Global Green Growth Institute

Global Green Growth Institute
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GREEN GROWTH PERFORMANCE MEASUREMENT (GGPM) CONCEPT AND METHODS

Report on Foci for Improving the Framework and Process for Engaging Experts

1. Objective of the Report

This report has two main objectives: first, to provide information on the main activities to improve the framework of the Green Growth Performance Measurement (GGPM) project, particularly the concept and methods for the Green Growth Index; and second, to provide an update on the ongoing process of engaging experts from international, intergovernmental, and non-government organizations as well as government, research, and development organizations in different regions. Improvements to the framework during late 2017 and early 2018 were a response to the valuable comments and suggestions from expert consultations during 2017. This year, consultations with a wider number of experts and countries are aimed at gaining additional comments and suggestions on the improved concept and methods of the Index. Table 1 summarizes the expert consultations that have been planned for 2018. The goal of the consultations is to achieve an inclusive and collaborative process in developing the Green Growth Index, which integrates stakeholders' preferences and priorities as well as creates a platform for transparent development of the Index.

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Table 1. International and Regional Consultation Workshops in 2018*

Geographical coverage	Date	Location	Partner
International**	7-8 June	Graduate Institute, Jacques Freymond Auditorium, Geneva, Switzerland	Green Growth Knowledge Platform
Asia-Pacific	23-24 August	UN Conference Center in Bangkok, Thailand	UN Economic and Social Commission for Asia and the Pacific
Middle East and North Africa	16-17 September	Ministry of Climate Change and Environment in Dubai, UAE	Ministry of Climate Change and Environment, UAE
Africa	20-21 September	United Nations Conference Centre in Addis Ababa, Ethiopia	-
Latin America and the Caribbean	4-5 October	NH Hotel, Centro Historico, Mexico City, Mexico	Ministry of Environment, Mexico

*Reports on the consultations are provided in Annex A for the International Experts' Workshop, Annex B for the Asia-Pacific Regional Workshop, and Annex C for the Middle East and North Africa Regional Workshop

**The participants in the international workshop were experts from international and intergovernmental organizations, academic organizations, and government agencies which are working and have broad knowledge on global indicators and indices. They are referred to as "international experts" in this report.

2. Brief History of the Green Growth Index

GGGI developed the pilot version of the Green Growth Index through a consultancy contract with Vivid Economics (VE) and the Economics Intelligence Unit (EIU) during 2016 and 2017. The early stages of Index development included a consultative process, albeit limited in scope (Figure 1). GGGI's GGPM project team consulted with thematic and sectoral experts within GGGI and communicated expert feedback to VE and EIU. The pilot version of the Index and Tool was presented through a series of stakeholder events in 2017, including the first international experts' workshop in South Korea in February; three in-country workshops in Indonesia, Philippines and Vietnam in July; a country consultation in Ethiopia; and an introductory "soft launch" of the Green Growth Index and Simulation Tool during Global Green Growth Week 2017 in Addis Ababa.

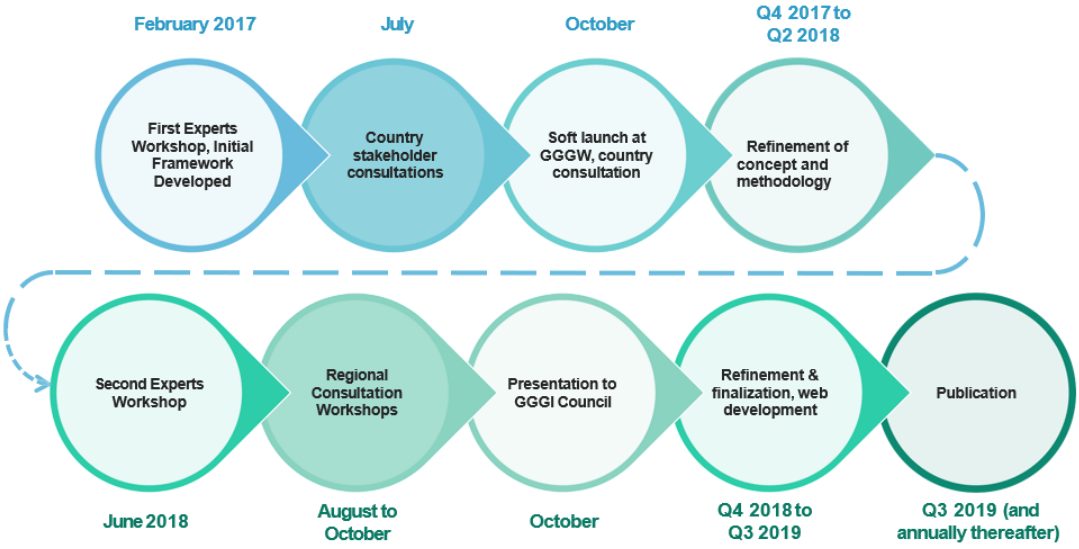


Figure 1. Phases in the Development of the Index

In the pilot version of the Green Growth Index, the conceptual framework was based on a matrix of indicators that capture five dimensions of green growth and GGGI's main sectoral (or thematic) areas (Figure 2). By taking a broad matrix-based approach to performance measurement, it aimed to capture the complex, cross-sectoral, and multi-dimensional nature of green growth. In addition, this approach was thought to offer transparency in terms of data coverage, allowing areas of weakness to be readily identified and highlighted for future improvement going forward. Therefore, rather than "hiding" difficult-to-measure green growth areas behind a composite index, the matrix-based framework aimed to bring data gaps out into the open and invite discussion on solutions and alternatives. However, despite these advantages, GGGI received important comments and suggestions on the pilot version of the Green Growth Index during the various stakeholder events in 2017, which led to significant improvements in the concept and methods. Among other suggestions, some stakeholders raised concerns on the use of a matrix to define green growth as many indicators are not easily decomposable into sectors.

	Energy	Transport	Cities	Industry	Water	AFOLU
Resource efficiency	Conversion Efficiency of Fossil-fired Electricity Generation	Energy Intensity of Road Passenger Transport	Urban Population Density Municipal Solid Waste Generated / GDP	Industrial Energy Intensity	Freshwater withdrawal per capita	Agri. Water Withdrawal / GVA Agri. Land Area / GVA
Utilisation of natural assets	CO_2 / kWh of Electricity Generation	Transport CO_2 / GDP Transport NO_x / Capita	Residential & Commercial CO_2 / GDP $PM_{2.5}$ Exposure	Industrial CO_2 / GVA Industrial Water Withdrawal / GVA	Freshwater Withdrawal / Total Renewable Water Resources	Agri. Emissions of PM_{10} / GVA and GHG / GVA % Change in Primary Forest Area and Total Forest Area
Resilience	No. of Electrical outages Diversity of Electricity Mix	% of road network paved	% of Population made Homeless by Natural Disasters		% of agricultural land irrigated	Red list index score
Opportunities	Growth in share of renewables in power generation	Buses per 1,000 people		Green complexity index		**Agricultural productivity growth**
Social inclusion	% of Population with Access to: • Electricity • Clean Cooking	Road fatalities per 100,000 people	% of Urban Population Living in Slums	Urban poverty	% of Population with Access to: • an Improved Water Source • Improved Sanitation	Rural Poverty Malnourishment

Figure 2. Matrix-based Framework of the Pilot Version

2. Foci of the Improved Framework

2.1 Concept

Figure 3. Definition of Green Growth

The concept of the Green Growth Index builds on the definition of green growth, which, prior to GGGI's refreshed 2016-2020 Strategy, is based on the joint research of experts from the Green Growth Knowledge Platform (GGKP) Research Committee on Measurement and Indicators (GGKP 2013). It emphasizes economic growth that is environmentally sustainable and socially inclusive (Figure 3). A sustainable environment can be achieved through efficient use of resources and protection of natural capital, while social inclusion can be enhanced through creation of green economic opportunities for the different sectors of the economy and different parts of the society. Environmentally sustainable and socially inclusive growth will help create a low-carbon and climate resilient economy and society, and vice versa.

The revised framework builds on work initiated by the Green Growth Knowledge Platform (GGKP 2016) which emphasizes five main themes of relevance for measuring inclusive green growth:

(i) natural assets;
(ii) resource efficiency and decoupling;

(iii) risks and resilience;
(iv) economic opportunities/efforts; and
(v) inclusiveness.

These five themes, or dimensions, are used for the Green Growth Index as they convey relevant and differentiated information about what constitutes green growth. Resource (use) efficiency is an essential component of green growth as it accounts not only for the quantity of resources being consumed, but how efficiently they are being consumed. Resource depletion is a major concern for the long-term sustainability of societies as many economic activities rely on them. Natural capital protection refers to our efforts in maintaining our environment and ecosystems in good health to support and allow life to thrive. Green economic opportunities monitor the shift of our societies to create and foster more sustainable economic activities and employment which have positive rather than negative environmental impacts. The social inclusion dimension evaluates how all members of society gain access to these new opportunities and take part in social growth. Resilience is the final dimension monitoring how capable governments and communities are to prevent, prepare, recover, and adapt to various risks.

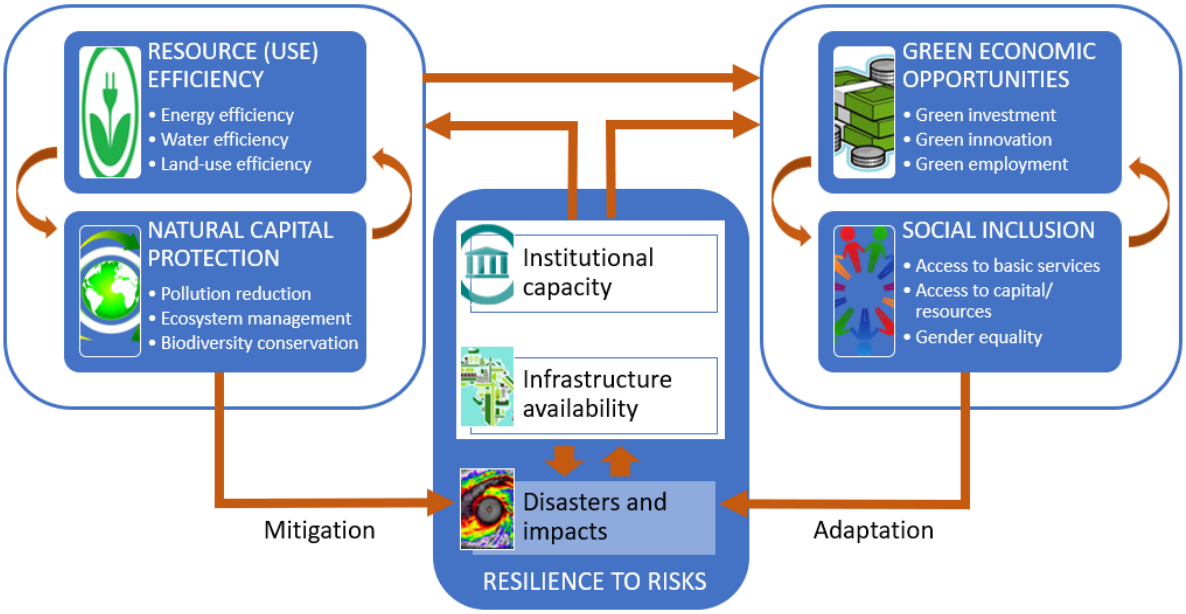


Figure 4. Conceptual Framework for the Green Growth Index

These five themes are structured to form the conceptual framing of the Green Growth Index (Figure 4). Resource use and efficiency and natural capital protection represent efforts to enhance environmental sustainability. Green economic opportunities and social inclusion represent efforts for socio-economic development. The central theme is the dimension on resilience, representing how strong, adaptable, and sustainable communities and the environment are in the face of multifaceted risks (e.g. climate impacts, biodiversity loss, etc.). For example, addressing the nexus of resilience and resource efficiency in urban areas has the potential to generate social, economic,

and environmental returns far beyond those which could be achieved by addressing these agendas separately (Dodman et al., 2017). Natural capital with enhanced resilience has a greater ability to persist and adapt in the face of change, to continue to provide ecosystem services, and to adapt and transform in beneficial ways (Guerry et al., 2015). Similarly, enhancing society's resilience will only be possible by maintaining and enhancing ecosystem resilience as social, economic, and ecological sustainability are interdependent (EEA, 2015). Institutions and infrastructure enhance resilience not only through pre-disaster mitigation and post-disaster adaptation, but also by creating an enabling environment for resource efficiency (USAID, 2018), natural capital protection (Amjad et al., 2015), green economic opportunities (UNDESA et al., 2012), and social inclusion (UNICEF 2016). From an institutional perspective, an enabling environment relates to competence on political leadership, capacity to implement policies and regulations, facilitation of stakeholders' participation, etc. (Fioramonti and Kononykhina, 2014; GGBP 2014).

The revised conceptual framework for the Green Growth Index addresses many limitations in the matrix-based framework. The former clearly shows the interlinkages among the different dimensions, helping to ensure that the concept is comprehensive and robust by capturing all relevant indicators of green growth in the framework. Moreover, it includes many indicators on social inclusion and economic opportunities that were omitted in the matrix-based framework. Many indicators for these dimensions cut across different sectors and cannot be easily matched into the matrix (Figure 2). The previous framework also excluded indicators on biodiversity and ecosystem services in the natural assets (or capital) dimension.

2.2 Methods

GGGI is applying a stepwise approach to enhance the credibility and acceptability of the Green Growth Index (Figure 5). After concept building, the second step will be empirical application to systematically address methodological issues such as scaling, normalization, weights, and aggregation of the data. The third step is to check for the robustness of the Green Growth Index. This step will measure the explanatory power of the indicators and dimension sub-indices as well as sensitivity and uncertainty levels of the Index. The fourth step, which will focus on the presentation of the indicators, dimension sub-indices, and Green Growth Index, will require attention to enhance the comprehensibility and policy relevance of the results. It will consider not only illustration of results in maps, diagrams, and tables but also assessment of results using benchmarks and ranks. Except for the robustness check, GGGI presented and discussed all steps with experts during the International Experts' Workshop in Geneva in June 2018 (See Annex A). GGGI will consult with the international experts on the results of the robustness check when the final list of relevant indicators and data have been identified from the four regional workshops.

The discussion below highlights the usefulness of consultations with experts on methods for developing the Green Growth Index. For methods which require an in-depth knowledge on developing composite indices, such as scaling, outliers, and normalization, only the international experts are being consulted.

2.2.1 Empirical Application

Data Selection

There are several alternative data for each indicator and their relevance to countries depend on economic, social, environmental, and institutional contexts. The consultations with experts will ensure that the data to be selected for the indicators are relevant to the regional contexts, while ensuring global applicability of the Index. Figure 5 presents the preliminary list of data that were selected for the green growth indicators. They were selected based on results of literature review and expert judgement. Annex D provides details on the data including definition, sources and link to green growth and SDGs. GGGI has sought experts in both the international and regional workshops to assess the relevance of the indicators and data. The feedback from the workshops in Bangkok and Dubai to date has shown that while data for the indicators in resource efficiency, natural capital protection, and social inclusion are mostly considered highly relevant, those in green economic opportunities and resilience to risks will need revisions to make them more relevant to the regional contexts (Annex B and C).

Approaches	Activities	Rationale and Description	Discussion Points
Concept building	• Objectives and utility	• Guide development of the concept and inform purpose of the global index	Yes
	• Concept and definition	• Assess suitability of dimensions and sub-aggregation of indicators	Yes
	• Dimensions and indicators	• Asses relevance of indicators and underlying drivers (i.e. data) for the dimensions	Yes
Empirical application	• Data selection & imputation	• Use of credible and updated data, conduct correlation analysis to exclude redundant data and inter-/extrapolation to close data gap	Yes
	• Normalisation and weights	• Issues to be considered in identifying thresholds for normalization of data and weights of the indicators	Yes
	• Aggregation and interpretation	• Assess suitable methods for aggregation (e.g. arithmetic versus geometric) taking into account target users	Yes
Robustness check	• Explanatory power	• Use of correlation and cluster analyses to compare index with available global land degradation indicators, environmental and governance indices	Maybe
	• Sensitivity analysis	• Use of sensitivity analysis to check the sensitivity of global index to changes in the methods	Maybe
	• Uncertainty analysis	• Use of different aggregation methods on the dataset and comparison of the indices from these methods	Maybe
Presentation	• Global pattern and trend	• Present global index on map and table to compare index and ranks across all countries	Yes
	• Regional & dimension structure	• Present global index and dimension sub-indices on map and diagram to compare across regions	Yes
	• Country and indicator specifics	• Present normalised indicators in web-diagram to check pattern across regions	Yes

Figure 5. Stepwise methods for developing the Green Growth Index

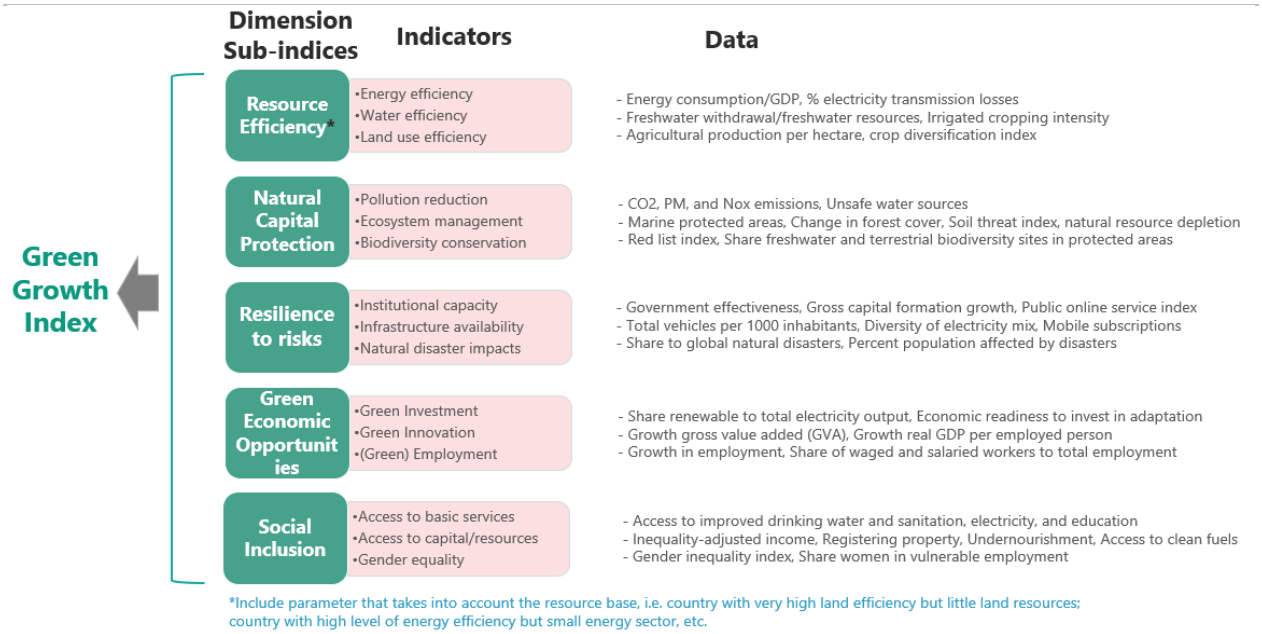


Figure 6. Indicators and Data for the Green Growth Index

Scaling

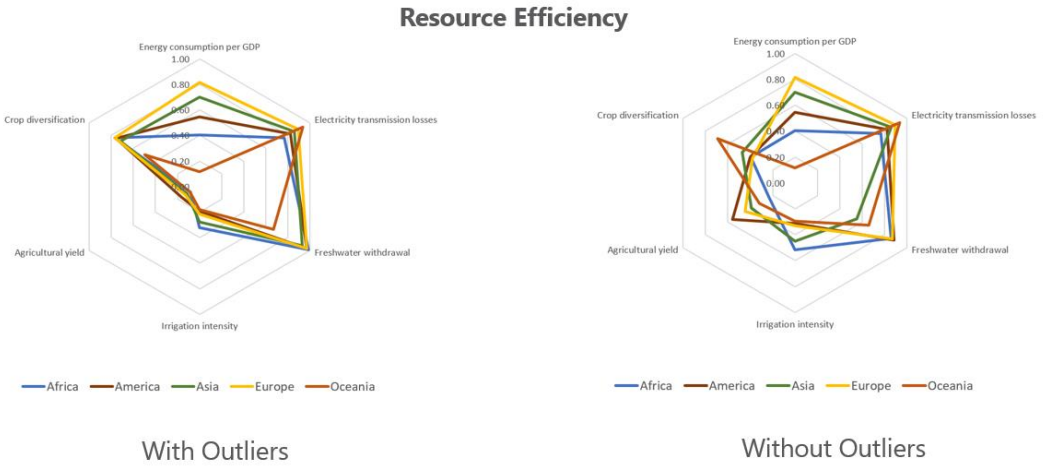
Based on expert and stakeholder feedback, GGGI plans to incorporate scaling to align each country's performance relative to its comparative advantage or its resource base. For example, a country can have a very high performance in energy intensity, which is expressed as the ratio of total final energy consumption to GDP (TFC/GDP). However, sectors (e.g., industry) using energy can be small relative to the rest of the sectors. The data TFC/GDP will need to be scaled to avoid assigning an extremely high value on energy intensity to a country with limited overall energy consumption as compared to countries with large energy sectors.

To illustrate, the data on TFC/GDP were scaled using sectoral data on Gross Value Added (GVA), where $TFC/GDP_{scaled} = TFC/GDP * GVA_{industry}/GVA_{total}$. The example below shows that scaled data corrects what appears to be the significantly exaggerated energy intensity in LDC and developing countries, which do not have large industrial sectors.

Country	GVA Industry	Not scaled	Scaled
Congo Republic	0.474	0.155	0.000
Pakistan	0.467	0.190	0.000
Yemen	0.449	0.046	0.000
Kenya	0.444	0.275	0.001
Costa Rica	0.399	0.090	0.000
Philippines	0.390	0.064	0.000

Outliers

While some outliers are manifestations of the real structure of the data, others may be due to poor quality of data. Data with extreme values can significantly influence the value of the index. To illustrate the effects of outliers, the resource efficiency for different regions was plotted using raw data with outliers and data corrected for outliers. In this example, three data have outliers including irrigation intensity, agricultural yield, and crop diversification. The results below show that when outliers are not corrected, the aggregate values tend to gather close to each other (i.e., left diagram). The outliers will be corrected by computing percentiles as basis for capping the extreme values.



Normalization

Because data have different units, they cannot be directly aggregated into an index. Normalization is a method to transform the data into the same scale, i.e., between 0 and 1, or between 0 and 100. However, assigning a value of 0 to a country receiving the lowest score for one datum is often not appropriate because it does not conform to reality, e.g., zero gender equality implies that women do not have any rights whatsoever in a society. In such cases, data can be normalized using minimum and maximum threshold values as shown below (i.e. ***a*** and ***b***).

Using data thresholds will be useful for two reasons: First, it will avoid zero values, which not only make the scores appear unrealistic or irrelevant but also prevent the use of geometric mean (i.e., cannot aggregate a set of data with zero values). Geometric mean is a more useful method of aggregation than arithmetic mean because the former does not assume substitutability, i.e., low performance in one indicator can be compensated by increasing performance in another. Second, it also allows room for progress if the maximum is not set to 1 or 100. GGGI proposes to identify values for minimum and maximum thresholds based on international standards or targets (where they exist), evidence from literature, or expert judgement (i.e., normative approach). The equation for the normalization is as follows:

$$X' = a + \frac{(X - X_{\min})(b - a)}{X_{\max} - X_{\min}}.$$

Where $\boldsymbol{a}$ = minimum threshold, $\boldsymbol{b}$ = maximum threshold, $\boldsymbol{X}$ = original data, $\boldsymbol{X_{min}}$ = minimum value of the dataset, $\boldsymbol{X_{max}}$ = maximum value of dataset, and $\boldsymbol{X'}$ = normalized data.

Aggregation Weights

Weights can be attached to each indicator or dimension to emphasize its relative importance. Statistical methods such as Principal Component Analysis can be used to generate weights, but the weights that are generated will depend on the structure of available data. When the structure of data changes over time, the weights also change (resulting in some uncertainty). Another method is the Analytical Hierarchy Process, which can be used to collect opinions on weights based on expert judgement (resulting in some subjectivity). The question is whether to use weights regardless of the uncertainty and subjectivity issues in these methods. The experts in both international and regional workshops are being consulted on their opinions on using weights.

2.2.2 Presentation

The improved framework of the Green Growth Index makes it possible for GGGI to the use national data with larger geographical and historical coverage. This in turn makes it possible to present the Index on maps to compare across countries and regions. The sample maps shown in Figure 6 are based on the preliminary indices that were computed from the data listed in Annex D. These results were presented for illustration to participants during the workshops (not used for comparing green growth performance). Not all data used in the computation are scaled, normalized and corrected for outliers because information on these methods are currently being collected from the international experts and available literature.

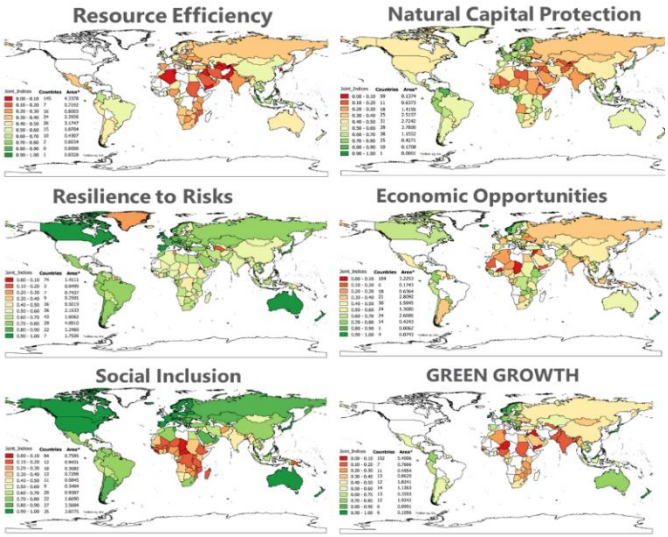


Figure 6. Illustration of Green Growth Index

An important goal of Green Growth Index is to measure performance, which can be achieved through benchmarking. The experts from international and regional workshops are being consulted on the relevant "sustainability targets" that can be used for benchmarking green growth performance. These targets can be based on expert knowledge and experience or adopted from relevant literature. The use of global ranks will be among the most challenging issue to address in the presentation of the Green Growth Index. During the regional workshops, the GGPM team is consulting with participants on their preference for different methods of ranking. For example, experts in both the Asia-Pacific and MENA regional workshops suggested using ranks for group of countries, i.e. according to regions, development level (i.e. industrial, least developed, etc.), etc. (Annex B).

3. Process for Expert Engagement

3.1 International experts

About 20 experts from international, non-governmental and academic organizations as well as selected European government agencies participated in the International Experts' Workshop in Geneva in June 7-8, 2018. The experts were invited to be members of an expert group, which the GGGI proposed and launched during the workshop. The main goal in forming the expert group is to provide technical support to the multi-dimensional concept and systematic methods of the Green Growth Index. The expert group has three main tasks:

- Provide comments and suggestions on the concept and methods of the Index during the international workshop;
- Provide inputs to the report on concept and methods of the Index by:
  - Completing the semi-structured surveys which collect their feedback on data relevance, scaling, outliers and normalization as well as aggregation weights, ranking and benchmarking; and
  - Providing comments on the reports from the four regional consultation workshops, particularly those issues where opinions of regional experts tend to diverge; and
- Provide specialized expertise on topics that require focus through one-on-one consultations via e-mail, skype, and personal meetings.

GGGI anticipates that a wide range of expertise will be integrated in the technical report on the concept and methods of the Index through collaboration with the expert group in developing the Green Growth Index. GGGI will publish this report to provide a technical background on how the Green Growth Index is developed the users of the Index. The dedicated support of the expert group will be acknowledged through authorship in the technical report. Please refer to Annex A for details on international experts' workshop and expert group.

3.2 Regional experts

Building on the international expert workshop, GGGI is conducting two-day workshops in each of the four regions where GGGI works – Asia-Pacific, MENA, Africa, and Latin America – to present and discuss recent improvements to the Green Growth Index (Table 1). These regional workshops are conducted in close collaboration with different organizations including the United Nations Economic and Social Commission for Asia and the Pacific in Bangkok, the Ministry of Climate Change and Environment in Dubai, and the Ministry of Environment in Mexico City. The GGPM team has also been working very closely with the GGGI Country Offices in Thailand, UAE, Ethiopia, and Mexico in preparing and conducting these regional workshops.

The main goal of each workshop is to gather feedback on the improved version of the Green Growth Index from GGGI Member and partner countries. The stakeholder feedback is intended to provide a critical opportunity to determine how to make the Index as useful and as relevant as possible. The consultation is meant not only to provide a platform for dialogue and interaction

between the GGGI and stakeholders, but also to raise awareness on the Green Growth Index and ensure the process to develop and improve the tool is done transparently.

The structure of the two-day consultations follows similar format in all regions, which consists of the following:

- Welcome remarks from local counterparts and GGGI Country Representatives in the host countries, emphasizing the importance of the workshop;
- GGPM team presentations of the concept and methods (i.e., section 2 in this report);
- Breakout sessions for the participants to discuss the questions raised by the GGPM team during the presentations;
- Reporting and write-up sessions for the participants to share their opinions on the questions to the workshop participants; and
- Concluding remarks from the local partners, Country Representatives, and GGPM team.

Among other things, the discussion points during the breakout sessions include the following:

- **Indicators and data:** How will you rate the level of importance of the indicators and data used in each indicator (i.e. High, Medium, Low, Not relevant)? Please provide a brief explanation of your answer. If your answer is low or not relevant, can you suggest other indicators and data?
- **Scores**: What "targets" can be used to compare performance within the system (e.g., average scores of top 10 countries)? What "targets" can be used to measure performance outside the system (e.g., set of SDG targets)? Note: Scores of each dimension would be compared to or measured against a given target
- **Ranks:** Do you think it is useful to present ranks? Please explain why. Please suggest ways to present ranks that can minimize political debate.
- **Weights**: Why will you use weights? Do you think it is necessary to use weights for dimensions, indictors, and data? Why?

As of this draft report (dated 19 September 2018), GGGI had successfully complete the consultations in the Asia-Pacific and MENA regions, providing valuable feedback to improve the relevance for decision makers in the region. Annex B and C provide details of this feedback and lists of experts who participated in the regional workshops. After the regional workshops, the experts will continue to provide support to the development of the Green Growth Index by providing comments on the draft technical report on concept and methods, and GGGI will ensure that their feedback is appropriately integrated into the report. The dedicated support of the experts from the four regions will be acknowledged by including them as expert reviewers in the technical report.

4. Next Steps

4.1 Integration of Expert Opinions

After conducting the four regional workshops, the GGPM team will consolidate and assess the opinions of the participants on the issues raised and discussed during the workshops. It will share the reports from the workshops with the expert group and prepare a questionnaire for the expert

group based on the consolidated opinions. The responses to the questionnaire will guide GGGI in preparing the draft technical report on the concept and methods of the Green Growth Index.

Prior to the publication of the final report, the GGPM team will take the following steps:

a) Share the draft report with experts from both international and regional workshops for comments;
b) Revise the draft report based on the comments from (a) and share the revised draft report with the thematic experts in GGGI;
c) Revise the draft report based on the comments from (b) and submit the revised draft report to the Director General for comments and approval; and
d) Submit the approved draft report to the Council Members for comments and to request the Council's concurrence with GGGI's plans to proceed with developing and publishing the Green Growth Index starting in 2019.

4.2 Further Strategic Collaboration

UN Environment's Green Economy Progress Index

During the International Experts' Workshop in Geneva, GGGI and UN Environment agreed to collaborate to ensure that the Green Growth Index and Green Economy Progress Index will be developed as complementary tools. With the support of the GGKP Working Group on Measurement and Indicators, the two institutions plan to work on country case studies to apply both indices next year.

Laos Workshop

After the experts from Laos reported to their office, , National Institute for Economic Research, on the results of the Asia-Pacific Regional Workshop, the government submitted a request to the GGGI Country Office in Laos to conduct a similar workshop for local experts in Laos this year. The GGPM team is currently coordinating with the GGGI Country Office to prepare for this workshop in November 2018.

UAE Composite Index

The UAE Ministry of Climate Change and Environment is planning to develop a composite index from the 41 indicators currently used in UAE's Green KPIs framework. Following the completion of the MENA workshop, the Ministry requested the GGPM team to support the Ministry in developing the composite index starting in October 2018.

Colombia Subnational Index

Prior to the regional consultation workshop in Mexico, the GGGI Colombia team expressed interest in collaborating on the development of a subnational green growth index for Colombia to highlight disparities and priority areas within the country. GGGI is exploring the possible synergies with the work of the GGPM team and related programs.

4.3 Updating the GGPM components

The GGPM has three components – Green Growth Index, Simulation Tool, and Evidence Library. The Simulation Tool can be used to simulate and understand the impacts of different policy options on green growth performance. This Tool is linked to the Index because they use the same set of indicators and data. However, the current version of the Tool is based on the matrix-based framework of the Green Growth Index. It will be updated next year to include the indicators and data that will be added in the improved framework of the Index. The Evidence Library will be updated this year based on the improved conceptual framework of the Green Growth Index.

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Annex A
GGPM REPORT
International Expert Workshop on
Measuring Green Growth Opportunities and Country Performance

Graduate Institute, Jacques Freymond Auditorium
Geneva, 7-8 June 2018

1. Background

The Global Green Growth Institute (GGGI), based in Seoul, South Korea, convened a workshop on 7-8 June 2018 in Geneva to discuss progress in developing the Green Growth Index and Simulation Tool and related initiatives. The workshop was conducted in close collaboration with Green Growth Knowledge Platform (GGKP), which is a global network of international organizations and experts that identifies and addresses major knowledge gaps in green growth theory and practice, and primarily consisted of experts representing the GGKP Metrics and Indicators Working Group.

This expert workshop was the second consultation with experts from international, NGOs, and leading academic organizations, and aimed to present and gather feedback on the concept and methods of the ***improved version*** of the Green Growth Index. The first international workshop, which was held in Seoul in February 2017, aimed to present and gather feedback on the ***pilot version*** of the Green Growth Index and Simulation Tool. Improvements in the Index had been guided by the comments and suggestions from not only this first expert workshop but also three in-country workshops that were held in Hanoi, Indonesia (July 6), Jakarta, Indonesia (July 11) and Manila, Philippines (July 27) last year.

GGPM Expert Group

Experts on global indicators and indices participating in the two-day workshop in Geneva were from: international organizations such as the International Labour Organization (ILO), the UN Environment, the United Nations Industrial Development Organization (UNIDO), the United Nations Development Programme (UNDP), the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), the Organisation for Economic Cooperation and Development (OECD), and the World Bank; non-government organizations such as Luc Hoffmann Institute, the Water Footprint Network, and the Green Economy Coalition; academic and research institutions such as The Energy and Resources Institute (TERI), Nanjing University, École polytechnique fédérale de Lausanne (EPFL), and the University of British Columbia; and government institutions such as Italian Ministry Environment, Swiss Ministry of Environment, and German Corporation for International Cooperation. The participants are now members of the ***international expert group***,

which the Green Growth Performance Measurement (GGPM) Project formed during the expert workshop in Geneva. Through this group, the experts[1] will continue to support the improvement of the Green Growth Index and contribute to publication of its concept and methods. Among other things, they will provide expert opinions on the technical robustness and policy relevance of the suggestions given by ***regional experts*** during the Regional Consultation Workshops in Asia-Pacific, Middle East and North Africa (MENA), Africa, and Latin America.

Open Discussion

2. Workshop Agenda

The first day of the international expert workshop opened with welcome statements by Orestes Anastasia, Deputy Head of GGGI's Office of Thought Leadership; Fulai Sheng, Senior Economist in UN Environment; Žiga Žarnić, Special Advisor in OECD and GGKP Working Group Co-chair; and John J. Maughan, Research Programme Manager in the GGKP Secretariat. Lilibeth Acosta, GGPM Project Manager, presented the concept and methods of the Green Growth Index and Orestes Anastasia presented the preliminary scores and ranks of the Index. The presentations were followed by open discussions with experts providing their constructive opinions on the improved version of the Index and suggestions on ways forward to further enhance the Index (see section 2 below). After the presentation of Jose Pineda, Professor in University of Colombia, on UN Environment's Green Economy Progress Index, Jose and Lilibeth led a discussion on comparison of the Green Growth and Green Economy indices. The aim was to identify points of complementarity and areas of collaboration to increase buy-in of green-related performance and progress measurements. Whereas the Green Growth Index is a performance index and essentially takes a snapshot of country metrics in a given year across more than 30 countries, the Green Economy Progress Index is a tool that allows countries to measure their individual progress over time.

Usman Iftikhar's Presentation

The second day of the workshop was mainly devoted to presentations and discussion of the GGKP Metrics and Indicators Working Group on the subject of Green Economic Opportunities: Guillermo Montt, Senior Economist in ILO and Ronal Gainza, Programme Officer in UN Environment presented green

[1] The expert from FAO was not able to participate in the workshop but joined the expert group after the workshop.

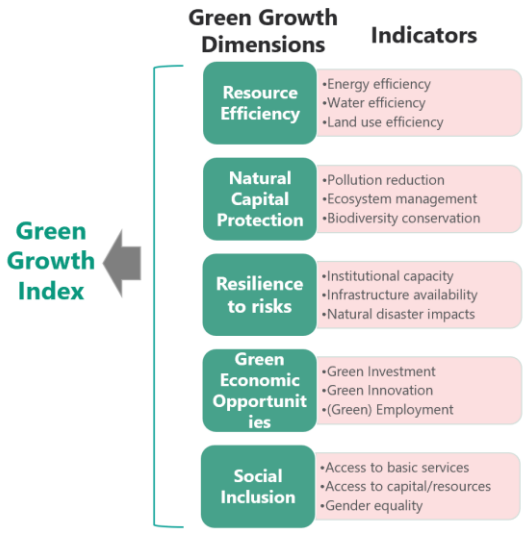
employment; Fabio Eboli, Senior Economist in the Italian Ministry of Environment and Christine Weinreich, Advisor German Corporation for International Cooperation presented on green trade; Usman Iftikhar, Environmental Economics Specialist in UNDP and Aastha Sharma, Research Associate at TERI presented on green investment; and Žiga Žarnić, Special Advisor in OECD presented on green innovation. Žiga Žarnić and Guillermo Montt led the open discussion on the next steps for the GGKP Metrics and Indicators Working Group. The presentations and discussion were very relevant for the Green Growth Index because green economic opportunities are one of its five green growth dimensions. Lilibeth Acosta provided an overview and presented the next steps for the developing the GGGI's Simulation Tool for modelling green growth. The workshop concluded with a discussion on GGGI's collaboration with the GGKP and UN Environment, and the strategy for the expert group's ongoing contributions to the Green Growth Index.

3. Highlights of the Workshop

3.1 Improved Framework of the Index

3.1.1 Concept

During the international experts' workshop in Geneva in 2018, GGGI's presentation on the concept of Green Growth Index highlighted the need to shift away from a matrix-based approach (i.e., used in the pilot version) to a dimension-focused concept (i.e., used in the updated version). The pilot version excluded many indicators on social inclusion and economic opportunities because available data for these indicators cut across different sectors and cannot be easily matched into the matrix. Moreover, indicators on biodiversity and ecosystem were missing in the natural assets (or capital) dimension. The improved version of the Index builds on a more comprehensive and robust framework that covers most relevant indicators of green growth. Experts' feedback was generally positive with quite a few constructive suggestions, many of which were partly considered in the improved version of the Green Growth Index. For example:



Improved Framework of the Index

- ***Indicators***: add material flows/efficiency in resource efficiency; strengthen the resilience indicators, for example, by using ND-Gain Index; check the definition of social inclusion to cover all relevant indicators; capture losses in ecosystem services; use of indicators on consumption are more relevant than on production, but data for the former is lacking.
- ***Data selection***: use more data related to the Human Development Index (HDI); check tnhe correlation of various CO_2-related data; there are many relevant OECD data but not for developing and least developed countries; data comparability across countries is important; it is important to link data to SDGs, particularly related to social inclusion; water footprint can serve as a more relevant measure than the current freshwater indicator; need to consider the implications of using proxy (i.e., second best) data.

- ***Geographical and temporal coverage***: the Index should include more than 100 countries, and not only those where GGGI works; check data consistency over multiple years; check amount of data that do not change every year as this will affect the necessity for updating and publishing the Index annually.

The GGKP Metrics and Indicators discussion on Green Economic Opportunities also highlighted useful information to improve the Green Growth Index. One important point was that green growth needs to be considered more than simply reducing harm to the environment and costs to the economy. Capturing the impacts of trade along the value chain is also important. Reflecting value chain considerations in green economic opportunities is currently challenging due to lack of global data, although insufficient data is not a reason for excluding important indicators as data can be updated as they become available. Green trade may be more relevant for the Index than green innovation because innovation is linked to other indicators including employment, trade, and investment. Data on investment and innovation such as research and development as well as productivity can be highly correlated. Moreover, innovation can represent social capacity such as novel start-up business.

Approaches	Activities	Rationale and Description	Discussion Points
Concept building	• Objectives and utility	• Guide development of the concept and inform purpose of the global index	Yes
	• Concept and definition	• Assess suitability of dimensions and sub-aggregation of indicators	Yes
	• Dimensions and indicators	• Asses relevance of indicators and underlying drivers (i.e. data) for the dimensions	Yes
Empirical application	• Data preparation & outliers	• Check for outliers and criteria to cap, conduct correlation analysis to exclude redundant data and imputation to close data gap	Yes
	• Normalisation and weights	• Issues to be considered in identifying thresholds for normalization of data and weights of the indicators	Yes
	• Aggregation and interpretation	• Assess suitable methods for aggregation (e.g. arithmetic versus geometric) taking into account target users	Yes
Robustness check	• Explanatory power	• Use of correlation and cluster analyses to compare index with available global land degradation indicators, environmental and governance indices	Maybe
	• Sensitivity analysis	• Use of sensitivity analysis to check the sensitivity of global index to changes in the methods	Maybe
	• Uncertainty analysis	• Use of different aggregation methods on the dataset and comparison of the indices from these methods	Maybe
Presentation	• Global pattern and trend	• Present global index on map and table to compare index and ranks across all countries	Yes
	• Regional & dimension structure	• Present global index and dimension sub-indices on map and diagram to compare across regions	Yes
	• Country and indicator specifics	• Present normalised indicators in web-diagram to check pattern across regions	Yes

GGPM's stepwise approach for Green Growth Index

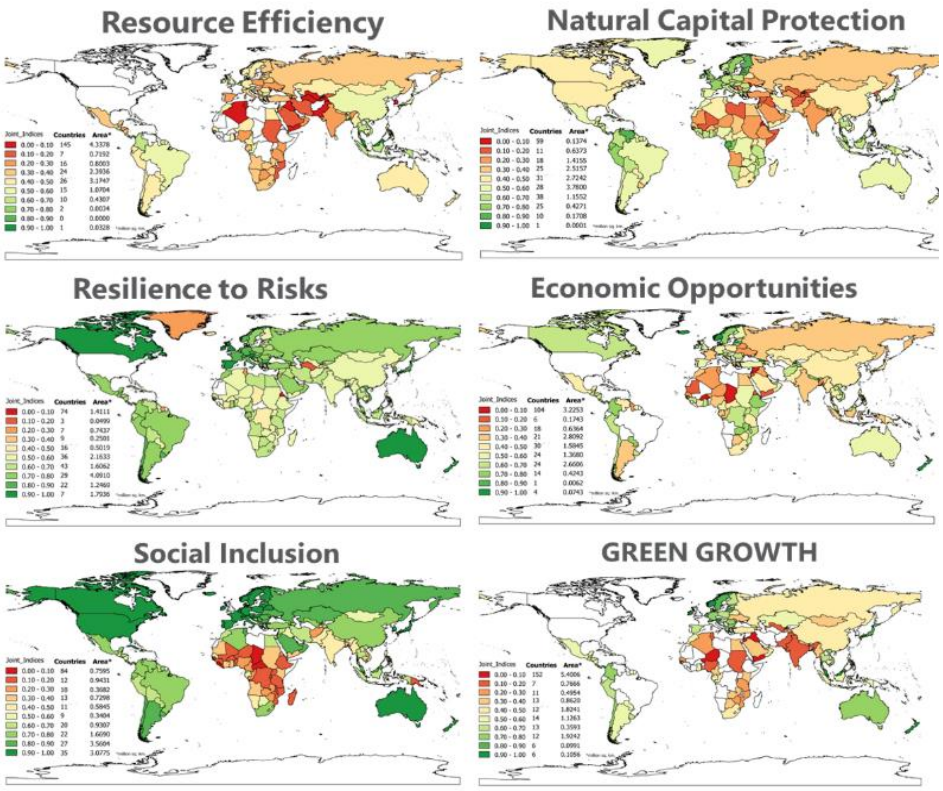
3.1.2 Methods

The presentation on the methods of Green Growth Index focused on technical the issues of outliers, scaling, and normalization and imputation of data, as well as weights and aggregation of indicators. Because they affect distribution of scores, the discussion focused on methods for investigation (i.e., multivariate test) and finding solutions. Expert feedback on the methodology included the following:

- ***Outliers***: Outliers can reflect the structure of the system, so one needs to assess their conceptual relevance. But if caused by inadequate data quality, outliers require attention and correction. The use of scaling factors in preparing data and normative minimum and maximum levels in normalizing data can correct for outliers. The latter is preferred over capping values of outliers based on percentiles, which depend on data structure that can change over time. Depending on data, thresholds can be

used to avoid zero in normalized values. However, “thresholds” may not be an appropriate term to use in normalization because they are used in different contexts such as tipping points, non-linearity, etc.

- ***Imputation***: The use of imputed data to replace missing data may not be acceptable to policy makers. Moreover, organizations that publish the data may have already conducted imputation.
- ***Weights***: Weights can be based on statistical estimates (i.e., Principal Component Analysis - PCA) or expert judgement (i.e., data collected from Analytical Hierarchy Process - AHP). PCA does not provide stable weights over time due to changes in data structure, while those from AHP are subjective and depend on level of expertise. The results from PCA and AHP can be used in sensitivity analysis of the Index. Indices always have implicit weights, i.e., no weights imply equal weights.
- ***Aggregation***: Aggregation needs to be done at different levels – indicator, dimension, and index levels. Information at different aggregation levels is useful because of the nested nature of policy decision making. It also allows traceability of factors with large impacts on the index. Use of geometric mean is better than arithmetic mean (also called simple average) because it does not assume substitutability of indicators and takes account of asymmetry in data.



Preliminary Green Growth Index

3.1.3 Scores and Ranks

Scores and ranks can be very useful but may also spark unwanted controversy. Their presentation thus needs careful consideration. Expert opinions diverge on whether to use ranks. Some suggested using ranks for individual countries despite potential controversy because they provide easily understood information

on performance and progress. A well-developed index will necessarily score some countries lower. Controversy can be minimized through different presentations of ranks, for example, grouping ranks based on policy challenges, focusing on the dynamics in ranks rather than comparing specific ranks, etc. Others suggested that using targets instead of ranks is valuable, e.g., comparing scores against SDG targets. For the Green Growth Index to measure performance, it is important to compare to targets. Nevertheless, countries are perhaps more familiar with national rather than global targets. Still, targets can be used at different levels. It will also be important to present scores in diagrams and maps. When using colors to indicate scores, "green" should be allocated for performance that successfully achieve green performance and not simply the higher ranked countries which are still not meeting thresholds or targets.

3.2 GGGI's Simulation Tool

Excel-based Simulation Tool

A brief demonstration of GGGI's Simulation Tool pointed out to its user-friendly interface, making it appealing to country stakeholders. Because the Tool is linked to the Index, the models and parameters in the Tool will need updating to consider the changes in the set of indicators and data in the improved version of the framework. All the interlinkages between sectors will also need updating. The experts raised valuable comments on the Simulation Tool. Its interface is strong and appealing, providing high value added. It was suggested to review similar models (e.g. International Futures) to get additional ideas on improving the Tool's interface. The strength of the Tool is that it maps against the Green Growth Index—"a unique selling point no other institution could make". It was suggested to add maps to visualize results and capture issues that are relevant at different stages of decision-making. The results need to be validated to ensure that they are not contradictory to the results of the national models.

The experts are very interested to learn more about how the models behind the Tool work (e.g., optimization, interlinkages). In addition to the methodological report, they recommended that GGGI invest time to integrate explanations on the models and parameters in the Tool. The experts also see the potential of extending the modelling capability of the Tool, by creating a mechanism that will allow users to select a particular outcome and work backwards to see what the required policy inputs would be. This may be structurally difficult to do, but there are ways of running a process to explore multiple outcomes.

4. Next Steps to Move Forward

4.1 Building Synergy: GGGI and UN Environment's Indices

UN Environment's Green Economy Progress (GEP) Index aims to inspire policy change and inform policymaking. The methodology is implemented at the national level taking local context into account, and weights are targets which are specifically tailored to individual country contexts. The framework includes: (1) the GEP Index, with 13 indicators (corresponding to planetary boundaries); (2) a Dashboard of sustainability, with six indicators (focusing on well-being); and (3) the GEP combined with ranking by area of least progress.

UN Environment's GEP Index

The selection criteria consider mapping with the inclusive green economy narrative, data coverage, transparency and comparability, and linkages with SDGs. Progress is measured as change that happened relative to change that one envisioned would happen. Weights are normalized, and indicators that are exceeded more greatly have greater priority. Targets are ambitious but feasible. Thresholds are set as the value of goods (bads) in 25th (or 75th) percentile of distribution in 2000. Indicators are weighted on a case-by-case basis for each country. Targets are based on top 10 best performing countries.

Participating experts identified interesting complementarity between the Green Growth Index and the GEP Index: the GEP Index focuses more on progress while the Green Growth Index focuses more on performance. The progress index works with weighting related to working towards specific thresholds, using international standards and conventions (within a relative peer group). The Green Growth Index can make use of a similar benchmarking approach to enhance comparability. Some of the indicators in the Green Growth Index and GEP Index are the same, but because progress in the GEP Index is based on narratives on future green growth pathways, it does not duplicate the performance measurement of the Green Growth Index which is based on baseline (current) year and past trends. There is also a plan to include indicators on resilience and risk in the GEP Index, which will align it more to the framework of the Green Growth Index.

Participants identified two important opportunities for collaboration. First, GGGI and UN Environment will continue to collaborate to enhance the complementarity of the Green Growth Index and Green Economy Progress Index, particularly in terms of the indicators. Second, GGGI and UN Environment proposed to jointly prepare and publish a report on the application of the Green Growth Index and GEP Index on one or two countries with support from the GGKP.

4.2 Expert Group: Goal and Tasks

Experts participating in the workshop formed the Expert Group for the GGPM project during the international expert workshop in Geneva in June 2018 (Table B1). Experts who were not able to attend the workshop but expressed interest to support the Green Growth Index were also invited to join the expert group. The affiliation and contact details of the members of the expert group are presented in Table A1. All have technical expertise in indicators and indices that cover different aspects of green growth. The main goal for forming the expert group is to provide technical support to the multi-dimensional concept and systematic methods of the Green Growth Index.

The expert group will have three main tasks:

1. Provide comments and suggestions on the concept and methods of the Index during the international workshop (*see section 2*);
2. First, respond to semi-structured surveys which collect their feedback on data relevance, scaling, outliers and normalization as well as aggregation weights, ranking and benchmarking, and second, report from the four regional consultation workshops, particularly those issues where opinions of regional experts tend to diverge; and
3. Provide specialized expertise on topics that require focus through one-on-one consultations via e-mail, skype, and personal meetings.

Tasks of the GGPM Expert Group

Table B1. Name and contact details of the members of expert group

Last Name	First Name	Organisation	City	E-mail
1. Beibei	Liu	Nanjing University	Nanjing	lbeibei@nju.edu.cn
2. Cantore	Nicola	UNIDO	Vienna	N.CANTORE@unido.org
3. Chonobayashi	Shun	World Bank	New York	schonabayashi@worldbank.org
4. Eaton	Derek	Luc Hoffmann Institute	Geneva	djf.eaton@gmail.com
5. Eboli	Fabio	Italian Ministry Environment	Rome	Eboli.Fabio@minambiente.it
6. Farnia	Luca	FEEM	Venice	luca.farnia@feem.it
7. Gainza	Ronal	UN Environment	Geneva	ronal.gainza@un.org
8. Giulia	Baldi Marta	EPFL	Geneva	marta.baldi@epfl.ch
9. Hogeboom	Hendrik Jan	Water Footprint Network	Amsterdam	rick.hogeboom@waterfootprint.org
10. Hopkins	Christopher John	Green Economy Coalition	London	chris.hopkins@greeneconomycoalition.org
11. Iftikhar	Usman Ali	UNDP	New York	usman.iftikhar@undp.org
12. Jacob	Arun	UNESCAP	Bangkok	jacoba@un.org
13. Maughan	John	GGKP	Geneva	jmaughan@ggkp.org
14. Montt	Guillermo	ILO	Geneva	montt@ilo.org
15. Nierhoff	Niklas	Swiss Ministry of Environment, FOEN	Geneva	Niklas.Nierhoff@bafu.admin.ch
16. Pineda Salazar	Jose Gregorio	University Vancouver	Vancouver	Jose.Pineda@sauder.ubc.ca
17. Sharma	Aastha	TERI	Delhi	Aastha.Sharma@teri.res.in
18. Sheng	Fulai	UN Environment	Geneva	Fulai.SHENG@unep.org
19. Tubiello*	Francesco	FAO	Rome	Francesco.Tubiello@fao.org
20. Weinreich	Christine	GIZ	Bonn	christine.weinreich@giz.de
21. Zarnic	Ziga	OECD, GGKP	Paris	Ziga.ZARNIC@oecd.org

*Did not participate in the expert workshop in Geneva but invited to join the expert group.

Annex B
GGPM REPORT
Asia-Pacific Regional Consultation Workshop on the GGGI Green Growth Index and Simulation Tool

United Nations Conference Center, Bangkok, Thailand
23-24 August 2018

1. Background

The first regional consultation workshop on the revised GGGI Green Growth Index and Simulation tool was organized in Bangkok in partnership with the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP) and with support from the GGGI Country Office in Thailand. The purpose of the workshop was to gather feedback on the improved version of the Green Growth Index from GGGI Member and partner countries in the Asia-Pacific region. The consultation was meant not only to provide a platform for dialogue and interaction between the GGGI and stakeholders, but also to raise awareness on the Green Growth Index and to ensure the process to develop and improve the tool is done transparently.

Asia-Pacific Regional Experts

Asia-Pacific Regional Experts participating in the two-day workshop in Geneva were from: Office of Natural Resources and Environmental Policy and Planning (ONEP) in Thailand, National Economic and Development Authority (NEDA) in the Philippines, Thailand Greenhouse Gas Management Organization (TGO), Thailand Environment Institute (TEI), National Institute for Economic Research in Laos, China National Institute of Standardization (CNIS), Yezin Agricultural University in Myanmar, Climate Change & Development Authority in Papua New Guinea, Ministry of Planning in Cambodia, Ministry of Forests and Environment in Nepal, Badan Pusat Statistik (BPS-Statistics) in Indonesia, Ministry of Planning and Investment in Vietnam, Ministry of Environment and Tourism of Mongolia, PRO-Green in Thailand, and Department of Energy in Vanuatu. There were 25 participants in total, including four GGGI staff members.

Leading up to the GGGI Council meeting on October 31, 2018, GGGI is also planning three other regional workshops, including:

- Middle East and North Africa: Dubai, UAE, 16-17 September 2018;
- Africa: Addis Ababa, Ethiopia, 20-21 September 2018; and
- Latin America: Mexico City, Mexico, 4-5 October 2018.

2. Workshop agenda

The Asia-Pacific workshop opened with welcome statements by UNESCAP Environment Affairs Officer Hitomi Rankine, GGGI Thailand Country Representative Khan Ram-Indra, and GGGI Green Growth Performance Measurement Project Manager Lilibeth Acosta-Michlik. Brief presentations on a country stakeholder workshop held in Jakarta, Indonesia in 2017 and a technical expert workshop in Geneva, Switzerland in June 2018 were given by Kurnya Roesad, Senior Officer in the GGGI Country Office in Indonesia and Arun Jacob, Environment Affairs Officer in UN-ESCAP, respectively.

Welcome statements

Breakout session reporting

The first day of the workshop continued with a presentation of the Green Growth Index, its historical development, its revision, its new concept and framework, its structure, its indicators, and its scoring and ranking methodology. During breakout sessions, participants were split into four groups to discuss the Index, from its concept and framework to its scoring and ranking methodology. This approach created an interactive environment for proactive participation, and each group reported back on its discussions.

The second day followed a similar same structure with brief presentations, breakout sessions, and group reporting. Discussions focused on the use of weights within the Index, with the presentation of an Analytical Hierarchy Process (AHP) Tool to compute preferences, as well as on the pilot version of the simulation tool to gain insights on its future development during 2019. The workshop concluded with a "writeshop" session where participants within their groups submitted a report highlighting key takeaways and suggestions for revising and enhancing the Index and Tool.

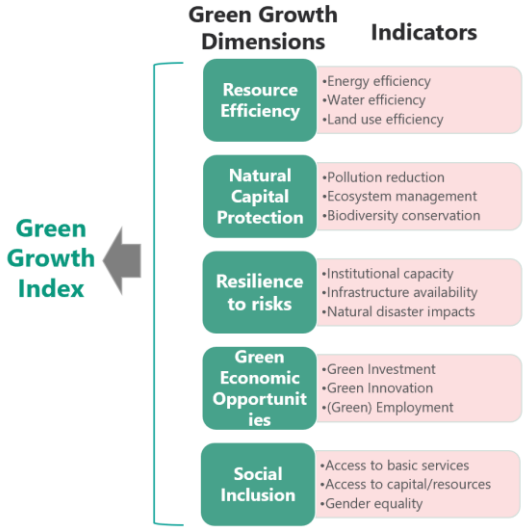
3. Highlights of the Breakout Sessions

3.1 Concept and Framework

In general, most participants found the indicators and data as highly relevant, although several commented that clearer and more detailed explanations are needed to fully understand the underlying concepts and aims of the indicator dimensions and of the indicators themselves. The final version of the Green Growth Index will address these concerns and those listed below. Table 1 summarizes the level of importance participants gave to each indicator and data.

Participants viewed Resource Efficiency indicators as relevant, especially with respect to energy and water efficiency. However, they considered the data used for the land use efficiency indicators as less relevant and participants raised concerns about the links between the data used and the indicator.

Participants also considered Natural Capital Protection indicators to be relevant, although they raised concerns about the similarity between some of the data and indicators used and suggested that biodiversity-related data could be a sub-indicator for ecosystem management.



Improved Framework of the Index

Green Economic Opportunities indicators were seen as slightly less relevant than in the other dimensions. Participants suggested that clearer definitions and more pertinent data to the dimension are needed for the indicators to be clearly understood by the participants.

Participants saw Resilience indicators as relevant in most cases but raised concerns about the links between some indicators and green growth or on the necessity for example to differentiate between transport infrastructure types.

Social Inclusion indicators were considered highly relevant, although many participants requested improved definitions. One participant suggested that inequality among social groups within communities is a concern to take into account, as well as access to food storage. This last indicator may be more suitable in the Resilience dimension in relation with food security.

Table 1. Summary of the level of importance participants gave to each indicator and data (Details are in section 4)

Dimension	Indicator	Data	High* relevance	Medium relevance	Low relevance
Resource Efficiency	Energy efficiency	1. Energy intensity (Total Final Consumption/GDP)	1111+		
		2. Transmission and distribution losses	111+		1
	Water efficiency	1. Withdrawal/freshwater resources	111		1
		2. Irrigated cropping intensity	11	1	1
	Land use efficiency	1. Agricultural output (tons) / hectare	111+		
		2. Crop diversification index	111+	1	
Natural Capital Protection	Pollution reduction	1. Air pollution - CO_2 / GDP	1111+		
		2. Air pollution - PM2.5 Exposure	1111		
		3. Air pollution - Ambient Ozone	1111		
		4. Unsafe water sources	1111		
	Ecosystem management	1. Protected areas / marine areas	1111		
		2. Forest cover change	1111		
		3. Soil threat	1111+		
		4. Natural resources depletion (% of GNI)	1111+		

	Biodiversity conservation	1. Endangered Species - Red List Index	1111+		
		2. Freshwater protected areas	1111+		
		3. Terrestrial protected areas	1111+		
Resilience to Risks	Institutional capacity	1. Government Effectiveness	111		1
		2. Gross capital formation growth	11		11
		3. Online Service Index	11+	1	1
	Infrastructure availability	1. Passenger vehicles/1000 inhabitants	1111+		
		2. Diversity of electricity mix	1111+		
		3. Mobile cellular subscriptions	11+	11	
	Natural disaster impacts	1. Natural disasters - Share to global	111		1
		2. Disaster impacts - Total affected	111		1
Green Economic Opportunities	Green Investment	1. Mitigation - Renewable electricity output	111+	1	
		2. Adaptation - economic readiness to leverage private and public sector investment for adaptive actions	111+	1	
	Green Innovation	1. Growth Gross Value Added	1+	111	
		2. Growth of real GDP/employed person	1	111	
	Green Employment	1. Employment Growth	1	111	
		2. Wage and salaried workers	1+	11	1
Social Inclusion	Access to basic services	1. Access to drinking water	1111+		
		2. Access to sanitation	1111+		
		3. Access to electricity	1111+		
		4. education - Human capital index	1111+		
	Access to capital/ resources	1. Prevalence of undernourishment	1111+		
		2. Access to clean fuels and technologies for cooking	1111+		
		3. Inequality-adjusted income index	111+		1
		4. Registering Property	11+		1
	Gender equality	1. Gender Inequality Index (GII)	1111+		
		2. Accessing institutions	111+		1
		3. Vulnerable employment, female	111+		1

*Note: Plus signs (“+”) in the high relevance field relate to additional comments made by one or more groups.

Participants suggested a number of additional indicators and to consider in the framework to address specific issues. Examples of such suggestions are shown in the table below, organized by dimension.

Resource Efficiency	**Natural Capital Protection**	**Green Economic Opportunities**	**Resilience to Risks**	**Social Inclusion**
Energy efficiency: indicator to capture mineral/mining sector needed Indicator needed account for role of renewables Land use efficiency: indicator needed to capture land use	Soil erosion should be included as indicator to capture water quality Include marine biodiversity Ecosystem management and Biodiversity conservation can be	Indicator needed to capture government’s commitment to green investment Number of green jobs should be an additional indicator	Institutional capacity: include private sector players in disaster mitigation response Infrastructure availability: access to non-telecommunications infrastructure needed	Access to capital: add indicator capturing intellectual property rights regarding green technology include indicators to capture indigenous people

due to urban sector development Land use efficiency: Land rehabilitation as portion of total land should be included as an indicator	merged as they overlap		Economic losses from disasters	as part of property rights registration Reserve food system indicator needed (food storage) Disparity / inequality between caste systems an issue for some countries Need indicator to capture access of female workers to decent jobs

3.2 Scores

The suggestions provided by groups concerning the use of targets established within the results of the Green Growth Index tended to converge around building categories according to specific information such as level of development, group of ranking of the countries, and average value of the dimension.

The suggestions of the groups concerning the use of targets established outside of the results of the Green Growth Index also tended to converge towards the applicability of using international conventions and frameworks (e.g., SDG targets were mentioned as one suggestion). One group suggested using country-specific SDG targets. However, since the aim here is to compare the performance of countries or group of countries against a common goal, it may be more useful to also build categories for these targets.

3.3 Ranks

All groups agree on the usefulness of applying ranks to countries. They will help to prioritize development and encourage positive competition. Suggestions on ways of ranking include forming groups according to income, distance (i.e., geographic such as regions, subregions), political issues and challenges. One useful suggestion was to exclude zero scores to encourage performance. Participants commented that another suggestion, to conduct a “periodic evaluation” of ranks, would not be necessary as the scores and ranks will be updated every year.

3.4 Simulation tool

The simulation tool interface was generally considered user-friendly by most workshop participants. Participants found the information provided to be clear and concise for each tab. They mentioned, however, that the display of results could be more customizable to allow for multiple user-specified country, regional, or dimensional comparisons.

Participants also found the instructions given to guide the users on how to use the file to be generally clear. Most participants commented that these instructions could nonetheless be developed further, providing more details and guidance to the user to allow for more understandable navigation within the file. Including more descriptive elements could also enhance the comprehension of the displayed results for the data and the dimensional breakdown of the indicators.

Participants unanimously agreed that it should be possible for policy inputs to be country-specific to allow for more accurate cross-country comparison and to be more representative of the specific context of different countries. The tool should also include more information on the policy model assumptions. The policy input options should be more flexible to enable a more accurate simulation of future green growth performance according to their policy developments and action plans. Some participants highlighted that the temporal component of the data should be more clearly visible, as well as with respect to the timeframe of the simulation itself. Participants suggested aligning the differentiated policies to the policy planning cycle of the concerned countries. To ensure user adoption of the tool, participants suggested including a protocol to verify the accuracy of the data and therefore receiving the vetting from the corresponding countries.

Participants also recommended allowing for subnational application of the tool to increase its implementation reach and relevance to compare the green growth performance of regions within specified countries.

3.5 Evidence Library

Participants agreed that the Evidence Library should be extended to include a full description of the indicators used in the tool and to provide justification for their inclusion. It should also contain an explanation for the choice of dimensions and calculation methods. Some participants suggested that the Evidence Library should also identify possible proxies for the selected indicators and data.

3.6 Weights

All groups agreed on the usefulness of using weights to prioritize indicators and show relative importance of the dimensions. One suggestion was to consider the different priorities of countries when assigning weights. While linking weights to priorities would be useful for the Simulation Tool, it would not be very appropriate for the Index to require similar weights across countries in order to allow for comparability.

While all groups agreed with using weights for dimensions and indicators, some did not agree with using weights for data. Using weights for dimensions will show the importance of the different dimensions and direct impacts on the Index. Using weights for indicators will show impacts on the dimension sub-indices. The issue of applying weights to show impacts will be more relevant for the Simulation Tool, while use of weights in the Index is more appropriate for showing the importance of each indicator. It was not suggested to use weights for data because there are too many data points to assign weights. Moreover, many of which will be replaced as better become available, so applying weights may be difficult. The discussion referred to a suggestion from the international expert group meeting in Geneva on indicating the relative level of relevance of data in terms of “high”, “moderate”, “low”, and “not relevant” as a way of assigning weights. One downside of taking this approach, still is that applying weights differently each year, such as when new data become available, will make it more difficult to compare indices between years.

Not all participants were able to complete the AHP Excel Tool due to time constraints. Some of them provided their preferences for indicators on sticky notes. For this reason, the overall weights were not computed, but these will be integrated into the final Green Growth Index methodology report.

4. Group workshop reports

4.1 Group 1

Members:

- Gao Dongfeng, China National Institute of Standardization
- Minh Hue Tran, Ministry of Planning and Investment, Vietnam
- Saykam Voladet, National Institute for Economic Research, Laos
- Sirikanda Watcharathai, Thailand Greenhouse Gas Management Organization
- Nidatha Martin, Climate Change & Development Authority, Papua New Guinea

Group 1 in breakout session

Discussion 1: Index concept and framework

1. How will you rate the level of importance of the indicators and data used in each indicator?
Refer to Table 1 for the description of the data.

Dimension	Indicators	Number of Data			
		1st Data	2nd Data	3rd Data	4th Data
Resource Efficiency	Energy Efficiency				
	Water Efficiency				
	Land-Use Efficiency				
Natural Capital Protection	Pollution Reduction				
	Ecosystem Management				
	Biodiversity Conservation				
Resilience to Risks	Institutional Capacity				
	Infrastructure Availability				
	Natural Disaster Impacts				
Green Economic Opportunities	Green Investment				
	Green Innovation				
	Green Employment				
Social Inclusion	Access to Basic Services				
	Access to Capital Resources				
	Gender Equality				

Legend: Level of relevance
High

Moderate
Low
No additional data

2. Please provide a brief explanation on your answer above?
3. If your answer is low or not relevant, can you suggest other indicators and data?

- % electricity transmission losses - Duplicates the results for indicator 1.1.1 – should be integrated into 1.1.1
- Irrigated cropping intensity - Requires further clarification, Other sectors are not included (e.g., industrial water-usage), How is the intensity measured for each crop? Water intensity differs between crops
- Agricultural production per hectare - Needs to provide clear link to land-use efficiency
- Soil threat index - How do we identify a soil threat index without baseline information coverage the total country land mass?
- Natural resource depletion - How do we identify the total mineral resources when some are still undiscovered?
- Red list index - Requires further clarification
- Share freshwater and terrestrial biodiversity sites in protected areas - Consider including ocean/marine biodiversity and conservation
- Public online service index - Further clarification required
- Total vehicles per 1000 inhabitants - Consider how the data will differ between least developed countries in terms of road infrastructure/vehicles and total population
- Share to global natural disasters - This is important, but the indicator requires clarification. How will the link be made between national and global disaster percentages? How is this relevant to infrastructure?
- Access to education - Further clarification required as to how this links to green innovation
- Inequality-adjusted income - How is this result determined?
- Gender inequality index - This should be a 'sub-index' of GVA?
- Share of women in vulnerable employment - How is this calculated, with a link to 'green' employment?

Discussion 2: Scores and Ranks

SCORES

1. **What "targets" can be used to compare performance within the system?**
   Identify the dimensions into levels of importance according to country-specific situations; this will determine how each dimension can contribute to the overall Green Growth Index result. The dimension targets can be grouped into percentages out of 100 with a Green Growth Index value of 0-1. A separate field should be added to represent areas where no data is available.

2. **What "targets" can be used to measure performance outside the system?**
   Existing target data from each country can be used to measure performance (e.g. NDC's, UNFCCC framework indicators, etc.). These target baselines can be integrated into Green Growth Index indicators where applicable.

RANKS

1. **Do you think it is useful to present ranks? Why?**
   Ranking is important because it provides the means necessary to establish averages for comparison between countries and assists to prioritize areas that require attention in strengthening the overall Green Growth Index.

2. **Please suggest ways to present ranks that can minimize political debates.**
   Identify a ranking system that is applicable to countries political structure, which can be averaged into groups to provide a less significant distance/gap between results. E.g., Asian countries with similar political structure can be grouped into one data set and averages can be developed to determine a suitable, unbiased ranking system.

Discussion 3: Weights

A. **Why will you use weights?**
   Weights need to be used because each dimension and indicators have different importance. We would like to suggest using weights based on country assessments.

B. **Do you think it is necessary to use weights for 1, 2 and 3 (and why)?**
   1. **Dimension**
   2. **Indicators**
   3. **Data**

   Weights should be used at all levels because each level has different importance and strong linkages to green growth.

Discussion 4: Simulation Tool

A. **Simulation Tool Interface**
   1. **Sufficiently clear and concise for each tab?**
      Each tab is represented effectively and information under each section is relevant.

B. **Simulation Tool Functionality**
   1. **Instructions of tool sufficiently clear?**
      The simulation tool is user-friendly; however, more guidance is required o how to describe the data results (charts/graphs) in an actual report.
   2. **Policy input options sufficiently flexible?**
      There is no flexibility among selecting specific indicators and dimensions for each country in order to customize results and comparisons. The set of indicators for each country in this simulation tool version provide the same results for policy recommendations across all countries – this may be inconsistent in terms of different country situations.

C. Evidence Library

1. Utility to extend from simulation tool to the index?

This is very important because it significantly affects the results produced in the Green Growth Index, which then produces policy recommendations.

4.2 Group 2

Members:

- Montri Chamnanrot, Thailand Environment Institute
- Amphayvan Chanmany, National Institute for Economic Research, Laos
- Nyo Mar Htwe, Yezin Agricultural University, Myanmar
- Akhanda Sharma, Ministry of Forests and Environment, Nepal

Group 2 during hands-on

Discussion 1: Index concept and framework

1. How will you rate the level of importance of the indicators and data used in each indicator?

Refer to Table 1 for the description of the data.

Dimension	Indicators	Number of Data			
		1st Data	2nd Data	3rd Data	4th Data
Resource Efficiency	Energy Efficiency				
	Water Efficiency				
	Land-Use Efficiency				
Natural Capital Protection	Pollution Reduction				
	Ecosystem Management				
	Biodiversity Conservation				
Resilience to Risks	Institutional Capacity				
	Infrastructure Availability				
	Natural Disaster Impacts				
Green Economic Opportunities	Green Investment				
	Green Innovation				
	Green Employment				
Social Inclusion	Access to Basic Services				
	Access to Capital Resources				
	Gender Equality				

Legend:	Level of relevance
	High
	Moderate
	Low
	No additional data

2. Please provide a brief explanation on your answer above?

3. If your answer is low or not relevant, can you suggest other indicators and data?

- Total Final Energy Consumption/GDP - consideration of renewable energy as one of the proportions in the energy source.
- Irrigated cropping intensity (%) - include other sectors that consume water as fish farming and industrial use and effluents as well
- Agricultural output (tonnes) / hectares - Should include urban sector/ development- forest sector and land use change
- Age-standardized Disability-Adjusted Life Years lost per 100,000 persons, or the DALY rate - should include indicator for soil conservation (reduction in land slide and top soil erosion)
- Red List Index - both crop and animal conservation should be included in the data
- Online Service Index – high relevance as it creates awareness and participation
- passenger vehicles per 1000 inhabitants – need categorization of vehicle considering electric vehicles
- Diversity of electricity mix (Herfindal) – Proportion of renewable source of electricity
- Share to global disaster – Consider coping capacity of the population
- Total affected by disaster (Percent of population) – need to clearly define natural disasters and impacts of disaster- should measure considering economic loss
- Renewable electricity output (% of total electricity output) (Growth) – should consider other sectors as forest
- Growth rate of real GDP per employed person – Technology development should be included
- Wage and salaried workers, total (% of total employment) – repeated with social inclusion dimension
- Population with access to sanitation– Health care service and housing service (energy efficient house) needs to be considered
- Prevalence of undernourishment (% of population) – Available Reserve food and seed system should be considered
- Inequality-adjusted income index – Generation of green employment will be useful
- Registering Property – How to reflect for GG index
- Vulnerable employment, female (% of female employment) – consider lower cast as well

Discussion 2: Scores and Ranks

SCORES

1. **What "targets" can be used to compare performance within the system?**
   We suggested few targets that could be considered to compare country's performance within the system, such as (1) compare country performance by categorizing country's group—developed and developing country or income ranking (GDP/capital). Doing this would make more sense to compare the country with similar levels of development; (2) compare country performance with their peer/neighboring countries. Comparing country performance this way could also avoid the bias.
2. **What "targets" can be used to measure performance outside the system?**
   We suggested also some targets that could be considered to compare country performance outside the system, such as we could use some SDG targets that linked to GGI, or another target outside the system such as OECD's target.

RANKS

1. **Do you think it is useful to present ranks? Why?**
   We do think that it is a useful way to present the country ranking. Because it could be the way to encourage a country to perform better as they would see in which areas or sectors that could be improved/prioritized.

2. **Please suggest ways to present ranks that can minimize political debates.**
   In order to minimize political debates, we would like to suggest that the ranking should be present both on overall performance and each dimension/or some indictor that the country has performed well also as to give them an encouragement for some areas that still doing not quite well. Also, provide some suggestions for the country to improve their performance in case the country has a bottom rank.

Discussion 3: Weights

A. **Why will you use weights?**
   Using weight is good for simulation tool. We can identify more valuable indicators depending on the specific country's performance.

B. **Do you think it is necessary to use weights for 1, 2 and 3 (and why)?**
   1. **Dimension**
   2. **Indicators**
   3. **Data**

   It is necessary to use weights for dimension or indicators or both. It is important for each country to identify which sector is important for that country. Depending on the specific country, the weight will be different. If we set more weight on one sector for one country, it is estimated to all countries. So, it will be bias estimate on this sector when compare to the country which are not good in that sector. For the data, weight should not be used because there are so many data are put in that tools and it will be more complicated to estimate.

Discussion 4: Simulation Tool

A. **Simulation Tool Interface**
   1. **Sufficiently clear and concise for each tab?**
      The simulation tool is clear and user friendly. It is quite concise for each tab.

B. **Simulation Tool Functionality**
   1. **Instructions of tool sufficiently clear?**
      Instructions of tool is sufficiently clear, but it is better to add tutorial (help) to deal with too much information. There is only consider for the sector. So, the linkage with dimension should be established.
   2. **Policy input options sufficiently flexible?**

Policy input options is quite flexible. However, it is not feasible to compare between country to country. It can compare with the country average value to identify the specific country condition which is above or below the average.

C. Evidence Library

1. Utility to extend from simulation tool to the index?

Utility to extend from simulation tool is good to extend and can be used for green growth index.

4.3 Group 3

Members:

- Pathom Chaiyapruksaton, Thailand Greenhouse Gas Management Organization
- Hellen Wilson Tom, Department of Energy, Vanuatu
- Nanik Supriyani, BPS-Statistics Indonesia
- Turbadrakh Tumenjargal, Ministry of Environment and Tourism of Mongolia
- Mary Descery Joy B. Bongcac, National Economic and Development Authority, Philippines

Group 3 in breakout session

Discussion 1: Index concept and framework

1. How will you rate the level of importance of the indicators and data used in each indicator?

Refer to Table 1 for the description of the data.

Dimension	Indicators	Number of Data			
		1st Data	2nd Data	3rd Data	4th Data
Resource Efficiency	Energy Efficiency				
	Water Efficiency				
	Land-Use Efficiency				
Natural Capital Protection	Pollution Reduction				
	Ecosystem Management				
	Biodiversity Conservation				
Resilience to Risks	Institutional Capacity				
	Infrastructure Availability				
	Natural Disaster Impacts				
Green Economic Opportunities	Green Investment				
	Green Innovation				
	Green Employment				
Social Inclusion	Access to Basic Services				
	Access to Capital Resources				
	Gender Equality				

Legend:	Level of relevance
	High
	Moderate
	Low
	No additional data

2. Please provide a brief explanation on your answer above?

3. If your answer is low or not relevant, can you suggest other indicators and data?

- Resource Efficiency – The group deems that relevant data and information for other sectors should also be considered (e.g. fisheries, forestry, etc.),
  - Land used efficiency rating
    - Rehabilitated mined out area as a proportion of total mining should be take into consideration and included as significant data to reflect in land used efficiency.
- Natural capital protection
  - Pollution reduction
    - CO2 is not related air pollution; we would like to suggest using the emission SO2 etc. CO2 maybe/consider transferring to resource efficiency dimension.
  - Ecosystem management
    - It should consider the coverage of protected areas in general (terrestrial and marine) as some countries are landlocked.
  - Biodiversity conservation
    - Biodiversity conservation is quite similar/correlated to the ecosystem management given that outcome is on ensuring provision of ecosystem services.
- Resilience to Risks
  - Institutional capacity
    - More clarification is needed on who/which government agencies should be assessed for their capacities, is it the specific agency involved in disaster risk reduction (DRR) or including private sector implementing DRR initiatives.
    - Consider including the number of DRR-enhanced sectoral/development plans
  - Infrastructure availability
    - We understand that the indicator should be related to the disaster risk reduction/mitigation. As such, the data to be used should be related to resilience. Aside from data on mobile communication access, other early warning systems in place should also be considered given that not all have access to mobile communication.
    - Consider including data for DRR/emergency response facilities (e.g. hospitals, evacuation centers, etc.
    - Should generally include measure on how to "build back better"
  - Natural disaster impacts
    - Natural Disaster Impact is of high relevance to the dimension. Natural disaster impact is not only talking about loss (victims of disaster) but also damage (related to economic impact). So, we need to add the economic impact. For example, the number of house damage by disaster, etc.
- Green Economic Opportunities – The group deems that more clarity on the following indicators is needed, hence, the medium relevance rating:
  - Green Investment

        - Investments in mitigation should consider or be linked to the mitigation actions in the Nationally Determined Contributions. We deem that only including data on renewable energy share might be too limiting.
    - Green Innovation
        - Innovation should look at intellectual property rights
        - Clarify if data is on labor for green innovation
    - (Green) Employment
        - Should consider green jobs. Otherwise, if employment in general, this might be more appropriately reflected in social inclusion
- Social Inclusion
    - Access to basic services
        - Should also take into account provision of basic health services unless this is already considered under sanitation
        - Should also consider access to basic services of indigenous peoples
    - Access to capital resources
        - Take into account property rights of indigenous peoples (e.g. ancestral lands/domains)
    - Gender equality

Discussion 2: Scores and Ranks

A. Scores

1. What "targets" can be used to compare performance within the system?

Across all dimensions, we would suggest the top quartile based on the global ranking with periodic re-evaluation.

2. What "targets" can be used to measure performance outside the system?

The targets of international conventions and frameworks can be used to measure performance outside the system. In particular, the targets for the following may be considered:

- Resource efficiency – UNFCCC/ Nationally determined contributions (NDC)
- National Capital Protection – Convention on Biodiversity/Aichi Biodiversity Targets
- Resilience to risks – Sendai Framework
- Economic opportunities – SDGs
- Social inclusion – SDGs

B. Ranks

1. Do you think it is useful to present ranks? Why?

- Yes. Comparison with other countries will provide insights on how to improve or enhance performance on a particular dimension.

2. Please suggest ways to present ranks that can minimize political debates.

- The annual updating (periodic assessment) of the index could minimize political debates among countries. The countries can compare their performance to others and find ways to improve in certain dimensions, which upon reassessment may result in improved overall green growth score/index.

Discussion 3: Weights

A. Why use weights?

Assigning weights is important because will indicate/articulate the importance/prioritization that a country assigns to specific dimensions and indicators.

B. Do you think it is necessary to use weights for the following:

- Dimension – Yes, given that the dimensions have direct impact on the green growth index
- Indicators – Yes, the indicators have direct impact on the dimensions/sub-indices and the weights to be assigned will reflect the priorities of a particular country
- Data – No, data deals with facts and will be used in calculating the values for the indicators anyway.

Discussion 4: Simulation Tool

General comments on the simulation tool:

a. ***On the filters.*** The filters should be customizable and allow specific countries to be compared to each other. The current version filters per region only.
b. ***On time component of the simulations.*** The time component should be included and, if possible, aligned with the planning cycles of different countries. The current version provides the outcomes of particular policy inputs/changes but provides no indication of how long those results would accrue (e.g. short-term, medium-term?).
c. ***On the data quality assurance protocol.*** The tool should have a protocol on how to ensure that the data inputted into the system is accurate and was vetted by countries.
d. ***On applicability of tool for sub-national green growth performance assessment.*** The tool would have more value-added if it can be used/adopted domestically to assess and compare the green growth performance of regions/provinces in a particular country.

Comments on the Evidence Library:

The evidence library should include explanation/description of the dimensions of the green growth index, including the indicators, data requirements and possible proxies.

4.4 Group 4

Members:

- Chittinee Charoenchitt, Office of Natural Resources and Environmental Policy and Planning, Thailand
- Christian Mortelliti, Environment and Development Division, UNESCAP, Thailand
- Vannakreth San, Ministry of Planning, Cambodia
- Jiranut Silamut, Office of Natural Resources and Environmental Policy and Planning, Thailand

Group 4 in breakout session

Discussion 1: Index concept and framework

1. How will you rate the level of importance of the indicators and data used in each indicator?
Refer to Table 1 for the description of the data.

Dimension	Indicators	Number of Data			
		1st Data	2nd Data	3rd Data	4th Data
Resource Efficiency	Energy Efficiency				
	Water Efficiency				
	Land-Use Efficiency				
Natural Capital Protection	Pollution Reduction				
	Ecosystem Management				
	Biodiversity Conservation				
Resilience to Risks	Institutional Capacity				
	Infrastructure Availability				
	Natural Disaster Impacts				
Green Economic Opportunities	Green Investment				
	Green Innovation				
	Green Employment				
Social Inclusion	Access to Basic Services				
	Access to Capital Resources				
	Gender Equality				

Legend:	Level of relevance
	High
	Moderate
	Low
	No additional data

2. Please provide a brief explanation on your answer above?
3. If your answer is low or not relevant, can you suggest other indicators and data?

Most of the indicators are rated high relevance. Several indicators such Growth GVA (Productivity), Growth rate of real GDP per employed person, etc. are rated medium relevance due to the lack of understanding the meanings and benefits of these indicators.
Clear definition should be defined for each indicator, for example, decent jobs/employment (what are they?), green jobs/employment (what are they?), Green Value Added (GVA), etc.
In addition, the method to calculate the value of the indicator should be provided/defined. Therefore, those indicators can be used and measured in the national context.
Some indicators are not relevant to the national context, i.e., share to global disaster.

Discussion 2: Scores and Ranks

A. Scoring

1. Measurement of each country's achievement or performance should be used in the system in order to define the rank of the country's performance in each dimension.

2. Each country needs to have its own target values to be reported compared with the global SDGs targets.

B. Ranking

1. Avoid giving the score "Zero". It can be done in categories with rankings inside. So the country with poor performance is not shown directly.
2. Ranking the country's performance is very useful because it can help the country to make more efforts, share the best practices, positive competition.
3. In order to minimize the political debates, ranks should be categorized in various groups with rankings such as developing countries, developed countries, or regions, etc.

Discussion 3: Weights

A. Weights should be used to set and show the order of priorities.
B. Weight is also necessary to give to dimensions and indicators, but not data. Moreover, sector needs to be given weights because priorities can be given differently to the sectors based on the country's situation and context.

Discussion 4: Simulation Tool

A. Simulation tool interface: It is sufficiently clear and concise for each tab.

B. Simulation tool functionality

1. Instructions of tool sufficiently clear
2. Policy input options are not sufficiently flexible. They should be flexible because they can help each country to have their different policy inputs for the purposes of their policy development and action.

C. Evidence Library

Incorporate the definition of all indicators and method for calculation of the values of the indicators in the tool.

Annex C
GGPM REPORT
Middle East and North Africa Regional Consultation Workshop on the GGGI Green Growth Index and Simulation Tool

Ministry of Climate Change and Environment, Dubai, UAE
16-17 August 2018

1. Background

The second regional consultation workshop on the revised GGGI Green Growth Index and Simulation tool was organized in Dubai in partnership with the Ministry of Climate Change and Environment (MOCCAE) and with support from the GGGI Country Office in UAE. The purpose of the workshop was to gather feedback on the improved version of the Green Growth Index from GGGI Member and partner countries in the Middle East and North Africa (MENA) region. The consultation was meant not only to provide a platform for dialogue and interaction between the GGGI and stakeholders, but also to raise awareness on the Green Growth Index and to ensure the process to develop and improve the tool is done transparently.

MENA Regional Experts

MENA Regional Experts participating in the two-day workshop in Geneva were from: the Ministry of Environment in Jordan; the Royal Scientific Society in Jordan; the Environment Agency in Abu Dhabi; the Dubai Municipality; the Ministry of Climate Change and Environment in Dubai; the Ministry of Infrastructure Development in Dubai; the Federal Competitiveness and Statistics Authority in Dubai; the Road and Transport Authority in Dubai; Zayed University in Dubai; the Department of Urban Planning and Municipality in Abu Dhabi; the Department of Transport in Abu Dhabi; and the Environment Agency in Abu Dhabi. There were 33 participants in total, including seven GGGI staff members.

Leading up to the GGGI Council meeting on October 31, 2018, GGGI led the first regional consultation workshop for Asia-Pacific in Bangkok, Thailand on 23-24 August 2018 and is also planning two further workshops in the following regions:

- Africa: Addis Ababa, Ethiopia, 20-21 September 2018; and
- Latin America: Mexico City, Mexico, 4-5 October 2018.

2. Workshop agenda

The MENA workshop opened with welcome statements by Engineer Aisha Mohamed Abdullah Al Abdooli, Director of Green Development and Environmental Affairs, Ministry of Climate Change and Environment (MOCCAE); Mohammed Angawi, Acting GGGI Country Representative in UAE; and Orestes Anastasia, Deputy Head of GGGI's Office of Thought Leadership.

Welcome Statement by Engineer Aisha

In her welcome statements, Engineer Aisha recognized the challenges of pollution and climate change, and the important opportunity to promote the UAE Vision 2021 to achieve green objectives and economic growth. MOCCAE has established 41 green KPIs covering social, environmental, and economic aspects of sustainable development. The KPIs are reported annually to UAE Council on Climate Change and Environment and used as the basis of UAE's annual green economy repot. She was pleased to know about Green Growth Index that looks at countries around the world. Tomoo Machiba, Principal Policy Advisor from the MOCCAE, presented the UAE's Green Economy Transformation (UAE Green KPIs). The first day of the workshop continued with a presentation of the Green Growth Index, its historical development, its revision, its new concept and framework, its structure, its indicators, and its scoring and ranking methodology.

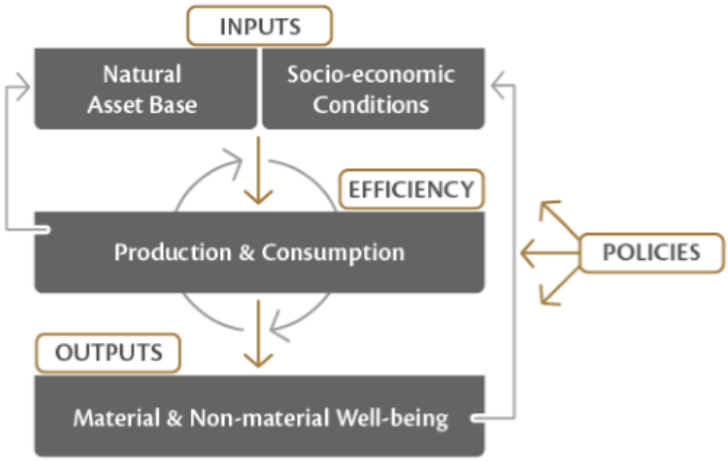
During breakout session, participants were split into four groups to discuss the Index, from its concept and framework to its scoring and ranking methodology. This approach created an interactive environment for proactive participation. The breakout session continued in the second day, followed by a "writeshop" session where participants within their groups submitted a report highlighting key takeaways and suggestions for revising and enhancing the Index. The Simulation Tool was presented during the workshop to inform the participants about the planned improvements next year. The workshop concluded with the reporting of each group on the highlight of their group discussions.

Breakout Session

3. Highlights of the Presentations and Discussions

3.1 UAE Green KPIs

The Principles of sustainable development were adopted in UAE in 1971. Vision 2021 establishes six objectives to prepare UAE to be among the best countries in the world by 2021 (the golden jubilee). The Green Key Performance Indicators (KPIs) are intended to support UAE's ongoing efforts to achieve the Vision. The UAE Green Growth Strategy was also launched in 2012.



Framework for Developing the UAE Green KPIs

The UAE Green Agenda 2030, which has five pillars – economy, social development, environment and natural resources, energy and climate action, green life, and sustainable use of resources – provides a unified framework for action. The Green KPIs are based on input-output framework, where inputs such as natural asset base and socio-economic conditions lead to outputs that represent well-being. Efficiency is highlighted as interfacing the inputs and outputs, which helps to promote sustainable production and consumption. The Green KPIs have 41 indicators which are grouped into environmental, economic, and social dimensions. The indicators are published annually in the State of Green Economy Report 2017.

MOCCAE also plans to develop a composite index to combine all 41 KPIs into a single number measured against 2030 targets. Some data issues remain to be addressed, e.g., discrepancies between local and United Nations data, or the absence of local data and use of UN estimates, and there is a dedicated program to improve green economy data. UAE plans to launch the Green KPI Dashboard before the end of October 2018. There are also plans to use more open source data and possibly customize display of KPI information, e.g., comparing countries.

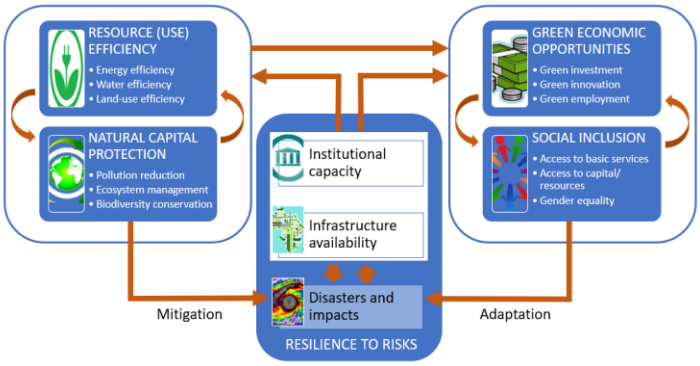
3.1 GGGI's Green Growth Index

It was emphasized that the Green Growth Index is still undergoing improvement and the regional workshop is part of a process to further develop the framework. The participants expressed interest in understanding what is meant by "green" in green growth and the conceptual framing of the Green Growth Index. Reference was made to selected dimensions in the Index, namely Resource Use/Efficiency and Natural Capital Protection, which emphasize the environmental ("green") aspects of sustainable development and lead to Green Economic Opportunities and Social Inclusion. Improved Social Inclusion has a positive feedback for resource protection.

The participants raised important issues on the framework of Green Growth Index. One proposal was for ecosystem management and biodiversity conservation to be combined. Alternatively, another remark was that biodiversity, which is an output of ecosystem management, can be used as targets to measure

performance. There are also more relevant indicators for GGGI to consider for Social Inclusion, such as community participation, educational programs, and green employment. However, while these are useful indicators, it was noted that data are not available at the global level.

Participants discussed how institutional capacity and infrastructure availability provide the enabling environment can be separated from resilience to risks. There is a need to consider country performance in the country's context (e.g., water availability). Scaling of data will help to address these issues. When using data from international organizations, there is a need to be careful about components of indicators because they often rely on metadata. It was suggested that GGGI look deeply at the quality of data being collected and fairly apply indicators consistently for all countries by using the same sources across all countries and regions. On the issue of presentation, it was mentioned that some indices, like the SDG dashboard, are very selective in what they present, and context is lost, e.g., the reporting timeline of specific data is inconsistent and countries are not compared fairly. It is thus important to address the issue of comparability and making the Index comprehensive and informative.



Conceptual Framework for the Index

Some participants asked about the origin of the Green Growth Index. The idea of developing the Green Growth Index emerged organically from GGGI as a way of more effectively tracking green growth performance, but it something that is of interest to all member countries. There was thus no specific request for GGGI Index, although some countries are already developing their own national indices and are also keen to develop similar indices at the subnational level (and this is also a request suggested by multiple countries after seeing the Green Growth Index). The value of a global index is that it provides consistency at the global level, and can be more inclusive.

To align with the SDGs, the Index is already using several SDG indicators. A new Index should be able to help change the course of development, such as to shift away from conventional development. Since the concept of green growth is still nascent, developing and confirming the indicators will be important for further defining green growth (i.e., do we have all the right indicators?). There are also interlinkages between each dimension to green growth that need to be considered in developing a green growth framework. There are several indices of green growth that are based on different frameworks (e.g. Environmental Performance Index). To avoid duplication of indices, for example, GGGI and UN Environment have agreed to explore the linkages between the Green Growth Index and Green Economy Progress Index, respectively.

The discussion on methods highlighted concerns about global ranking. Once an index is developed, many, including government officials, can become consumed with the country's rank relative to other countries', and end up losing focus on improving performance. In discussion, at first UAE participants expressed a preference not to be ranked, although later this was qualified to indicate ranking would be acceptable if all data and indicators were confirmed as valid and accurate, i.e., perhaps after the first or second year that the Green Growth Index is published.

Another option is to score countries without ranking them, but then the individual score may still be an issue. The comparison of scores against countries' own performance can be used in lieu of ranking. The SDG targets can be used to measure country performance for an indicator or data against that external target. In any case, the preliminary results of the Green Growth Index are not yet compared to any targets and are only meant for illustration and were computed without any weighing of indicators and scaling of data.

4. Group workshop reports

4.1 Group 1

Members:

- Abeer Al-Aysah, Federal Competitiveness & Statistics Authority, Dubai
- Jehan Haddad, Royal Scientific Society, Jordan
- Bilal Jaber, Road and Transport Authority, Dubai
- Fatima Habshi, Ministry of Climate Change and Environment, Dubai
- Naoko Machiba, Ministry of Climate Change and Environment, Dubai

Group 1 in breakout session

SCORES

What targets can be used to compare performance within the system?

- Where not available, refer to the top 2-3 countries in each regional and/or level of economic development. The top countries in each group would be compared to each other.

What targets can be used to measure performance outside the system?

- Use international standards where available (including consideration of SDGs). Need to make sure the data is accurate, leading to the possible idea of surveying national information.

RANKS

Is it useful to present ranks? Why?

How ranks can be presented to minimize political debate?

- Yes, and the participants like the idea of ranking, to promote competition and to motivate countries to reach the top.
- But absolute ranks seem problematic until it can be shown that the index is solid (e.g., data is accurate). It may be better to group countries, such as one-fifth percentiles. Mentioned wanting to get to the "top ten".

- As the Index becomes stronger, can move from a scale-based system to full ranking. Can do this at the global level and at both the regional level and economic development level.

WEIGHTS

Why use weights?

- Need weights for all—dimensions, indicators, and data. Data can be weighted after the index is finalized; not yet.
- Results of the weighting exercise for Group 1 is as follows:

	Priority	**Weights**
Resource Efficiency		
Energy	high	40
Water	medium	40
Landuse	low	20
Natural Capital Protection		
Pollution Reduction	high	50
Ecosystem management	medium	25
Biodiversity Conversation	medium	25
Green Economic Opportunities		
Green Investment	high	60
Green Innovation-Trade	low	15
Green Employment	medium	25
Social Inclusion		
Access to Basic Services	high	45
Access to Capital - Resources	medium	30
Gender Equality	medium	25
Resilience to Risks		
Institutional capacity	high	40
Infrastructure availability	medium	20
Natural disaster impacts	low	30

SIMULATION

- Good interface

OTHER GENERAL COMMENTS

- There is a preference to collect data from countries, but it is challenging for some countries to collect data themselves (so just as hard to ask GGGI to do so)
- Ultimately, GGGI needs to ensure high quality of data collected across all countries. Some data resulting from academic research or surveys is unreliable.
- Finally, it was recommended that GGGI report results of the Index every two or three years (one even said every five years).

4.2 Group 2

Members:

- Maha Alm'ayta, Ministry of Environment, Jordan
- Ayad Hamzah, Dubai Municipality
- Peter Farrington, Dubai Municipality
- Hussein Hamed, Environment Agency, Abu Dhabi
- Humaid Kanji, Environment Agency, Abu Dhabi

Group 2 in breakout session

	Priority	Weights	Notes
Resource Efficiency			
Energy	high	40	add energy cosumption per capita
Water	high	40	Add percentage of TSE resuse. Consumption rate per capita and per GDP, by Sector. Groundwater consumption reduction (percentage)
Landuse	Med	20	Crop Diversity Index, agricultural production per capita
Natural Capital Protection			
Pollution Reduction	High	40	Delete ozone as an indicator.
Ecosystem management	High	30	
Biodiversity Conversation	High	30	Biodiversity conservation can be a target, and outcome of ecosystem management
Green Economic Opportunities			
Green Investment	High	40	Add energy efficiency, sustainable consumption and production
Green Innovation-Trade	Medium	20	
Green Employment	High	40	It should be a greening of all jobs, not just creation of green jobs.
Social Inclusion			
Access to Basic Services	High	45	Add community awareness and engagement (new indicator); Data: Number of public events, public participation. Add Public consultation activities, Health care; Human rights. Green Education programs.

Access to Capital - Resources	High	30	
Gender Equality	Medium	25	
RESILIENCE TO RISK			
Institutional capacity	High	40	Disaster should be more than just "climate change" focused.
Infrastructure availability	HIgh	40	Travel distance per inhabitant. Delete total vechicles per 1000. Trip duration. Access to public transport.
Natural disaster impacts	Med	20	Monetary value of natural disaster impacts. Time required to restore basic services.
**** Note: Weights to be the same for all H indicators***			

4.3 Group 3

Members:

- Jihad Alsawair, Ministry of Environment, Jordan
- Tomoo Machiba, Ministry of Climate Change and Environment, Dubai
- Amna AlSuwaidi, Zayed University, Dubai
- Mouza Alghfeli, Zayed University, Dubai
- Fatmah AlHantoubi, Department of Transport, Abu Dhabi

Group 3 in breakout session

INDICATORS AND DATA

Resource Efficiency

- Energy: 3 dimensions are required to measure: production, transmission and consumption
- Water: Water network loss should be accounted; Water depends on availability of each country, not simply comparable
- Landuse: Productivity not comparable between countries; Crop diversity, methodology uncertain, depending on countries
- Where is material efficiency?
- Where is waste/recycling?

Natural Capital Protection

- Pollution: CO2/GDP not relevant here (efficiency); PM2.5 chemical composition should be considered; Water quality is important but data source is a question
- Ecosystem and Biodiversity are confusing and should be merged. Forest is not relevant to some countries; Soil threat uncertain methodology; Minerals also up to countries with resources or not
- Biodiversity: Freshwater not important or covered by terrestrial protected areas

Resilience to Risks

- Institutional capacity: Policy implementation … composite index to be avoided; Gross capital formation should be part of investment; Online is OK but only part of the picture
- Infrastructure: Sanitation and health should be added; No. of vehicles not relevant; Electricity diversity is a double counting and not necessarily lead to resilience; Mobile access is double counting with online access.
- Natural disaster: Share to global disaster should be out as countries can't make a difference; add infrastructure and economic impacts, along with impact on population.

Green Economic Opportunities

- Indicators should be focused on green projects (green investment, green innovation, green jobs), general indicators won't provide right picture.
- Investment: RE per electricity or total energy? Readiness…. Composite index should be avoided.
- Innovation: Both indicators not relevant or may misrepresent
- Employment: General indicators not helpful or may misrepresent

Social Inclusion

- Basic services: Education is relevant but composite index should be avoided. Health and transport services should be added.
- Capital: Fuels not relevant, not access to capital; Inequality … tricky to include and composite to be avoided (e.g. UAE should account only for nationals); Property … depends on country's land ownership structure
- Gender: Data source is a question and composite to be avoided. Vulnerable employment is unclear. Disability should also be included.

TARGETS

- Use national targets combined with global targets
- Regional targets can be considered to make more relevant

RANKS & WEIGHS

- Combining all indicators into one index makes sense? What does the result mean??
- Differentiation of weighting between countries? For instance, different weighting between countries with abundant water and lack of water?
- Resource efficiency: 40/40/20

- Natural Capital: 50/25/25
- Resilience: 40/40/20
- Opportunities: 33/33/33
- Social: 33/33/33

4.4 Group 4

Members:

- Mashael Al Ansari, Ministry of Climate Change and Environment, Dubai
- Mouza Al Zaabi, Environment Agency, Abu Dhabi
- Tala AbuShuqair, Ministry of Infrastructure Development, Dubai
- Roda Al Haj Naser, Zayed University, Dubai
- Fatima Kokhardi, Ministry of Climate Change and Environment, Dubai
- Mubarak Al Juaidi, Department of Transport, Abu Dhabi

Group 4 in breakout session

	Priority	Data		Notes
		Relevant	Irrelevant	
Resource Efficiency				
Energy	H			Data should include energy production rather than transmission losses
Water	H		Y	UAE doesn't have fresh water and not AG country - proposing to measure the optimization of using treated water rather than fresh water & the efficiency of storing the rainwater
Landuse	**H**		**Y**	**UAE is not AG country - use SDG11 for sustainable cities growth**
Natural Capital Protection				
Pollution Reduction	H			to be consider air quality index (CO_2 is not pollutant) - to consider water quality parameters

Ecosystem management	H	Y		
Biodiversity Conversation	H			Minerals are irrelevant
Green Economic Opportunities				
Green Investment	H			We propose to add other green economies such as waste management
Green Innovation-Trade	H		Y	Data is not relevant
Green Employment	H		Y	Data is not relevant
Social Inclusion				
Access to Basic Services	H		Y	to measure the transportation modes rather than no of vehicles - to measure WIFI coverage rather than the mobile subscription - to include education, stormwater & health
Access to Capital - Resources	H			
Gender Equality	H			
Notes:				
Weights to be the same for all H indicators				
We propose to follow the SDGs				
We see more benefit to have global ranking to enhance and improve countries growth				

Annex D
Description of Data for the Green Growth Index

Description	Data	Definition [data source] [1]	Links to Green Growth and SDGs
1st Dimension: ENERGY EFFICIENCY			
Energy intensity	Total Final Energy Consumption/GDP	Total Final Consumption (TFC) is the sum of the consumption in the end-use sectors and for non-energy use. Energy used for transformation processes and for own use of the energy producing industries is excluded. Final consumption reflects for the most part deliveries to consumers. Backflows from the petrochemical industry are not included in final consumption (see from other sources under supply and petrochemical plants in transformation). Note that international aviation bunkers and international marine bunkers are not included in final consumption except for the world total, where they are reported as world aviation bunkers and world marine bunkers in transport. [International Energy Agency]	Less use of energy in producing goods and services contribute to efficient use of available natural resources. Data has negative relationship to green growth. Links to SDG 7 Affordable and Clean Energy; SDG 12 Sustainable consumption and production; SDG 13 Climate action
Power generation efficiency	Transmission and Distribution Losses of Electricity (% of output)	Transmission and distribution losses comprise 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. Low levels of electricity losses mean that a country's electricity distribution system is efficient, which supports economic growth. [International Energy Agency]	Losses are wasted resources and not use in producing goods and services. Data has negative relationship to green growth. Links to SDG 7 Affordable and clean energy; SDG 12 Sustainable consumption and production; SDG 13 Climate action
1st Dimension: WATER EFFICIENCY			
Water intensity	Freshwater withdrawal as a proportion of available freshwater resources	The level of water stress: freshwater withdrawal as a proportion of available freshwater resources is the ratio between total freshwater withdrawn by all major sectors and total renewable freshwater resources, after taking into account environmental water requirements. SDG Target Addressed - By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity. [Food and Agriculture Organization]	Use of water resources, particularly if supply is limited, needs to be reduced to avoid environmental stress. Data has negative relationship to green growth. Links to SDG 6 Clean water and sanitation; SDG 12 Sustainable consumption and production

[1] Unless other references are cited, the information is drawn from data sources.

Water efficiency	Irrigated cropping intensity (%)	The fraction of the cultivated area that is harvested. The cropping intensity may exceed 100 percent where more than one crop cycle is permitted each year on the same area. In AQUASTAT, the cropping intensity has been calculated on irrigated crops only and becomes practically the ratio of the harvested irrigated areas over the area equipped for full control irrigation actually irrigated. Irrigation, by decoupling the crop production from the natural precipitation, increases cropping intensity in countries where temperatures are not a limiting factor. [Food and Agriculture Organization]	Agriculture is largest consumer of water resources. Increased cropping intensity (more harvest seasons per year) implies that more water is consumed for agriculture. Data has negative relationship to green growth. Links to SDG 2 Zero hunger; SDG 6 Clean water and sanitation; SDG 12 Sustainable consumption and production
1st Dimension: LAND EFFICIENCY			
Agricultural Land Productivity	Agricultural output (tonnes) / hectares	Agricultural land refers to the share of land area that is arable, under permanent crops, and under permanent pastures. Arable land includes land defined by the FAO as 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. [Food and Agriculture Organization]	Higher yield represents efficient use of land resources, i.e. more produce for less land. Data has positive relationship to green growth. Links to SDG 2 Zero hunger; SDG 12 Sustainable consumption and production
Agricultural Land Productivity	Crop diversification index (Herfindahl)	Crop diversification refers to the raising of varieties of crops in a given area in a crop season. To achieve agricultural sustainability there must be crop diversification (Dali and Mili 2010) or Herfindahl (higher value less mix, lower value higher mix). [Food and Agriculture Organization]	More crops in given unit of land allow efficient use of land resources and improve crop (bio)diversity. Data has positive relationship to green growth. Links to SDG 2 Zero hunger; SDG 12 Sustainable consumption and production
2nd Dimension: EMISSION AND POLLUTION REDUCTION			
Greenhouse gas emissions	CO2 / GDP	IEA data include CO2 emissions from (Fossil) Fuel Combustion. The IEA data provide sectoral breakdown (Transport, Industry, Commercial/Residential, etc.) which is currently used in the subsectors in the matrix [International Energy Agency]	Carbon emissions contribute to global warming. Less emission for every unit of production of goods and services reduces air pollution.

			Data has negative relationship to green growth. Links to SDG 7 Affordable and clean energy; SDG 12 Sustainable consumption and production; SDG 13 Climate action
Air pollution	PM2.5 Exposure	Population-weighted exposure to ambient PM2.5 pollution is defined as the average level of exposure of a nation's population to concentrations of suspended particles measuring less than 2.5 microns in aerodynamic diameter, which are capable of penetrating deep into the respiratory tract and causing severe health damage. Exposure is calculated by weighting mean annual concentrations of PM2.5 by population in both urban and rural areas. [Downloaded from World bank; Brauer, M. et al. 2016, for the Global Burden of Disease Study 2016]	Particulate matter emissions are harmful to health. Data has negative relationship to green growth. Links to SDG 3 Health and wellbeing; SDG 11 Sustainable cities and communities
Air pollution	Ambient Ozone	Age-standardized Disability-Adjusted Life Years lost per 100,000 persons, or the DALY rate due to ambient ozone. Age-standardization is a statistical technique used to compare populations with different age structures, in which the characteristics of the populations are statistically transformed to match those of a reference population. Useful because relative over- or under-representation of different age groups can obscure comparisons of age-dependent diseases (e.g., ischemic heart disease or malaria) across populations. [Institute for Health Metrics and Evaluation]	Ground Level Ozone was an issue near busy roads (it is formed from NOx and VOCs in the presence of sunlight). Data has negative relationship to green growth. Links to SDG 3 Health and wellbeing; SDG 11 Sustainable cities and communities; SDG 13 Climate action
Water Quality	Unsafe water sources	Age-standardized Disability-Adjusted Life Years lost per 100,000 persons, or the DALY rate due to unsafe water sources. [Institute for Health Metrics and Evaluation]	Water pollution is harmful to the human health and environment. Data has negative relationship to green growth. Links to SDG 3 Health and wellbeing; SDG 6 Clean Water and sanitation; SDG 11 Sustainable cities and communities
2nd Dimension: ECOSYSTEM MANAGEMENT			
Marine protection	Coverage of protected areas in relation to marine areas	Percent of marine waters in a natural or cultural heritage marine protected area. This indicator is expressed as percentage protected of total surface area of national waters. The marine area indicator can be expressed by different zones under national jurisdiction (e.g. territorial waters, exclusive economic zones etc.).	Protected area is an important form of ecosystem management and helps protect the environment. Data has positive relationship to green growth.

		SDG Target Addressed - By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information. [UNEP World Conservation Monitoring Centre (UNEP-WCMC) and the IUCN World Commission on Protected Areas (WCPA)]	Links to SDG 2 Zero hunger; SDG 14 Life below water
Forest protection	% Change in Total Forest Cover	Ratio of Forest Cover / Land Area Values. Percent change is calculated 5-Year Change of the ratio. Forest area is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agroforestry systems) and trees in urban parks and gardens. [Food and Agriculture Organization]	Forests are important sources of carbon emission mitigation as they absorb carbon from the atmosphere. Data has positive relationship to green growth. Links to SDG 13 Climate action; SDG 15 Life on land
Land protection	Soil threat	This map is presented on pages 134-135 of the Global Soil Biodiversity Atlas. The map shows the potential rather than the actual level of threat to soil organisms. For the development of this map, the following threats and corresponding proxies were chosen: loss of aboveground biodiversity, agricultural use, overgrazing, fire risk, soil erosion, land degradation and climate change. [European Commission Joint Research Center]	Soil biodiversity is lost due to human activities. Biodiversity loss reduces the productivity of the soil. Data has negative relationship to green growth. Links to SDG 2 Zero hunger; SDG 13 Climate action; SDG 15 Life on land
Land minerals protection	Adjusted savings: natural resources depletion (% of GNI)	Natural resource depletion is the sum of net forest depletion, energy depletion, and mineral depletion. Net forest depletion is unit resource rents times the excess of roundwood harvest over natural growth. Energy depletion is the ratio of the value of the stock of energy resources to the remaining reserve lifetime (capped at 25 years). It covers coal, crude oil, and natural gas. Mineral depletion is 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 staff estimates based on sources and methods described in "The Changing Wealth of Nations 2018: Building a Sustainable Future" Lange et al 2018]	Resource depletion will not sustain economic growth. Data has negative relationship to green growth. Links to SDG 13 Climate action; SDG 15 Life on land
2nd Dimension: BIODIVERSITY CONSERVATION			
Species diversity (Endangered Species)	Red list index	The RLI uses data from the IUCN Red List of Threatened Species. The IUCN Red List uses quantitative criteria based on population size, rate of decline, and area of distribution to assign species to one of seven categories of relative extinction risk, ranging from 'Extinct' to 'Least Concern' (or to a 'Data Deficient' category for species that are very poorly known). An RLI value of 1.0 equates to all species being categorised as Least Concern, and	Biodiversity sustains economic growth and environmental sustainability. Data has positive relationship to green growth. Links to SDG 2 Zero hunger; SDG 14 Life below Water; SDG 15 Life on land

		hence that none are expected to go extinct in the near future. An RLI value of zero indicates that all species have gone Extinct. [International Union for Conservation of Nature]	
Freshwater biodiversity	Proportion of important sites for freshwater biodiversity that are covered by protected areas	Proportion of important sites for freshwater biodiversity that are covered by protected areas, by ecosystem type SDG Target Addressed: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements. [United Nations Statistics Division]	Biodiversity sustains economic growth and environmental sustainability. Data has positive relationship to green growth. Links to SDG 2 Zero hunger; SDG 6 Clean water and sanitation; SDG 14 Life below Water; SDG 15 Life on land
Terrestrial biodiversity	Proportion of important sites for terrestrial biodiversity that are covered by protected areas	Proportion of important sites for terrestrial biodiversity that are covered by protected areas, by ecosystem type SDG Target Addressed: By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements. [United Nations Statistics Division]	Biodiversity sustains economic growth and environmental sustainability. Data has positive relationship to green growth. Links to SDG 2 Zero hunger; SDG 15 Life on land
3rd Dimension: INSTITUTIONAL CAPACITY			
Policy implementation capacity	Government Effectiveness	Reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. [World Bank]	Capacity of government to provide public services is crucial to mitigating and adapting to disaster risks and impacts. Data has positive relationship to green growth. Links to SDG 16 Peace, justice and strong institutions; SDG 17 partnership for the goals
Economic growth generation	Gross capital formation growth	Computed average 5 years growth rate of gross capital formation based on constant local currency. Aggregates are based on constant 2010 U.S. dollars. Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. [World Bank national accounts data, and OECD National Accounts data files]	Capacity of public and private institutions to build facilities can help to adapt to disaster impacts. For example, roads, hospitals, etc. are necessary facilities during disasters. Data has positive relationship to green growth. Links to SDG 8 Decent work and economic growth; SDG 9 Industry, innovation and

			infrastructure; SDG 17 partnership for the goals
Public service	Online Service Index	The online services component of the E-Government Development Index (EGDI) is a composite indicator measuring the use of ICT by governments to deliver public services at national level. [United Nations Department of Economic and Social Affairs, UNDESA]	Capacity of government to provide information through modern communication system is important to recover from disaster and develop resilient society. Data has positive relationship to green growth. Links to SDG 9 Industry, innovation and infrastructure; SDG 16 Peace, justice and strong institutions;
3rd Dimension: INFRASTRUCTURE AVAILABILITY			
Transportation service	Passenger vehicles per 1000 inhabitants	Passenger cars refer to road motor vehicle, other than a motor cycle, intended for the carriage of passengers and designed to seat no more than nine persons (including the driver). The term "passenger car" therefore covers microcars (need no permit to be driven), taxis and hired passenger cars, provided that they have fewer than ten seats. [International Road Federation]	Availability of transportation helps in disaster recovery and builds resilient society. Data has positive relationship to green growth. Links to SDG 9 Industry, innovation and infrastructure; SDG 11 Sustainable cities and communities; SDG 13 Climate action
Electricity sources diversity	Diversity of electricity mix (Herfindahl)	The electricity generation mix is a useful indicator of trends in the diversity and origin of electricity. The electricity system is undergoing a period of significant change as we transition from a large-scale conventional fossil fuel dominated generation mix to intermittent renewable generation. (https://www.ofgem.gov.uk/) [International Energy Agency]	Different sources of energy help to build a resilient society. Data has positive relationship to green growth. Links to SDG 7 Affordable and clean energy; SDG 9 Industry, innovation and infrastructure; SDG 11 Sustainable cities and communities; SDG 13 Climate action
Communication	Mobile cellular subscriptions (per 100 people)	Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology. The indicator includes (and is split into) the number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months). The indicator applies to all mobile cellular subscriptions that offer voice communications.	Use of mobile phones has been critical in supporting affected people and coordinating support during disasters. Data has positive relationship to green growth.

		[International Telecommunication Union, World Telecommunication/ICT Development Report and database]	Links to SDG 9 Industry, innovation and infrastructure; SDG 11 Sustainable cities and communities; SDG 13 Climate action
3rd Dimension: NATURAL DISASTER IMPACTS			
Natural disasters	Share to global disaster	Include disasters form natural hazards such as meteorological - caused by short-lived, micro- to meso-scale extreme weather and atmospheric conditions that last from minutes to days, hydrological - caused by the occurrence, movement, and distribution of surface and subsurface freshwater and saltwater, climatological - caused by long-lived, meso- to macro-scale atmospheric processes ranging from intra-seasonal to multi-decadal climate variability, and biological - A hazard caused by the exposure to living organisms and their toxic substances (e.g. parasites, bacteria, or viruses such as malaria). [Centre for Research on the Epidemiology of Disasters]	Some countries are more vulnerable to natural disasters than others. Resilience to risks can be affected by the frequency and types of disasters. Data has negative relationship to green growth. Links to SDG 1 No poverty, SDG 11 Sustainable cities and communities; SDG 13 Climate action
Disaster impacts	Total affected by disaster (Percent of population)	Proportion of the population affected by the natural disasters. [Centre for Research on the Epidemiology of Disasters]	Impacts of the disasters can be measured by the number of affected people. The larger the number of affected people the more difficult to recover from disasters due to magnitude of impacts and the logistics required to support them. Data has negative relationship to green growth. Links to SDG 1 No poverty, SDG 11 Sustainable cities and communities; SDG 13 Climate action
4th Dimension: GREEN INVESTMENT			
Investment in Mitigation	Renewable electricity output (% of total electricity output) (Growth)	Computed 5 years compound growth in renewable electricity as a share of electricity generated by renewable power plants in total electricity generated by all types of plants. [International Energy Agency]	Investment in renewable energies such as electricity can support mitigation initiatives. Data has positive relationship to green growth. Links to SDG 7 Affordable and clean energy; SDG 9 Industry, innovation and infrastructure; SDG 12 Responsible production and consumption; SDG 13 Climate action

Investment in adaptation	Economic readiness to leverage private and public sector investment for adaptive actions	Readiness to make effective use of investments for adaptation actions thanks to a safe and efficient business environment. ND-GAIN measures overall readiness by considering three components: economic readiness, governance readiness and social readiness. The World Bank Doing Business (DB) indicators, which have been used by many studies to evaluate countries' investment climate by measuring procedures, time and cost of performing business activities through business life cycles (e.g. Commander & Svejnar, 2011; Hallward-Driemeier & Pritchett, 2011; Morris & Aziz, 2011; Collier & Duponchel, 2013). As the economic readiness in ND-GAIN seeks to capture the business condition that attract adaptation investment, a description of the general investment climate is a good proxy for the economic component of readiness. [World Bank]	Investment to enhance adaptive capacity will help to build resilience of communities. Data has positive relationship to green growth. Links to SDG 9 Industry, innovation and infrastructure; SDG 13 Climate action; SDG 17 Partnerships for the goals
4th Dimension: GREEN INNOVATION			
Capital productivity	Growth GVA (Productivity)	Computed 5 years compound growth rate of the total value added (GVA). Gross value added is the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector. [World Bank national accounts data, and OECD National Accounts data files]	Growth in GVA measures how labour and capital are efficiently used through new technologies and innovative ideas. Data has positive relationship to green growth. Links to SDG 8 Decent work and economic growth; SDG 9 Industry, innovation and infrastructure
Labour efficiency	Growth rate of real GDP per employed person	Computed 5 years average growth rate of real GDP per employed person. Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors. UN data for SDG indicators. [International Labour Organization]	Increase in labour productivity through innovation support green growth. But it will be important to use data related to green employment as they become available. Data has positive relationship to green growth. Links to SDG 8 Decent work and economic growth; SDG 9 Industry, innovation and infrastructure
4th Dimension: GREEN EMPLOYMENT			
Available employment	Employment (to population ratio, 15+, total) Growth	Computed 5 years compound growth in employment and population ratio, which is the proportion of a country's population that is employed. Employment is defined as persons of working age who, during a short reference period, were engaged in	This is only a proxy data because no data is available yet on green employment.

		any activity to produce goods or provide services for pay or profit, whether at work during the reference period (i.e. who worked in a job for at least one hour) or not at work due to temporary absence from a job, or to working-time arrangements. Ages 15 and older are generally considered the working-age population. [International Labour Organization]	Data has positive relationship to green growth. Link to SDG 1 No poverty; SDG 8 Decent work and economic growth; SDG 10 Reduced inequalities
Decent employment	Wage and salaried workers, total (% of total employment)	Computed 5 years compound growth rate in wage and salaried workers (employees), who are those workers who hold the type of jobs defined as "paid employment jobs," where the incumbents hold explicit (written or oral) or implicit employment contracts that give them a basic remuneration that is not directly dependent upon the revenue of the unit for which they work. [International Labour Organization]	Decent employment supports green growth and align to SDG targets on employment. Data has positive relationship to green growth. Link to SDG 1 No poverty; SDG 8 Decent work and economic growth
5th Dimension: ACCESS TO BASIC SERVICES			
Drinking water	Population with access to drinking water	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 [World Health Organization and United Nations Children's Fund]	One of the most important basic services, where quality (i.e. safe drinking water) is also related to health. Data has positive relationship to green growth. Links to SDG 3 Good health and wellbeing; SDG 6 Clean water and sanitation; SDG 10 Reduced inequalities
Sanitation	Population with access to sanitation	Improved sanitation facilities are those designed to hygienically separate excreta from human contact. These include wet sanitation technologies (flush and pour flush toilets connecting to sewers, septic tanks or pit latrines) and dry sanitation technologies (ventilated improved pit latrines; pit latrines with slabs; or composting toilets). Improved facilities shared with other households have previously been reported separately and did not count towards the MDG target. [World Health Organization and United Nations Children's Fund]	One of the most important basic services, where quality (i.e. improved sanitation) is also related to health of people and environment. Data has positive relationship to green growth. Links to SDG 3 Good health and wellbeing; SDG 6 Clean water and sanitation; SDG 10 Reduced inequalities
Electricity	Population with access to electricity	Percent of total population with access to electricity. It will be more useful to consider access of rural population to renewable electricity, but data not yet available. [World Bank, International Energy Agency, and the Energy Sector Management Assistance Program]	One of the most important basic services, where renewable sources of electricity could contribute more to green growth. Data has positive relationship to green growth.

			Links to SDG 3 Good health and wellbeing; SDG 7 Affordable and clean energy; SDG 10 Reduced inequalities
Education	Human capital index	The Human Capital Index measures countries' ability to maximize and leverage their human capital endowment. The four components of the index are (i) adult literacy rate; (ii) the combined primary, secondary and tertiary gross enrolment ratio; (iii) expected years of schooling; and (iv) average years of schooling. [United Nations Department of Economics and Social Affairs]	One of the most important basic services that will allow people to contribute more effectively and productively to green growth. Data has positive relationship to green growth. Links to SDG1 No poverty; SDG 4 Quality education; SDG 10 Reduced inequalities
5th Dimension: ACCESS TO CAPITAL/RESOURCES			
Food security	Prevalence of undernourishment (% of population)	Population below minimum level of dietary energy consumption (also referred to as prevalence of undernourishment) shows the percentage of the population whose food intake is insufficient to meet dietary energy requirements continuously. Data showing as 5 may signify a prevalence of undernourishment below 5%. [Food and Agriculture Organization]	Availability and affordability of nutritious food is important to health of the people and enables them to contribute better to green growth. Data has positive relationship to green growth. Links to SDG 1 No poverty; SDG 2 Zero hunger; SDG 3 Good health and wellbeing; SDG 10 Reduced inequalities;
Fuels	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. Under WHO guidelines, kerosene is excluded from clean cooking fuels. [World Bank, WHO Global Household Energy database]	Clean fuels and technologies are important to health of the people and enables them to contribute better to green growth. Data has positive relationship to green growth. Links to SDG 1 No poverty; SDG 2 Zero hunger; SDG 3 Good health and wellbeing; SDG 10 Reduced inequalities; SDG 13 Climate action
Income equality	Inequality-adjusted income index	HDI income index adjusted for inequality in income distribution based on data from household surveys. [United Nations Development Programme]	Equality in income contributes to equal opportunities and better working environment, which improve labour productivity and economic growth.

			Data has positive relationship to green growth. Links to SDG 1 No poverty; SDG 8 Decent work and economic growth; SDG 10 Reduced inequalities
Access to property including land	Registering property	Property rights examines the steps, time and cost involved in registering property; measures the quality of the land administration system including reliability of infrastructure, transparency of information, geographic coverage, land dispute resolution, and equal access to property rights [World Bank]	Equal property and land rights create equal opportunities to and reduce conflicts in society, which enhances green growth. Data has positive relationship to green growth. Links to SDG 1 No poverty; SDG 2 Zero hunger; SDG 10 Reduced inequalities; SDG 16 Peace, justice and strong institutions
5th Dimension: GENDER EQUALITY			
Basic rights	Gender Inequality Index (GII)	It measures gender inequalities in three important aspects of human development—reproductive health, measured by maternal mortality ratio and adolescent birth rates; empowerment, measured by proportion of parliamentary seats occupied by females and proportion of adult females and males aged 25 years and older with at least some secondary education; and economic status, expressed as labour market participation and measured by labour force participation rate of female and male populations aged 15 years and older. [United Nations Development Programme]	Equal rights to women enable them to contribute to green growth. Data has positive relationship to green growth. Links to SDG 5 Gender equality; SDG 10 Reduced inequalities; SDG 16 Peace, justice and strong institutions
Incentive or capacity to work	Accessing institutions	Accessing institutions explores women's ability to interact with public authorities and the private sector in the same ways as men, through examining constraints on women's decision-making and freedom of movement. [World Bank]	Equal access to institutions enables more women to participate in important positions in public and private sectors. Data has positive relationship to green growth. Links to SDG 5 Gender equality; SDG 10 Reduced inequalities; SDG 16 Peace, justice and strong institutions
Decent employment	Vulnerable employment, female (% of female employment)	Vulnerable employment (often unprotected by labour legislation) is contributing family workers and own-account workers (as opposed to wage and salaried workers) as a percentage of total employment. (average of male and female) [International Labour Organization]	Decent employment contributes to safety and security in work and enable women to contribute more productively in green growth.

			Data has positive relationship to green growth. Links to SDG 5 Gender equality; SDG 8 Decent work and economic growth; SDG 10 Reduced inequalities; SDG 16 Peace, justice and strong institutions