial crisis assessment surveys administered by telephone to assess the effects of the global financial crisis of 2008–09. https://data.worldbank.org/indicator/IC.ELC.OUTG.ZS	World Bank
B.2.4	Average number of electrical outages per month	number per month	The indicator reflects the number of electrical outages reported by those companies which had experienced electrical outages during the previous fiscal year. Data is collected through surveys conducted by private contractors on behalf of the World Bank, with generally 1,200–1,800 interviews being conducted in larger economies, 360 interviews in medium-sized economies, and 150 interviews in smaller economies. https://www.enterprisesurveys.org/content/dam/enterprisesurveys/documents/methodology/Indicator-Descriptions.pdf	World Bank
B.2.5	Average duration of an electrical outage	hours	The indicator reflects the average duration of electrical outages reported by those companies which had experienced electrical outages during the previous fiscal year. Data is collected through surveys conducted by private contractors on behalf of the World Bank, with generally 1200–1800 interviews being conducted in larger economies, 360 interviews in medium-sized economies, and 150 interviews in smaller economies. https://www.enterprisesurveys.org/content/dam/enterprisesurveys/documents/methodology/Indicator-Descriptions.pdf	World Bank
B.2.6	Electricity mix	GWh	The indicator captures the amount of electricity generated by the following types of fuel over one calendar year. Coal and peat include all coal, both primary (including hard coal and lignite) and derived fuels (including patent fuel, coke oven coke, gas coke, BKB, gas works gas, coke oven gas, blast furnace gas, and oxygen steel furnace gas). Natural gas comprises gases, occurring in underground deposits, whether liquefied or gaseous, consisting mainly of methane. It includes both non-associated gas originating from fields producing only hydrocarbons in gaseous form and associated gas produced in association with crude oil as well as methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas). It includes gas consumed by gas processing plants and gas transported by pipeline. Quantities of gas that are reinjected, vented, or flared are excluded. Crude oil comprises crude oil, natural gas liquids, refinery feedstocks, and additives as well as “other hydrocarbons.” Crude oil includes field or lease condensates (separator liquids), which are recovered from associated and non-associated gas where it is commingled with the commercial crude oil stream. Oil products comprise refinery gas, ethane, LPG, aviation gasoline, motor gasoline, jet fuels, kerosene, gas/diesel oil, fuel oil, naphtha, white spirit, lubricants, bitumen, paraffin waxes, petroleum coke, and “other oil products.” Oil products are any oil-based products which can be obtained by distillation and are normally used outside the refining industry, except finished products, which are classified as refinery feedstocks. Hydro refers to the electricity produced in hydro power plants. Hydro output excludes output from pumped storage plants. Biofuels and waste are comprised of solid biofuels, liquid biofuels, biogases, industrial waste, and municipal waste. The non-energy use of biomass is not taken into consideration, and quantities are null by definition. Renewables include geothermal, solar, wind, and tide/wave/ocean energy and the use of these energy forms for electricity and heat generation. Unless the actual efficiency of the geothermal process is known, the quantity of geothermal energy entering electricity generation is inferred from the electricity production at geothermal plants, assuming an average thermal efficiency of 10%. For solar, wind, and tide/wave/ocean energy, the quantities entering electricity generation are equal to the electrical energy generated. IEA 2018, World Energy Balances, proprietary data	IEA

B.3	Water productivity			
B.3.1	Water productivity	USD/m^3 per year (constant 2010)	Water productivity is defined as total GDP divided by annual freshwater withdrawal. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. GDP is expressed in constant 2010 US dollars. Annual freshwater withdrawal is defined as an economy's total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100% of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where water reuse is significant. Withdrawals for agriculture and industry are total withdrawals for irrigation and livestock production and for direct industrial use (including for cooling thermoelectric plants). Withdrawals for domestic uses include drinking water, municipal use or supply, and use for public services, commercial establishments, and homes. Data is collected at irregular intervals for some countries. The GGPA is using the most recent value available for any country. http://data.worldbank.org/indicator/ER.GDP.FWTL.M3.KD	World Bank
B.3.2	Annual freshwater withdrawals, industry	% of total freshwater withdrawal	The indicator is the share of annual freshwater withdrawals by industry within total annual freshwater withdrawals. Annual freshwater withdrawal is defined as an economy's total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100% of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where there is significant water reuse. Withdrawals for industry are total withdrawals for direct industrial use (including withdrawals for cooling thermoelectric plants). http://databank.worldbank.org/data/reports.aspx?source=2&series=ER.H2O.FWIN.ZS	World Bank
B.3.3	Annual freshwater withdrawals, agriculture	% of total freshwater withdrawal	The indicator is the share of annual freshwater withdrawals by agriculture within total annual freshwater withdrawals. Annual freshwater withdrawal is defined as an economy's total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100% of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where there is significant water reuse. Withdrawals for agriculture are total withdrawals for irrigation and livestock production. http://databank.worldbank.org/data/reports.aspx?source=2&series=ER.H2O.FWAG.ZS	World Bank
B.3.4	Annual freshwater withdrawals, domestic	% of total freshwater withdrawal	The indicator is the share of annual freshwater withdrawals for domestic uses within total annual freshwater withdrawals. Annual freshwater withdrawal is defined as an economy's total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100% of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where there is significant water reuse. Withdrawals for domestic uses include drinking water, municipal use or supply, and use for public services, commercial establishments, and homes. http://databank.worldbank.org/data/reports.aspx?source=2&series=ER.H2O.FWDM.ZS	World Bank
B.3.5	Annual freshwater withdrawal per capita	m^3 per capita	The indicator is defined as total annual freshwater withdrawals divided by the total population of a country or area. Annual freshwater withdrawal is defined as an economy's total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100% of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where water reuse is significant. Withdrawals for agriculture and industry are total withdrawals for irrigation and livestock production and for direct industrial use (including for cooling). Withdrawals for domestic uses include drinking water, municipal use or supply, and use for public services, commercial establishments, and residences. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Freshwater withdrawal: http://databank.worldbank.org/data/reports.aspx?source=2&series=ER.H2O.FWTL.K3 Population: http://databank.worldbank.org/data/reports.aspx?source=2&series=SP.POP.TOTL	World Bank

B.3.6	Baseline Water Stress Index	0–5 (higher score = greater competition among users)	The ratio of total annual water withdrawals (municipal, industrial, and agricultural) to total renewable supply. The values are normalized on a scale from 0 to 5. Renewable water resources include all surface water and groundwater resources that are available on a yearly basis without consideration of the capacity to harvest and use this resource. Exploitable water resources, which refer to the volume of surface water or groundwater that is available with an occurrence of 90% of the time, are considerably less than renewable water resources, but no universal method exists to assess such exploitable water resources. The indicator is based on a one-time evaluation by WRI covering 2013. https://www.wri.org/resources/charts-graphs/water-stress-country	WRI
B.4	**Agricultural productivity**			
B.4.1	Agricultural productivity	international dollar /km^2 per year	Agricultural productivity is defined as agricultural production divided by agricultural land area. Agricultural production is captured in the form of the economic value of agricultural output. It is calculated by multiplying gross production in physical terms by output prices at the farm gate. Since intermediate uses within the agricultural sector (seed and feed) have not been subtracted from production data, this value of production aggregate refers to the notion of "gross production." Value of production in constant terms is derived using the average prices of a selected year or years, known as the base period. US dollar figures for value of gross production are converted from local currencies using official exchange rates as prevailing in the respective years and expressed at constant 2004–2006 US dollars. Agricultural land area is defined as the total area of arable land under permanent crops and under permanent pastures. See B.4.4 for more details. Agricultural production: http://www.fao.org/faostat/en/#data/QV Agricultural land: http://data.worldbank.org/indicator/AG.LND.AGRI.K2	FAO, World Bank
B.4.2	Growth in agricultural productivity	annual growth rate (%)	Growth in agricultural productivity is defined as the annual growth rate of agricultural production divided by agricultural land area. Agricultural production is captured in the form of the economic value of agricultural output. It is calculated by multiplying gross production in physical terms by output prices at the farm gate. Since intermediate uses within the agricultural sector (seed and feed) have not been subtracted from production data, this value of production aggregate refers to the notion of "gross production." Value of production in constant terms is derived using the average prices of a selected year or years, known as the base period. US dollar figures for value of gross production are converted from local currencies using official exchange rates as prevailing in the respective years and expressed at constant 2004–2006 US dollars. Agricultural land area is defined as the total area of arable land under permanent crops and under permanent pastures. See B.4.4 for more details. Agricultural production: http://www.fao.org/faostat/en/#data/QV Agricultural land: http://data.worldbank.org/indicator/AG.LND.AGRI.K2	FAO, World Bank
B.4.3	Agricultural production	thousand international USD	Agricultural production is defined as gross production in physical terms multiplied by output prices at the farm gate. Value of production in constant terms is derived using the average prices of a selected year or years, known as the base period. US dollar figures for value of gross production are converted from local currencies using official exchange rates as prevailing in the respective years and expressed at constant 2004–2006 US dollars. http://www.fao.org/faostat/en/#data/QV	FAO
B.4.4	Share of agricultural land in total land area	%	Agricultural land refers to the total land area that is arable, under permanent crops, and under permanent pastures. Arable land includes land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines but excludes land under trees grown for wood or timber. Permanent pasture is land used for five or more years for forage, including natural and cultivated crops. Total land area is defined by FAO as the area under national sovereignty excluding the area under inland waters and coastal waters. Country area is defined as area under national sovereignty and is the sum of land area, inland waters, and coastal waters and excludes the exclusive economic zone. Agricultural land: http://databank.worldbank.org/data/reports.aspx?source=2&series=AG.LND.AGRI.K2 Land area: http://www.fao.org/faostat/en/#search/Land%20area	World Bank

B.4.5	Water withdrawal for agricultural use	% of total water withdrawal	The indicator is the share of annual freshwater withdrawals for agriculture in total annual freshwater withdrawals. Annual freshwater withdrawals for agriculture is defined as the quantity of self-supplied water withdrawn for irrigation, livestock, and aquaculture purposes. It can include water from primary renewable and secondary freshwater resources, as well as water from over-abstraction of renewable groundwater, or withdrawal from fossil groundwater, direct use of agricultural drainage water, direct use of (treated) wastewater, and desalinated water. Water for the dairy and meat industries and industrial processing of harvested agricultural products is excluded. Annual freshwater withdrawals refer to total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. http://www.fao.org/nr/water/aquastat/data/glossary/search.html?termId=4250&submitBtn=s&cls=yes	FAO
B.4.6	Fertilizers use per area of cropland	kg/ha	The data describes the use of chemical and mineral fertilizers per area of cropland (which corresponds to the sum of arable land and permanent crops) at national, regional, and global levels in a time series from 2002 to 2016. The fertilizers include nutrient nitrogen N, nutrient phosphate P2O5, and nutrient potash K2O. http://www.fao.org/faostat/en/?#data/EF	FAO
B.4.7	Pesticides use per area of cropland	kg/ha	The indicator is defined as the annual agricultural use of total pesticides in active ingredients for the following categories of pesticides: fungicides, bactericides, herbicides, insecticides, plant growth regulators, seed treatment fungicides, seed treatment insecticides, mineral oils, rodenticides, disinfectants, and other pesticides NES (not elsewhere specified). The sum of active ingredients is divided by the area of cropland (which is the sum of arable land and land under permanent crops). http://www.fao.org/faostat/en/#data/EP	FAO
B.4.8	Agriculture Orientation Index for Government Expenditures (SDG 2.a.1)	ratio	The Agriculture Orientation Index (AOI) for Government Expenditures is defined as the share of government expenditures in agriculture divided by the share of value added from the agriculture sector in total GDP. Government expenditure is defined as expenditure by the national government on agriculture as a share of total expenditure by the national government. The indicator only captures expenditures by the national government; interventions by subnational governments are excluded. Government expenditures are all outlays or expenses associated with supporting a particular sector, including compensation of employees and subsidies and grants paid as transfers to individuals or corporations in that sector. For a full description, see the *Government Finance Statistics Manual* (GFSM) *2001*, developed by the International Monetary Fund (http://www.imf.org/external/pubs/ft/gfs/manual/). The agriculture sector refers to the agriculture, forestry, fishing, and hunting sector. A score greater than 1 reflects a comparatively higher orientation toward the agriculture sector, which receives a higher share of government spending relative to its contribution to economic value added. A score lower than 1 reflects a lower orientation to agriculture, while a score equal to 1 reflects neutrality in a government's orientation to the agriculture sector. This indicator is aligned with the definitions of SDG indicator 2.a.1 Agriculture Orientation Index for Government Expenditures. https://unstats.un.org/sdgs/indicators/database/	FAO

B.5	Labor productivity			
B.5.1	Labor productivity	thousand USD (constant 2010)	Labor productivity represents the total volume of output, measured in terms of GDP, produced per unit of labor, measured in terms of the number of employed persons, during a given time reference period. Employment comprises all persons of working age who—during a specified brief period, such as one week or one day—were in the following categories: (1) paid employment (whether at work or with a job but not at work) or (2) self-employment (whether at work or with an enterprise but not at work). For international comparability, the working age population is often defined as all persons aged 15 and older, but this may vary from country to country based on national laws and practices. https://www.ilo.org/ilostat/faces/oracle/webcenter/portalapp/pagehierarchy/Page27.jspx?subject=LPY&indicator=GDP_205U_NOC_NB&datasetCode=A&collectionCode=ILOEST&_afrLoop=2393952035653331&_afrWindowMode=0&_afrWindowId=fbc0egmlh_1#!%40%40%3Findicator%3DGDP_205U_NOC_NB%26_afrWindowId%3Dfbc0egmlh_1%26subject%3DLPY%26_afrLoop%3D2393952035653331%26datasetCode%3DA%26collectionCode%3DILOEST%26_afrWindowMode%3D0%26_adf.ctrl-state%3Dfbc0egmlh_57	ILO
B.5.2	GDP per capita	USD (current)	GDP per capita is gross domestic product divided by total population of a country or area. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://databank.worldbank.org/data/reports.aspx?source=2&series=NY.GDP.PCAP.CD	World Bank
B.5.3	Unemployment rate (SDG 8.5.2)	% of persons in labor force	Persons in unemployment are defined as all those of working age (usually persons aged 15 and above) who were not in employment, carried out activities to seek employment during a specified recent period, and were available to take up employment given a job opportunity, where: (1) "not in employment" is assessed with respect to the short reference period for the measurement of employment; (2) "seek employment" refers to any activity, during the last four weeks or one month, for the purpose of finding a job or setting up a business or agricultural undertaking; (3) the point when the enterprise starts to exist should be used to distinguish between search activities aimed at setting up a business and the work activity itself, as evidenced by the enterprise's registration to operate or when financial resources become available, the necessary infrastructure or materials are in place, or the first client or order is received, depending on the context; (4) "currently available" serves as a test of readiness to start a job in the present, assessed with respect to the same reference period used to measure employment in a given country. Depending on national circumstances, the reference period may be extended to include a short subsequent period not exceeding two weeks in total, to ensure adequate coverage of unemployment situations among different population groups. This indicator is aligned with the definitions of SDG indicator 8.5.1 Unemployment rate. https://unstats.un.org/sdgs/indicators/database/	ILO
B.5.4	Youth unemployment rate (SDG 8.6.1)	% of youth	Youth unemployment rate is defined as the proportion of youth not in education, employment, or training. For the purposes of this indicator, youth is defined as all persons between the ages of 15 and 24 (inclusive). According to the International Standard Classification of Education (ISCED), education is defined as organized and sustained communication designed to bring about learning. Persons in employment are defined as all those who—during a short reference period, such as one week or one day—performed work for others in exchange for pay or profit. Persons are considered to be in training if they are in a non-academic learning activity through which they acquire specific skills intended for vocational or technical jobs. This indicator is aligned with the definitions of SDG indicator 8.6.1 Proportion of youth (aged 15–24 years) not in education, employment or training. https://unstats.un.org/sdgs/indicators/database/	ILO

B.5.5	Population aged 0–14 years	% of total population	The population between the ages 0 and 14 as a percentage of the total population. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://databank.worldbank.org/data/reports.aspx?source=2&series=SP.POP.0014.TO.ZS	World Bank
B.5.6	Proportion and number of children aged 5–17 years engaged in child labor (SDG 8.7.1)	% of total number of children	The number of children engaged in child labor corresponds to the number of children reported to be in child labor during the reference period (usually the week prior to the survey). The proportion of children in child labor is calculated as the number of children in child labor divided by the total number of children in the population. For the purposes of this indicator, children include all persons aged 5 to 17. This indicator is aligned with the definitions of SDG indicator 8.7.1 Proportion and number of children aged 5–17 years engaged in child labor. https://unstats.un.org/sdgs/indicators/database/	UNICEF, ILO
B.6	**Transport and logistics**			
B.6.1	Buses per 1,000 people	number per 1,000 people	Buses and motor coaches are defined as passenger road motor vehicles designed to seat more than nine persons (including the driver). Statistics also include minibuses designed to seat more than nine persons (including the driver). IRF 2018, proprietary data. https://worldroadstatistics.org/	IRF
B.6.2	Passenger cars per 1,000 people	number per 1,000 people	Passenger cars are defined as road motor vehicles, other than a motorcycle, intended for the carriage of passengers and designed to seat no more than nine persons (including the driver). Passenger cars include microcars (needing no permit to be driven), taxis, vans designed for transport of passengers, and passenger hire cars, provided that they have fewer than ten seats. IRF 2018, World Road Statistics, proprietary data. https://worldroadstatistics.org/	IRF
B.6.3	Motorcycles per 1,000 people	number per 1,000 people	Motorcycles are defined as two- or three-wheeled road motor vehicles not exceeding 400 kg of unladen weight. All such vehicles with a cylinder capacity of 50 cc or over are included, as are those under 50 cc which do not meet the definition of a moped. IRF 2018, World Road Statistics, proprietary data. https://worldroadstatistics.org/	IRF
B.6.4	Passenger and freight volumes by transport mode (SDG 9.1.2)	% of passenger km, % of ton km	Passenger and freight volumes are the sum of the passenger and freight volumes reported for road transport, rail transport, and air carriers measured in passenger kilometers and freight kilometers, respectively. This indicator is aligned with the definitions of SDG indicator 9.1.2 Passenger and freight volumes by transport mode. https://unstats.un.org/sdgs/indicators/database/	ICAO
B.6.5	% of road network paved	% of road	The indicator is defined as the length of paved road network divided by the length of the total road network. Paved roads refer to all roads that are surfaced with crushed stone (macadam) and hydrocarbon binder or bituminized agents, with concrete or with cobblestones. IRF 2018, World Road Statistics, proprietary data. https://worldroadstatistics.org/	IRF
B.6.6	Road traffic death rate	number of deaths per 100,000 population	The indicator reflects the estimated number of deaths due to fatal road traffic injury per 100,000 population. The current definition of a road traffic fatality for harmonization of surveillance purposes is "any person killed immediately or dying within 30 days as a result of a road traffic injury accident." http://apps.who.int/iris/bitstream/handle/10665/44122/9789241563840_eng.pdf?sequence=1&isAllowed=y&ua=1	WHO

B.7	Technology			
B.7.1	Proportion of population covered by a 2G mobile network (SDG 9.c.1)	% of population	The percentage of inhabitants living within range of a mobile-cellular signal, irrespective of whether they are mobile phone subscribers or users. This is calculated by dividing the number of inhabitants within range of a mobile-cellular signal by the total population and multiplying by 100. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 9.c.1 Proportion of population covered by a 2G mobile network. https://unstats.un.org/sdgs/indicators/database/	ITU
B.7.2	Proportion of population covered by at least a 3G mobile network (SDG 9.c.1)	% of population	The percentage of inhabitants living within range of a mobile-cellular signal, irrespective of whether they are mobile phone subscribers or users. This is calculated by dividing the number of inhabitants within range of a mobile-cellular signal by the total population and multiplying by 100. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 9.c.1 Proportion of population covered by a 3G mobile network. https://unstats.un.org/sdgs/indicators/database/	ITU
B.7.3	Proportion of population covered by at least a 4G mobile network (SDG 9.c.1)	% of population	The percentage of inhabitants living within range of a mobile-cellular signal, irrespective of whether they are mobile phone subscribers or users. This is calculated by dividing the number of inhabitants within range of a mobile-cellular signal by the total population and multiplying by 100. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 9.c.1 Proportion of population covered by a 4G mobile network. https://unstats.un.org/sdgs/indicators/database/	ITU
B.7.4	Research and development expenditure (SDG 9.5.1)	% of GDP	Research and development (R&D) expenditure as a proportion of gross domestic product (GDP) is the amount of R&D expenditure divided by the total output of the economy. This indicator is aligned with the definitions of SDG indicator 9.5.1 Research and development expenditure as a proportion of GDP. https://unstats.un.org/sdgs/indicators/database/	UNESCO
B.7.5	Share of medium and high-tech industry in value added of manufacturing (SDG 9.b.1)	%	The indicator is calculated as the share of the sum of the value added from medium and high-tech industry economic activities within the value added of manufacturing. The medium and high-tech industry is defined using OECD classification by International Standard Industrial Classification of All Economic Activities (ISIC) Revision 3 and Revision 4 Division. Manufacturing refers to Section C of ISIC Rev.4, and Section D of ISIC Rev.3. This indicator is aligned with the definitions of SDG indicator 9.b.1 Share of medium and high-tech industry in value added of manufacturing. https://unstats.un.org/sdgs/indicators/database/	UNIDO
B.8	**Solid waste management**			
B.8.1	Municipal solid waste generation intensity	kg of waste/USD (constant 2010)	The indicator is the ratio between municipal solid waste (MSW) and GDP. Municipal solid waste is defined as the waste mainly produced by households, also including similar waste generated from sources such as commerce, offices, and public institutions. The amount of municipal solid waste refers to the solid waste collected by or on behalf of municipal authorities and disposed of through the waste management system. It does not include amounts of municipal solid waste collected through informal waste management systems. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. GDP is measured at constant 2010 US dollars. Municipal solid waste generation: http://www.atlas.d-waste.com/ GDP: http://data.worldbank.org/indicator/NY.GDP.MKTP.KD	Dwaste, World Bank

B.8.2	Compliance with Multilateral Environmental Agreements (SDG 12.4.1)	score in %	The indicator reflects the share of Multilateral Environmental Agreements (MEAs) to which a country is an official party (i.e., having ratified, accepted, approved, or accessed the agreement) and has submitted the information to the secretariat of the relevant MEA, as required by each of the agreements. The indicator captures the following five MEAs: (1) the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal (Basel Convention), (2) the Rotterdam Convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade (Rotterdam Convention), (3) the Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention), (4) the Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol), and (5) the Minamata Convention on Mercury (Minamata Convention). This indicator is aligned with the definitions of SDG indicator 12.4.1 Compliance with Multilateral Environmental Agreements. https://unstats.un.org/sdgs/indicators/database/	UNEP
B.9	**Recycling**			
B.9.1	Recycling rate of municipal solid waste	% of MSW	The indicator is defined as the amount of municipal solid waste (MSW) recycled divided by the amount of municipal solid waste collected by or on behalf of municipal authorities and disposed of through the waste management system. Municipal solid waste is defined as the waste mainly produced by households, also including similar waste generated from sources such as commerce, offices, and public institutions. http://www.atlas.d-waste.com/	ISWA
B.10	**Wastewater management**			
B.10.1	Share of population with access to improved sanitation	% of population	Improved sanitation facilities are those designed to hygienically separate excreta from human contact. There are three main ways to meet the criteria for having a safely managed sanitation service (SDG 6.2). People should use improved sanitation facilities which are not shared with other households, and the excreta produced should either (1) be treated and disposed in situ, (2) stored temporarily and then emptied and transported to treatment offsite, or (3) transported through a sewer with wastewater and then treated offsite. https://washdata.org/data/household#!/table?geo0=country	WHO, UNICEF
B.10.2	Proportion of population practicing open defecation (SDG 6.2.1)	% of population	The proportion of population practicing open defecation refers to the share of the population defecating in the open within the total population. Open defecation refers to the practice of defecating in fields, forest, bushes, open bodies of water, on beaches, in other open spaces, or disposed of with solid waste. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 6.2.1 Proportion of population practicing open defecation. https://unstats.un.org/sdgs/indicators/database/	WHO, UNICEF
B.10.3	Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (SDG 3.9.2)	deaths per 100,000 population	The mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All [WASH] services) is defined as the number of deaths from unsafe water, unsafe sanitation, and lack of hygiene (exposure to unsafe WASH services) in a year, divided by the total population, and multiplied by 100,000. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All [WASH] services). https://unstats.un.org/sdgs/indicators/database/	WHO
B.10.4	Disability-adjusted life years (DALYs) due to unsafe sanitation	years	Disability-adjusted life years (DALYs) are defined as the sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost. A safe sanitation system is defined by WHO as a system that separates human excreta from human contact at all steps of the sanitation service chain, from toilet capture and containment through emptying, transport, treatment (in-situ or offsite), and final disposal or end use. Safe sanitation systems must meet these requirements in a manner consistent with human rights while also addressing co-disposal of greywater (water generated from the household but not from toilets), associated hygiene practices (e.g., managing anal cleansing materials), and essential services required for the functioning of technologies (e.g., flush water to move excreta through sewers). http://ghdx.healthdata.org/gbd-results-tool	IHME

	Indicator	Unit	Description	Source
C.	**Risk and resilience**			
C.1	**Greenhouse gas emissions**			
C.1.1	Carbon intensity	kg of CO_2/ USD (constant 2010)	Carbon intensity is defined as the amount of carbon dioxide (CO_2) emissions divided by gross domestic production. CO_2 emissions only include emissions from the burning of fossil fuels and manufacturing of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for the depreciation of fabricated assets or the depletion and degradation of natural resources. GDP is measured at constant 2010 US dollars. https://data.worldbank.org/indicator/EN.ATM.CO2E.KD.GD	World Bank
C.1.2	CO_2 emissions per capita	metric tons/ capita	The indicator is defined as the amount of carbon dioxide emissions divided by total population. Carbon dioxide emissions only include emissions from the burning of fossil fuels and manufacturing of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and flaring. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://databank.worldbank.org/data/reports.aspx?source=2&series=EN.ATM.CO2E.PC	World Bank
C.1.3	Total CO_2 emissions	kilo tons	Total carbon dioxide emissions capture CO_2 emissions from the burning of fossil fuels and manufacturing of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring but exclude emissions from land use such as deforestation. Total CO_2 emissions are the sum of CO_2 emissions from manufacturing industries and construction (C.1.4), CO_2 emissions from transport (C.1.5), CO_2 emissions from electricity and heat production (C.1.6), CO_2 emissions from residential buildings and commercial and public services (C.1.7), and CO_2 emissions from other sectors (C.1.8). http://databank.worldbank.org/data/reports.aspx?source=2&series=EN.ATM.CO2E.KT	World Bank
C.1.4	CO_2 emissions from manufacturing industries and construction	% of total CO_2 emissions from fuel combustion	The indicator captures the share of CO_2 emissions from manufacturing industries and construction in a country's total CO_2 emissions. CO_2 emissions from manufacturing industries and construction contain the emissions from combustion of fuels in industry. The IPCC category also includes emissions from industry auto-producers that generate electricity and/or heat. Manufacturing industries and construction also include emissions from coke inputs into blast furnaces, which may be reported either in the transformation sector, industry sector, or separate IPCC Source/Sink Category 2, Industrial Processes. http://databank.worldbank.org/data/reports.aspx?source=2&series=EN.CO2.MANF.ZS	World Bank
C.1.5	CO_2 emissions from transport	% of total CO_2 emissions from fuel combustion	The indicator captures the share of CO_2 emissions from the combustion of fuel for all transport activity in a country's total CO_2 emissions. CO_2 emissions from transport contain emissions from the combustion of fuel for all transport activity, regardless of the sector, except for international marine bunkers and international aviation. This includes domestic aviation; domestic navigation; and road, rail, and pipeline transport and corresponds to IPCC Source/Sink Category 1 A 3. http://databank.worldbank.org/data/reports.aspx?source=2&series=EN.CO2.TRAN.ZS	World Bank
C.1.6	CO_2 emissions from electricity and heat production	% of total CO_2 emissions from fuel combustion	The indicator captures the share of CO_2 emissions from electricity and heat production in a country's total CO_2 emissions. CO_2 emissions from electricity and heat production is the sum of three IEA categories of CO_2 emissions: (1) Main Activity Producer Electricity and Heat capturing emissions from main activity producer electricity generation, combined heat and power generation, heat plants, and emissions from own use of fuel in power plants. (2) Unallocated Auto-producers refer to the emissions from the generation of electricity and heat by auto-producers. (3) Other Energy Industries reflect emissions from fuel combusted in petroleum refineries; from the manufacture of solid fuels, coal mining, oil, and gas extraction; and other energy-producing industries. http://databank.worldbank.org/data/reports.aspx?source=2&series=EN.CO2.ETOT.ZS	World Bank
C.1.7	CO_2 emissions from residential buildings and commercial and public services	% of total CO_2 emissions from fuel combustion	The indicator captures the share of CO_2 emissions from residential buildings and commercial and public services in a country's total CO_2 emissions. CO_2 emissions from residential buildings and commercial and public services contain all emissions from fuel combustion in households. http://databank.worldbank.org/data/reports.aspx?source=2&series=EN.CO2.BLDG.ZS	World Bank

C.1.8	CO_2 emissions from "other" sectors	% of total CO_2 emissions from fuel combustion	The indicator captures the share of CO_2 emissions from "other" sectors in a country's total CO_2 emissions. CO_2 emissions from "other" sectors, less residential buildings and commercial and public services, refer to the emissions from commercial/institutional activities, residential, agriculture/forestry, fishing, and other emissions not specified elsewhere that are included in the IPCC Source/Sink Categories 1 A 4 and 1 A 5. In the 1996 IPCC Guidelines, the category also includes emissions from auto producers in the commercial, residential, and agricultural sectors that generate electricity and/or heat. http://databank.worldbank.org/data/reports.aspx?source=2&series=EN.CO2.OTHX.ZS	World Bank
C.1.9	Total methane emissions	kt of CO_2e	Methane (CH_4) emissions are those stemming from human activities, such as agriculture and from industrial CH_4 production. Methane emissions are expressed in carbon dioxide equivalents using the global warming potential, which allows for effective contributions of different gases to be compared. The GWP100 metric of the IPCC Second Assessment Report for methane amounts to 21, namely a kilogram of CH_4 is 21 times as effective at trapping heat in the earth's atmosphere as a kilogram of carbon dioxide within 100 years. https://data.worldbank.org/indicator/EN.ATM.METH.KT.CE	World Bank
C.1.10	Methane emissions from agriculture	thousand metric tons of CO_2e	Agricultural CH_4 emissions are emissions from animals, animal waste, rice production, agricultural waste burning (nonenergy, onsite), and savannah burning (IPCC category 4). Methane emissions are expressed in carbon dioxide equivalents using the global warming potential, which allows for effective contributions of different gases to be compared. The GWP100 metric of the IPCC Second Assessment Report for methane amounts to 21, namely a kilogram of CH_4 is 21 times as effective at trapping heat in the earth's atmosphere as a kilogram of carbon dioxide within 100 years. CH_4 emissions result largely from agricultural activities, industrial production landfills and wastewater treatment, and other sources such as tropical forest and other vegetation fires. https://data.worldbank.org/indicator/EN.ATM.METH.AG.KT.CE	World Bank
C.1.11	Energy-related methane emissions	thousand metric tons of CO_2e	CH_4 emissions from energy processes are emissions from the production, handling, transmission, and combustion of fossil fuels and biofuels (IPCC category 1). Methane emissions are expressed in carbon dioxide equivalents using the global warming potential, which allows for effective contributions of different gases to be compared. The GWP100 metric of the IPCC Second Assessment Report for methane amounts to 21, namely a kilogram of CH_4 is 21 times as effective at trapping heat in the earth's atmosphere as a kilogram of carbon dioxide within 100 years. https://data.worldbank.org/indicator/EN.ATM.METH.EG.KT.CE	World Bank
C.1.12	Share of energy-related methane emissions	% of total	This indicator captures the share of CH_4 emissions from energy-related activities in a country's total CH_4 emissions. https://data.worldbank.org/indicator/EN.ATM.METH.EG.ZS	World Bank
C.1.13	Share of methane emissions from agriculture	% of total	This indicator captures the share of CH_4 emissions from agricultural activities in a country's total CH_4 emissions. https://data.worldbank.org/indicator/EN.ATM.METH.AG.ZS	World Bank

C.2	Emission trends			
C.2.1	Change in carbon intensity	Annual growth rate (%)	Annual growth rate in national emissions of CO_2 per unit of GDP over the latest five years available. See C.1.1 for the definition of carbon intensity.	World Bank
C.2.2	Change in CO_2 emissions per capita	Annual growth rate (%)	Annual growth rate in national emissions of CO_2 per capita over the latest five years available. See C.1.2 for the definition of CO_2 emissions per capita.	World Bank
C.2.3	Change in total CO_2 emissions	Annual growth rate (%)	Annual growth rate in national emissions of CO_2 over the latest five years available. See C.1.3 for the definition of total CO_2 emissions.	World Bank
C.2.4	Change in CO_2 emissions from manufacturing and construction	Annual growth rate (%)	Annual growth rate in national emissions of CO_2 from manufacturing and construction over the latest five years available. See C.1.4 for the definition of emissions of CO_2 from manufacturing and construction.	World Bank
C.2.5	Change in CO_2 emissions from transport	Annual growth rate (%)	Annual growth rate in national emissions of CO_2 from transport over the latest five years available. See C.1.5 the definition of emissions of CO_2 from transport.	World Bank
C.2.6	Change in CO_2 emissions from electricity and heat production	Annual growth rate (%)	Annual growth rate in national emissions of CO_2 from electricity and heat production over the latest five years available. See C.1.6 for the definition of emissions of CO_2 from electricity and heat production.	World Bank
C.2.7	Change in CO_2 emissions from residential and commercial and public services	Annual growth rate (%)	Annual growth rate in national emissions of CO_2 from residential and commercial and public services over the latest five years available. See C.1.7 for the definition of emissions of CO_2 from residential and commercial and public services.	World Bank
C.2.8	Change in CO_2 emissions from "other" sectors	Annual growth rate (%)	Annual growth rate in national emissions of CO_2 from "other" sectors over the latest five years available. See C.1.8 for the definition of emissions of CO_2 from "other" sectors.	World Bank
C.2.9	Change in total methane emissions	Annual growth rate (%)	Annual growth rate of national emissions of CH_4 over the latest five years available. See C.1.18	World Bank
C.3	**Carbon stock**			
C.3.1	Carbon stock in living biomass	million tons per year	Carbon stock in living biomass is defined as the quantity of carbon contained in a reservoir or system of living forest biomass which has the capacity to accumulate or release carbon. http://www.fao.org/forest-resources-assessment/en/	FAO
C.3.2	Total forest cover	1,000 ha	Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. http://www.fao.org/faostat/en/#data/RL	FAO
C.3.3	Change in forest cover	annual change in total forest cover (%)	Annual percent change in forest cover between 2005 and 2015. Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. http://www.fao.org/faostat/en/#data/RL	FAO

C.4	Mitigation			
C.4.1	Electricity generation from renewable sources	% of total electricity output	The indicator is defined as electricity generated from renewable sources divided by total electricity generation. Electricity generation from renewable sources includes geothermal, solar photovoltaic, solar thermal, tide, wind, industrial waste, municipal waste, primary solid biofuels, biogases, bio-gasoline, bio-diesels, other liquid biofuels, non-specified primary biofuels and waste, and charcoal. It excludes hydro power. http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.ELC.RNWX.ZS	World Bank
C.4.2	Change in electricity generation from renewable sources	Annual growth rate (%)	Annual growth rate of electricity generated from renewable source. See C.2.1 for the definition of electricity generated from renewable sources.	World Bank
C.4.3	Electricity mix	GWh	The indicator captures the amount of electricity generated by the following types of fuel over one calendar year. Coal and peat include all coal, both primary (including hard coal and lignite) and derived fuels (including patent fuel, coke oven coke, gas coke, BKB, gas works gas, coke oven gas, blast furnace gas, and oxygen steel furnace gas). Natural gas comprises gases, occurring in underground deposits, whether liquefied or gaseous, consisting mainly of methane. It includes both non-associated gas originating from fields producing only hydrocarbons in gaseous form and associated gas produced in association with crude oil as well as methane recovered from coal mines (colliery gas) or from coal seams (coal seam gas). It includes gas consumed by gas processing plants and gas transported by pipeline. Quantities of gas that are reinjected, vented, or flared are excluded. Crude oil comprises crude oil, natural gas liquids, refinery feedstocks, and additives as well as "other hydrocarbons." Crude oil includes field or lease condensates (separator liquids), which are recovered from associated and non-associated gas where it is commingled with the commercial crude oil stream. Oil products comprise refinery gas, ethane, LPG, aviation gasoline, motor gasoline, jet fuels, kerosene, gas/diesel oil, fuel oil, naphtha, white spirit, lubricants, bitumen, paraffin waxes, petroleum coke, and "other oil products." Oil products are any oil-based products which can be obtained by distillation and are normally used outside the refining industry, except finished products which are classified as refinery feedstocks. Hydro refers to the electricity produced in hydro power plants. Hydro output excludes output from pumped storage plants. Biofuels and waste are comprised of solid biofuels, liquid biofuels, biogases, industrial waste, and municipal waste. The non-energy use of biomass is not taken into consideration, and quantities are null by definition. Renewables include geothermal, solar, wind, and tide/wave/ocean energy and the use of these energy forms for electricity and heat generation. Unless the actual efficiency of the geothermal process is known, the quantity of geothermal energy entering electricity generation is inferred from the electricity production at geothermal plants assuming an average thermal efficiency of 10%. For solar, wind and tide/wave/ocean energy, the quantities entering electricity generation are equal to the electrical energy generated. IEA 2018, World Energy Balances, proprietary data	IEA
C.4.4	Access to clean fuels and technologies for cooking	% of population	Access to clean fuels and technologies for cooking is the proportion of total population primarily using clean cooking fuels and technologies for cooking. Clean cooking fuels include biogas, ethanol, electricity, and LPG. Under WHO guidelines, kerosene is excluded from clean cooking fuels. The Global Alliance for Clean Cookstoves defines clean cooking technologies as (1) stoves/fuels that meet Tier 2 for efficiency or higher; (2) stoves/fuels that meet Tier 3 for indoor emissions or higher; and stoves/fuels that meet Tier 3 for overall emissions or higher. For more details on performance targets for thermal efficiency, emissions of carbon monoxide and fine particulate matter, safety, and durability, see Voluntary Performance Targets at (https://www.cleancookingalliance.org/technology-and-fuels/standards/defining-clean-and-efficient.html) Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.CFT.ACCS.ZS	World Bank
C.4.5	Fossil fuel subsidies	USD/capita	The indicator is based on IEA estimates for subsidies to fossil fuels that are consumed directly by end-users or consumed as inputs to electricity generation divided by total population. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. https://www.iea.org/media/publications/weo/IEA-Subsidies-2010-18.xlsx	IEA

C.5	Vulnerability to climate change			
C.5.1	Notre Dame Global Adaptation Initiative (ND-Gain) Index	0–100	A country's ND-GAIN score is composed of a vulnerability score and a readiness score. Vulnerability measures a country's exposure, sensitivity, and capacity to adapt to the adverse impacts of climate change. ND-GAIN measures overall vulnerability based on 36 indicators covering the following six sectors: food, water, health, ecosystem services, human habitat, and infrastructure. Readiness measures a country's ability to leverage investments and convert them to adaptation actions. ND-GAIN measures overall readiness based on nine indicators covering the following three components: economic readiness, governance readiness, and social readiness. A higher index score indicates lower vulnerability and higher readiness. http://gain.nd.edu/our-work/country-index/download-data/	ND-GAIN
C.5.2	Exposure to climate change	0–1	Under the ND-GAIN Index, exposure is defined as the degree to which a country is exposed to climate change from a biophysical perspective. Exposure indicators are projected impacts for the coming decades and are therefore invariant over time. Indicators used to capture exposure include projected change of cereal yields, projected population change, projected change of annual runoff, projected change of groundwater recharge, projected change of deaths from climate change-induced diseases, projected change of length of transmission season of vector-borne disease, projected change of biome distribution, projected change of marine biodiversity, projected change of warm period, projected change of flood hazard, projected change of hydropower generation capacity, and projection of sea level rise impact. A higher score indicates higher exposure. http://gain.nd.edu/our-work/country-index/download-data/	ND-GAIN
C.5.3	Sensitivity to climate change	0–1	Under the ND-Gain Index, sensitivity is defined as the degree to which a country is affected by the adverse impacts of climate change, such as the extent to which it depends on sectors that are susceptible to the adverse impact of climate change and the share of the population sensitive to climate hazard due to topography and demography, among others. A country's sensitivity can vary over time. Indicators used to capture sensitivity include food import dependency, share of rural population, fresh water withdrawal rate, water dependency ratio, slum population, dependency on external resources for health services, dependency on natural capital, ecological footprint, urban concentration, age dependency ratio, dependency on imported energy, and population living less than 5 meters above sea level. A higher score indicates higher sensitivity. http://gain.nd.edu/our-work/country-index/download-data/	ND-GAIN
C.5.4	Adaptive capacity to climate change	0–1	Under the ND-Gain Index, adaptive capacity is defined as the ability of a country to adjust to the adverse impacts of climate change and as a result reduce the associated damage. Indicators used to capture adaptive capacity include agriculture capacity, child malnutrition, access to reliable drinking water, dam capacity, medical staffs, access to improved sanitation facilities, protected biomes, engagement in international environmental conventions, quality of trade and transport-related infrastructure, paved roads, electricity access, and disaster preparedness. A higher score indicates lower adaptive capacity. http://gain.nd.edu/our-work/country-index/download-data/	ND-GAIN
C.5.5	Share of population made homeless by natural disasters	number of people per 1,000 population	The population made homeless by natural disasters is defined as the number of people whose house is destroyed or heavily damaged and therefore need shelter after an event divided by the total population. Natural disasters include biological, geophysical, climatological, hydrological, meteorological, and extra-terrestrial disasters. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. Population made homeless by natural disasters: https://www.emdat.be/emdat_db/ Total population: http://databank.worldbank.org/data/reports.aspx?source=2&series=SP.POP.TOTL	EM-DAT, World Bank

C.5.6	Disaster Risk Reduction (SDG 1.5.3)	0–1	The indicator measures the adoption and implementation of national disaster risk reduction strategies in line with the Sendai Framework. The Sendai Framework is a 15-year, voluntary, non-binding agreement aiming for the substantial reduction of disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural, and environmental assets of persons, businesses, communities, and countries. Binary scores (0 for no, 1 for yes) are given in 10 categories that are weighted equally. The categories look at the following elements in a DRR strategy: 1. Does the strategy cover different timescales, with targets, indicators, and time frames? 2. Does the strategy aim at preventing the creation of risk? 3. Does the strategy aim at reducing existing risk? 4. Does the strategy aim at strengthening economic, social, health, and environmental resilience? 5. Does the strategy address the recommendations under priority 1 of the Sendai Framework "Understanding disaster risk?" 6. Does the strategy address the recommendations under priority 2 of the Sendai Framework "Strengthening disaster risk governance to manage disaster risk?" 7. Does the strategy address the recommendations under priority 3 of the Sendai Framework "Investing in disaster risk reduction for resilience?" 8. Does the strategy address the recommendations under priority 4 of the Sendai Framework "Enhancing disaster preparedness for effective response and to 'Build Back Better' in recovery, rehabilitation and reconstruction?" 9. Does the strategy promote policy coherence relevant to disaster risk reduction, such as sustainable development, poverty eradication, and climate change, notably with the SDGs the Paris Agreement? 10. Does the strategy have mechanisms to follow up, periodically assess, and publicly report on progress? This indicator is aligned with the definitions of SDG indicator 1.5.3 Score of adoption and implementation of national DRR strategies in line with the Sendai Framework. https://unstats.un.org/sdgs/indicators/database/	UNISDR
C.5.7	Share of local governments that adopted and implemented local disaster risk reduction strategies (%) (SDG 1.5.4)	%	This indicator refers to the share of local governments of UN member states that have adopted and implemented local disaster risk reduction strategies in line with national disaster risk reduction strategies. The number of local governments are counted by member states and expressed as a percentage of the total number of local governments in the country. Local governments are determined by the reporting country for this indicator, considering subnational public administrations with responsibility to develop local disaster risk reduction strategies. Countries are encouraged to report on progress made by the lowest level of government accorded the mandate for disaster risk reduction, as the Sendai Framework promotes the adoption and implementation of local disaster risk reduction strategies in every local authority. This indicator is aligned with the definitions of GGPA indicator C.3.7 and SDG indicator 1.5.4. https://unstats.un.org/sdgs/indicators/database/	UNISDR
C.6	**Cost of climate change**			
C.6.1	Financial losses from relevant natural loss events	million USD	Financial losses are estimated extrapolating the insured losses based on insurance penetration. Data for the insured losses are relatively reliable because they reflect claims actually paid by insurance companies. The greater the insurance penetration, the more accurate the estimate of overall financial losses. Financial losses refer to direct losses (e.g., loss of homes, household property, schools, vehicles, machinery, livestock, etc.) calculated on the basis of replacement and repair costs. Indirect losses—such as higher transport costs due to infrastructure damage, loss of jobs, and loss of rental income—are excluded. Similarly, consequential losses capturing the economic impact of a natural disaster—such as reduced tax revenues, lower economic output, or a weaker currency—are also excluded. Relevant loss events are defined as natural loss events with more than one fatality or normalized overall financial losses equal to or higher than USD 100,000, 300,000, 1,000,000, or 3,000,000 depending on the assigned World Bank income group of the affected country. http://natcatservice.munichre.com/?filter=eyJ5ZWFyRnJvbSI6MjAxNiwieWVhclRvIjoyMDE2fQ%3D%3D&type=2	NatCat Service

C.6.2	Climate Risk Index	index score	The Global Climate Risk Index 2018 ranks countries according to the extent that they have been affected by the impacts of weather-related loss events. The index is based on data provided by the Munich Re's NatCat Service, including (1) the number of deaths, (2) the number of deaths per 100,000 inhabitants, (3) the sum of financial losses in US dollars adjusted for purchasing power parity (PPP), and (4) financial losses as a share of gross domestic product. The index captures losses caused by weather-related events, including storms and floods as well as temperature extremes and mass movements (heat and cold waves, etc.). Geological incidents—such as earthquakes, volcanic eruptions, or tsunamis—are excluded. Financial losses are estimated extrapolating the insured losses based on insurance penetration. Data for the insured losses are relatively reliable because they reflect claims actually paid by insurance companies. The greater the insurance penetration, the more accurate the estimate of overall financial losses. Financial losses refer to direct losses (e.g., loss of homes, household property, schools, vehicles, machinery, livestock, etc.) calculated on the basis of replacement and repair costs. Indirect losses—such as higher transport costs due to infrastructure damage, loss of jobs, and loss of rental income—are largely excluded. Similarly, consequential losses capturing the economic impact of a natural disaster—such as reduced tax revenues, lower economic output, or a weaker currency—are also largely excluded. The ranking is calculated based on a normalized score for each of the four indicators, according to the following weighting: 1/6 for death toll, 1/3 for deaths per 100,000 inhabitants, 1/6 for absolute financial losses, and 1/3 for financial losses as a share of GDP. A higher score indicates lower risk. https://germanwatch.org/sites/germanwatch.org/files/Global%20Climate%20Risk%20Index%202019_2.pdf	German-watch
C.6.3	Damage from natural disasters	million USD	The indicator captures the estimated amount of damage to property, crops, and livestock from natural disasters. The estimate covers the value all damages and economic losses directly or indirectly related to the disaster. For each disaster, the registered figure corresponds to the damage value at the moment of the event, with value of estimated damage being given in million US dollars (current value). Natural disasters include biological, geophysical, climatological, hydrological, meteorological, and extra-terrestrial disasters. https://www.emdat.be/emdat_db/	ED-MAT
C.7	**Dependence on resource extraction**			
C.7.1	Share of exports of extractive industry in total exports	% (of total exports)	This indicator is the sum of the gross value of export of extractive natural resources and products divided by total export. Products from the extractive industry correspond to Standard International Trade Classification (SITC) product codes 27, 28, 68, 321, 322, 325, 333, 334, 335, 342, 343, 344, 345, 667, and 971 as defined and used in the calculation of the Extractive Dependence Index (EDI) by the Extractive Industries Transparency Initiative (EITI). For export data: https://unctadstat.unctad.org/wds/ReportFolders/reportFolders.aspx For EDI: https://eiti.org/sites/default/files/documents/theextractivesdependenceindexnovember2015.pdf	UNCTAD, EITI
C.7.2	Share of extractive industry in total GDP	% of GDP (constant 2000 USD)	This indicator is defined as the ration between the value added in mining and quarrying divided by gross domestic production. Value added in mining and quarrying is defined as the value of output of the mining and quarrying industries less the value of intermediate consumption (intermediate inputs). Mining and quarrying are a subset of industry (ISIC 10–14). Data is only available for African countries for the period 1965–2011. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. GDP is measured in constant 2000 US dollars. For mining and quarrying: https://datacatalog.worldbank.org/dataset/africa-development-indicators For GDP: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD	World Bank

	Indicator	Unit	Description	Source
D.	**Social inclusion**			
D.1	**Poverty**			
D.1.1	Poverty headcount ratio at USD 1.90 a day (2011 PPP) (SDG 1.1.1)	% of population	The poverty headcount ratio is defined as the percentage of the population living on less than USD 1.90 per day. The international poverty line is currently set at USD 1.90 a day at 2011 international prices. The indicator is also known as the abject poverty rate (extreme poverty). The indicator is identical to SDG 1.1.1 Proportion of population below international poverty line. http://data.worldbank.org/indicator/SI.POV.DDAY and https://unstats.un.org/sdgs/indicators/database/	World Bank
D.1.2	Proportion of population living below the national poverty line (SDG 1.2.1)	% of population	National poverty rates are defined based on country-specific poverty lines in local currencies. They differ across countries and deviate from the USD 1.90-a-day international poverty line. The rural poverty rate is the percentage of the rural population living below the national poverty line (or in cases where a separate, rural poverty line is used, the rural poverty line). The urban poverty rate is the percentage of the urban population living below the national poverty line (or in cases where a separate, urban poverty line is used, the urban poverty line). This indicator is aligned with the definitions of SDG indicator 1.2.1 Co Proportion of population living below the national poverty line. https://unstats.un.org/sdgs/indicators/database/	World Bank
D.1.3	Proportion of population with access to electricity (SDG 7.1.1)	% of population	Following the definitions put forward by the IEA and the UN, the indicator captures the number of households with an electricity connection divided by the total number of households within the country. In its current form, this indicator is aligned with the definitions of SDG indicator 7.1.1 Proportion of population with access to electricity. https://datacatalog.worldbank.org/search?search_api_views_fulltext_op=AND&query=access+to+electricity&nid=&=Apply&sort_by=search_api_relevance&sort_by=search_api_relevance	World Bank
D.1.4	Access to clean fuels and technologies for cooking	% of population	Access to clean fuels and technologies for cooking is the proportion of total population primarily using clean cooking fuels and technologies for cooking. Clean cooking fuels include biogas, ethanol, electricity, and LPG. Under WHO guidelines, kerosene is excluded from clean cooking fuels. The Global Alliance for Clean Cookstoves defines clean cooking technologies as (1) stoves/fuels that meet Tier 2 for efficiency or higher, (2) stoves/fuels that meet Tier 3 for indoor emissions or higher, and stoves/fuels that meet Tier 3 for overall emissions or higher. For more details on performance targets for thermal efficiency, emissions of carbon monoxide and fine particulate matter, safety, and durability, please refer to Voluntary Performance Targets under the following link: https://www.cleancookingalliance.org/technology-and-fuels/standards/defining-clean-and-efficient.html. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://databank.worldbank.org/data/reports.aspx?source=2&series=EG.CFT.ACCS.ZS	World Bank
D.1.5	Percentage of population with access to improved drinking water	% of population	Drinking water services refers to the accessibility, availability, and quality of the main source used by households for drinking, cooking, personal hygiene, and other domestic uses. The population using non-piped improved drinking water sources is calculated by subtracting piped water sources from all improved water sources. Improved drinking water sources are those which, by nature of their design and construction, have the potential to deliver safe water. The JMP subdivides the population using improved sources into three groups according to the level of service provided: safely managed, basic, and limited drinking water services. Improved drinking water sources include the following: piped water into a dwelling, yard, or plot; public taps or standpipes; boreholes or tube wells; protected dug wells; protected springs; packaged water; delivered water; and rainwater. The WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene (JMP) developed the concept of "improved" water sources, which was used as a proxy for "safe water," as such sources are likely to be protected against fecal contamination, and this metric has been used since 2000 to track progress towards the Millennium Development Goals target 7c. https://washdata.org/data/household#!/table?geo0=region&geo1=sdg	JMP

D.1.6	Water Quality Index	0–100 (higher scores indicate higher quality)	The Water Quality Index uses three parameters to determine the water quality of a country's freshwater bodies, measuring nutrient levels (dissolved oxygen, total nitrogen, and total phosphorus), and two parameters measuring water chemistry (pH and conductivity). The WQI is a proximity-to-target composite of water quality, adjusted for monitoring station density in each country, with the maximum score of 100. Higher scores indicate higher water quality. Data is available for a single year (2010). https://epi.envirocenter.yale.edu/epi-downloads	EPI
D.1.7	Share of population with access to improved sanitation	% of population	Improved sanitation facilities are those designed to hygienically separate excreta from human contact. There are three main ways to meet the criteria for having a safely managed sanitation service (SDG 6.2). People should use improved sanitation facilities which are not shared with other households, and the excreta produced should either (1) be treated and disposed in situ, (2) stored temporarily and then emptied and transported to treatment offsite, or (3) transported through a sewer with wastewater and then treated offsite. https://washdata.org/data/household#!/table?geo0=country	WHO, UNICEF
D.1.8	Proportion of population using safely managed sanitation services (SDG 6.2.1)	% of population	The proportion of population using safely managed sanitation services, including a basic handwashing facility with soap and water, is measured by the share of the population using a basic sanitation facility which is not shared with other households and where excreta is safely disposed in situ or treated offsite ("improved sanitation"). A basic handwashing facility is defined as a device to contain, transport, or regulate the flow of water to facilitate handwashing with soap and water in the household. This indicator is a proxy of actual handwashing practice, which has been found to be more accurate than other proxies such as self-reports of handwashing practices. Improved sanitation facilities include the following: flush or pour flush toilets to sewer systems, septic tanks or pit latrines, ventilated improved pit latrines, pit latrines with a slab, and composting toilets. Safely disposed in situ refers to circumstances where pit latrines and septic tanks are not emptied, but the excreta remain isolated from human contact. For example, households that use twin pit latrines or safely abandon full pit latrines and dig new facilities would be counted as using safely managed sanitation services. Treated offsite discounts circumstances where excreta from toilet facilities conveyed in sewers (as wastewater) or emptied from pit latrines and septic tanks (as fecal sludge) does not reach a treatment site. For example, a portion may leak from the sewer itself or, due to broken pumping installations, be discharged directly to the environment. Similarly, a portion of the fecal sludge emptied from containers may be discharged into open drains, to open ground or water bodies, rather than being transported to a treatment plant. Finally, even when the excreta reach a treatment plant, a portion may remain untreated, due to dysfunctional treatment equipment or inadequate treatment capacity, and be discharged to the environment. This indicator is aligned with the definitions of SDG indicator 6.2.1 Proportion of population using safely managed sanitation services. https://unstats.un.org/sdgs/indicators/database/	WHO, UNICEF
D.1.9	Mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene (SDG 3.9.2)	deaths per 100,000 population	The mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All [WASH] services) is defined as the number of deaths from unsafe water, unsafe sanitation, and lack of hygiene (exposure to unsafe WASH services) in a year, divided by the total population, and multiplied by 100,000. Unsafe water refers to surface water or any unimproved drinking water source or improved water source that is not accessible on premises, not available when needed, or subject to fecal (and priority chemical) contamination. Unsafe sanitation is considered as open defecation or an unimproved sanitation facility or improved sanitation, which is shared with other households or where excreta is not safely disposed in situ or treated offsite. Lack of hygiene refers to the absence of a basic handwashing facility with soap and water. A basic handwashing facility is defined as a device to contain, transport, or regulate the flow of water to facilitate handwashing with soap and water in the household. This indicator is a proxy of actual handwashing practice, which has been found to be more accurate than other proxies such as self-reports of handwashing practices. This indicator is aligned with the definitions of SDG indicator 3.9.2 Mortality rate attributed to unsafe water, unsafe sanitation, and lack of hygiene. https://unstats.un.org/sdgs/indicators/database/	WHO

D.1.10	Disability-adjusted life years (DALYs) due to unsafe water source	years	Disability-adjusted life years (DALYs) are the sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost. The definition of an unsafe water source considers the share of households with access to different water sources (safely managed, basic, limited, unimproved, surface water) and reported use of household water treatment methods (boiling or filtering, chlorinating or solar filtering, no treatment). Unsafe water sources refer to water from limited, unimproved, and surface water sources without any treatment. A limited water source refers to drinking water from an improved source for which collection time exceeds 30 minutes for a roundtrip including queuing. An unimproved water source refers to drinking water from an unprotected dug well or unprotected spring. Surface water refers to drinking water directly from a river, dam, lake, pond, stream, canal, or irrigation canal. http://ghdx.healthdata.org/gbd-results-tool	IHME
D.1.11	Disability-adjusted life years (DALYs) due to no access to handwashing facility	years	Disability-adjusted life years (DALYs) are the sum of years lost due to premature death (YLLs) and years lived with disability (YLDs). DALYs are also defined as years of healthy life lost. Access to a handwashing facility is defined as the percentage of households with access to a handwashing facility with soap, water, and a wash station. A basic handwashing facility is defined as a device to contain, transport, or regulate the flow of water to facilitate handwashing with soap and water in the household. http://ghdx.healthdata.org/gbd-results-tool	IHME
D.2	**Food security**			
D.2.1	Prevalence of undernourishment (SDG 2.1.1)	% of population	Prevalence of undernourishment is defined as the percentage of population whose calorific intake is insufficient to meet minimum dietary energy requirements continuously (at least one year). The minimum dietary energy requirement is the weighted average of the minimum energy requirements of the different age/sex groups. In a specified age/sex category, the minimum dietary energy requirement is the minimum amount of dietary energy per person that is considered adequate to meet the energy needs at a minimum acceptable body mass index of an individual engaged in low physical activity. http://data.worldbank.org/indicator/SN.ITK.DEFC.ZS	World Bank
D.2.2	Prevalence of stunting among children under 5 years of age (SDG 2.2.1)	% of population	Child stunting refers to a child who is too short for their age as the result of chronic or recurrent malnutrition. A child is stunted when their height-for-age is 2 or more standard deviations below the median of the World Health Organization (WHO) Child Growth Standards. The indicator only refers to children under 5 years of age. This indicator is aligned with the definitions of SDG indicator 2.2.1 Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization [WHO] Child Growth Standards) among children under 5 years of age. https://unstats.un.org/sdgs/indicators/database/	UNICEF, WHO, World Bank
D.2.3	Prevalence of moderate or severe food insecurity in the population (SDG 2.1.2)	% of population	The indicator measures the percentage of individuals in the population who have experienced food insecurity at moderate or severe levels during the reference period. Levels of food insecurity, defined as a latent trait, are measured based on the FAO Food Insecurity Experience Scale. The scale is based on measurements in more than 140 countries worldwide, starting in 2014. This indicator is aligned with the definitions of SDG indicator 2.1.2 Prevalence of moderate or severe food insecurity in the population based on the Food Insecurity Experience Scale (FIES). https://unstats.un.org/sdgs/indicators/database/	FAO

D.3	**Health**			
D.3.1	Healthy life expectancy at birth	years	The average number of years that a person can expect to live in "full health" by taking into account years lived in less than full health due to disease and/or injury. Estimates for healthy life expectancy at birth are based on the WHO life tables and WHO estimates for years lost due to disability. WHO figures for years lost due to disability are largely based on the estimates for years lost due to disability from the Global Burden of Disease 2016 study, with adjustments to disability weights and prevalence for certain causes. http://apps.who.int/gho/data/view.main.HALEXREGv?lang=en	WHO, World Bank
D.3.2	Maternal mortality ratio (SDG 3.1.1)	number of deaths per 100,000 live births	The indicator is defined as the number of maternal deaths during a given time period per 100,000 live births during the same time period. Maternal deaths are defined as the annual number of female deaths from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes) during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy. This indicator is aligned with the definitions of SDG indicator 3.1.1 Maternal mortality ratio. https://unstats.un.org/sdgs/indicators/database/	WHO
D.3.3	Under-five mortality rate (SDG 3.2.1)	number of deaths per 1,000 live births	The probability of a child born in a specific year or period dying before reaching the age of five years, if subject to age-specific mortality rates of that period, expressed as the number of deaths per 1,000 live births. This indicator is aligned with the definitions of SDG indicator 3.2.1 Under-five mortality rate. https://unstats.un.org/sdgs/indicators/database/	UNICEF
D.3.4	Neonatal mortality rate (SDG 3.2.2)	number of deaths per 1,000 live births	The probability of a child born in a specific year or period dying during the first 28 completed days of life, if subject to age-specific mortality rates of that period, expressed as the number of deaths per 1,000 live births. This indicator is aligned with the definitions of SDG indicator 3.2.2 Neonatal mortality rate. https://unstats.un.org/sdgs/indicators/database/	UNICEF
D.3.5	Government health expenditure	% of GDP	Public expenditure on health from domestic sources as a share of the economy divided by GDP. This includes health domestic transfers and grants, subsidies to voluntary health insurance beneficiaries, and non-profit institutions serving households or enterprise financing schemes as well as compulsory prepayment and social health insurance contributions. Relevant health care functions covered by the indicator include curative care, rehabilitative care, long-term care, ancillary services, medical goods, preventive care, governance, health system and financing administration, and other health care services. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. https://data.worldbank.org/indicator/SH.XPD.GHED.GD.ZS	World Bank
D.3.6	Government health expenditure per capita	USD/capita (current)	The total amount of public expenditure on health from domestic sources divided by total population, expressed in current US dollars. Public expenditure on health from domestic sources includes health domestic transfers and grants, subsidies to voluntary health insurance beneficiaries, and non-profit institutions serving households or enterprise financing schemes as well as compulsory prepayment and social health insurance contributions. Relevant health care functions covered by the indicator include curative care, rehabilitative care, long-term care, ancillary services, medical goods, preventive care, governance, health system and financing administration, and other health care services. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. https://data.worldbank.org/indicator/SH.XPD.GHED.PC.CD	World Bank
D.3.7	Current health expenditure	% of GDP	The level of current health expenditure, both public and private, divided by GDP. Estimates of current health expenditures include health care goods and services consumed during each year. This indicator does not include capital health expenditures, such as buildings, machinery, IT, and stocks of vaccines for emergency or outbreaks. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. https://data.worldbank.org/indicator/SH.XPD.CHEX.GD.ZS	World Bank

D.3.8	Health worker density (SDG 3.c.1)	number of health workers per 1,000 population	The indicator is defined as the number of health workers per 1,000 people. Health workers are defined as medical personnel belonging to one of the following categories: Physicians, including generalists and specialist medical practitioners; Nursing and midwifery personnel; Dentists, dental technicians/assistants and related occupation personnel; Pharmaceutical personnel, including pharmacists, pharmaceutical technicians/ assistants, and related occupations. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 3.c.1 Health worker density, by type of occupation. https://unstats.un.org/sdgs/indicators/database/	WHO
D.4	**Education**			
D.4.1	Primary education completion rate	% of relevant age group	The primary completion rate is measured by the number of new entrants (enrollments minus repeaters) in the last grade of primary education, regardless of age, divided by the population at the entrance age for the last grade of primary education. Data limitations preclude adjusting for students who drop out during the final year of primary education. The intended age for the last grade of each level of education is the age at which pupils would enter the grade if they had started school at the official primary entrance age, had studied full time, and had progressed without repeating or skipping a grade. For example, if the official age of entry into primary education is 6 years, and if primary education has 6 grades, the intended age for the last grade of primary education is 11 years. In this case, 14–16 years (11 + 3 = 14 and 11 + 5 = 16) would be the reference age group for calculation of the primary completion rate. https://data.worldbank.org/indicator/SE.PRM.CMPT.ZS	World Bank
D.4.2	Lower secondary education completion rate	% of relevant age group	The completion rate for lower secondary education is measured by the percentage of a cohort of children aged 3–5 years above the intended age for the last grade of lower secondary education who have completed that grade. http://data.uis.unesco.org/Index.aspx?DataSetCode=EDULIT_DS	UNESCO
D.4.3	Share of population having attained upper secondary	%	The share of population having attained upper secondary education refers to the population of 25 years and older that has attained upper secondary education as defined in the UNESCO International Standard Classification of Education level 3 divided by the total population of 25 years and older. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://data.uis.unesco.org/	UNESCO
D.4.4	Share of population having attained a bachelor's degree	%	The share of population having attained a bachelor's degree refers to the population of 25 years and older that has attained a bachelor's degree or equivalent as defined in the UNESCO International Standard Classification of Education level 6 divided by the total population of 25 years and older. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. http://data.uis.unesco.org/	UNESCO
D.4.5	Gender parity index for achievement in reading (SDG 4.5.1)	ratio of female to male	The gender parity index (GPI) in reading is the ratio of female to male students achieving at least minimum proficiency level in reading at a certain education level. Depending on the data source and year, the indicator measures the ratio in the student group who achieved reading in grade 2 or 3, during primary level or during lower secondary level. A value between 0.97 and 1.03 would reflect gender parity, while values below 0.97 show an advantage for boys and values above 1.03 reflect an advantage for girls. The data covers all ages. This indicator is aligned with the definitions of SDG indicator 4.5.1 Gender parity index for achievement in reading, by education level. https://unstats.un.org/sdgs/indicators/database/	UNESCO

D.4.6	Socio-economic parity status index for achievement in reading (SDG 4.5.1)	ratio of low to high socio-economic status	The socio-economic parity status index for achievement in reading indicates the ratio of the bottom to the top wealth quintile of students achieving at least minimum proficiency level in reading at a certain level of education. Depending on the data source and year, the indicator measures the ratio in the student group who achieved reading in grade 2 or 3, during primary level or during lower secondary level. A value between 0.97 and 1.03 would reflect social-economic parity, while values below 0.97 show an advantage for the top wealth quintile and values above 1.03 reflect an advantage for the bottom wealth quintile. The data covers all ages. This indicator is aligned with the definitions of SDG indicator 4.5.1 Low to high socio-economic parity status index for achievement in reading, by education level. https://unstats.un.org/sdgs/indicators/database/	UNESCO
D.4.7	Government expenditure on education	% of GDP	Government expenditure on education is measured as the total amount government expenditure on education (current, capital, and transfers) divided by GDP. It includes expenditure funded by transfers from international sources to government. Government expenditure includes local, regional, and central government expenditure. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Expenditures and GDP are measured in constant US dollars. https://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS	World Bank
D.4.8	Government expenditure per student	USD per student	Government expenditure on education per student is defined as the total government expenditure on education (current, capital, and transfers) divided by the total number of students. It is the sum of amounts of government expenditure for primary, secondary, and tertiary education. Expenditure is measured in constant US dollars. The number of students is defined as the sum of the number of students in primary education, secondary education, and tertiary education. Expenditure is measured in constant 2010 US dollars. Please refer to the definitions of indicators D.4.9 to D.4.11 for more details. For school age population (primary education): https://databank.worldbank.org/data/reports.aspx?source=1159&series=SP.PRM.TOTL.IN# For school age population (secondary education): https://databank.worldbank.org/data/reports.aspx?source=1159&series=SP.SEC.TOTL.IN For school age population (tertiary education): https://databank.worldbank.org/data/reports.aspx?source=1159&series=SP.TER.TOTL.IN# For attainment rates by level of education: http://data.uis.unesco.org/ For GDP per capita (constant 2010 USD): https://data.worldbank.org/indicator/NY.GDP.PCAP.KD For government expenditure per student, primary (% of GDP per capita): https://data.worldbank.org/indicator/SE.XPD.PRIM.PC.ZS For government expenditure per student, secondary (% of GDP per capita): https://data.worldbank.org/indicator/SE.XPD.SECO.PC.ZS For government expenditure per student, tertiary (% of GDP per capita): https://data.worldbank.org/indicator/se.XpD.teRt.pc.zs	World Bank, UNESCO
D.4.9	Government expenditure on primary education per student	USD per student	Government expenditure on primary education per student is defined as the total government expenditure on primary education (current, capital, and transfers) divided by the total number of students in primary education. The number of students in primary education is defined as the population within the age group theoretically corresponding to a given level of education as indicated by theoretical entrance age and duration. Expenditure is measured in constant 2010 US dollars. For school age population (primary education): https://databank.worldbank.org/data/reports.aspx?source=1159&series=SP.PRM.TOTL.IN# For GDP per capita (constant 2010 USD): https://data.worldbank.org/indicator/NY.GDP.PCAP.KD For government expenditure per student, primary (% of GDP per capita): https://data.worldbank.org/indicator/SE.XPD.PRIM.PC.ZS	World Bank, UNESCO

D.4.10	Government expenditure on secondary education per student	USD per student	Government expenditure on secondary education per student is defined as the total government expenditure on secondary education (current, capital, and transfers) divided by the total number of students in secondary education. The number of students in secondary education is defined as the population within the age group theoretically corresponding to a given level of education as indicated by theoretical entrance age and duration multiplied by the average share of attainment for lower and upper secondary education. Expenditure is measured in constant US dollars. For school age population (secondary education): https://databank.worldbank.org/data/reports.aspx?source=1159&series=SP.SEC.TOTL.IN For attainment rates by level of secondary education: http://data.uis.unesco.org/ For GDP per capita (constant 2010 USD): https://data.worldbank.org/indicator/NY.GDP.PCAP.KD For government expenditure per student, secondary (% of GDP per capita): https://data.worldbank.org/indicator/SE.XPD.SECO.PC.ZS	World Bank, UESCO
D.4.11	Government expenditure on tertiary education per student	USD per student	Government expenditure on tertiary education per student is defined as the total government expenditure on tertiary education (current, capital, and transfers) divided by the total number of students in tertiary education. The number of students in tertiary education is defined as the population within the age group theoretically corresponding to a given level of education as indicated by theoretical entrance age and duration multiplied by the share of attainment for tertiary education. Expenditure is measured in constant 2010 US dollars. For school age population (tertiary education): https://databank.worldbank.org/data/reports.aspx?source=1159&series=SP.TER.TOTL.IN# For attainment rates by level of tertiary education: http://data.uis.unesco.org/ For GDP per capita (constant 2010 USD): https://data.worldbank.org/indicator/NY.GDP.PCAP.KD For government expenditure per student, tertiary (% of GDP per capita): https://data.worldbank.org/indicator/se.XpD.teRt.pc.zs	World Bank, UNESCO
D.4.12	Research and development expenditure as a proportion of GDP (SDG 9.5.1)	% of GDP	Research and development (R&D) expenditure as a proportion of gross domestic product (GDP) is the amount of R&D expenditure divided by the total output of the economy. This indicator is aligned with the definitions of SDG indicator 9.5.1 Research and development expenditure as a proportion of GDP. https://unstats.un.org/sdgs/indicators/database/	UNESCO
D.5	**Inequality**			
D.5.1	Gini coefficient	0–100	The Gini coefficient measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. The Gini coefficient measures the area between the Lorenz curve and the hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. A Gini coefficient of zero represents perfect equality and 100 represents perfect inequality. http://data.worldbank.org/indicator/SI.POV.GINI	World Bank
D.5.2	Gender Inequality Index (GII)	0–1	The Gender Inequality Index (GII) is a composite index measuring three dimensions: (1) health measured in the maternal mortality ratio and adolescent birth rate; (2) empowerment measured in the female and male population aged 25 years and older with at least secondary education, and female and male shares of parliamentary seats; and (3) labor market (economic status) measured in female and male labor force participation rates of female and male populations aged 15 years and older. The index is based on the general mean of general means of different orders. The first level of aggregation is by a geometric mean within one dimension, calculated separately for women and men. The second level of aggregation combines the gender-specific indices across dimensions into a female gender index and male gender index. Finally, these two gender indices are combined using a harmonic mean. The GII ranges from 0 to 1. The higher the GII value, the more disparities between females and males. http://hdr.undp.org/en/data	UNDP

D.5.3	Proportion of women in managerial positions (SDG 5.5.2)	% of the total number of persons in senior and middle management	This indicator refers to the proportion of females in the total number of persons employed in senior and middle management. For the purposes of this indicator, senior and middle management correspond to major group 1 in both ISCO-08 and ISCO-88 minus category 14 in ISCO-08 (hospitality, retail, and other services managers) and minus category 13 in ISCO-88 (general managers), since these comprise mainly managers of small enterprises. This indicator is aligned with the definitions of SDG indicator 5.5.2 Proportion of women in managerial positions. https://unstats.un.org/sdgs/indicators/database/	ILO
D.5.4	Proportion of seats held by women in national parliaments (SDG 5.5.1)	% of total number of seats	The indicator is measured by the number of seats held by female members in single or lower chambers of national parliaments, expressed as a percentage of all occupied seats. National parliaments can be bicameral or unicameral. This indicator covers the single chamber in unicameral parliaments and the lower chamber in bicameral parliaments. It does not cover the upper chamber of bicameral parliaments. Seats refer to the number of parliamentary mandates, or the number of members of parliament. This indicator is aligned with the definitions of SDG indicator 5.5.1 Proportion of seats held by women in national parliaments. https://unstats.un.org/sdgs/indicators/database/	IPU
D.6	**Good governance**			
D.6.1	Corruption Perception Index (CPI)	1–100 country ranking	The CPI scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be. It is a composite index, a combination of surveys and assessments of corruption, collected by a variety of reputable institutions. A higher score indicates lower levels of perceived corruption. https://www.transparency.org/news/feature/corruption_perceptions_index_2017	TI
D.6.2	Bribery incidences (SDG 16.5.2)	% of firms	Bribery incidences are measured by the share of companies having experienced at least one request for a gift or informal payment when meeting with tax officials. Data for the indicator is based on company-level surveys conducted in World Bank client countries (Enterprise Surveys). These surveys are conducted via face-to-face interviews with top managers or business owners of registered (formal) manufacturing and service companies, with five or more employees that are either fully or partially private. For each country, the survey is conducted approximately every four to five years. This indicator is aligned with the definitions of SDG indicator 16.5.2 Bribery incidence (% of firms experiencing at least one bribe payment request). https://unstats.un.org/sdgs/indicators/database/	World Bank
D.6.3	ITUC Global Rights Index	1–5	The International Trade Union Confederation has compiled a list of 97 indicators corresponding to violations recorded in the ITUC Survey. A country will receive a point for each violation matching the indicators. Once all data has been processed and the final scores are tallied, countries are rated on a scale from 1 to 5. A higher score indicates a larger number of violations being committed. https://www.ituc-csi.org/IMG/pdf/ituc-global-rights-index-2018-en-final-2.pdf	ITUC
D.6.4	The Fragile States Index	Scores	The Fragile States Index (FSI) is an annual ranking of 178 countries based on 12 indicators across the following 4 categories. (1) Cohesion, including indicators for the security apparatus, factionalized elites, and group grievance. (2) Economic, including indicators for economic decline, uneven economic development, human flight, and brain drain. (3) Political, including indicators for state legitimacy, public services, human rights, and rule of law. (4) Social, including indicators for demographic pressure, refugees and IDPs, and external intervention. A higher score indicates a higher level of instability. http://fundforpeace.org/fsi/excel/	FOP

<table>
<tr><td>D.7</td><td colspan="4">Business environment</td></tr>
<tr><td>D.7.1</td><td>Ease of Doing Business ranking</td><td>1–190</td><td>The Ease of Doing Business ranking is determined by sorting countries' aggregate scores on 41 indicators across the following 10 topics, giving equal weight to each topic.
(1) Starting a business, including procedures, time, cost, and minimum capital to start a limited liability company;
(2) Dealing with construction permits, including procedures, time, and cost to complete all formalities to build a warehouse, and the quality control and safety mechanisms in the construction permitting system;
(3) Obtaining electricity—including procedures, time, and cost—to become connected to the electrical grid, the reliability of the electricity supply, and the transparency of tariffs;
(4) Registering property—including procedures, time, and cost—to transfer a property, and the quality of the land administration system;
(5) Acquiring credit, including movable collateral laws and credit information systems;
(6) Protecting minority investors, including the extent of disclosure, extent of director liability, ease of shareholder suits, extent of shareholder rights, extent of ownership and control, and extent of corporate transparency;
(7) Paying taxes—including payments, time, and total tax—and the contribution rate for a firm to comply with all tax regulations as well as post-filing processes;
(8) Trading across borders, including time and cost to export in terms of documentary compliance and border compliance, as well as time and cost to import in terms of documentary compliance and border compliance;
(9) Enforcing contracts—including time and cost—to resolve a commercial dispute, and the quality of judicial processes;
(10) Resolving insolvency, including the recovery rate for a commercial insolvency, and the strength of the legal framework for insolvency;
The rankings for all economies are benchmarked to May 2018. Higher ranks indicate that the regulatory environment is more conducive to the starting and operation of a local firm.
http://www.doingbusiness.org/Rankings</td><td>World Bank</td></tr>
<tr><td>D.7.2</td><td>Ease of Doing Business scores</td><td>0–100</td><td>The Ease of Doing Business (distance to frontier) score captures the gap between an economy's performance and a measure of best practice across 41 indicators for the 10 topics, giving equal weight to each topic. The value for each topic is based on a distance to the frontier score. The distance to the frontier score benchmarks economies with respect to a measure of regulatory best practices; it shows the gap between an economy's performance and the best performance on each indicator. Indicators are normalized to a common unit, based on the best and worst regulatory performance across all economies. Both the best regulatory performance and worst regulatory performance are established every five years and remain at that level for the five years regardless of any changes in data in interim years.
For the 10 topics and the associated indicators, please refer to the definition of GGPA indicator D.7.1.
A higher score indicates closer proximity to the benchmark of 100, suggesting that the regulatory environment is more conducive to the starting and operation of a local firm.
http://www.doingbusiness.org/en/data/doing-business-score</td><td>World Bank</td></tr>
<tr><td>D.7.3</td><td>Index of Economic Freedom</td><td>Rank: 1–180
Score: 0–100</td><td>The measure of economic freedom based on a total of 70 indicators across 12 components, quantitative and qualitative factors, grouped into four categories:
(1) Rule of law, including property rights (5), government integrity (6), and judicial effectiveness (3);
(2) Government size, including government spending, tax burden (3), and fiscal health (2);
(3) Regulatory efficiency, including business freedom (13), labor freedom (7), and monetary freedom (2);
(4) Open markets, including trade freedom (2), investment freedom (21), and financial freedom (5).
Each of the twelve components is graded on a scale of 0 to 100. A country's overall score is derived by averaging the scores, with equal weight being given to each.
A higher score indicates a higher level of economic freedom.
https://www.heritage.org/index/download</td><td>Heritage Foundation</td></tr>
</table>

D.8	Access to formal finance			
D.8.1	Proportion of adults with an account at a bank or other financial institution or with a mobile-money-service provider (SDG 8.10.2)	% of adults	The indicator captures the percentage of adults (above 15 years of age) who report having an account (by themselves or together with someone else) at a bank or another type of financial institution or personally using a mobile money service in the past 12 months. Data for the indicator comes from World Bank's Global Findex database, which is based on representative individual-level surveys worldwide. Sampling weights are used for calculating country-level aggregates. The surveys are conducted every three years, with the first round of the survey in 2011, the second in 2014, and the third in 2017. Adult population is calculated as total population minus the population between the ages 0–14. In cases where the share of population between ages 0–14 is not available, the regional share of population between ages 0–14 is used. In cases where data for the most recent period is not available, data for the previous period is repeated. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is the definitions of SDG indicator 8.10.2 Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider. https://unstats.un.org/sdgs/indicators/database/	World Bank
D.8.2	Number of commercial bank branches (SDG 8.10.1a)	number of branches per 100,000 adults	The indicator is defined as the number of commercial banks branches at end-year reported by the central bank or the main financial regulator of the country divided by total population above 15 years of age, multiplied by 100,000. Financial institutions include commercial banks, non-deposit-taking microfinance institutions, deposit-taking microfinance institutions, and credit union and financial cooperatives, among others. The adult population is calculated as total population minus the population between the ages 0–14. In cases where the share of population between ages 0–14 is not available, the regional share of population between ages 0–14 is used. In cases where data for the most recent period is not available, data for the previous period is repeated. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 8.10.1a Number of commercial bank branches per 100,000 adults. https://unstats.un.org/sdgs/indicators/database/	IMF
D.8.3	Number of automated teller machines (ATMs) (SDG 8.10.1b)	number of ATMs per 100,000 adults	The indicator is defined as the number of automated teller machines (ATMs) in the country for all types of financial institutions as reported by the central bank or the main financial regulator of the country divided by total population above 15 years of age, multiplied by 100,000. Financial institutions include commercial banks, non-deposit-taking microfinance institutions, deposit-taking microfinance institutions, and credit union and financial cooperatives, among others. The adult population is calculated as total population minus the population between the ages 0–14. In cases where the share of population between ages 0–14 is not available, the regional share of population between ages 0–14 is used. In cases where data for the most recent period is not available, data for the previous period is repeated. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. This indicator is aligned with the definitions of SDG indicator 8.10.1b Number of automated teller machines (ATMs) per 100,000 adults. https://unstats.un.org/sdgs/indicators/database/	IMF

A2. Diagnostic Indicators

	Indicator	Unit	Definition	Source
A	**Resource-efficient growth**			
A.1	**Energy efficiency**			
A.1.1	Energy intensity	MJ/USD (constant 2011 PPP)	Energy intensity is defined as total primary energy supply (TPES) divided by GDP measured at purchasing power parity in constant 2011 USD. TPES as defined by the International Recommendations for Energy Statistics (IRES), is measured as indigenous production plus imports, minus exports, stock changes, and fuels supplied to international marine and aviation. Primary energy is any energy commodity that can be captured directly from natural resources without transformation. Gross domestic product (GDP) is the measure of economic output. For comparisons over time, GDP is measured in constant terms. http://data.worldbank.org/indicator/EG.EGY.PRIM.PP.KD	World Bank
A.1.2	Distribution losses of electricity	% of output	Transmission and distribution losses include both technical and non-technical electricity losses. Technical losses are caused by physical characteristics of the grid and the electricity-generating system. The amount of losses is mainly dependent on the size of the country (length of power lines), voltage of transmission, and distribution and quality of network. Transmission and distribution losses comprises all losses due to transport and distribution of electrical energy, including losses in overhead transmission lines and distribution networks as well as losses in transformers which are not considered as integral parts of the power plants. Non-technical losses mainly refer to electricity theft. http://data.worldbank.org/indicator/EG.ELC.LOSS.ZS	World Bank
A.2	**Resource productivity**			
A.2.1	Material intensity	kg/USD (constant 2005 USD)	The ratio between gross domestic product and the total amount of domestic materials (construction/industrial minerals, metal, ores, fossil fuels and biomass) extracted. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. GDP is expressed in constant 2005 US dollars. The original website is not available and has been updated. For the original link: http://www.materialflows.net/data/datadownload For the updated link: http://www/materialflows.net/visualisation-centre	SERI
A.2.2	Water productivity	USD/m^3 per year (constant 2010)	Water productivity is defined as total GDP divided by the annual freshwater withdrawal. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. GDP is expressed in constant 2010 US dollars. Annual freshwater withdrawals are total water withdrawals, not counting evaporation losses from storage basins. Withdrawals also include water from desalination plants in countries where they are a significant source. Withdrawals can exceed 100% of total renewable resources where extraction from nonrenewable aquifers or desalination plants is considerable or where water reuse is significant. Withdrawals for agriculture and industry are total withdrawals for irrigation and livestock production and for direct industrial use (including for cooling thermoelectric plants). Withdrawals for domestic uses include drinking water and municipal use or supply and use for public services, commercial establishments, and homes. Data is collected at irregular intervals for some countries. The GGPA is using the most recent value available for any country. http://data.worldbank.org/indicator/ER.GDP.FWTL.M3.KD	World Bank
A.2.3	Municipal solid waste generation intensity	kg/USD (constant 2010 USD)	The indicator is the ratio between municipal solid waste MSW) and GDP (constant 2010 US dollars). Municipal solid waste is defined as the waste mainly produced by households, also including similar waste generated from sources such as commerce, offices, and public institutions. The amount of municipal solid waste refers to the solid waste collected by or on behalf of municipal authorities and disposed of through the waste management system. It does not include amounts of municipal solid waste collected through informal waste management systems. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Municipal solid waste generation: http://www.atlas.d-waste.com/ GDP: http://data.worldbank.org/indicator/NY.GDP.MKTP.KD	Dwaste, World Bank

A.2.4	Recycling rate of solid waste	% of MSW	The indicator is defined as the amount of municipal solid waste (MSW) recycled divided by the amount of municipal solid waste collected by or on behalf of municipal authorities and disposed of through the waste management system. Municipal solid waste is defined as the waste mainly produced by households, including also similar waste generated from sources such as commerce, offices and public institutions. http://www.atlas.d-waste.com/	Dwaste
A.2.5	Agricultural (land) productivity	USD/ha	Agricultural land productivity is defined as agricultural production divided by the total area of arable land under permanent crops and under permanent pastures. The economic value of agricultural output is calculated by multiplying gross production in physical terms by output prices at the farm gate. Since intermediate uses within the agricultural sector (seed and feed) have not been subtracted from production data, this value of production aggregate refers to the notion of "gross production." Value of production in constant terms is derived using the average prices of a selected year or years, known as the base period. US dollar figures for value of gross production are converted from local currencies using official exchange rates as prevailing in the respective years. Agricultural production: http://www.fao.org/faostat/en/#data/QV Agricultural land: https://data.worldbank.org/indicator/AG.LND.ARBL.HA	FAO, World Bank
A.3	**Other productivity factors**			
A.3.1	Labor productivity	thousand USD (constant 2005 USD)	Labor productivity represents the total volume of output (measured in terms of GDP) produced per unit of labor (measured in terms of the number of employed persons) during a given time reference period. Employment comprises all persons of working age who—during a specified brief period, such as one week or one day—were in the following categories: (1) paid employment (whether at work or with a job but not at work) or (2) self-employment (whether at work or with an enterprise but not at work). For international comparability, the working age population is often defined as all persons aged 15 and older, but this may vary from country to country based on national laws and practices. http://www.ilo.org/global/statistics-and-databases/research-and-databases/kilm/lang--en/index.htm	ILO
A.3.2	Logistics Performance Index	1–5 (higher scores indicate higher performance)	The Logistics Performance Index's overall score reflects perceptions of a country's logistics performance based on the efficiency of the customs clearance process, quality of trade- and transport-related infrastructure, ease of arranging competitively priced international shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time. Scores for the six areas are averaged across all respondents and aggregated to a single score using principal components analysis. http://data.worldbank.org/indicator/LP.LPI.OVRL.XQ http://siteresources.worldbank.org/INTLAC/Resources/ConnectingtoCompete.pdf	World Bank
A.3.3	Technological readiness	1–7 (higher scores indicate higher readiness)	The technological readiness index aims to measure the agility with which an economy adopts existing technologies to enhance the productivity of its industries; the index covers the areas of (1) technological adoption (availability of latest technologies, firm-level technology absorption, FDI, and technology transfer) and (2) ICT use (Internet users, broadband Internet subscriptions, Internet bandwidth, mobile broadband subscriptions, mobile telephone subscriptions, and fixed telephone lines). http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf	World Economic Forum

B	**Eco-efficient growth**			
B.1	**Quantity of natural assets**			
B.1.1	Coastal shelf fishing pressure	ton/km^2	Fish stocks measures the percentage of a country's total catch—within its exclusive economic zone (EEZ)—that is comprised of species that are overexploited or collapsed, weighted by the quality of fish catch data. The data for the indicator was published as part of Yale University's Environmental Protection Index but has been discontinued. Latest data available covers the year 2010. http://epi2016.yale.edu/sites/default/files/2014%20EPI%20Raw%20Data%20Files.zip	EPI
B.1.2	Changes in forest cover	annual change in total forest cover (%)	The annual percent change in forest cover between 2000 and 2012. Forests are defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10%, or trees able to reach these thresholds in situ. It does not include land that is predominantly under agricultural or urban land use. http://faostat3.fao.org/download/R/RL/E	FAO
B.1.3	Baseline Water Stress Index	0–5 (higher score = greater competition among users)	The ratio of total annual water withdrawals (municipal, industrial, and agricultural) to total renewable supply. The values are normalized on a scale from 0 to 5. Renewable water resources include all surface water and groundwater resources that are available on a yearly basis without consideration of the capacity to harvest and use this resource. Exploitable water resources, which refer to the volume of surface water or groundwater that is available with an occurrence of 90% of the time, are considerably less than renewable water resources, but no universal method exists to assess such exploitable water resources. The index is based on a one-time evaluation by WRI covering 2013. https://www.wri.org/publication/aqueduct-country-and-river-basin-rankings	WRI
B.1.4	Natural resources depletion	% of GNI	Natural resources depletion is the sum of net forest depletion, energy depletion, and mineral depletion. Net forest depletion is the product of unit resource rents and the excess of roundwood harvest over natural growth. In a country where incremental growth exceeds wood extraction, net forest depletion would be zero, no matter the absolute volume or value of wood extracted. Energy depletion is the ratio of the present value of energy resource rents, discounted at 4%, to the exhaustion time of the resource. Rent is calculated as the product of unit resource rents and the physical quantities of energy resources extracted. It covers hard and soft coal, crude oil, and natural gas. Mineral depletion is the ratio of the present value of mineral resource rents, discounted at 4%, to the exhaustion time of the resource. Rent is calculated as the product of unit resource rents and the physical quantities of mineral extracted. It covers tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. Gross national Income (GNI and formerly GNP) is the sum of value added by all resident producers plus any product taxes (less subsides) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. http://data.worldbank.org/indicator/NY.ADJ.DRES.GN.ZS	World Bank
B.2	**Quality of natural assets**			
B.2.1	Changes in the number of engendered species	% change	Changes in number of endangered species in a country, based on the IUCN Red List of Threatened Species between 2013 and 2015. Endangered species are defined as the sum of "Critically Endangered," "Endangered," and "Vulnerable" categories in the IUCN Red List. http://cmsdocs.s3.amazonaws.com/summarystats/2015-4_Summary_Stats_Page_Documents/2015_4_RL_Stats_Table_5.pdf	IUCN
B.2.2	Water Quality Index	0–100 (higher scores indicate higher quality)	The Water Quality Index uses three parameters to determine the water quality of a country's freshwater bodies, measuring nutrient levels (dissolved oxygen, total nitrogen, and total phosphorus), and two parameters measuring water chemistry (pH and conductivity). The WQI is a proximity-to-target composite of water quality, adjusted for monitoring station density in each country, with a maximum score of 100. Higher scores indicate higher water quality. Data is available for a single year (2010). http://epi2016.yale.edu/sites/default/files/2010epi_data_0.xls	EPI
B.2.3	Trends in soil health	0–50 (higher scores indicate higher soil health)	The Trends in Soil Health Index measures the physical part related to loss of soil mass and structure and the long-term chemical conditions of the soil in terms of nutrients and absence of toxicities built up. Higher scores indicate higher soil health. Data is available for a single year (2005). Unpublished document.	FAO
B.2.4	Population exposure to $PM_{2.5}$	% of population	This indicator is a measure of the weighted average of the percentage of the population exposed to elevated levels of $PM_{2.5}$, by measuring instances when $PM_{2.5}$ concentrations exceeded 10, 15, 25, and 35 µg/m^3, which are the WHO's air quality guidelines and interim targets. http://epi2016.yale.edu/sites/default/files/2014%20EPI%20Raw%20Data%20Files.zip	EPI

C	**Climate-resilient growth**			
C.1	**Climate change mitigation**			
C.1.1	CO_2 emission trends	Annual growth rate (%)	The indicator is defined as the amount of carbon dioxide emissions divided by total population. Carbon dioxide emissions only include those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship, except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. http://data.worldbank.org/indicator/EN.ATM.CO2E.KT	World Bank
C.1.2	Carbon Intensity	kg of CO_2/USD (constant 2010 USD)	Carbon intensity is defined as the amount of carbon dioxide emissions (CO_2) divided by gross domestic production. CO_2 emissions only include those stemming from the burning of fossil fuels and the manufacture of cement. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. GDP is measured at constant 2010 US dollars. GDP: http://data.worldbank.org/indicator/NY.GDP.MKTP.CD CO_2 emissions: http://data.worldbank.org/indicator/EN.ATM.CO2E.KT	World Bank
C.1.3	Renewable energy production	% of total electricity output	The indicator is defined as electricity generated from renewable sources divided by total electricity generation. Electricity generation from renewable sources includes geothermal, solar photovoltaic, solar thermal, tide, wind, industrial waste, municipal waste, primary solid biofuels, biogases, bio-gasoline, biodiesels, other liquid biofuels, non-specified primary biofuels and waste, and charcoal. It excludes hydro power. http://data.worldbank.org/indicator/EG.ELC.RNWX.ZS	World Bank
C.1.4	Carbon stock in living forest biomass	million tons per year	Carbon stock in living biomass is defined as the quantity of carbon contained in a reservoir or system of living forest biomass which has the capacity to accumulate or release carbon. http://www.fao.org/docrep/013/i1757e/i1757e14.pdf	FAO
C.2	**Climate change adaptation**			
C.2.1	Climate change exposure	0–1 (higher scores indicate higher exposure)	Under the ND-GAIN Index, exposure is defined as the degree to which a country is exposed to climate change from a biophysical perspective. Exposure indicators are projected impacts for the coming decades and are therefore invariant overtime. Indicators used for this index include projected change of cereal yields, projected population change, projected change of annual runoff, projected change of groundwater recharge, projected change of deaths from climate change-induced diseases, projected change of length of transmission season of vector-borne disease, projected change of biome distribution, projected change of marine biodiversity, projected change of warm period, projected change of flood hazard, projected change of hydropower generation capacity, and projection of sea level rise impact. Higher scores indicate higher exposure. https://gain.nd.edu/our-work/country-index/download-data/	NDGAIN
C.2.2	Sensitivity to climate change	0–1 (higher scores indicate higher sensitivity)	Under the ND-GAIN Index, sensitivity is defined as the degree to which a country is affected by the adverse impacts of climate change, such as the extent to which it depends on sectors that are susceptible to the adverse impact of climate change and the share of the population sensitive to climate hazard due to topography and demography, among others. A country's sensitivity can vary over time. Indicators used for this index include food import dependency, rural population, fresh water withdrawal rate, water dependency ratio, slum population, dependency on external resources for health services, dependency on natural capital, ecological footprint, urban concentration, age dependency ratio, dependency on imported energy, and population living under 5 m above sea level. Higher scores indicate higher sensitivity. https://gain.nd.edu/our-work/country-index/download-data/	NDGAIN
C.2.3	Adaptive capacity to climate change	0–1 (higher scores indicate higher adaptive capacity)	Under the ND-GAIN Index, adaptive capacity is defined as the ability of a country to adjust to the adverse impacts of climate change and reduce the associated damage. Indicators used for this index include agriculture capacity, child malnutrition, access to reliable drinking water, dam capacity, medical staffs, access to improved sanitation facilities, protected biomes, engagement in international environmental conventions, quality of trade and transport-related infrastructure, paved roads, electricity access, and disaster preparedness. Higher scores indicate higher adaptive capacity. https://gain.nd.edu/our-work/country-index/download-data/	NDGAIN

A3. Dashboard Indicators

Theme	Sub-theme	Indicator	Unit	Description	Source
Natural Drivers	Geography and climate	Land size	km^2	Land size refers to a country's total land area, excluding areas covered by inland water bodies, national claims to continental shelf, and exclusive economic zones. http://data.worldbank.org/indicator/AG.LND.TOTL.K2	World Bank
		Renewable internal freshwater per capita	thousand cubic meters per capita	Renewable internal freshwater refers to internal renewable freshwater resources from internal river flows and groundwater from rainfall in a country. Renewable internal freshwater resources per capita are calculated using the World Bank's population estimates. http://data.worldbank.org/indicator/ER.H2O.INTR.PC	World Bank
		GEF Benefits Index for Biodiversity	0–100 (higher scores indicate higher biodiversity)	The GEF Benefits Index (GBI) is built as one of the pillars of the GEF Resource Allocation Framework. The GBI for biodiversity seeks to measure a country's potential to generate global environmental benefits in the focal areas of biodiversity. It is the sum of the weighted average of the country's score for marine biodiversity (20%) and terrestrial biodiversity (80%). The score for terrestrial biodiversity is based on four indicators: represented species, threatened species, represented ecoregions, and threatened ecoregions. The score for marine biodiversity is based on a single indicator: represented fish species. http://data.worldbank.org/indicator/ER.BDV.TOTL.XQ	GEF
		Average precipitation	mm per year	Average precipitation is the long-term average in depth (over space and time) of annual precipitation in a country. Precipitation is defined as any kind of water that falls from clouds as a liquid or a solid. http://data.worldbank.org/indicator/AG.LND.PRCP.MM	World Bank
	Demography	Total population	million persons	Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship, except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of their country of origin. http://data.worldbank.org/indicator/SP.POP.TOTL	World Bank
		Urbanization rate	% of total population	The urbanization rate refers to the proportion of people living in urban areas as defined by national statistical offices. This indicator is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects. To estimate urban populations, the UN's ratio of urban to total population was applied to the World Bank's estimates of total population. Percentages urban are the numbers of persons residing in an area defined as "urban" per 100 total population. http://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS	World Bank, UNPD
		Urban population growth rate	annual change (%)	Annual growth in the total population living in urban areas as defined by national statistical offices. See A.2.2 for the definition of urban population. http://data.worldbank.org/indicator/SP.URB.GROW	World Bank, UNPD

Human-Induced Drivers	**Economy**	Total GDP	billion USD	Gross domestic production (GDP) is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. GDP is in current US dollars. http://data.worldbank.org/indicator/NY.GDP.MKTP.CD	World Bank
		Share of value added from agriculture in GDP	% of GDP	The indicator is defined as the ratio between value added from agriculture and a country's total GDP. Agriculture corresponds to International Standard Industrial Classification (ISIC) divisions 1–5 and includes forestry, hunting, and fishing as well as cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the ISIC, revision 3 or 4. The United Nations System of National Accounts calls for value added to be valued at either basic prices (excluding net taxes on products) or producer prices (including net taxes on products paid by producers but excluding sales or value added taxes). Both valuations exclude transport charges that are invoiced separately by producers. Total GDP is measured at purchaser prices. http://data.worldbank.org/indicator/NV.AGR.TOTL.ZS	World Bank
		Share of value added from manufacturing in GDP	% of GDP	The indicator is defined as the ratio between value added from manufacturing and a country's total GDP. Manufacturing refers to industries belonging to International Standard Industrial Classification (ISIC) divisions 15–37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the ISIC, revision 3. For countries where value added in the national accounts is reported at basic price, gross value added at factor cost is used as the denominator. The basic price is the amount receivable by the producer exclusive of taxes payable on products and inclusive of subsidies receivable on products. The equivalent for imported products is the CIF (cost, insurance, and freight) value; that is, the value at the border of the importing country. http://data.worldbank.org/indicator/NV.IND.MANF.ZS	World Bank
		Share of value added from services and other sectors in GDP	% of GDP	The indicator is defined as the ratio between value added from services and other sectors and a country's total GDP. Services and other sectors correspond to International Standard Industrial Classification (ISIC) divisions 50–99, and they include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services, such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The industrial origin of value added is determined by the ISIC, revision 3 or 4. The United Nations System of National Accounts calls for value added to be valued at either basic prices (excluding net taxes on products) or producer prices (including net taxes on products paid by producers but excluding sales or value added taxes). Both valuations exclude transport charges that are invoiced separately by producers. Total GDP is measured at purchaser prices. Financial intermediation services indirectly measured (FISIM) is an indirect measure of the value of financial intermediation services (i.e., output) provided but for which financial institutions do not charge explicitly as compared to explicit bank charges. Although the 1993 SNA recommends that the FISIM are allocated as intermediate and final consumption to the users, many countries still make a global (negative) adjustment to the sum of gross value added. http://data.worldbank.org/indicator/NV.SRV.TETC.ZS	World Bank

		GDP growth rate	% per year	The indicator is defined as the annual percentage change of GDP at market prices based on constant local currency. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG	World Bank
		GDP (PPP) per capita	USD (current)	The indicator is defined as GDP per capita based on purchasing power parity (PPP), with the gross domestic product being converted to international dollars using purchasing power parity rates and divided by population. An international dollar has the same purchasing power over GDP as the US dollar has in the United States. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. http://data.worldbank.org/indicator/NY.GDP.PCAP.CD	World Bank
		Unemployment rate (SDG 8.5.2)	% of persons in labor force	Unemployment refers to the share of the labor force that is without work but available for and seeking employment. Persons in unemployment are defined as all those of working age (usually persons aged 15 and above) who were not in employment, carried out activities to seek employment during a specified recent period, and were available to take up employment given a job opportunity, where: (1) "not in employment" is assessed with respect to the short reference period for the measurement of employment; (2) to "seek employment" refers to any activity—when carried out, during a specified recent period comprising the last four weeks or one month—for the purpose of finding a job or setting up a business or agricultural undertaking; (3) the point when the enterprise starts to exist should be used to distinguish between search activities aimed at setting up a business and the work activity itself, as evidenced by the enterprise's registration to operate or by when financial resources become available, the necessary infrastructure or materials are in place, or the first client or order is received, depending on the context; (4) "currently available" serves as a test of readiness to start a job in the present, assessed with respect to the same reference period used to measure employment in a given country. Depending on national circumstances, the reference period may be extended to include a short subsequent period not exceeding two weeks in total, to ensure adequate coverage of unemployment situations among different population groups. http://data.worldbank.org/indicator/SL.UEM.TOTL.ZS	World Bank
	Governance and finance	Foreign direct investment (inflow)	% of GDP	Foreign direct investment is defined as the net inflows of investment to acquire a lasting management interest (10% or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. The indicator shows net inflows (new investment inflows less disinvestment) in a country from foreign investors, divided by GDP. http://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS	World Bank
		Ease of Doing Business index	country ranking	The Ease of Doing Business ranking is determined by sorting countries' aggregate scores on 41 indicators across 10 topics, giving equal weight to each topic. The 10 topics are starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investors, paying taxes, trading across borders, enforcing contracts, and resolving insolvency. Higher ranks indicate that the regulatory environment is more conducive to the starting and operation of a local firm. http://www.doingbusiness.org/rankings	World Bank

		Corruption Perception Index	1–100 country ranking	The CPI scores and ranks countries/territories based on how corrupt a country's public sector is perceived to be. It is a composite index, a combination of surveys and assessments of corruption, collected by a variety of institutions. A higher rank indicates lower levels of perceived corruption. http://www.transparency.org/research/cpi/overview	Transparency International
	Human well-being	Access to improved water source	% of population	Access to an improved water source refers to the percentage of the population using an improved drinking water source, including piped water on premises (piped household water connection located inside the user's dwelling, plot, or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection). https://washdata.org/data/household#!/	WHO, UNICEF
		Access to improved sanitation facilities	% of population	Access to improved sanitation facilities refers to the percentage of the population using improved sanitation facilities, including flush/pour flush (to piped sewer system, septic tank, pit latrine), ventilated improved pit (VIP) latrine, pit latrine with slab, and composting toilet. https://washdata.org/data/household#!/	WHO, UNICEF
		Access to electricity	% of population	Access to electricity is the percentage of population with access to electricity. Electrification data is collected from industry, national surveys, and international sources. Following the definitions put forward by the IEA and the UN, the indicator captures the number of households with an electricity connection divided by the total number of households within the country. https://www.iea.org/energyaccess/database/	IEA
		Human Development Index	country ranking	The Human Development Index (HDI) is a composite index reflecting the following three dimensions: health, education, and standard of living. The index is the geometric mean of a country's score in the three dimensions. The HDI simplifies and captures only part of what human development entails. It does not reflect on inequalities, poverty, human security, and empowerment, among others. The health dimension is assessed by life expectancy at birth. Education is measured by mean of years of schooling for adults aged 25 years and more and expected years of schooling for children of school entering age. Standard of living is measured by gross national income per capita. The HDI uses the logarithm of income to reflect the diminishing importance of income with increasing GNI. http://hdr.undp.org/en/composite/trends	UNDP
		Population headcount ratio at USD 1.25 a day	% of population	Poverty headcount ratio at USD 1.25 per day is defined as the percentage of the population living on less than USD 1.25 per day. The original link is no longer available.	World Bank
		Gini coefficient	0–100	The Gini coefficient measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution. The Gini coefficient measures the area between the Lorenz curve and the hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. A Gini coefficient of zero represents perfect equality and a score of 100 represents perfect inequality. http://data.worldbank.org/indicator/SI.POV.GINI	World Bank

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Based in Seoul, Republic of Korea, the Global Green Growth Institute (GGGI) is a treaty-based international, inter-governmental organization that supports developing country governments transition to a model of economic growth that is environmentally sustainable and socially inclusive. GGGI delivers programs for more than 30 Members and partners – in Africa, Asia, the Caribbean, Europe, Latin America, the Middle East and the Pacific – with technical support, capacity building, policy planning and implementation, and by helping to build a pipeline of bankable green investment projects.

GGGI supports its Members and partners to deliver on the Sustainable Development Goals and the Nationally Determined Contributions to the Paris Agreement.

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