5 Expert Consultations

From the beginning of developing the Green Growth Index in 2016, GGGI has placed significant value on consultations with experts from different fields and institutions from different parts of the world for several reasons such as to increase policy relevance of the green growth indicators, create awareness on the utility and enhance uptake of the Index, and encourage collaboration on its application. When the Index was first published in 2019, over 300 experts from about 40 countries have been consulted. Many of these experts remained involved in the annual review of the Index, but GGGI continues to invite more experts to make the review as comprehensive and global as possible. This section discusses the approach for and results of the expert review on the 2020 Green Growth Index.

5.1 Online survey

5.1.1 Questionnaire design

The expert consultation was conducted through an online survey from November 1 to December 30, 2020. The questionnaire was semi-structured consisting of five parts (Appendix 2):

- Involvement in the review – whether experts have participated in the previous reviews
- Personal information – name, gender, organization, and country
- Work qualification – field of expertise, relevance of work to indicators or composite index as well as to green growth
- Expert opinion on the new indicators – GE1, BE3, GB2, SE1, SP2, and GN1; SL1 was not included but mentioned in the questionnaire because the new indicator was not yet available during the survey; GE2 and GE3 were not included because the updates only refer to other units of measurement; and SE2 was not included because the changes dealt with the availability of the time-series data, which cannot be influenced by the experts
- Method for aggregating indicators – options for aggregation method to increase the number of countries with scores for green economic opportunities, which is the dimension with not only the least number of indicators but also with lowest country coverage due to data availability

5.1.2 Response rate

Table 3 presents a summary of the response rates to the online survey by a group of experts. The overall response rate is 54%, with the expert group and scientists accounting for the highest response rate within the types (80%) and over the total number (31%) of experts, respectively. The scientists who were invited to participate in the review are mainly those currently engaged in the Task Forces on scenarios and models, knowledge and data, and policy tools of the IPBES and authors in the Working Group II of the Sixth Assessment Report of the IPCC. The low response rate among scientists can be attributed to their very busy schedule in their respective tasks for these task forces and working groups. In the case of policymakers, the invitees are mainly those who participated in the four regional workshops in 2018. The reasons for the low response rate among them are either due to their busy schedules or retirement from their offices. With the expectation that many experts would be unable to participate, the number of invites for the online survey had been significantly increased this year, resulting to 110 completed questionnaires (as compared to 90 last year). However, there are only a few participants from the NGOs this year. Thus, the number of experts to be invited from NGOs and private sector will be increased in the next surveys to enhance participation from this group.

Table 3 Number of experts who were invited and responded to the survey

Types of experts	Number of invited experts	Number of experts complete survey	Response rate	
			Within Types	Total
GGGI experts	40	21	53%	19%
Expert group	35	28	80%	25%
Policymakers	70	21	30%	19%
Scientists	50	34	68%	31%
NGOs	10	6	60%	5%
Total	**205**	**110**	**54%**	

5.1.3 Respondents' characteristics

Table 4 describes the characteristics of the experts from the different organizations who participated in the review. The majority of the experts come from international organizations and academic/research organizations with a combined share to a total number of experts of about 66%. While gender balance was taken into account when sending invites for the online survey, the response rate was higher among male experts, particularly from international organizations and NGOs. The gender ratio was highest among the experts from academic/research organizations at 0.95, where relatively more female experts participated in the review as compared to other organizations. More than half of the experts also participated in the review of the 2019 Green Growth Index, with the highest percentage coming from the government organizations. The experts who participated for the first time in the review this year come from academic/research organizations. Although only 69% of the experts work on indicators and composite indices, a high percentage of them (85%) are working on issues related to green growth. Surprisingly, only 62% percent of the academic/research

experts indicated that their work is related to green growth even though all of them are supporting IPBES and IPCC initiatives, which are both relevant to the green growth dimensions on efficient and sustainable resource use and natural capital protection. This implies that, while most experts from international organizations, governments, and NGOs are very knowledgeable about the green model of growth, those from the academe are not.

Table 4 Characteristics of experts who participated in the review, by type of organizations

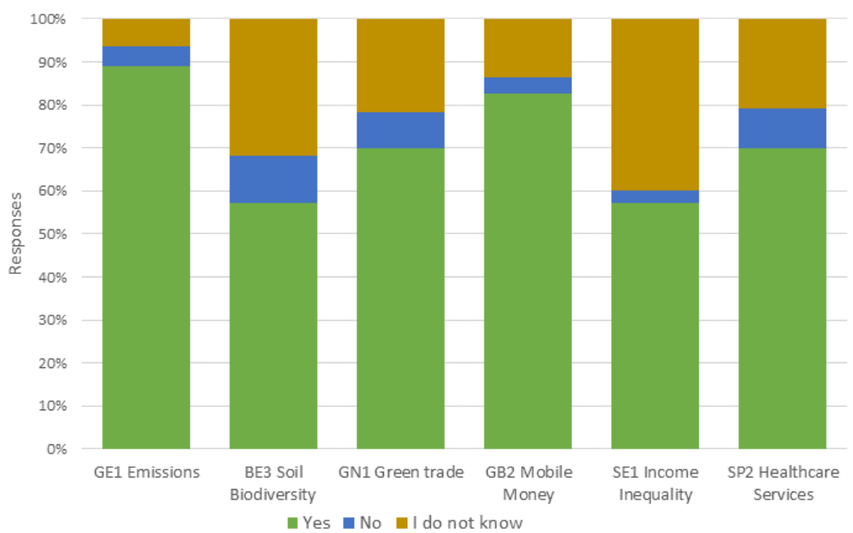
Characteristics of experts	Types of organizations				Total
	International organization	Government	Academic, research	Non-government	
Number of experts	36	25	37	12	110
Gender (female-male) ratio	0.57	0.79	0.95	0.09	0.64
Participated in 2019 review	53%	68%	19%	58%	45%
Work related to indicators	72%	72%	62%	75%	69%
Work related to green growth	97%	96%	62%	92%	85%

5.2 Expert feedback

5.2.1 New green growth indicators

Figure 18 presents the responses of the experts to the questions related to the new green growth indicators. Over 80% of the experts agreed to include the new indicators for GE1: Ratio of CO2 emissions including Agriculture, Forestry and Other Land Use (AFOLU) to population and GB2: Share of adults (15 years and older) with an account at a financial institution or mobile-money-service provider. Experts' responses to the inclusion of GN1: Share of patent publications in environmental technology to total patents (cumulative) and SP2: Universal health coverage (UHC) service coverage index as new green growth indicators were also mainly positive, with about 70% of them responding "Yes" to the question. The positive responses for the inclusion of BE3: Above-ground biomass stock in forest and SE1: Inequality in income based on Palma ratio were the lowest, albeit still above 50%. But the main reason for disagreeing for their inclusion is the lack of expertise among over 30% of the experts, thus responding "I do not know to the question". Only about 17% and 37% of the experts indicate that they have expertise in social inclusion and social and gender equality, and biodiversity and ecosystem, respectively.

Figure 18 Responses of the experts to the questions related to the new green growth indicators



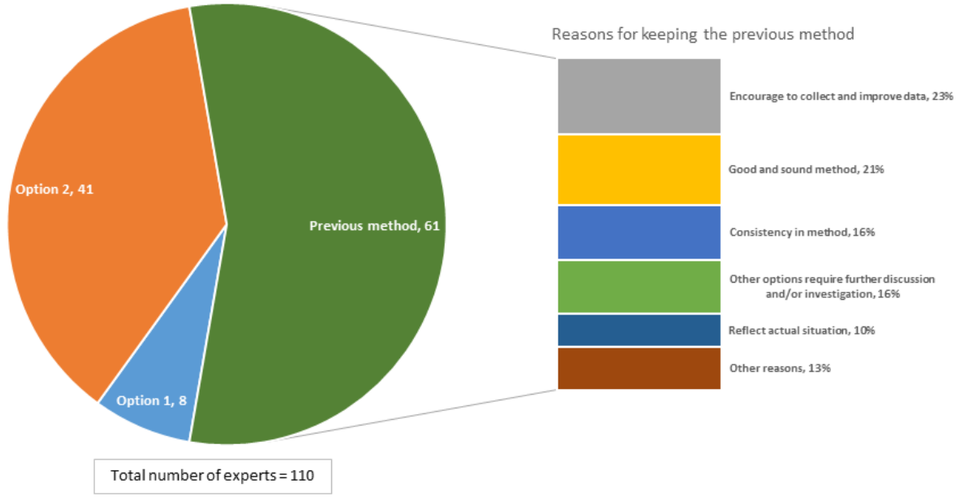
5.2.2 Aggregation method

The last question posted to the reviewers in the survey is their consensus to change the method to aggregate the four indicators for the green economic opportunities. In 2019, the overall scores for Green Growth Index were computed only for 116 countries because many countries (particularly in Africa and the Middle East) lack data for these indicators. As with the other green growth dimensions, the scores for the green economic opportunities dimension were only computed for countries with three or four indicators. But unlike other dimensions, many countries had only two green economic opportunities indicators and thus the country scores for this dimension were not computed. Because the green growth concept assumes that the four dimensions are equally important, no score on Green Growth Index was computed for countries which lack green economic opportunities scores. But several countries expressed their interest to have scores for Green Growth Index and know their ranks relative to their peer countries in 2020. In view of this, two options were proposed for the computation of green economic opportunities scores for countries with only two indicators for this dimension.

- Option 1 for new method: Identify two indicators with the highest scores and compute the geometric mean of these two indicators (i.e., Other indicators with the lowest scores are excluded)
- Option 2 for new method: Compute geometric mean if at least two indicators have scores (i.e., Only the countries with one indicator will be excluded)
- Previous method: Compute geometric mean only for countries having at least three indicators with scores (i.e., Countries with only one or two indicators were excluded)

Figure 19 presents the responses of the experts to the question on the aggregation method. More than half of the 110 experts did not agree on the two options and suggested to continue to use the previous method. The most important reason for this is the need to encourage the countries to collect and improve their data, with several experts suggesting that GGGI should play a key role in supporting the countries on this. Many experts also suggested keeping the previous method to keep the consistency, as this method is already good and sound.

Figure 19 Responses of the experts to the question on modifying the aggregation method for the green economic opportunities dimension



5.3 Next steps forward

5.3.1 Indicators and proxy variables

Although a significant improvement has been made in the 2020 Green Growth Index by updating 10 green growth indicators, further improvements still lie ahead. As shown in Table 5, many of the challenges identified from the previous report still remain, including limited time-series data for indicators on the share of freshwater withdrawal to available freshwater resources (EW2), share of organic agriculture to total agricultural land area (SL2), municipal solid waste (MSW) generation per capita (EQ3), share of patent publications in environmental technology to total patents (GN1), share of youth (aged 15–24 years) not in education, employment, or training (SE3), and proportion of population above statutory pensionable age receiving a pension (SP1). Moreover, the 2020 Green Growth Index continues to lack additional indicators for efficient and sustainable resource use as well as green economic opportunities, which have implications on the weights of the indicators across dimensions. For example, the dimension on green economic opportunities with only four indicators is receiving relatively higher weight as compared to natural capital protection and social inclusion, each with 12 indicators. GGGI will thus continue to review the indicators in the next years.

Table 5 Relevance of indicators for the Green Growth Index and desired improvements for proxy variables

Codes	Baseline indicators	Relevance	Desired improvement and remarks
EE1	Ratio of total primary energy supply to GDP (MJ per $2011 PPP GDP)	High	
EE2	Share of renewable to total final energy consumption (Percent)	High	
EE3	-	-	Additional indicator to measure energy productivity
EW1	Water use efficiency (USD per m^3)	High	
EW2	Share of freshwater withdrawal to available freshwater resources (Percent)	Moderate	Improvement of time series data
EW3	-	-	Additional indicator to measure water treatment; data currently scanty
SL1	Soil nutrient budget (Kilogram nitrogen per hectare)	High	Included in Green Growth Index in 2020
SL2	Share of organic agriculture to total agricultural land area (Percent)	Moderate	Improvement of time series data
SL3	-	-	Additional indicator to measure sustainable land management; to be made available by FAO
ME1	Total domestic material consumption (DMC) per unit of GDP (Kilogram per GDP)	High	
ME2	Total material footprint (MF) per capita (Tons per capita)	High	
ME3	-	-	Additional indicator to measure material and waste recycling
EQ1	PM2.5 air pollution, mean annual population-weighted exposure (Micrograms per m^3)	Moderate	To be combined with PM10 as data availability improves
EQ2	DALY rate due to unsafe water sources (DALY lost per 100,000 persons)	Proxy	Can be replaced with water pollution; no identified sources yet
EQ3	Municipal solid waste (MSW) generation per capita (Tons per year per capita)	Moderate	Improvement of time series data
GE1	Ratio of CO_2 emissions to population, including AFOLU (Tons per capita)	High	
GE2	Ratio of non-CO_2 emissions to population, excluding AFOLU (CO_2eq tons per capita)	High	
GE3	Ratio of non-CO_2 emissions in agriculture to population (CO_2eq tons per capita)	High	
BE1	Average proportion of key biodiversity areas covered by protected areas (Percent)	High	
BE2	Share of forest area to total land area (Percent)	Proxy	Can be replaced with indicator on SDG 15.2.1 Forest area annual net change rate when time-series data and country coverage improve
BE3	Above-ground biomass stock in forest (Tons per hectare)	High	Included in Green Growth Index in 2020
CV1	Red list index (Index)	Proxy	Can be replaced by species of relevance to tourism, local, and indigenous communities
CV2	Tourism and recreation in coastal and marine areas (Score)	Proxy	Can be replaced by sustainable eco-tourism in different ecosystems; no identified sources yet
CV3	Share of terrestrial and marine protected areas to total territorial areas (Percent)	Proxy	Can be replaced by protected areas managed by indigenous and local communities
GV1	Adjusted net savings, including particulate emission damage (Percent GNI)	Proxy	Can be replaced by investment in renewable energy or green technology
GV2	-	-	Additional indicator to measure investment in Key Biodiversity Areas or protected areas; no identified sources yet

Table 5 Relevance of indicators for the Green Growth Index and desired improvements for proxy variables (continued)

Codes	Baseline indicators	Relevance	Desired improvement and remarks
GV3	-	-	Additional indicator to measure investment in human skills in green jobs; no identified sources yet
GT1	Share of export of environmental goods (OECD and APEC class.) to total export (Percent)	Moderate	Improvement in the classification of environmental goods
GT2	-	-	Additional indicator to measure sustainable trade in certified products, to be made available by certification organization; data currently scanty
GT3	-	-	Additional indicator to measure trade in waste materials; no identified sources yet
GJ1	Share of green employment in total manufacturing employment (Percent)	Moderate	Improvement in the indicator to measure green employment in a different economic sector
GJ2	-	-	Additional indicator to measure skills generated in green employment; no identified sources yet
GJ3	-	-	Additional indicator to measure wage gap in green and standard employment; no identified sources yet
GN1	Share of patent publications in environmental technology to total patents (7 yrs moving ave.)	Moderate	Improvement in data availability for more countries
GN2	-	-	Additional indicator to measure green innovation in entrepreneurships; no identified sources yet.
GN3	-	-	Additional indicator to measure green innovation
AB1	Population with access to safely managed water and sanitation (Percent)	High	
AB2	Population with access to electricity and clean fuels/technology (Percent)	Moderate	Improvement of the indicator to measure renewable electricity
AB3	Fixed Internet broadband and mobile cellular subscriptions (Number per 100 people)	High	
GB1	Proportion of seats held by women in national parliaments (Percent)	Moderate	Can be combined with an indicator on positions held by women in managerial positions; data currently scanty
GB2	Ratio female to male with an account at a financial institution or mobile-money-service provider, age 15+ (Ratio)	High	
GB3	Getting paid, covering laws and regulations for equal gender pay (Score)	Proxy	Can be replaced by an indicator measuring gender parity in salary and benefits
SE1	Inequality in income based on Palma ratio (Ratio)	High	
SE2	Ratio of urban-rural access to basic services, i.e. electricity (Ratio)	Moderate	Improvement of the indicator to measure renewable electricity; to add safely managed drinking water and sanitation, which have scanty time-series data
SE3	Share of youth (aged 15–24 years) not in education, employment, or training (Percent)	Moderate	Improvement in time series data
SP1	Proportion of population above statutory pensionable age receiving a pension (Percent)	Moderate	Improvement in time series data
SP2	Universal health coverage (UHC) service coverage index (Index)	High	Included in Green Growth Index in 2020
SP3	Proportion of urban population living in slums (Percent)	Proxy	Can be replaced by indicator on inadequate housing, including homelessness; to be made available by UN-Habitat

The collaboration with other international organizations could provide a solution in developing additional indicators for green economic opportunities. The Working Group on Metrics and Indicators of the GGKP will soon publish a report on Measuring Economic Opportunities with Policy Linkages: Employment, Innovation, Trade and Investment, which will provide useful thematic guidance for collaborative work. Another important challenge, however, is identifying appropriate sustainability targets for not only the additional indicators, but also for the existing indicators which are not part of the SDGs or other international sustainability goals. These include, among others, the four indicators for the green economic opportunities. As mentioned in the previous report, sustainability targets are critical information for the Green Growth Index because they are used to benchmark green growth performance. For indicators without available targets, mean values of the top five performing countries are used in lieu of internationally agreed sustainability targets. A drawback of this method is that it allows countries to already reach the targets regardless of their performance on a given indicator. One step that GGGI has been taking on this was to request the producer or publisher of the data to recommend targets for the indicator. This has been done, for example, for the share of freshwater withdrawal to available freshwater resources, and soil nutrient budget, cropland nutrient flow per unit area, which were published by FAO.

5.3.2 Data availability and gaps

Although the GGPM team aimed to have a wide data coverage in terms of the number of countries and years, some of the more relevant indicators did not meet these criteria. For example, there were only data for less than 100 countries on one indicator for green economic opportunities, which is the share of patent publications in environmental technology to total patents and two indicators for social inclusion, namely the share of youth (aged 15-24 years) not in education, employment, or training and the proportion of urban population living in slums. No alternative proxy variables are currently available for these indicators. The indicators for social inclusion, however, are expected to improve in the coming years because they are SDG indicators. There was data for only one year for the municipal solid waste (MSW) generation per capita (Table 6), but this is a proxy variable and expected to be replaced by more desired data in the next few years. Data for all the indicators included in the Green Growth Index are publicly available online, except for the share of green employment in manufacturing to total employment (GJ1). The data were mainly collected from international organizations; this offers important advantages for measuring performance across countries. For example, collecting data from national agencies for more than 100 countries will be cumbersome, whereas data from international organizations are collected from national agencies and have already undergone consistency checks. Nonetheless, during the regional consultation workshops, some regional experts expressed concerns over using data from international organizations (Acosta et al., 2019a). To address these concerns, data for the indicators are published on the Green Growth Index website to enable users to undertake a consistency check of the data. Moreover, GGGI will help to communicate any concerns on the correctness and validity of the data to the international organizations that are responsible for producing and publishing the data.

The most recent available data vary across indicators (Table 6). To enable computation of the Green Growth Index for 2019, the most recent data were used as baseline and values were assumed to hold until 2019. For the missing data between the time-series from 2005, the adjacent data were used to represent data for the missing years (i.e. imputed data). On the other hand, the indicators with missing data for several consecutive years were not imputed.

Table 6 Characteristics of the indicators in terms of data availability and required imputation

Indicator codes*	Available data	Baseline data	Data download source[a]	Website	Year(s) imputed for 2020 Green Growth Index
EE1	1990-2017	2017	UNSTATS	https://unstats.un.org/sdgs/indicators/database/	2018, 2019
EE2	1990-2017	2017	UNSTATS	-same-	2018, 2019
EW1	2000-2017	2017	UNSTATS	-same-	2018, 2019
EW2	2000-2017	2017	UNSTATS	-same-	2018, 2019
SL1	1961-2018	2018	FAOSTAT	http://www.fao.org/faostat/en/	2019
SL2	2004–2017	2017	FAOSTAT	-same-	2018, 2019
ME1	1970–2017	2017	UNSTATS	https://unstats.un.org/sdgs/indicators/database/	2018, 2019
ME2	1990–2015	2015	UNEP-IRP	https://www.resourcepanel.org/global-material-flows-database	2015-2019
EQ1	1990–2017	2017	WB data	https://data.worldbank.org/indicator	2018, 2019
EQ2	2000–2019	2019	GHDx	http://ghdx.healthdata.org/about-ghdx/about-data-availability	-
EQ3	2019	2019	WB Waste	https://datacatalog.worldbank.org/dataset/what-waste-global-database	-
GE1	1960–2016	2016	ClimateWatch	https://www.climatewatchdata.org/ghg-emissions	2017-2019

Table 6 Characteristics of the indicators in terms of data availability and required imputation (continued)

Indicator codes*	Available data	Baseline data	Data download source[a]	Website	Year(s) imputed for 2020 Green Growth Index
GE2	1990–2016	2016	ClimateWatch	-same-	2017-2019
GE3	1990–2016	2016	ClimateWatch	-same-	2017-2019
BE1*	2000–2019	2019	UNSTATS	https://unstats.un.org/sdgs/indicators/database/	-
BE2	1990–2020	2019	UNSTATS	-same-	-
BE3	2000, 2010, 2015-2020	2019	UNSTATS	-same-	-
CV1	1993–2020	2019	UNSTATS	-same-	-
CV2	2012–2019	2019	OHI	http://www.oceanhealthindex.org/region-scores/annual-scores-and-rankings	-
CV3*	2016-2018	2018	WB data	https://data.worldbank.org/indicator	2019
GV1	1990–2018	2018	WB data	-same-	2019
GT1*	2000–2017	2017	UN COMTRADE	https://comtrade.un.org/	2018, 2019
GJ1	2000–2017	2017	Moll de Alba and Todorov 2018, 2019	Not available online, data computed and shared by the authors	2018, 2019
GN1*	1980–2018	2018	WIPO	https://www3.wipo.int/ipstats/index.htm?tab=patent	2019
AB1*	2000–2017	2017	UNSTATS	https://unstats.un.org/sdgs/indicators/database/	2018, 2019
AB2*	2000–2017	2017	UNSTATS	-same-	2018, 2019
AB3*	2000–2018	2018	WB data	https://data.worldbank.org/indicator	2019
GB1	1990, 1997–2020	2019	UNSTATS	https://unstats.un.org/sdgs/indicators/database/	-
GB2	2011, 2014, 2017	2017	UNSTATS	-same-	2018-2019
GB3	2009–2019	2019	WB WBL	https://wbl.worldbank.org/en/wbl-data	-
SE1*	2000–2018	2018	WB data	https://data.worldbank.org/indicator	2019
SE2*	2000–2018	2018	WB data	-same-	2019
SE3	1990–2018	2018	UNSTATS	https://unstats.un.org/sdgs/indicators/database/	2019
SP1	2000-2019	2019	UNSTATS	-same-	-
SP2	2000, 2005, 2010, 2015, 2017	2017	UNSTATS	-same-	2018, 2019
SP3	2000, 2005, 2010, 2014, 2016, 2018	2016	UNSTATS	-same-	2019

Notes:
**Refer to Figure 3 for the definition of the indicator codes, those with asterisks refer to indicators computed by the GGPM team using data downloaded from the indicated sources in this table.*
a This refers to the source where data were downloaded from. The original source of the data, which refers to the developers and/or publishers of the indicators, are mentioned in Table 8.

The availability of data is another important challenge that affects the relevance of the indicators. The GGPM team considered the indicators to be of high relevance for the framework if they are not only conceptually relevant but also publicly available. The completeness or lack of data influences the scores for the Green Growth Index. For example, a country with complete data for all indicators for green economic opportunities will have lower scores if one of the four indicators has a value of zero, thus pulling down the values of other indicators. In contrast, another country with incomplete data will have a higher score because the fourth indicator, which may also have a value of zero but missing and unknown, will be excluded by default. The lack of data, thus, causes some level of uncertainty in the results of the Green Growth Index. Allowing missing values is, however, necessary for two reasons; first is to allow substitutability of indicators that represent the same concept as represented by the indicator category and second is to maintain a larger number of countries until the last level of aggregation. Not allowing for substitutability at the first and second levels of aggregation will exclude countries with missing values. Table 7 provides information on data gaps for indicators in the Green Growth Index by region and their implications on the number of countries.

If there were no missing values, the index could be computed for about 243 countries globally. Due to data gaps, however, the current index has been computed only for 117 countries. The data gap is the largest for the indicators for green economic opportunities, with Oceania and the Americas having as high as 82% and 55% missing values, respectively. Data gaps for each country are presented in Chapter 7 Statistical tables.

Table 7 Summary of data gaps for indicators in Green Growth Index and its dimensions by region, 2019

Region	Number of countries	Green Growth Dimensions				Green Growth Index
		Resource efficiency	Natural capital protection	Green economic opportunities	Social inclusion	
Africa	59	22%	10%	48%	25%	26%
The Americas	55	35%	23%	55%	45%	40%
Asia	51	12%	9%	25%	18%	16%
Europe	51	22%	18%	25%	24%	22%
Oceania	27	59%	35%	82%	60%	59%
Global	243	27%	17%	44%	32%	30%

Note: The percentage refers to the proportion of countries without data for the indicators in their respective regions. Countries with no data for all dimensions were excluded from the count.

5.3.3 Sustainability targets

Because the sustainability targets are benchmarked against the Green Growth Index, the policy relevance of the scores to measure the distance to internationally agreed goals depend on the reliability of these targets. The targets were grouped into three types (Table 8): SDG targets, other targets, whose sources are not from the SDG indicators, and the mean of the top five performers. If the targets are not available from the SDG indicators and other reliable literature, they were computed based on the average values of the top five performing countries (bottom five5 performing countries for negative relationship to green growth). About 30% of the targets remained based on mean values of the top five performing countries, allowing countries to already reach the targets regardless of their performance on a given indicator. The mean values of top performers in the share of green employment in manufacturing to total employment, for example, is only 14%. This allows the countries to already have a score of 100 at this low level of green employment. An important step to improve the Green Growth Index is, thus, to have a valid and sufficient basis for the targets of the indicators which are currently not considered in any internationally agreed goals such as SDGs, Climate Paris Agreement, and Aichi Biodiversity Target. This holds particularly for the available indicators for green economic opportunities. GGGI will continue to request the producer or publisher of data to recommend targets for the indicator. If this will not be possible, the experts of the international expert group will be sought to come up with agreed targets for the purpose of the Green Growth Index.

The targets in the Green Growth Index were aligned as much as possible with the SDG targets, using the information on sustainability targets applied in relevant global indices such as the SDSN's SDG Index and OECD's SDG Indicators. The SDG targets are either explicit or implicit. Because implicit SDG targets leave room for interpretation, different targets were given to the same SDG indicator (Table 8). For the Green Growth Index, the GGPM team did not attempt to interpret the SDG targets but used the available interpretation, such as that suggested by OECD (OECD, 2019a, 2019b) and by SDSN (Sachs et al., 2019; Sachs et al., 2018). Whenever the suggestions on the targets diverge, the team adopted the SDSN targets because, as with the Green Growth Index, the SDSN methodology was developed based on the global context. In the future, the alignment with the SDG targets will continue to be important to provide consistent policy recommendations to the countries.

Table 8 Details on the sustainability targets used to benchmark the normalization functions

Indicators	Link to Green Growth	Case	Min Max	Unstat SDG Indicator	Targets	Countries Reaching Targets	Tpye of Targets	Source of Data	Source of Tagets
RESOURCE EFFICIENCY									
EE1: Ratio of total primary energy supply to GDP (MJ per $2011 PPP GDP)	negative	4	0.43 18.96	Yes	0.928 MJ per GDP	2	Mean top 5 performers	SE4ALL	Method based on Sachs et al. (2019)
EE2: Share of renewable to total final energy consumption (Percent)	positive	3	0.00 97.12	Yes	51.4%	45	Other targets	SE4ALL	Sachs et al. (2019)
EW1: Water use efficiency (USD per m^3)	positive	3	0.64 1179.77	Yes	265.7579346 USD per m^3	4	Other targets	FAO	OECD (2019)
EW2: Share of freshwater withdrawal to available freshwater resources (Percent)	negative	5	0.10 1708.00	Yes	25% and 75%	101	Other targets	FAO	FAO 2017
SL1: Soil nutrient budget (Kilogram nitrogen per hectare)	negative	3	0.21 2743.73	No	0 and 5 kg N per hectare	16	Mean top 5 performers	FAO	Method based on Sachs et al. (2019)
SL2: Share of organic agriculture to total agricultural land area (percent)	positive	3	0.00 81.14	No	11.90%	11	Other targets	FAO	OECD 2017b
ME1: Total domestic material consumption (DMC) per unit of GDP (DMC kg per GDP)	negative	4	0.02 15.76	Yes	0.169685364 kg per USD	5	Other targets	IRP	OECD (2019)
ME2: Total material footprint (MF) per capita (MF tons per capita)	negative		0.40 116.73	Yes	5.0 MF tons per capita	60	Other targets	IRP**	Stefan Bringezu (2015)
NATURAL CAPITAL PROTECTION									
EQ1: PM2.5 air pollution. mean annual population-weighted exposure (Micrograms per m^3)	negative	4	5.86 99.73	Yes	10 micrograms per m^3	23	Other targets	Brauer et al. 2016	WHO 2005; OECD (2019)
EQ2: DALY rate due to unsafe water sources (DALY lost per 100,000 persons)	negative	2	0.82 7363.76	Yes	0 in every 100,000 population	0	SDG Target (explicit)	IHME	OECD (2019)
EQ3: Municipal solid waste (MSW) generation per capita (Tons per year per capita)	negative	4	0.04 1.59	No	0.001752675 ton per year per capita	1	Other targets	WB	Sachs et al. (2019)

Table 8 Details on the sustainability targets used to benchmark the normalization functions (continued)

Indicators	Link to Green Growth	Case	Min Max	Unstat SDG Indicator	Targets	Countries Reaching Targets	Tpye of Targets	Source of Data	Source of Tagets
EQ3: Municipal solid waste (MSW) generation per capita (Tons per year per capita)	negative	4	0.04 1.59	No	0.001752675 ton per year per capita	1	Other targets	WB	Sachs et al. (2019)
GE1: Ratio of CO_2 emissions to population, including AFOLU (Tons per capita)	negative	4	0.11 38.71	No	0,1018121 ton per capita	0	Mean top 5 performers	WRI	Method based on Sachs et al. (2019)
GE2: Ratio of non-CO_2 emissions to population, excluding AFOLU (CO_2eq tons per capita)	negative	4	-4.77 22.23	No	0 ton per capita	4	Mean top 5 performers	WRI	Method based on Sachs et al. (2019)
GE3: Ratio of non-CO_2 emissions in agriculture to population (CO_2eq tons per capita)	negative	4	0.00 8.67	No	0 ton per capita	7	Mean top 5 performers	FAO	Method based on Sachs et al. (2019)
BE1: Average proportion of Key Biodiversity Areas covered by protected areas (Percent)	positive	3	0.00 100.00	Yes	100%	1	SDG target (implicit)	IUCN, UNEP-WCMC	Sachs et al. (2019)
BE2: Share of forest area to total land area (Percent)	positive	3	0.00 98.26	Yes	17%	137	Other targets	FAO	OECD (2019)
BE3: Above-ground biomass stock in forest (Tons per hectare)	positive	3	0.00 500.39	Yes	428,688 tons per hectare	2	Mean top 5 performers	FAO	Method based on Sachs et al. (2019)
CV1: Red list index (Index)	positive	1	0.40 1.00	Yes	1 index	0	Other targets	BirdLife International and IUCN	OECD (2019); Sachs et al. (2019)
CV2: Tourism and recreation in coastal and marine areas (Score)	positive	3	0.00 100.00	No	100 score	19	Other targets	Ocean Health Index	Sachs et al. (2019)

Table 8 Details on the sustainability targets used to benchmark the normalization functions (continued)

Indicators	Link to Green Growth	Case	Min Max	Unstat SDG Indicator	Targets	Countries Reaching Targets	Tpye of Targets	Source of Data	Source of Tagets
CV3: Share of terrestrial and marine protected areas to total territorial areas (Percent)	positive	3	0.00 99.46	Yes	13.5 % for both terrestrial and marine	77	SDG Target (explicit) for marine; Other targets for terrestrial	UNEP-WCMC	(Leadly et. al., 2014)
GREEN ECONOMIC OPPORTUNITES									
GV1: Adjusted net savings, including particulate emission damage (Percent GNI)	positive	3	-99.38 40.85	No	37.9440% GNI	1	Mean top 5 performers	WB	Method based on Sachs et al. (2019)
GT1: Share of export of environmental goods (OECD and APEC class.) to total export (Percent)	positive	3	0.00 34.55	No	18.28%	1	Mean top 5 performers	UN-COMTRADE	Method based on Sachs et al. (2019)
GJ1: Share of green employment in total manufacturing employment (Percent)	positive	3	0.00 0.21	No	14%	1	Mean top 5 performers	Moll de Alba and Todorov 2018, 2019	Method based on Sachs et al. (2019)
GN1: Share of patent publications in environmental technology to total patents (7 yrs moving ave.)	positive	3	0.00 0.08	No	0.05124%	2	Mean top 5 performers	WIPO	Method based on Sachs et al. (2019)
SOCIAL INCLUSION									
AB1: Population with access to safely managed water and sanitation (Percent)	positive	3	11.63 100.00	Yes	100% for both water and sanitation	3	SDG Target (explicit)	WHO/ UNICEF	OECD (2019); Sachs et al. (2019)
AB2: Population with access to electricity and clean fuels/technology (Percent)	positive	3	7.15 97.50	Yes	100% for both	0	SDG Target (explicit)	SE4ALL	Sachs et al. (2019)
AB3: Fixed Internet broadband and mobile cellular subscriptions (Number per 100 people)	positive	3	10.20 187.94	Yes	100 subscriptions per 100 people	9	SDG Target (explicit for mobile, implicit for internet)	ITU	Sachs et al. (2019)

Table 8 Details on the sustainability targets used to benchmark the normalization functions (continued)

Indicators	Link to Green Growth	Case	Min Max	Unstat SDG Indicator	Targets	Countries Reaching Targets	Tpye of Targets	Source of Data	Source of Tagets
GB1: Proportion of seats held by women in national parliaments (Percent)	positive	3	0.00 61.25	Yes	50% for parliament	2	SDG Target (explicit)	IPU	OECD (2019); Sachs et al. (2019)
GB2: Gender ratio of account at a financial institution or mobile-money-service provider (Ratio)	negative	4	1.00 6.82	Yes	1 equality ratio	0	Other targets	WB	Normative
GB3: Getting paid, covering laws and regulations for equal gender pay (Score)	positive	3	0.00 100.00	No	100%	51	Other targets	WB	Normative
SE1: Inequality in income based on Palma ratio (Ratio)	negative	4	0.82 7.01	No	0.86131 ratio	2	Mean top 5 performers	WB	Method based on Sachs et al. (2019)
SE2: Ratio of urban-rural access to basic services, i.e., electricity (Ratio)	negative	4	1.00 37.26	Yes	1 equality ratio	119	Other targets	SE4ALL	Normative
SE3: Share of youth (aged 15-24 years) not in education, employment or training (Percent)	negative	2	2.90 48.50	Yes	0%	0	SDG Target (explicit)	ILO	OECD (2019)
SP1: Proportion of population above statutory pensionable age receiving a pension (Percent)	positive	3	2.30 100.00	Yes	100%	55	SDG Target (explicit)	ILO	OECD (2019)

Table 8 Details on the sustainability targets used to benchmark the normalization functions (continued)

Indicators	Link to Green Growth	Case	Min Max	Unstat SDG Indicator	Targets	Countries Reaching Targets	Tpye of Targets	Source of Data	Source of Tagets
SP2: Universal health coverage (UHC) service coverage index (Index)	positive	1	25.00 89.00	Yes	100%	0	Other targets	WHO	Normative
SP3: Proportion of urban population living in slums (Percent)	negative	4	0.00 95.40	Yes	0%	3	Other targets	UN-Habitat	Normative

i Sustainable Energy for All (SE4ALL) database from the SE4ALL Global Tracking Framework led jointly by the World Bank, International Energy Agency, and the Energy Sector Management Assistance Program

ii Alternative target is 58.62368011 percent based on OECD report (2019)

iii Alternative targets are 10 percent and 12.5 percent based on OECD (2019) and Sachs et al. (2019), respectively

iv OECD (2017) metadata, based on Share of agricultural land area under certified organic farm management

v UN Environment: Secretariat of the International Resource Panel (IRP), website:resourcepanel@unep.org

vi Institute for Health Metrics and Evaluation (IHME)

vii WRI (2015) CAIT country greenhouse gas emissions: sources & methods. CAIT dataset of the World Resources Institute (WRI) is based on various sources including International Energy Agency (IEA), Carbon Dioxide Information Analysis Center (CDIAC) of the U.S. Dept. of Energy), Energy Information Administration (EIA) of the U.S. Dept. of Energy.

viii WRI (2015) CAIT country greenhouse gas emissions: sources & methods. CAIT dataset is based on United States Environmental Protection Agency (EPA).

ix Alternative targets are 92.69 and 37.73 percent for mountain and terrestrial/freshwater based on OECD (2019)

x Based on scores for other OHI indicators

xi World Database on Protected Areas (WDPA) where the compilation and management is carried out by United Nations Environment World Conservation Monitoring Centre (UNEP-WCMC) in collaboration with governments, non-governmental organizations, academia and industry. The data is available online through the Protected Planet website (protectedplanet.net).

xii Average value for 17 percent terrestrial and 10 percent marine

xiii World Intellectual Property Organization (WIPO)

xiv WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply, Sanitation and Hygiene (washdata.org).

xv Alternative targets are 100 percent for electricity and 95 percent for clean fuels based on OECD (2019)

xvi International Telecommunication Union (ITU), World Telecommunication/ICT Development Report and database

xvii Alternative targets are 40.37400055 percent for total fixed broadband subscriptions per 100 inhabitants and 100 percent for proportion of population covered by a mobile network, by technology, based on OECD (2019)

xviii Inter-Parliamentary Union (IPU)

xix Refers to the actual indicator and not to the ratio between female and male

xx Palma ratio was computed from the income data downloaded from the World Bank

xxi Refers to the actual indicator and not to the ratio between urban and rural

xxii Alternative target is 8.1 percent based on Sachs et al. (2019)

xxiii WHO (2019) The Global Health Observatory, https://www.who.int/data/gho/data/major-themes/universal-health-coverage-major