UNITED NATIONS DEVELOPMENT PROGRAMME

Capturing Collective Progress on Adaptation

A Proposal to move forward on the UNFCCC Global Stocktake

2024

Lead Author:
Joel B. Smith, Independent Researcher, USA.

Co-Authors:
Rohini Kohli, UNDP
Prakash Bista, UNDP
Patricia Velasco, UNDP

Contributing Authors:
Myles Whittaker
Olivia Diaz

Acknowledgements
The authors would like to thank reviewers and colleagues for their cogent comments. Very careful and thoughtful reviews on a draft of the report were provided by Dr. Anand Patwardhan of the University of Maryland and Korinna von Teichman, Consultant to the United Nations Framework Convention on Climate Change Secretariat. Helpful suggestions on organization of this report were provided by Stephanie Renfrow. The authors would also like acknowledge with great appreciation the valuable contributions and comments received from Keti Chachibaia, Rajesh Sharma and Claudia Ortiz of UNDP. The report was edited by Melanie Pisano of UNDP.

About UNDP
UNDP is the leading United Nations organization fighting to end the injustice of poverty, inequality, and climate change. Working with our broad network of experts and partners in 170 countries, we help nations to build integrated, lasting solutions for people and planet. Learn more at undp.org or follow at @UNDPclimate.

UN Disclaimer
The views expressed in this publication are those of the author(s) and do not necessarily represent those of the United Nations, including UNDP or the UN Member States.

United Nations Development Programme
One United Nations Plaza, New York, NY 10017, USA.

Cover photo: ©UNDP Bhutan

Capturing Collective Progress on Adaptation

A Proposal to move forward on the UNFCCC Global Stocktake

Table of Contents

Acronyms and abbreviations 4
Executive Summary 7
Introduction 11
Part I: UNFCCC decisions on the Global Goal on Adaptation and the Global Stocktake 12
Part II: Considerations in incorporating adaptation into the Global Stocktake 15
Part III: Current approaches, policies, and indicators 24
Part IV: Options to begin the process of measuring progress towards meeting the Global Goal on Adaptation 46
References 55
Appendix I: Stakeholder interviews 63


©UNDP Rwanda/Mucyo Serge

Acronyms and abbreviations

AC	Adaptation Communication
AF	Adaptation Fund
BTR	Biennial Transparency Report
CBD	Convention on Biological Diversity
COP	Conference of Parties
COSIE	Observation, Monitoring, and Environmental Information Centre
DALY	Disability Life Adjusted Year
DCC	Department of Climate Change (Vietnam)
DRR	Disaster risk reduction
EBRD	European Bank for Reconstruction and Development
EWS	Early Warning Systems
ETF	Enhanced Transparency Framework
FAO	Food and Agriculture Organization of the United Nations
FIES	Food Insecurity Experience Scale
GBD	Global Burden of Disease
GCF	Green Climate Fund
GEF	Global Environment Facility
GGA	Global Goal on Adaptation
GHG	greenhouse gases
GlaSS	Glasgow-Sharm el-Sheikh work programme
GST	Global Stocktake
HDI	Human Development Index
INS	National Institute for Statistics (Guinea)
IWMI	International Water Management Institute
IPCC	Intergovernmental Panel on Climate Change
L&D	Loss and Damage
LDCF	Least Developed Countries Fund
M&E	Monitoring and Evaluation
MEL	Monitoring, Evaluation, and Learning
MHEWS	Multi-Hazard Early Warning System
MONRE	Ministry of Environment and Natural Resources
NAI	Non-Annex I
NAP	National Adaptation Plan
NDC	Nationally Determined Contributions

NGO	Non-Government Organization
PNDES	National Plan for Economic and Social Development (Guinea)
RDD	Research, Development, and Deployment
SCCF	Special Climate Change Fund
SDG	Sustainable Development Goal
ToC	Theory of Change
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNDRR	United Nations Disaster Risk Reduction
UNEP	United Nations Environment Programme
UNEP DTU	UNEP and the Danish Technical University
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WHO	World Health Organization

©Priscilla Mora / UNDP Costa Rica

Executive Summary

The United Nations Framework Convention on Climate Change (UNFCCC) Paris Agreement at COP21 called for development of Global Goals on Adaptation (GGA) and periodic stocktaking of progress towards meeting those goals. UNFCCC COP28, which concluded in December 2023, adopted the UAE Framework for Global Climate Resilience, which identified seven adaptation targets and four sets of adaptation policy cycle targets to measure implementation of adaptation and reduction in climate risks.

The first stocktake concluded at COP28, but there was insufficient information to determine whether adaptation measures taken to date or identified for future implementation would be adequate to adapt to expected impacts of climate change. This paper suggests approaches on how progress on adaptation to climate change can be measured in future Global Stocktakes, beginning with the next scheduled stocktake in 2028.

While it is much easier to measure what adaptation actions are being planned or implemented, it is far more challenging to assess how effective those actions will be in reducing or eliminating climate change risks to society and nature. A logic model can be used to distinguish between inputs, outputs and outcomes. Inputs enable change to happen and include risk assessments, adaptations, finance, and technology. Outputs are essentially the adaptation actions, such as Early Warning Systems (EWS) and changes in agriculture or water management. Outcomes measure wellbeing of society and nature. Outcomes can be measured and assessed in sectors, such as human health, agriculture, and ecosystems. In the language of logic models, it appears to be much more difficult to measure the effectiveness of adaptations, i.e., outputs, on outcomes than to measure the effectiveness of inputs such as planning and finance on outputs.

A key challenge facing the UNFCCC is ensuring that the stocktake process is country driven and can be implemented by all countries. Technical and financial assistance to support universal implementation of the measurement system will most likely be needed. A review of existing monitoring, evaluation and learning (MEL) systems found that some developing countries have well developed MEL systems while others are at a more nascent stage. Many countries can, with financial and technical assistance, develop sophisticated systems to monitor and evaluate vulnerability to climate change and the effectiveness of adaptation investments, although it can take time to help develop fully functioning MEL systems.

A major hurdle to taking stock of global adaptation is the lack of a universal indicator on vulnerability and adaptation. Adaptation will happen in many sectors and these sectors tend to have distinct indicators. Without a single indicator to measure vulnerability and adaptation across all sectors, it is quite challenging to assess the total adequacy of adaptation actions.

One way forward is to use some cross-cutting indicators and sector indicators to measure progress on adaptation. This paper proposes using existing suites of indicators and metrics, such as the Human Development Index (HDI), Sustainable Development Goals (SDGs), and sector specific indicators, such as the Global Burden of Disease (GBD), Food and Agriculture Organizations of the United Nations (FAO) indicators on agriculture and water, and others to measure the effect of adaptations on outcomes *where possible to do so*. The main principle is to measure what can be measured and have future stocktakes expand and improve indicators. While this approach will not universally measure adaptation progress, it can provide insight on progress in many key aspects of adaptation.

For the 2028 stocktake, a limited suite of output indicators could be used to measure some cross-cutting indicators and progress in some sectors. This could include, but not be limited to the following:

- Inputs: measure the number of countries with adaptation plans, amount of financing, and number of MEL systems implemented by countries.
- Outputs: measure the number of adaptations being planned or implemented and the number of EWS implemented.
- Outcomes: measure progress towards:
    1. Life expectancy as a general indicator of human health;
    2. Income per capita as a general indicator of economic well-being;
    3. Percentage of national population living in poverty to indicate access to economic well-being;
    4. Percentage of population experiencing malnutrition as an indicator of food security; and
    5. Water supply per capita as an indicator of the state of water resources.

In subsequent stocktakes, beginning in 2033, the coverage can be expanded to other sectors, namely ecosystems and biodiversity, infrastructure and settlements, and cultural heritage. In addition, development of indices to integrate multiple indicators in other sectors in future stocktakes may be needed. Critical considerations include that the process must be driven by parties to the UNFCCC and so all parties need to have sufficient capacity to apply indicators. The indicators should inform assessment of progress on adaptation and scales ranging from the local to national to global.

A key challenge is linking inputs not just to outputs, which is relatively straightforward, but ultimately to outcomes such as poverty livelihoods, adequate nutrition, water supplies, sustainable communities, and healthy ecosystems and biodiversity. Measuring the effectiveness of adaptations in improving societal and natural outcomes can be challenging since changes in development, societies, environment, and policies will also affect these outcomes. Work will be needed to improve measurement of the effectiveness of adaptations in improving outcomes.


©Melanie Pisano/UNDP

Introduction

The United Nations Framework Convention on Climate Change (UNFCCC) has identified the Global Goal on Adaptation (GGA) (UNFCCC, 2023a) and initiated a process to "periodically take stock" through a Global Stocktake (GST) (UNFCCC, 2023b, p.1) of "collective progress towards achieving" (ibid) long-term goals, such as the GGA. There are two major challenges concerning how adaptation is addressed in the GST,[1] including (1) how to assess progress adaptation actions have already had or can make towards achieving goals and targets, including improving climate resilience in sectors, such as agriculture, water resources, and ecosystems and (2) what indicators to use in measuring such progress.

Measuring progress on adaptation is challenging mainly because there is no single indicator that can be used to measure the need for and effectiveness of adaptation actions. This is contrast to greenhouse gas (GHG) mitigation, where global warming potentials can be used to measure the contribution of different GHGs to climate change and to compare the relative contributions of different activities and policies toward increasing or reducing the level of climate change (IPCC, 2021. Glossary.) We propose building on indicators that are already being widely used across the world to measure adaptation needs and progress for cross-cutting outcomes and in some sectors in the GGA in the next Global Stocktake in 2028. Global Stocktakes beyond 2028 can expand to other sectors and may need to apply indices where many indicators are needed to measure progress in some sectors.

A critical challenge to measuring the effectiveness of adaptation is not so much measuring what is being done to support adaptation, such as planning and finance or tracking implementation of adaptation actions but assessing the effectiveness of adaptation actions in helping societies and natural systems be more resilient to climate impacts.

This paper is divided into four parts. Part I presents the Paris Agreement's (COP21) (UNFCCC, 2015) definition of the GGA and GST followed by GGA targets expressed in the "UAE Framework for Global Climate Resilience" (hereafter referred to as the "UAE Resilience Framework") agreed to at the most recent meeting of the Conference of Parties to the UNFCCC (COP28), held in late 2023 (UNFCCC, 2023a).

Part II lays out considerations that can be used to assess adaptation within the GST. It examines the two challenges mentioned above of how to demonstrate the effect of adaptation actions on outcomes identified in the GGA and what indicators should be used in the process. The challenge of tying adaptation actions to outcomes is explored through use of Theory of Change (ToC) and Logic Models. The paper reviews the literature

1. The Global Stocktake also addresses the adequacy of mitigation efforts to meet global temperature targets and finance. This paper does not address mitigations or finance.

on principles that should apply when selecting indicators to measure adaptation progress and then proposes a set of principles that can be applied.

Parti III of the paper reviews current approaches and policies that affect the stocktake. These include the Adaptation Policy Cycle and existing monitoring and reporting systems. The section contains some brief case studies on monitoring and evaluation (M&E) systems in developing countries and then identifies indicators that are being widely used to assess wellbeing in human and natural systems.

Part IV presents a possible way forward for addressing adaptation in future Global Stocktakes, focusing on the next stocktake which will be in 2028. It proposes a relatively limited set of indicators for measuring some cross-cutting and sector progress on some of the Global Goal on Adaptation (GGAs) in the 2028 stocktake. It also proposes how the coverage on adaptation can be expanded to other sectors in stocktakes beyond 2028, how indices could be used in sectors with many indicators and offers concluding thoughts.

Part I: UNFCCC decisions on the Global Goal on Adaptation and the Global Stocktake

This section briefly reviews the UNFCCC agreements on the GGA and GST, summarizing decisions made in Paris at COP21 and in Dubai at COP28.

I.1 Paris Agreement (COP21)

The "Paris Agreement" to the UNFCCC (UNFCCC, 2015) established a broad global goal on adaptation (GGA) in Article 7:

> *"… of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2 [of the UNFCCC]."*
>
> (UNFCCC, 2015, Article 7.1)

The goal applies at levels ranging from local to international and should *"… protect people, livelihoods and ecosystems, taking into account the urgent and immediate needs of those developing country Parties that are particularly vulnerable to the adverse effects of climate change."* (UNFCCC, 2015, Article 7.2).

Article 14 of the Paris Agreement states that the Parties

> *"… shall periodically take stock of the implementation of this Agreement to assess the collective progress towards achieving the purpose of this Agreement and its long-term goals (referred to as the "Global Stocktake")."*

The Global Stocktake is intended to be comprehensive, equitable, and use the best available science and shall be conducted every five-years beginning in 2023.

Article 14 states that the GST *"… shall inform Parties in updating and enhancing, in a nationally determined manner, their actions and support in accordance with the relevant provisions of this Agreement, as well as in enhancing international cooperation for climate action."*

In addition, Article 7 states that the Global Stocktake shall recognize adaptation efforts of developing countries, enhance implementation of adaptations, *"Review the adequacy and effectiveness of adaptation and support provided for adaptation"* (Art. 7.14(c)), and *"Review the overall progress made in achieving the global goal on adaptation…"* (Art.7.14(d)).

In other words, in the thematic area of adaptation, the GST shall provide information on progress towards enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change. It could do so in a manner that can inform and enhance national action and international cooperation.

I.2 COP28

The 28th meeting of the Conference of the Parties (COP) to the UNFCCC concluded in December 2023 with decisions on the GGA and the GST. The GGA decision identified targets for the GGA, in the UAE Resilience Framework (UNFCCC, 2023a). The framework is the culmination of the two-year Glasgow-Sharm el-Sheikh (GlaSS) work programme on the GGA and identifies targets that link climate resilience to sustainable development.

The first seven thematic or sectoral targets address the broad goal of the GGA to *"… long-term transformational and incremental adaptation, towards reducing vulnerability and enhancing adaptive capacity and resilience, as well as the collective well-being of all people, the protection of livelihoods and economies, and the preservation and regeneration of nature, for current and future generations,"* (UNFCCC, 2023a, section 8) are water, food and agriculture, health, ecosystems and biodiversity, poverty and livelihoods, infrastructure, and cultural heritage. The text for the seven UAE Climate Resilience targets is:

1. Significantly reduce climate induced water scarcity and enhance resilience to climate induced water hazards to yield climate-resilient water supply and sanitation with safe and affordable access to water all;
2. Attain climate-resilient food and agriculture production, supply and distribution (defined as equitable access to food and nutrition), with increased sustainable and regenerative food production;
3. Attain resiliency against climate change health impacts, including promotion of climate-resilient health services and significant reduction in climate related morbidity and mortality;

4 Reduce climate impacts on ecosystems and biodiversity, including measures such as ecosystem-based adaptation, nature-based solutions, and restoration and conservation;

5 Increase resilience of infrastructure and human settlements to climate change impacts, including minimizing the effect of climate impacts on these systems;

6 Substantially reduce the adverse effects of climate change on poverty eradication and livelihoods, including promoting adaptive social measures;

7 Protect cultural heritage from climate related risks by developing adaptive strategies for cultural practices and heritage sites.

Three of the targets (health, infrastructure and human settlements, and poverty and livelihoods) address reduction in risks brought on by climate change while the other four targets seek to reduce climate risks. Reducing climate change risks entails reduction of increased risks caused by human-caused climate change, whereas reducing all climate risks includes addressing consequences from both natural and anthropogenic influences on climate.

Some of the targets provide outputs that can help in achieving the outcomes. None of the targets are specified or quantified to an extent sufficient to quantitatively measure progress towards achieving them. Terms such as "increase," "substantially," and "reduce" may need a quantitative definition, while to "attain resiliency" or "protect" systems will require specification of precise targets to enable measurement of progress.

In addition to the seven targets on achieving the GGA, the UAE Framework for Global Climate Resilience specifies adaptation policy cycle targets[2], which are:

1 By 2030, all Parties will have conducted vulnerability and hazard assessments and used them to inform adaptation plans [including National Adaptation Plans (NAPS)] and strategies;

2 By 2027, all Parties have established EWS and climate information services;

3 By 2030, all Parties have NAPs in place including policy instruments, strategies, and processes;

4 By 2030, all Parties have made progress in implementing their NAPs and have reduced impacts of key climate hazards;

5 By 2030, all Parties have designed, established, and operationalized MEL systems.

These targets reflect the dimensions of the iterative adaptation cycle, which are aligned with the National Adaptation Plan (NAP) process.[3] The framework also highlights cross-cutting

2. The COP decision combines impact, vulnerability and hazard assessments with early warning systems in paragraph (a). Since vulnerability assessments are distinct from EWS, they are split out here.

3. See https://unfccc.int/topics/adaptation-and-resilience/workstreams/national-adaptation-plans

considerations for countries to drive adaptation and implement the framework, including gender-responsive, participatory, and fully transparent approaches.

The UNFCCC decision on the GST (UNFCCC, 2023b) stated that while progress is being made in planning and implementing adaptations, the UNFCCC *"Notes* that there are gaps in implementation of, support for and collective assessment of the adequacy and effectiveness of adaptation" (Italics are in the decision; UNFCCC, 2023b, p. 7). Essentially, the first Global Stocktake did not determine whether planned or implemented adaptations have or will be adequate and effective in addressing climate change risks to society and nature.

Part II: Considerations in incorporating adaptation into the Global Stocktake

This part of the paper presents approaches and ideas that could be used in the GST to measure progress toward meeting the GGA. The first section discusses how the GST could assess progress toward meeting the GGA. The next section reviews the ToC and Logic Models, because these can help in assessing or projecting how effective adaptations are or could be in meeting the goals of the GGA. The third section identifies some key considerations regarding the state of adaptation indicators. The fourth section reviews the literature on attributes that adaptation indicators could have and then proposes three attributes for use in the paper. The final section identifies outstanding issues regarding adaptation indicators that are not resolved in this paper but may be considered and addressed in future GSTs.

II.1 What should the GST attempt to accomplish regarding adaptation?

The GST can inform the UNFCCC and the global community on progress towards meeting the GGA. More specifically, it can inform the Convention on the adequacy and effectiveness of adaptation around the world across many sectors and at different spatial scales (potentially ranging from local to global). The information on adequacy of adaptation could inform where financial and technical assistance on adaptation is needed. In addition, the GST can provide a unique opportunity to create a collaborative and collective MEL system to inform future adaptation, recognizing the adaptation efforts of developing countries and gathering lessons learned and best practices to enhance adaptation actions, including those on how to enable gender-responsive and socially inclusive approaches.

The decision on the global goal on adaptation invites Parties and non-Parties to "increase ambition and enhance adaptation action and support, in order to accelerate swift action at scale and at all levels, from local to global" (UNFCCC, 2023a, paragraph 9). This begs the question of to what extent adaptations can and should be compared at different geographic scales and aggregated. The attributes that adaptation indicators should have are discussed in section 3 below. One of the potential attributes is that indicators provide information at different scales and results that are comparable across different locations and

are aggregable. Whether the specific metrics used in indicators should be comparable and aggregable depends in part on how the information in the Global Stocktake is intended to be used. If parties desire to assess relative needs and progress on adaptation, then some degree of comparability of information could be generated by the stocktake. If assessing global progress on adaptation is desirable, then a capacity to aggregate results may be needed.

II.2 Use Theory of Change and Logic Models in the GST

II.2.1 Introduction to Theory of Change and Logic Models

The GST could provide information on the needs and state of adaptation and where and how adaptation is most needed to improve resiliency and sustainable development. Specifically, the GST could provide information on:

- The current state of adaptation. How successful are adaptation investments in reducing:
- Outcomes: measure progress towards:
    1. Current climate risks, and
    2. Future climate risks (noting uncertainties about climate change e.g., future radiative forcing and how climate can change, as well as taking account of changes in baseline conditions that affect climate vulnerability, such as changes in population, income, technology, behavior, and other factors).
- Gaps in adaptation. Where, in what sectors, for what vulnerable communities or systems, is adaptation most needed.

A key challenge in providing such information is whether to focus on what is being done to implement adaptations or the effectiveness of the adaptations. A full assessment needs to account for both. The ultimate test for the efficacy of climate change adaptations is whether or the extent to which they help maintain the health and welfare of human and natural systems. The ToC can help in understanding how adaptations can affect societal and natural wellbeing. Logic Models help identify and track components of the adaptation policy process.[4] This section explains Logic Models and then discusses how the components of them can be used to categorize climate change adaptations and key challenges that remain.

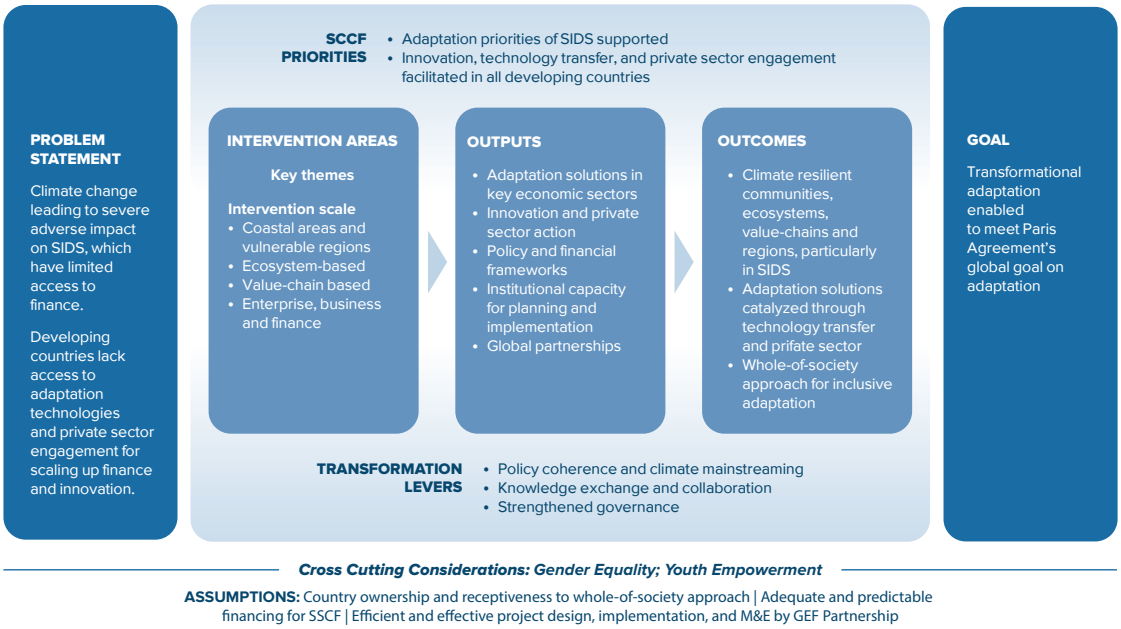
A basic Logic Model consisting of the following elements:

FIGURE 1. Logic Models

FIGURE 1.a Simple Logic Model

4. Others have also proposed use of Theory of Change and Logic Models to help assess effectiveness of climate change adaptations (e.g., ARA, 2022; IPAM, 2023).

FIGURE 1.b Application of Logic Model by GEF: "Theory of Change for Climate Change Adaptation Strategy for the SCCF"



Source: GEF, 2022.

Figure Caption: Figure 1A displays a generic Logic Model. Figure 1B displays how the GEF has applied it to the Special Climate Change Fund. "Intervention Areas" are inputs.

Inputs consist of investments in capacity and adaptation. These include:

- Vulnerability assessments;
- Adaptation planning, e.g., NAPs, sector plans;
- Adaptation funding;
- Capacity building e.g., training, building of institutions to support adaptation such as planning and MEL institutions; and
- Technology research, development, and deployment (RDD) e.g., RDD on heat or drought resistant crops or improved agricultural management practices to adapt to climate change.

Outputs are on the ground (e.g., "concrete") activities resulting from inputs. That is, outputs are essentially adaptation measures. They range from coastal protection measures to relocation of development to planting of climate resistant crops or varieties to use of different agricultural practices to deployment of water conservation measures or water supply enhancements to migration corridors or species transplantation to facilitate migration of species to new habitats.

Outcomes are the state of well-being. They are covered by Article 7 of the Paris Agreement and the GGA (UNFCCC, 2023a), including livelihoods, poverty, reduced consequences

from climate and weather disasters for water, agriculture, and other systems, and healthy natural ecosystems. Such outcomes are similar to those expressed in the SDGs, the Sendai Framework (United Nations, Undated), and the Convention on Biological Diversity (UNEP, 2022b).

Fundamentally in the Logic Model construction, inputs create outputs, which are intended to result in improved outcomes. There should be a clear line of traceability linking the three elements of the Logic Model. *The linkage from inputs to outputs to outcomes is critical.* The key point is to demonstrate that inputs ultimately reduce vulnerability to climate change.[5] For example, do adaptation plans (an input) result in specific adaptation actions being implemented (outputs) and do those adaptations reduce vulnerability to climate change (outcomes)? Just demonstrating that inputs are being done may not be sufficient to adequately show their effectiveness.

BOX 1: Example of inputs, outputs, outcomes

Assume a country has a program to subsidize planting of a more heat tolerant variety of maize to help reduce risks of crop failure from extreme heat.

The input would be what is done to encourage farmers to plant the new variety. The government might invest in development of the variety and then advise farmers of the benefits of the variety and how to obtain the new variety through its extension service or other mechanism. The amount of funds and staff time put into developing the variety and advising farmers could be measured. In addition, a subsidy or tax break could be offered to lower the effective price for farmers of purchasing the new variety. The total cost of the subsidy or tax break can be easily measured.

The output is the extent to which farmers purchase and plant the new variety. The number of farms and amount of planting done could be measured. This could be done by measuring sales of the new variety or surveying farmers about whether they planted the new variety and how much they planted. A survey could also ask whether there were other costs associated with the new variety such as fertilizer or weeding costs.

The outcome for the new maize variety is what happens to maize yields and ultimately what happens to food security. Farm level and national yields of the new maize variety could be measured through a survey of farmers or monitoring of maize sales by farmers to wholesalers (e.g., grain elevators). The effectiveness of the investment in improving food security could be measured by its impact on total (or total maize) production and ultimately by measuring total food supply per capita or malnutrition rates. Such measurements should continue over time to assess the sustainability of the adaptations.

5. See e.g.,Patton, 1997. Patton emphasizes the importance of having a "Theory of Action" and demonstrates how specific measures such as a health education campaign ultimately result in reductions in morbidity and mortality.

II.2.2 Key issues in using a Logic Model to measure adaptation needs and progress and using it in the GST

Climate change adaptation should improve the well-being of society and nature. Ultimately, societal and ecosystem outcomes should be better off with climate change adaptations than without them.

One of the most important challenges in applying a logic model to the GST for adaptation is linking inputs to outputs to outcomes. The GST should measure quantitatively how inputs affect outputs and how outputs affect outcomes. For example, the "Common Principles for Climate Change Adaptation Finance Tracking," developed by the International Development Finance Club – a network of national and multilateral development banks – asserts that a clear link must be demonstrated between specific project activities and reduction in vulnerability (Climate Policy Initiative, 2020). The Green Climate Fund (GCF) published an "Integrated Results Management Framework" that calls for measuring the effect of GCF programmes on "paradigm shift potential (e.g., shifting towards a climate-resilient development pathway) and outcome levels, such as increased resilience (GCF, 2021).

The link between inputs and outputs is stronger than the link between outputs and outcomes (ARA, 2022). It is more straightforward to assess and measure the effect of adaptations on behavior (outputs) than to measure the effect of change in behavior on outcomes. In the example given in the Box 1 above, it should be relatively straightforward to determine if farmers are planting the new crop variety. There are some challenges in measuring the effectiveness of inputs. For example, while the government has a program to promote the variety it could be that farmers were also encouraged to plant the new variety through conversations with other farmers, farmer organizations, or the media.

However, attribution of a change in outcome to a specific output can be more difficult because outcomes can be affected by many factors. Crop production can change because of changes in climate, technologies, market conditions, government policies, labor availability, or for other reasons. Thus, a key challenge for future GSTs may be to credibly attribute and quantify the effect of adaptation measures (outputs) on the well-being of society and nature (outcomes). As is discussed in Part IV, addressing this challenge could benefit from research on how to better link outputs to outcomes.

II.3 Key considerations in selecting adaptation indicators

The following are key considerations guiding the proposed selection of an initial set of indicators for the GST.

There is no universal adaptation indicator.

The literature on adaptation Indicators agrees that there is no single indicator for measuring adaptation (Adaptation Committee, 2021). This is primarily because there is no

single indicator for measuring vulnerability to climate change.[6] Without such a universal indicator for vulnerability, there is no single approach to measuring the effectiveness of adaptation. While economic means such as market prices and willingness to pay in principle can be used to compare vulnerability in monetary terms, these approaches are quite controversial and are unlikely to be widely accepted for use in climate change policy making.

Existing indicators measure the current state of human and ecosystem welfare.

A number of indicator systems have been in use for years and decades and some are being developed to measure the state of societal and ecosystem welfare. These include cross-cutting and sector-based systems. Cross-cutting measurement systems include the HDI, SDGs, and the Sendai Framework for Disaster Risk Reduction (United Nations, Undated a). Sector-based measurement systems include the World Health Organization's Global Burden of Disease (GBD) (Mathers, 2020), the FAO's development of indicators on food security (FAO, 2020) and water resources (FAO. AQUASTAT), and the Convention on Biological Diversity's (CBD) development of a set of indicators on biodiversity (CBD, 2022). These sets of indicators are discussed in more detail in Part III.

A key point is that several systems are in place that measure progress towards achieving goals and targets at a national and global levels and many of these systems are being managed by UN organizations, such as FAO. Thus, if appropriate, such systems could be used to support the GST. The usefulness of some of these systems for the GST are discussed later in this paper.

Comprehensive assessment of adaptation appears unachievable; thus, successive stocktakes could focus on measuring what can be measured.

Given that there is no single indicator to effectively measure vulnerability and adaptation and that so many different and complex sectors and systems are affected by climate change, it would be very difficult to identify and apply a suite of indicators to cover *all* aspects of adaptation.[7] Such a collection of indicators would be extremely broad and quite challenging to measure, compile and interpret. Indeed, given the complexities and how demanding it would be it seems virtually impossible to try to develop an all-inclusive

6. While there is no single climate change vulnerability indicator, indexes that estimate relative vulnerability of countries to climate change exist. Perhaps most notable is the "ND-GAIN" index. It combines indicators of exposure, sensitivity, and adaptive capacity across six sectors with readiness indicators on economics, governance, and society (ND-GAIN, 2023). Such indexes can help assess relative vulnerability across and could provide insight on where in total adaptation is working. More useful information can be provided by examining vulnerability and effect of adaptations by sector and by examining certain cross-cutting indicators such as life expectancy, income, and poverty. This report discusses below use of sector indexes that combine multiple sector-specific indicators.

7. Decision 3/CMA 4 identifies what a broad suite of metrics would include:

   - Themes: water; food and agriculture; cities, settlements and key infrastructure; health; poverty and livelihoods; terrestrial and freshwater ecosystems; and oceans and coastal ecosystems; tangible cultural heritage; mountain regions; and biodiversity;
   - Cross-cutting considerations: country-driven, gender-responsive, participatory and fully transparent approaches, human rights approaches, intergenerational equity and social justice, taking into consideration vulnerable groups, communities and ecosystems, and nature-based solutions, and based on and guided by the best available science including science-based indicators, metrics and targets, as appropriate, traditional knowledge, knowledge of indigenous peoples and local knowledge systems, ecosystem-based adaptation, nature-based solutions, community-based adaptation, disaster risk reduction and intersectional approaches with a view to integrating adaptation into relevant socioeconomic and environmental policies and actions, where appropriate (UNFCCC, 2023c).

suite of indicators. Therefore, it may be better to initially measure *some* aspects of vulnerability and adaptation rather than risk being bogged down trying to assess *all* of them. In other words, *some information on adaptation needs*, successes, and failures, especially where progress is being made on adapting to climate risks and where the greatest needs for adaptation are, *may be better than having no information.* However, all the GGA targets will eventually require application (and perhaps development) of appropriate indicators. While the current suite of indicators may not be broad enough to measure progress on all the GGA targets, additional indicators would need to be developed and applied in future stocktakes. The GST could initially proceed with a limited set of adaptation indicators so Parties can participate in the process, and have it yield insight on the state of adaptation even if the coverage of adaptation is not comprehensive. This also means that there would inevitably be gaps in information on sectors and impacts of climate change. In successive rounds of the GST, the number of adaptation outcomes and sectors covered by the GST could be increased. The matter of timing of when and what is measured in successive GST rounds is discussed below.

Demonstrate effectiveness of adaptation actions.

It is important to recognize that while a stocktake can include what is being done to implement adaptations (e.g., what is spent and what measures are being implemented) to be fully useful, it may ultimately need to measure how effective the adaptation actions are. In other words, while it is useful to know what adaptation actions are being implemented, the litmus test for effectiveness is whether the adaptation actions offset impacts of climate change and result in no net less or improvement in the well-being of individuals, society and nature. In the language of a Logic Model, the goal is to measure the effect of inputs and outputs on outcomes.

Use of qualitative indicators.

In many cases, use of qualitative indicators may be more appropriate than quantitative indicators. Some indicators measure the presence or absence of an adaptation, such as whether NAPs have been promulgated. Others may use subjective factors to assess progress or estimate quality. One option when using qualitative indicators is to adopt a ranking system such as high, medium, or low or a three-or five-point scale to score the effect of adaptations. Such ranking systems should be accompanied by clear criteria describing what is associated with each score to reduce randomness and arbitrariness in scoring.

Use indices to combine numerous indicators.

As is presented below, many current attempts to create climate change indicators involve application of numerous indicators. It can be very difficult to digest results from many different indicators. One approach is to consolidate indicators by using indices. Indices facilitate comparison of the state of vulnerability or effectiveness of adaptation across and within countries [e.g., ND-GAIN has indices comparing vulnerability of countries; (ND-GAIN, 2023)]. This can be done by combining different indicators such as the HDI does or

through establishment of equivalent measures across different outcomes, such as in Disability Life Adjusted Year (DALYs) (discussed in section III.4.3.2.1). How individual indicators or metrics are weighted in indices is important and must be transparent.

II.4 Desirable attributes for adaptation indicators

The GST can provide information to help review progress towards achieving the GGA. It can identify where and how adaptation is working or failing to reduce vulnerability to climate change. This will require defining indicators of vulnerability and metrics to measure vulnerability to climate change and the effectiveness of adaptation in reducing such vulnerabilities.[8] This section reviews how several studies in the literature suggest criteria for selecting indicators.

II.4.1 Literature Review

Several studies suggest criteria that can be used to define adaptation indicators. Leiter *et al.* (2019) suggest the following criteria for selection of "measures":

- Aggregable: The indicators are consistent and comparable. They can be aggregated to multi-national scales and preferably can be disaggregated to sub-national scales.
- Transparent: Is it clear what indicators are measuring and are the definitions consistently applied?
- Longitudinal: Can the indicator be tracked over time to measure progress over time?
- Feasible: Can nations measure and report on the indicators or do they impose an undue burden? Are the data used in the indicators widely available across countries?
- Coherent: Do the indicators support a general understanding of adaptation? This could be interpreted to mean whether the set of indicators provides a set of information that can provide information on progress toward meeting the GGA.
- Sensitive to national context: Is the indicator useful and appropriate given different national circumstances?

The European Bank for Reconstruction and Development (EBRD) in its guidance on implementing the "EBRD Green Economy Transition" (Climate Policy Initiative, 2018) presents the following criteria for selecting adaptation indicators:

- Granularity: This is clearly defined environmental activities that can be distinguished from non-environmental activities.
- Environmental benefits: Can measure environmental benefits against a baseline?

8. Indicators provide information on the state of a system, such as whether goals are being met and changes over time. Metrics are a specific quantitative measure used as part of an indicator. For example, obesity is an indicator of human health. Body mass index is a metric that can be used to measure obesity. This paper focuses on the role of indicators in the GST for adaptation. Specific metrics may be needed as part of the GST process.

- Minimal environmental performance and standards: Meets European Union environmental performance and social standards.
- No double counting where there are multiple benefits.

II.4.2 Proposed Attributes for Selecting Adaptation Indicators in the GST

The following four attributes are proposed for use in selecting adaptation indicators for use in future GSTs. Such indicators may be:

- Meaningful: Indicators could be clearly tied to the protection of people, livelihoods, and ecosystems from adverse effects of climate change.
- Universal: Indicators can be applied in all countries and to all relevant situations. This does not rule out tailoring indicators to national and local circumstances. This criterion recognizes that many indicators may only be appropriate in certain circumstances. Indicators of coastal vulnerability will be appropriate for nations with coasts but may not be for land-locked countries.
- Feasible: Since an option for indicators is that they be widely reported, many countries would need to be able to implement them. This criterion means that the capacity of countries to implement the indicators could be considered, particularly for developing countries. The implications of this are discussed in more detail below but favor use of data that are already being widely collected and reported.
- Granular, Comparable, and Aggregable: The indicators could be applied at different spatial and temporal scales. An attribute may be that data in an individual indicator can be combined across countries and ideally can be disaggregated within countries. To make them easier to compare across countries, Leiter *et al.* (2019) suggest use of normalized indicators, such as measuring risks per 100,000 people[9] or as a percentage of national gross domestic product (GDP). This approach avoids having larger countries dominate absolute measures such as number of people. In addition, the indicators could enable tracking of changes in vulnerability and effectiveness of adaptations over time.

II.5. Issues in assessing adaptation for the GST

There are several complex matters in building the Global Stocktake that may need to be eventually addressed in future stocktakes. These include:

II.5.1. How to account for co-benefits of adaptations?

Some adaptations will reduce greenhouse gas emissions. For example, water conservation not only decreases water withdrawals and consumption but can also reduce energy use for water treatment. Reductions in GHG emissions or other pollution emissions from adaptation measures can be reported and reflected in outcomes such as SDG 13 on climate action that may be tracked under the GHG emissions component of the GST.

9. See e.g., WHO, The Global Health Observatory. Undated.

II.5.2. How to account for maladaptation?

Many adaptations can have some adverse impacts (e.g., Barnett and O'Neil, 2010). A sea wall for example may protect inland settlements from sea level rise but can result in erosion of seaward beaches and could also trap runoff behind it. Increasing space cooling (e.g., air conditioning) to adapt to more extreme heat can, depending on sources of power production, increase GHG emissions (*ibid*). All adverse consequences from adaptations should be accounted for along with benefits, and for the purpose of the GST, should be reported.

Whether an adaptation rises to the level of maladaptation is a more controversial matter. One approach can be to label a measure as being a maladaptation if its damages (i.e., adverse impacts plus costs of implementation) exceed its benefits. In other words, a measure that causes more harm than good (i.e., results in net damages) could be considered as being maladaptive. A parallel approach to defining maladaptation is based on whether vulnerability to climate change is on net decreased because of the measure (Schipper *et al*., 2021).

What is most important for the GST, as with co-benefits, is that analysis of adaptation measures include all benefits and costs in reporting to the GST to the extent that is practical and feasible.

II.5.3 Relationship between GST and Loss and Damages

In principle, vulnerability to climate change is reduced first by mitigation and then by adaptation. Any residual vulnerability, particularly in developing countries, can be ameliorated or at least compensated through Loss and Damages (L&D). For example, to the extent that climate change harms livelihoods and incomes, the potential loss in income could be compensated by L&D.

It is not clear how straightforward the relationship between adaptation and L&D will be to measure through the GST. To the extent that vulnerabilities and effectiveness of adaptation can be quantified through measurement of outcomes, then implicitly, the residual loss could be L&D. Since it is so difficult to quantify vulnerability and adaptation, then it may also be challenging to estimate L&D as a function of net vulnerability after accounting for adaptation. This is an important emerging topic that needs more analysis.

Part III: Current approaches, policies, and indicators

The third part of this paper reviews approaches, policies, and indicators that are being used and can be built upon to select adaptation indicators for use in the GST. The first section presents the Adaptation Policy Cycle which lays out steps in developing, applying and monitoring climate change adaptation policies and measures. The second section reviews mechanisms Parties to the UNFCCC can use to report on adaptations needs, plans, and progress. The third section briefly describes how four developing countries

have developed and applied monitoring and evaluation systems. The fourth section discusses many indicators that are currently being used or are in development to measure cross-cutting (e.g., human welfare and disaster) or sector development adaptation needs and progress. This information presented in this part feeds into Part IV which builds on existing approaches to present an option future stocktakes could use to assess the state of adaptation.

III.1. Adaptation Policy Cycle

The Adaptation Policy Cycle is displayed in Figure 2. There are four activities the comprise the policy cycle:

1. Assess impacts, vulnerability and risk;
2. Plan for adaptation;
3. Implement adaptations; and
4. Monitor and evaluate adaptations.

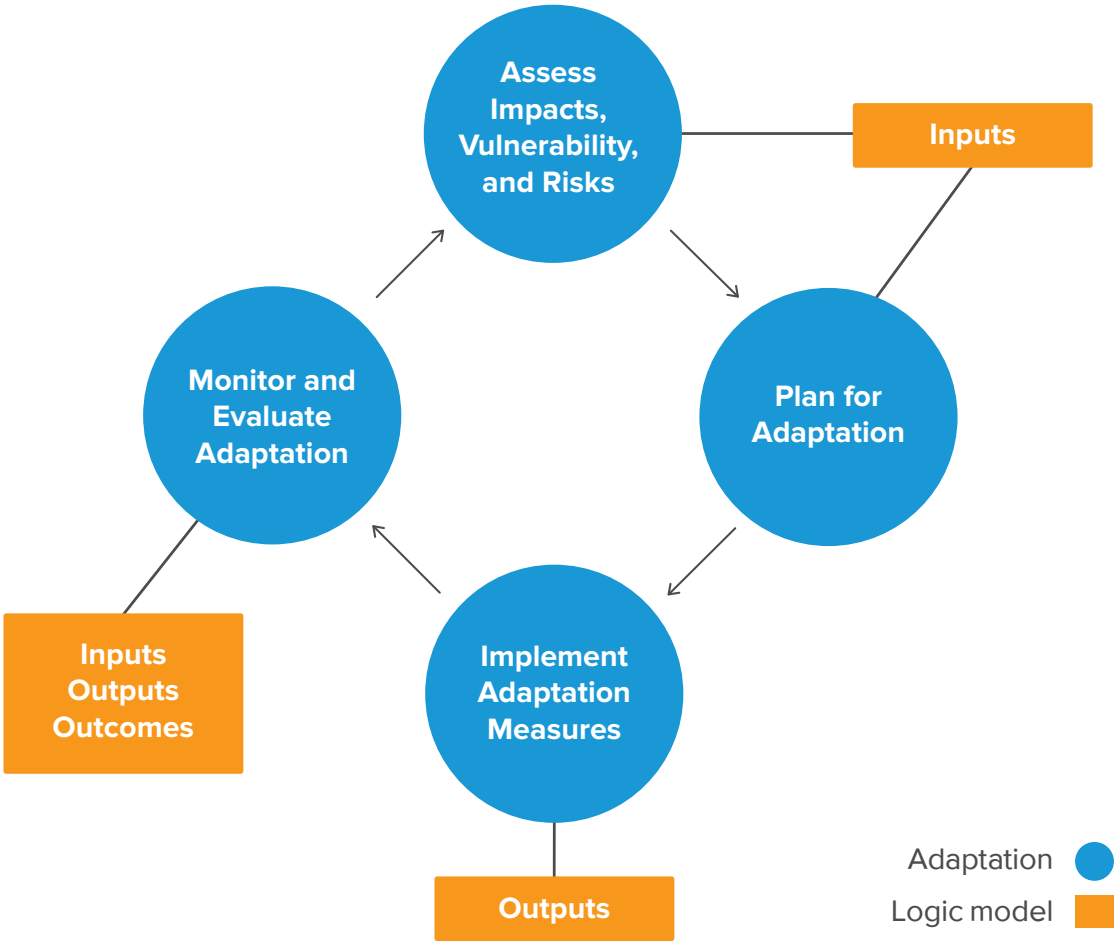
Each of these activities can be measured and reported by parties; indeed, some of these are already being measured.

- Assessing impacts, vulnerability, and risk can be measured by determining whether countries have conducted climate change vulnerability assessments. The measurement of this could include the geographic scale(s) of assessment(s), involvement of stakeholders, how results are disseminated, and how they are used. The UNFCCC Adaptation Committee is building country profiles on adaptation activities by Convention Parties. This is expected to include reporting on risk assessments carried out by countries (United Nations Climate Change, State of Adaptation, Undated; Korinna von Teichmann, UNFCCC Secretariat, Personal Communication April 2, 2024).
- Planning for adaptation can be measured by, for example, counting preparation of National Adaptation Plans (NAPs) and other adaptation planning mechanisms. The UNFCCC tracks submission of NAPs (United Nations Climate Change National Adaptation Plans, Undated). In addition, the UNEP Adaptation Gap Report measures whether countries have an adaptation plans, strategies, laws, or policies in place or in progress (UNEP, 2022a).
- The implementation of adaptation measures is already being counted. For example, United Nations Environment Programme (UNEP) counts new adaptation projects per start year and value of funding from the Adaptation Fund (AF), Green Climate Fund (GCF), the Least Developed Countries Fund (LDCF) and Special Climate Change Fund (SCCF) (UNEP, 2022a).
- Monitoring and evaluation of adaptations could be measured by counting the number of countries with MEL systems in place or being developed. This is being tracked by the NAP Global Network (NAP Global Network, 2023).

Indicators for the adaptation policy cycle include inputs, outputs, and outcomes. Both impact, risk and vulnerability studies and adaptation plans, strategies, laws, and policies are inputs to the policy process. As noted in the previous section, adaptation measures are outputs. Monitoring and evaluation can assess a) what inputs such as vulnerability studies and adaptation plans have been put in place; b) what adaptations (outputs) have been implemented; and c) ultimately what the eventual impact is on outcomes such as human health, property damage, and ecosystem health.

Figure 2 displays the Adaptation Policy Cycle (UNFCCC. Undated). The circles were drawn by UNFCCC. This paper adds identification of which components are inputs, outputs, and outcomes in the Logic Model boxes.

FIGURE 2. Adaptation Policy Cycle



Source: UNFCCC. Undated. "Adaptation and Resilience."

III.2 Monitoring and Reporting systems

A functioning GST system will require a monitoring system to collect data on indicators at the national and possibly sub-national levels; and second, a system to consolidate (as appropriate) and report results.

III.2.1 National level monitoring systems

The UNFCCC relies on parties for reporting on vulnerability and adaptation.

Almost half (48 percent) of NAP documents submitted to the UNFCCC already include MEL systems as part of their NAP processes; 55 percent of these reference specific indicators (NAP Global Network, 2023). Furthermore, as Klein *et al.* (2023) note, current monitoring systems are quite heterogenous and lack rigor. The Global Stocktake could use a mixed approach to identify a limited number of top-down targets that can be informed by a range of bottom-up, contextualized and existing indicators from national MEL systems.

III.2.2 Processes, instruments, and reporting

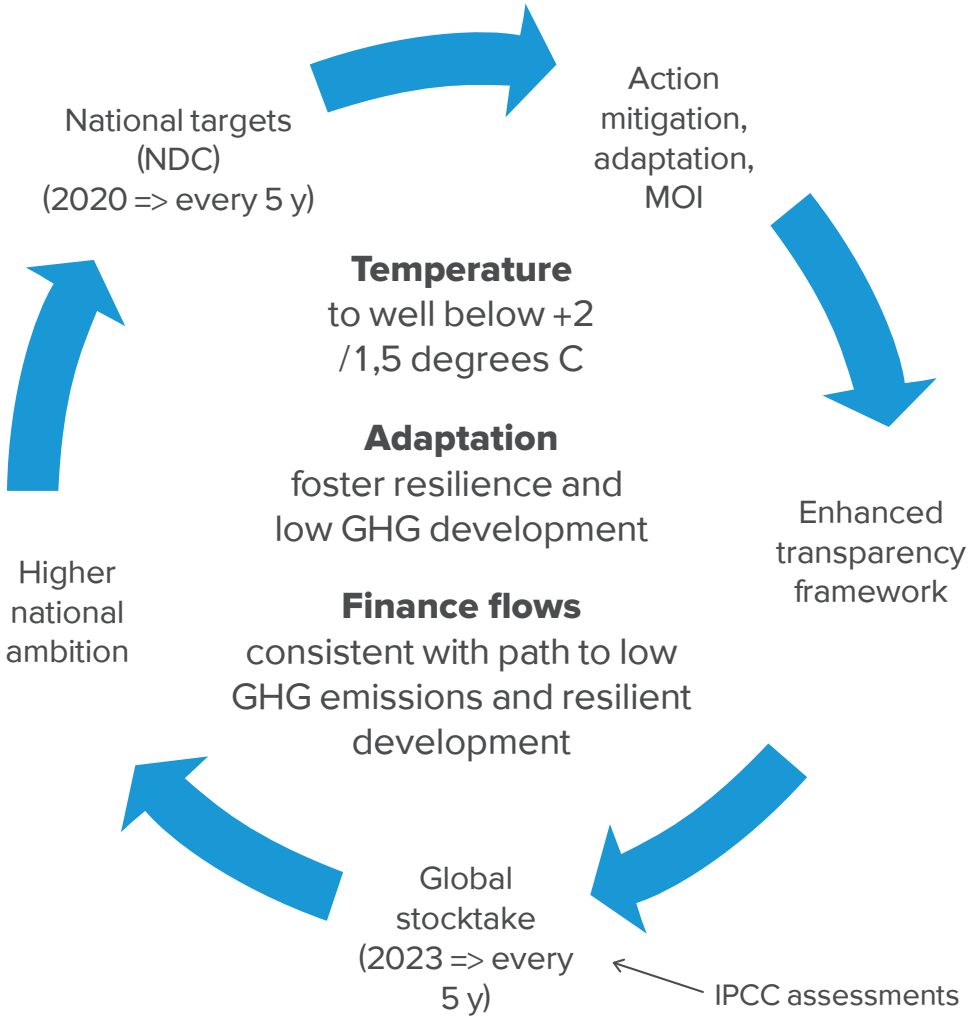
A number of mechanisms exist for reporting vulnerability and adaptation monitoring to the UNFCCC. This section discusses Nationally Determined Contributions (NDCs), Adaptation Communications (ACs), National Adaptation Plans (NAPs), and Biennial Transparency Reports (BTRs). The relationship between the GST and NDCs and BTRs, which are part of the Enhanced Transparency Framework (ETF), is displayed in Figure 4. Note that these monitoring and reporting systems need to inform updates of NDCs.

III.2.2.1 Nationally Determined Contributions (NDCs)

NDCs are a key component of the Paris Agreement and the achievement of its long-term goals. The Paris Agreement requests each country to outline and communicate their post-2020 climate actions, through their NDCs. NDCs are submitted every five years to the UNFCCC secretariat. To enhance the ambition over time, the Paris Agreement requires that successive NDCs represent a progression compared to the previous NDC and reflect its highest possible ambition (UNFCCC, 2015).

Parties are requested to submit the next round of NDCs (new NDCs or updated NDCs) starting in 2020 and every five years thereafter (e.g. by 2025, 2030), regardless of their respective implementation time frames (UNFCCC, Undated. NDCs).

FIGURE 3. Relationship of GST with other reporting mechanisms



Source: UNFCCC. Undated.

III.2.2.2 Adaptation Communications

Adaptation Communications (ACs) were established under the Paris Agreement, are voluntary and provide Parties an opportunity to report on priorities for adaptation, adaptation plans, implementation, and support needs. Among the identified purposes for ACs are to increase the visibility and profile of adaptation and report to the Global

Stocktake (UNFCCC. Undated. Adaptation Communications).

Parties may submit their ACs "as a component of or in conjunction with other communications or documents…" (Paris Agreement, Article 7.11; UNFCCC, 2015). This means Parties could submit their ACs as part of their BTRs. Furthermore, decision 9/CMA.1 solidified a linkage between ACs and the enhanced transparency framework in deciding that "Parties may, as appropriate, also submit and update their ACs as a component of or in conjunction with the reports on impacts and adaptation as stipulated in Article 13, paragraph 8" (9/CMA.1, para. 4; UNFCCC, 2018). However, if a Party submits its ACs as part of the BTRs, "it should clearly identify which part of the report is the adaptation communication" (18/CMA.1, para 13; UNFCCC, 2019).

The main roles of ACs are to:

- Increase the visibility and profile of adaptation and its balance with mitigation;
- Strengthen adaptation action and support for developing countries;
- Provide input to the Global Stocktake; and
- Enhance learning and understanding of adaptation needs and actions.

Countries are invited to provide information on:

a National circumstances, institutional arrangements, and legal frameworks,

b Impacts, risks, and vulnerabilities, as appropriate,

c National adaptation priorities, strategies, policies, plans, goals, and actions,

d Implementation and support needs of, and provision of support to, developing country parties,

e Implementation of adaptation actions and plans,

f Adaptation actions and/or economic diversification plans, including those that result in mitigation co-benefits,

g How adaptation actions contribute to other international frameworks and/or conventions, and

h Gender-responsive adaptation action and Traditional Knowledge, knowledge of Indigenous Peoples, and local knowledge systems related to adaptation, where appropriate and any other information related to adaptation.

The Global Stocktake will review collective progress toward achieving the purpose of the Paris Agreement and its long-term goals, including the global goal on adaptation. ACs can be one key sources of inputs used to synthesize the state of adaptation efforts, experiences, and priorities to assist the stocktake.

III.2.2.3 National Adaptation Plans (NAPs)

NAPs are a mechanism for least developed parties to report on medium and long-term adaptation needs and adaptation strategies and programs to adapt to climate change (UNFCCC, 2021). The emphasis of NAPs is on developing adaptation strategies. These strategies can be tied to national level planning such as development plans, poverty reduction plans, and sector plans. The strategies can also be linked to national budgets. NAPs can provide information to the GST on the enhanced implementation of adaptation and adequacy of adaptation and support in countries.

III.2.2.34 Biennial Transparency Reports (BTRs)

BTRs are required under the Paris Agreement to report on progress on NDCs and will be reported every two years beginning at the end of 2024. BTRs are intended to report on progress on meeting goals set by NDCs and NAPs including reporting on progress on adaptation. This includes reporting on indicators regarding the effectiveness of adaptation and where adaptation is "not sufficient" in averting impacts. (UNFCCC, 2019; see section 113). Because of this emphasis on granularity and the specific mention of indicators in the UNFCCC decision regarding BTRs, they appear to be the most appropriate mechanism to report on progress on meeting GST indicators.

Parties can use qualitative or quantitative indicators to track progress towards the implementation and achievement of their NDCs. The specific types of information on climate change impacts and adaptation that Parties can include, where appropriate, in their BTRs are outlined in paragraphs 104 to 117 of the annex to decision 18/ CMA.1 (UNFCCC, 2019). These include the general categories of national circumstances, institutions, legal frameworks, impacts and vulnerabilities, adaptation priorities and barriers, adaptation goals and efforts, progress on implementation of adaptation, monitoring and evaluation of adaptation, averting, minimizing, and addressing loss and damage associated with climate change impacts, cooperation, good practices, experience, and lessons learned.

III.2.3 Technical and financial support for monitoring and reporting

Adequate support for monitoring and reporting systems to enable Parties to participate in the GST fully and effectively can require several elements including:

- where current systems do not exist or need upgrading,
- technical support for development of and use of MEL systems to report on GST indicators,
- possible financial support for MEL systems development and deployment, and
- expert support for MEL systems.

Technical support for many developing countries will almost certainly be needed to help them in reporting on the GST. In similar reporting systems, such technical support

is provided by non-governmental organizations, such as the Partnership on Transparency in the Paris Agreement (Undated).

Building MEL systems and collecting data cost money and a GST system with broad participation by developing countries may require financial support. Financial support for development, maintenance, and upgrading of reporting systems is typically provided by developed countries and multi-lateral bodies, such as the GEF.

The application of a system of indicators can strongly benefit from continued review and guidance from experts on MEL. As an example, the CBD established an *ad hoc* Technical Expert Group on Indicators to provide expert advice on the development and application of a monitoring framework under the convention. In addition, the CBD Secretariat is tasked with providing guidance on the development of regional and national monitoring systems and supporting capacity building (UNEP, 2022b). A body of experts is needed to provide analysis and guidance to the UNFCCC for the GST process. This could be a function of existing expert bodies, such as the Adaptation Committee or the Least Developed Countries Expert Group or may require a new organization.

III.3 Case Studies on monitoring and evaluation systems in developing counties

This section surveys the state of development of M&E systems in four developing countries: Viet Nam, Moldova, Guinea, and Uruguay. Examining the on-the-ground progress made in establishing these systems by Non-Annex I (NAI) parties can improve understanding of how actual M&E systems are being developed, what they are measuring, and how they can help achieve the goals of the GGA and GST.

III.3.1 Vietnam

The Vietnamese government instituted a national M&E program[10] in January 2022 (GCF *et al.*, Undated). The Department of Climate Change (DCC) manages the program within the Ministry of Environment and Natural Resources (MONRE).

Viet Nam's M&E program tracks progress in six categories:

1. State management of climate change.
2. Strengthening resilience, capacity to adapt to climate change in all fields.
3. Mitigating natural disaster risks, minimizing damage caused by climate change.
4. Investment resources for climate change adaptation.
5. Science, technology, and international cooperation.
6. Training and awareness raising.

[10] Viet Nam refers to their program as monitoring and evaluation, not monitoring, evaluation and learning. In this section the acronym "M&E" is used.

The system will monitor progress for six SDGs:

- SDG 1: Poverty
- SDG 6: Water resources
- SDG 11: Sustainable cities
- SDG 13: Climate change action
- SDG 15: Terrestrial ecosystems

Data for the M&E system is collected at the national, regional, and local levels.[11] MONRE will prepare reports on progress every five years. While it is too early to assess progress, a 2023 report by the DCC found that M&E systems should a) build on existing M&E approaches; b) start with a limited number of indicators to build and test the system; c) have an online system; and d) invest in capacity building, consultation, and training (DCC, 2023a and DCC, 2023b.)

III.3.2 Moldova

Moldova is developing and implementing an M&E adaptation framework that is intended to track national, sector, and project-level adaptation results and tie them to a national budget tracking system. Indicators will measure geographical and climate risk factors and will be monitored through a cloud-based Excel program. The system will also measure vulnerability reduction, economic and social impacts, enhanced adaptive capacity, and mobilization of financial resources. This includes tracking progress in priority sectors including human health, forestry, energy, transport, water resources, and agriculture. A tool called Climate Budget Tagging (Bain *et al.*, 2019) will be integrated into the M&E framework.

Moldova's National Commission on Climate Change will oversee the implementation of the M&E framework and will use a Climate Change Information and Knowledge Management Platform (CCIKMP) to manage data on adaptation and make it available to stakeholders in the government, private sector, and civil society.

III.3.3 Guinea

Guinea has been working on an integrated system for monitoring development since the early 2010s, with a recent focus on climate change adaptation. However, its monitoring system is under development and as of the writing of this paper, is fragmented and does not yield regular data on development progress.

The building of an M&E system for Guinea stems from the promulgation of a 2040 vision for the country in 2011 and a five-year National Plan for Economic and Social Development (PNDES) in 2015. The PNDES has a Technical Monitoring System that divides monitoring among three entities: monitoring of macroeconomic and structural reforms by the Planning

[11] Local governments in Vietnam are developing their own NAP M&E indicators. As the DCC notes in its guidance on M&E, "At the local level: The Department of Natural Resources and Environment is responsible for advising the provincial People's Committees on how to monitor and evaluate the implementation of tasks at the local and community levels in the province and summarizing the implementation situation for the provincial People's Committees to report annually to MONRE and the NCCC before December 31." (DCC, 2022).

and Prospective Directorate; monitoring of program and project implementation by the National Directorate of Public Investment; and monitoring of SDGs by the National Institute of Statistics (INS).

UNDP and GCF sought to establish adaptation M&E mechanisms by leveraging the existing INS national M&E system and through the Observation, Monitoring, and Environmental Information Centre (COSIE). However, a joint UNDP and GCF assessment of adaptive capacity in Guinea found that, as of 2020, policy implementation has been fragmented across the national government, adaptation is not "effectively" integrated into national, sectoral, or local planning and budgeting, and the M&E system does not provide "regular, updated and reliable climate data" (UNDP and GCF, 2020).

The monitoring framework and details on targets and indicators are intended to be included in Guinea's first BTR due in 2024.

III.3.4 Uruguay

Uruguay has developed a comprehensive M&E strategy to assess adaptation progress at the national and local levels. The strategy encompasses two monitoring systems: the first examines the effectiveness of strategies through adaptation indicators, while the second, known as Adaptation Plan Progress, monitors the implementation of Uruguay's NAP. Mechanisms have been developed to update the system of indicators and to establish the technical parameters for the National GIS Adaptation tool and the Territorial Information System of the Ministry of Housing and Territorial Planning.

Uruguay is using adaptation plans to designate phases, managers, and sustainability mechanisms to institutionalize M&E. Data collection systems monitor adaptation measures and progress across sectors including health, disaster risk reduction (DRR), cities, infrastructure, territorial planning, biodiversity and ecosystems, coastal zones, water resources, agriculture, energy, tourism, and climate services. An open data format is used for information sharing.

Uruguay's M&E strategy and data collection systems support informed decision-making and the advancement of adaptation measures at the local and national levels. This includes the city-level 'NAP-Cities' approach that supports progress in environmental urban-related policy planning and demonstrates synergies with other national monitoring and information systems to enhance M&E capabilities.

III.3.5 Analysis of development of national M&E systems based on the case studies

All four countries studied are developing M&E systems to monitor adaptation progress appropriate for their national circumstances. Progress is establishing M&E systems is variable. In some cases, M&E systems are relatively well developed, whereas in other cases the development of such systems appears to be in a more nascent stage. Nonetheless, the case studies show that it is possible for many countries, if they are not doing so already, to develop sophisticated systems to monitor and evaluate vulnerability to climate change and the effectiveness of adaptation investments.

A key issue for whether such M&E systems can provide information to feed into the GST is the extent to which the systems are comparable; in particular, whether they can produce information using common input, output, and outcome indicators.

Another key issue that is highlighted in the Guinea case study is that effective M&E systems at a national level can take time to develop. Developing an effective GST will also likely time to fully develop. Development of both systems needs to proceed in a deliberate, but not hasty, process to organically create effective and integrated M&E systems at national and international levels. Thus, a key part of a GST is providing sufficient technical and financial support, as well as sufficient time to enable developing countries to build and improve their M&E systems.

III.4 Existing sets of adaptation indicators that could be used in the Global Stocktake

There are many cross-cutting and sector specific sets of indicators that have been developed over years and decades by international organizations and have been used around the world to measure important inputs, outputs, and outcomes. Some of the indicators could be used by the GST to measure adaptation progress towards the GGAs.

In this section, the potential usefulness of some indicators are examined based on whether they can help in monitoring progress towards the targets identified in the UAE Resilience Framework (UNFCCC, 2023a). Input indicators are being used by organizations such as the UNEP in their Adaptation Gap Report (UNEP, 2022a) and output indicators being used by the AF, the GCF, and the Global Environment Facility (GEF). Specific outcome Indicators are discussed because they are most relevant for measuring effectiveness of adaptation in reducing vulnerability to climate change.

This section first presents input indicators being widely used; then indicators of outputs; and finally, outcome indicators.

III.4.1 Input Indicators

The UAE Resilience Framework mentions targets[12] that are related to the "iterative adaptation [policy] cycle" (UNFCCC, 2023a, section 10). By 2027, the framework calls for:

- Establishment of EWS; and
- Establishment of climate information services.

The following 2030 targets are in the framework:

- Impact, vulnerability and risk assessments;
- Use of the assessments in formulating NAPs;
- NAPs, policy instruments, planning processes or strategies, and mainstreaming of adaptations;
- Progress in implementing NAPs, policies, and strategies, resulting in reductions of key climate hazards;
- Design, establishment, and operation of MEL systems along with the institutional capacity to fully implement the systems.

Vulnerability assessments, use of them in NAPs, and establishment of NAPs and MEL systems are considered to be inputs; while establishment of EWSs and climate information services, implementation of adaptations are considered to be outputs. Reductions in key climate hazards would be an outcome.

UNFCCC (2022) reports on adaptation needs, which are essentially vulnerabilities as reported by Parties to the UNFCCC through such reporting mechanisms as NDCs, NAPs, and ACs.

UNEP in its "Adaptation Gap Reports" (e.g., UNEP, 2022a) measures the following inputs to adaptations:

- National adaptation planning including the presence by country of adaptation planning instruments;
- Adaptation finance; and
- Adaptation projects

Measuring development of NAPs along with adaptation instruments and implementation of adaptations are two of the UAE Resilience Framework targets. Finance is not a target under the UEA Framework. The presence of MEL systems for adaptation is not yet being tracked but could be by UNEP as part of its Adaptation Gap Report or by other UN organizations.

12. The targets are in four sections, a through d,

In addition, GCF measures the extent to which their investments contribute to:

- Institutional and regulatory frameworks for low-emission climate resilient development;
- Technology deployment, development, dissemination, or transfer and innovation (GCF, 2021).

These inputs are not explicitly part of the UAE Resilience Framework, but they are important inputs to the adaptation process.

III.4.2. Output Indicators

A number of organizations including GCF, GEF and the AF are measuring output indicators.

TABLE 1. Output Indicators Already Being Used to Measure Adaptation

Table 1 displays some of the output indicators being used by these three funds.

Indicators	AF	GCF	GEF
Number of beneficiaries	*[13]	*	*
Assets improved or protected	*	*	
Meters of coastline protected	*		
Number of hectares improved or protected	*	*	*
Early Warning Systems	*		

Source: AF 2022; GCF, 2021; GEF, 2022.

All three organizations track the number of beneficiaries. The organizations distinguish between direct and indirect beneficiaries (e.g., AF, 2022), but (as with many indicators) tracking the exact number of project beneficiaries is a heterogenous exercise and can be difficult to apply standard practices (Frankfurt School, 2020).

All three organizations also track the number of hectares protected or improved. Here too, it is quite possible that different approaches are used to determine what protection and improvement mean.

Note that the number of beneficiaries and area of land protected or improved are measures of breadth of coverage, not depth. They do not indicate how much people benefit or what improvements are made in lands.

[13] The AF measures the number of direct and indirect beneficiaries (AF, 2022).

The UAE Resilience Framework requires monitoring of implementation of adaptations. This is being monitored by UNEP (UNEP, 2022a). The UNEP Adaptation Gap reports measure implementation of adaptation projects funded through the AF, GCF, LDCF, and SCCF of the GEF. The report also covers the number of adaptation projects in the Organization for Economic Cooperation and Development's Development Assistance Committee's Climate Related Development Finance Data Set. While the Gap Report covers key multi-lateral and bilateral funding of adaptation, this is most likely not comprehensive coverage of adaptations being implemented around the world.

The UAE resilience framework calls for universal implementation of EWS by 2027.[14] In addition to the Adaptation Fund tracking its funding of EWSs, UNDRR reports on the presence of multi-hazard early warning systems (MHEWS) and finds that 101 countries, covering 52 percent of the world's population has such systems. The report also notes that only 46 percent of least developing countries and 39 percent of Small Island Developing States have MHEWSs (UNDRR, 2023).

III.4.3 Outcome Indicators

This sub-section discusses cross-cutting and sector outcome indicators of wellbeing of society and nature that are widely used. Such outcomes could be used in the GGAs. Cross-cutting outcomes, i.e., those cover multiple sectors, are presented first, followed by outcomes that are for specific sectors.

III.4.3.1 Cross Cutting Outcome Indicators

Three existing cross-cutting sets of outcome indicators and indices are discussed and assessed for potential use in the GST. The three sets are the HDIs, SDGs, and the Sendai Framework for Disaster Risk Reduction.

III.4.3.1.1 Human Development Index (HDIs)

The HDIs combines measures of life expectancy, education, and per capita income to give an indication of national development levels (UNDP. HDI. Undated). Life expectancy and per capita income are affected by climate change, while literacy is only indirectly affected by climate change (e.g., through natural disasters and health).

Climate change can affect life expectancy through increased mortality from heat waves, diseases, climate disasters and other impacts of climate. The use of DALYs developed by WHO as a general indicator of health outcomes is discussed in section III.4.3.2.1 below.

The effects of climate change on per capita income are also widespread. There are many direct effects of climate change on economic sectors such as agriculture, fisheries, livestock production, forestry, tourism, and recreation. Many other sectors of the economy such water supply and sanitation, transportation, and infrastructure are also affected by climate change and variability. Impacts on these sectors can reverberate throughout the economy.

14. The UN Global Early Warning Initiative, called "Early Warnings for All," was established in 2022. It calls for universal coverage by multi-hazard early warning systems and for $3.1 billion in funding to achieve global coverage by such systems (WMO, 2022).

The UAE Resilience Framework calls for reducing adverse impacts of climate change on poverty eradication, not on average income levels. The HDI indicator per capita income is not the same as poverty levels. While increases in national income can reduce poverty, poverty rates can be affected by other factors (e.g., Heshmati, 2007; Quang Dao, 2008). Thus, HDI may be limited in helping to measure progress on the UAE goal of reducing poverty.

III.4.3.1.2 Sustainable Development Goals

Sustainable Development Goals measure progress on 17 goals and 169 targets for human and ecosystem wellbeing to be achieved by 2030 (UN.SDG). The goals were established in 2015 and follow promulgation of eight Millennium Development goals in the year 2000 to be reached by 2015. Data on a set of indicators linked to the goals and targets are being compiled and collected by the UN (UN. DESA, Undated).

Of the 17 SDGs that are linked to sustainable development, these SDGs are most sensitive to climate change and thus, may be candidates for inclusion in the GST:

1. SDG 1. No Poverty: Climate change threatens to increase poverty by limiting many livelihoods.
2. SDG 2. Zero Hunger: Climate change threatens to increase malnutrition.
3. SDG 3. Good Health and Wellbeing: Climate change threatens human health.
4. SDG 5. Gender Equality: Climate change impacts in many cases are more negative on women.
5. SDG 6. Clean Water and Sanitation: Climate changes affects water supplies and water quality.
6. SDG 8. Decent Work and Economic Growth: Climate change has many direct and indirect impacts on the economy and welfare of workers.
7. SDG 9. Industry, Innovation and Infrastructure: Infrastructure is affected by climate changes as are industrial process indirectly through infrastructure, water, transportation and other impacts.
8. SDG 10. Reduced Equalities: Climate change impacts tend to be the most negative on poor and marginalized communities.
9. SDG 11. Sustainable Cities and Communities: Climate change has many adverse impacts on cities and communities.
10. SDGs 13, Climate Action: 16, Institutions, and 17, Partnerships are all inputs and clearly related to climate change.
11. SDG 14. Life Below Water: Climate change affects marine aquatic ecosystems through changes in water temperature, circulation, and acidification.
12. SDG 15. Life on Land: Climate change affects terrestrial ecosystems through changes in climate and disturbances, such as disease and fire.

Note that some SDGs are less appropriate as key indicators for the GST.

- SDG 4 is on education and the relationship between climate change and education is discussed above under HDI.
- SDG 7 on affordable and clean energy is mainly tied to mitigation although climate change directly affects hydropower and can affect the efficiency of thermal power production and renewables, such as solar and wind power.
- SDG 12 on consumption contributes to climate change and can affect adaptation, but the links are not as strong as with other SDGs.

Some of the SDGs are the same or similar to UAE Resilience Framework goals.

- SDG 1 aligns with the UAE (9f goal) of reducing adverse climate effects on poverty.
- SDG 2 on eliminating hunger corresponds with the UAE (9b goal) of attaining a climate-resistant food and agriculture supply and distribution system, including ensuring equitable access to food and nutrition for all.
- SDG 3 on health is consistent with the UAE (9c goal) of making health resilient to climate change.
- SDG 6 on water and sanitation aligns with the UAE (9a goal) of enhancing climate resilience of water supply and sanitation systems.
- SDGs 9 on infrastructure and SDG 11 on sustainable cities and communities correspond with the UAE (9e goal) of increasing resilience of infrastructure and human settlements to climate change impacts.
- SDGs 14 on marine ecosystems and SDG 15 on terrestrial ecosystems align with UAE (9d goal) of reducing climate impacts on ecosystems and biodiversity.

FAO has a key role in measuring progress on SDGs. It is the "designated custodian agency" several of the SDGs that may be most relevant for climate change and align with the UAE Resilience Framework: SDG 2 (Hunger), SDG 6 (Clean Water and Sanitation), SDG 14 (Life below water) and SDG 15, Life on Land (Distefano *et al.*, 2023).

III.4.3.1.3 Sendai Framework for Disaster Risk Reduction

The Sendai Framework for Disaster Risk Reduction established seven goals in 2015 to reduce the effect of disasters on human health, economy, and infrastructure and to promote DRR through investments in strategies, cooperation, and disaster EWS (United Nations, Undated). The framework has seven targets to help reduce the effect of natural disasters on society. Of these the most relevant indicators and targets that could be used in the GST are displayed in Table 2:

TABLE 2. Sendai Framework targets and indicators

Targets	Indicators
Substantially reduce global mortality by 2030	Lower average number of deaths and missing persons per 100,000 from disasters between 2020-2030 compared to 2005-2015.
Substantially reduce the number of affected people globally by 2030	Lower the average global number of people affected by disasters through injury, harm to dwellings or livelihoods per 100,000 between 2020-2030 compared to 2005-2015.
Reduce direct disaster economic loss by 2030	Reduce economic losses to agriculture, productive assets, housing, infrastructure, or cultural heritage from disasters relative to GDP by 2030.
Reduce disaster damage to critical infrastructure and basic services, including health and education by 2030	Reduce damage to education, health, and critical infrastructure and education, health and basic services by 2030.

Source: UNISDR. 2017

The Sendai framework goals of reducing the effects of disasters on mortality and injury are consistent with the UAE (9c goal) of reducing climate related mortality and morbidity. The Sendai goal of reducing disaster economic losses has indicators on agriculture, productive assets, housing and infrastructure, and cultural heritage. These indicators line up with the UAE goals on agriculture (9b goal), infrastructure and settlements (9e goal), and cultural heritage (9f goal).

Table 3 lists the UAE Resilience Framework targets, whether the UAE targets overlap with the SDGs, the Sendai Framework, or the Convention on Biological Diversity and in the third column lists United Nations organizations currently tracking related indicators. There appears to be significant overlap with other development goals and targets and many targets are being tracked to at least some extent by UN organizations. However, two of the targes: climate hazards assessments and establishment of MEL systems do not overlap with SDG, Sendai, or CBD goals or targets.

TABLE 3. Tracking progress on UAE Resilience Framework targets

UAE Resilience Framework targets	Overlapping goals or targets	Organizations currently tracking related indicators
Water	SDG 6	FAO
Agriculture	SDG 2 Sendai	FAO
Health	SDG 3 Sendai	WHO
Ecosystems and Biodiversity	SDG 14 and SDG 15; CBD	CBD
Infrastructure and Human Settlements	SDG 9 and SDG 11 Sendai	UNCTAD on ports
Poverty and Livelihoods	SDG 1 Sendai	UNDP
Cultural Heritage	Sendai	UNESCO
Climate Hazards Assessment		UNFCCC through NDCs, ACs
Early Warning Systems	WMO Early Warnings for All Initiative	Adaptation Fund, UNDRR
National Adaptation Plans	SDG 13	UNFCCC/UNEP Gap Report
Adaptation Implementation	SDG 13	UNEP Gap Report
Monitoring, Evaluation, and Learning (MEL) Systems		

III.4.3.2 Sector specific sets of outcome indicators

In this section, indicators of outcomes for six different sectors – health, agriculture, water resources, ecosystems and biodiversity, infrastructure, and cultural heritage – are analyzed for possible inclusion, in whole or in part, in the GST. The GBD has the longest history of development and application for measuring human health. FAO has been working for years on Indicators for food security and water resources. CBD is currently developing a suite of Indicators to measure biodiversity. The United Nations Conference on Trade and Development (UNCTAD) measures some infrastructure. The United Nations Educational, Scientific and Cultural Organization (UNESCO) developed metrics for measuring protection against threats to cultural heritage.

III.4.3.2.1 Global Burden of Disease (GBD)

The World Health Organization (WHO) developed the GBD in 1990 and used it in the World Bank's 1993 "World Development Report" (Roser *et al.*, 2021). The GBD has been regularly updated and is now maintained at the University of Washington's Institute for Health Metrics and Evaluation (IHME, Undated).

The GBD uses a single metric: life years lost which combines loss of years from premature mortality with "'years of equivalent healthy life' lost" to morbidity (Mathers, 2020). The latter involves subjective judgment by experts to estimate years of equivalent healthy life lost. This yields "Disability Adjusted Life Years" (DALYs). The GBD is a comprehensive measure of health and thus combines health outcomes with varying sensitivities to climate change (IMHE, 2023).

The GBD has two advantages over the other systems of indicators considered in this report: 1) it has been in use for over 30 years; and b) it yields a single measure of health rather than relying on multiple indicators which are not combined. Since it includes disability, it is a more comprehensive indicator of health than the life expectancy indicator used in HDI. GBD has been used to measure the relative contribution of climate change to human health (Campbell-Lendrum and Woodruff, 2006).

The GBD could be a comprehensive indicator used to measure progress towards meeting the UAE goal of reducing climate change impacts on morbidity and mortality.

III.4.3.2.2 FAO Food Security Indicators

FAO has a central role in measuring the state of food security and the food security indicators developed by FAO, often in coordination with UNDP, could be used in the GST.

FAO has also been working in recent years to develop national level and global indicators of food security. For example, FAO and UNDP worked with the Government of Guatemala to identify 102 indicators of climate variability, climate vulnerability, food security, and adaptation (FAO and UNDP, 2020).

FAO has also been developing indicators that can be applied nationally and globally to measure the state of food insecurity. It created a Food Insecurity Experience Scale (FIES) (FAO *et al.*, 2022), that surveys household and individual about their state of food security including questions about access to food and worries about access to food (FAO, FIES. Undated).

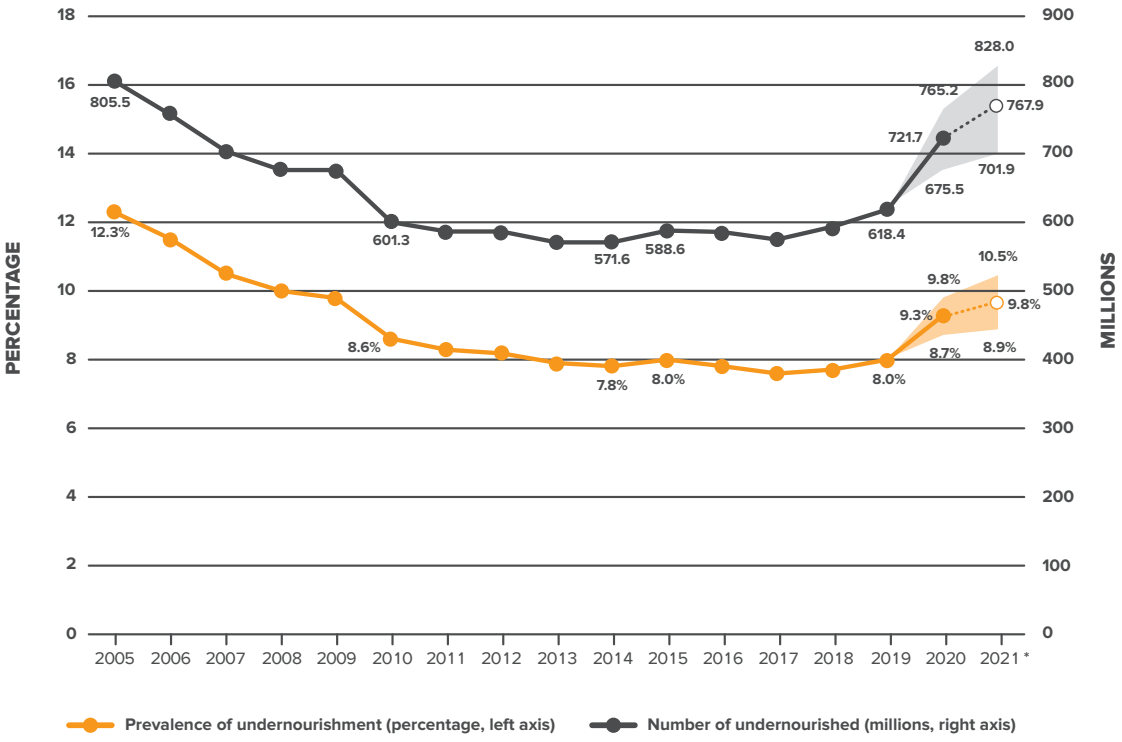
FAO also tracks progress on the number of people facing hunger, which could be a key indicator relative to UAE Resilience Framework target (9b goal) on adequate food and nutrition. Figure 3 is from FAO *et al.*, 2022 and displays trends in recent years in the absolute and percentage of global population facing hunger. After trending downward for about a dozen years after 2005, the incidence of global hunger started increasing in 2017. FAO *et al.* (2018) detected the increase in hunger and found that climate factors, notably increased climate variability, help explain the increase in hunger. The report finds that incidence of drought has noticeably increased since 1990 and concludes that extreme drought has contributed to increased hunger.[15]

A suite of indicators summarized in the FIES or a specific indicator such as the number or share of global population facing hunger could be a key indicator for the GST.

[15] The literature does not appear to be consistent on whether droughts are increasing globally as a result of climate change. For example, Dai (2021) found drought increasing in many parts of the world, Clark et al. (2022) find that many severe droughts are not attributable to climate change.

FIGURE 4. Change in number and share of global population facing hunger

BETWEEN 702 AND 828 MILLION PEOPLE IN THE WORLD FACED HUNGER IN 2021. CONSIDERING THE MIDDLE OF THE PROJECTED RANGE (768 MILLION), HUNGER AFFECTED 46 MILLION MORE PEOPLE IN 2021 COMPARED TO 2020, AND A TOTAL OF 150 MILLION MORE PEOPLE SINCE 2019, BEFORE THE COVID-19 PANDEMIC



NOTES: * Projected values for 2021 are illustrated by dotted lines. Shaded areas show lower and upper bounds of the estimated range.

Source: FAO *et al.*, 2022

The FAO indicators could be used to track progress toward the UAE goal of developing a climate-resilient food and agriculture production and distribution system.

III.4. 3.2.3 Water Resource Indicators: FAO's AQUASTAT and EBRD water indicators

FAO has a suite of indicators on water resources called AQUASTAT. It is a global data system managed by FAO to measure the state of water resources and agriculture water management. AQUASTAT contains 180 variables and indicators collected in more than 200 countries with some data going back to 1960. The data covers topics such as water withdrawals, wastewater produced and treated, pressure on water resources, irrigation and drainage, and environment and health. Results can be displayed by country or region (FAO. AQUASTAT. Undated). FAO has been working with national governments to collect data since 1994.[16]

16. Patricia Mejias Moreno, Personal Interview, July 13, 2023

An alternative to FAO's AQUASTAT for measuring the state of water security is the European Bank for Reconstruction and Development's set of indicators to measure the "Green Economy Transition" (Climate Policy Initiative, 2018.) These include three measures of outcomes on water resources:

- Water Use[17]: EBRD measure cubic meters of water use.
- Drinking Water: EBRD measures cubic meters of clean and good quality water and number of people connected to clean water supplies.
- Wastewater: EBRD measures cubic meters of wastewater treated per year (Climate Policy Initiative, EBRD, 2018).

All three of these measures could be expressed on a per capita basis, e.g., m3/capita of water supply, clean water, and treated water to normalize the data and make them more comparable across countries.

Some of the AQUASTAT indicators as well as all three EBRD water indicators can be used to measure whether the UAE water goals are being met.

III.4.3.2.4 Convention on Biological Diversity (CBD)

The CBD, which has been in existence for almost three decades, in 2022 adopted the Kumming-Montreal Global Biodiversity Framework. The framework identifies a vision for halting losses to biodiversity by 2030 and by 2050 fully valuing, conserving, and restoring ecosystem services. To help fulfill this vision the framework identifies four goals and 23 targets (UNEP, 2022b).

The CBD also identified a suite of indicators to measure progress toward achieving the goals and targets including three-dozen "headline indicators." These headline indicators are estimated at a national level from national data sources (UNEP, 2022c). For example, Goal A calls for an "increase of at least 15 percent in the area, connectivity and integrity of natural ecosystems" with other indicators including the extent of natural and modified ecosystems and a Species Habitat Index (CBD, 2021).

Technical support on implementing the CBD and specifically on monitoring targets and indicators is provided by the CBD Secretariat, which is advised by an *ad hoc* Technical Expert Group on Indicators (UNEP, 2022d).

Indicators to measure progress on meeting CBD goals could potentially be used to measure progress towards meeting the UAE Resilience Framework goal of reducing climate impacts on ecosystems and biodiversity.

[17] EBRD calls this indicator "water efficiency" but describes is as measuring water use (Climate Policy Initiative 2018). Water use is a more accurate description of what the indicator measures. Efficiency should take into account not just usage, but value of usage.

III.4.3.2.5. Infrastructure

The United Nations Conference on Trade and Development (UNCTAD) tracks the global state of port infrastructure through its "Global Port Infrastructure Sufficiency Index." The index tracks the time vessels spend in ports (turnaround time), safety and security in ports, and digitalization (UNCTAD, 2023). The first two factors can be affected by climate. For example, more severe weather could increase vessel turnaround time. The effects of climate change on port infrastructure, such as the effects of sea level rise or storms may indirectly affect these two indicators. FAO's AQUASTAT tracks irrigation and dams (FAO, AQUASTAT. Undated). We were unable to find United Nations tracking of the state of other infrastructure, such as roads, bridges, communications, and power supply.

III.4.3.2.6 Cultural heritage

UNESCO published "Thematic Indicators for Culture in the 2030 Agenda" to measure and monitor progress national and local levels toward meeting the 2030 SDGs regarding protection of cultural heritage (UNESCO, 2019).[18] The methodology includes 22 thematic indicators on environment and resilience, prosperity and livelihoods, knowledge and skills, and inclusion and participation.

One of the five indicators of environment and resilience is climate adaptation and resilience. This indicator measures contributions to mitigation and adaptation through "…sustainable safeguarding and management of tangible and intangible cultural heritage as well as natural heritage." (UNESCO, 2019, p. 42). This broad indicator is tied to the Sendai Framework regarding reducing economic damages and includes such specific indicators as:

- existence of disaster risk reduction plans for heritage sites;
- development of policy documents on impacts of climate change and natural disasters on cultural heritage;
- taking steps at heritage sites to reduce exposure of people and ecosystems to climate change risks and hazards
- review every five years of climate change and natural disaster impacts on heritage; and
- incorporating traditional and local knowledge as well as well as supporting the role of women in environmental management.

The measures are applied at the national and urban levels.

UNESCO's adaptation and resilience indicator could be used to help measure progress towards meeting the UAE Resilience Framework goal of protecting cultural heritage from climate risks.

18. SDG 11 addresses sustainable cities and communities. Target 11.4 under SDG 11 calls for the strengthening ofto protect cultural and natural heritage (UN Undated b).

As noted above, cultural heritage is one of the indicators of economic impacts under the Sendai Framework. This indicator measures damaged or destroyed cultural heritage that is attributed to disasters and has direct economic losses (UNDRR, Undated). This indicator could also be used to measure progress towards achieving the cultural heritage GGA.

III.4.4 Use of adaptation outcome indicators in the Global Stocktake

The development of the GST framework is an opportunity to learn lessons from existing global agreements and frameworks, such as the SDGs or the Sendai Framework for Disaster Risk Reduction. However, those frameworks have followed a top-down approach and include long lists of indicators that countries contextualize to match their national and sub-national situations. The Global Stocktake can make use of these complex processes and build upon what has worked rather than develop new indicators and processes. Developing new indicators could take longer to implement than using existing indicators and might impose additional burdens on parties, particularly developing country parties. Using existing indicators, particularly those that have already been widely applied, should require much less effort and be less disruptive than developing and applying new indicators.

Part IV: Options to begin the process of measuring progress towards meeting the Global Goal on Adaptation

The final part of the paper identifies options the UNFCCC could take in future global stocktakes beginning in 2028 and continuing beyond. It identifies a relatively limited approach that could be applied in the 2028 GST to begin assessing how adaptation measures address *some aspects* of climate change vulnerability. Stocktakes beginning in 2033 could build on what is done in the 2028 stocktake to provide additional and more comprehensive coverage of adaptation.

The first section discusses the need for consolidation of the many indicators that are or could be used into a small set of indicators or indices such as the HDI and GBD. The next section presents a set of indicators that could be used in the 2028 Stocktake and then discusses how GSTs after that could expand coverage. The final section contains the paper's conclusions.

IV.1. Need for consolidation of indicators

This paper's survey of sets of indicators for sustainable development, disaster risk management, and sector-based indicators finds that for many of these topics there can be dozens, scores, or even hundreds of indicators. For example, as noted above, FAO and UNDP worked with Guatemala to identify 102 food security indicators adaptation (FAO and UNDP, 2020). While the use of many indicators can provide depth and context to understanding the state of vulnerability and adaptation to climate change, the sheer

number of indicators can make it overwhelming and quite difficult to synthesize an understanding of the state of adaptation and the relative progress and difficulties experienced by different regions and countries. Think of a spreadsheet containing hundreds of columns of different indicators and rows for each reporting entity such as national parties. Such a spreadsheet would likely make it quite challenging to compare and synthesize results across different locations and sectors.

Thus, an approach to consolidate indicators is needed. There are two options. One is to select a small set of meaningful and broad indicators to assess adaptation. The second option is to develop indices that combine indicators.

IV.1.1 Select of small set of indicators

One option for consolidation of indicators is for the GST to select a handful of quite broad individual indicators that can be readily used to help understand the impacts of climate change and adaptation on societal and natural wellbeing. Some candidates are:

- Life expectancy as a general indicator of human health (used in the HDI) could be used an indicator measuring progress on the UAE Resilience target of attaining resilience against climate change health impacts.
- Income per capita as a general indicator of economic wellbeing (also used in HDI) and could be used to track progress toward the UAE Resilience target of substantially reducing adverse climate change effects on livelihoods. Note this indicator masks income inequities and is somewhat correlated with poverty levels (e.g., Heshmati, 2007; Quang Dao, 2008).
- Percentage of national population living in poverty to indicate whether access to economic wellbeing is equitable (measured by the World Bank; The World Bank, 2016) can help measure progress toward meeting the UAE Resilience Framework target of substantially reducing climate change impacts on poverty eradication.
- Percentage of population experiencing malnutrition as an indicator of food security (measured by FAO) and help in assessing progress towards the UAE Resilience Framework target of providing adequate food and nutrition in a climate resilient manner.
- Water supply per capita as an indicator of access to water resources (also measured by FAO) and can be used to indicate progress towards meeting the UAE Resilience Framework target of reducing climate induced water scarcity and creating climate resilient water supplies.

Such a small set of indicators can provide insight into the state of well-being and vulnerability to climate change for some of the UAE Resilience Framework targets. However, these indicators would not address all aspects of the agriculture, water, health and poverty and livelihoods targets; nor would they provide any information on meeting the ecosystem and biodiversity, infrastructure and human settlement, or cultural heritage targets.

In addition, as noted elsewhere, outcomes are useful in assessing the general state of development but do not necessarily show causality. For example, life expectancy can increase or decrease for many reasons including climate change and adaptation, but also changes in access to public health systems and pandemics. It will be critically important to demonstrate the effectiveness of climate adaptation inputs and outputs in changing climate related risks affecting outcomes, such as life expectancy. If the causes of changes in outcomes are not ultimately examined, then it will be difficult to assess the importance and effectiveness of adaptation interventions.

IV.1.2. Indices of vulnerability and adaptation

An alternative (although not necessarily a mutually exclusive) approach is to develop sector indices of vulnerability and adaptation.[19] These could be done for major topics and sectors. Perhaps the most prominent example of sectoral index is the GBD; discussed in Section III.4.3.2.1) which uses DALYs to give a general indication of health risks considering mortality and morbidity. Such indices have not yet been developed to assess the general state of sustainable development, disaster risk, food security, water resource security, or biodiversity.

International organizations that already have a clear leadership role in application of indicators or are clear intellectual leaders in sectors could be tasked with development of such indicators. For example;

- An index of sustainable development is developed by a consortium of UN organization such as UNDP, UNEP, and FAO;
- The UNDRR develops an index for disaster risk;[20]
- FAO develops an index for food security. The Food Insecurity Experience Scale (FAO *et al.*, 2022) may be sufficient for this purpose or may need expansion to include other metrics, such as for food production;
- The International Water Management Institute (IWMI) and FAO develop an index for water resource security (including quantify and quality of supplies); and
- CBD develops an index for biodiversity.

To make the indices comparable, each index should have a high, medium, and low quantitative thresholds[21] so the state of the different topics can be readily compared as hypothetically displayed in Table 4.

19. The possible use of comprehensive vulnerability indexes such as ND-GAIN is discussed in section II.3.
20. A hypothetical example is that an index yields a score between 0 and 100. A score of 0 to 33 could be "low;" a score of 34 to 66 could be "medium;" and a score of 67 to 100 could be "high."
21. A hypothetical example is that an index yields a score between 0 and 100. A score of 0 to 33 could be "low;" a score of 34 to 66 could be "medium;" and a score of 67 to 100 could be "high."

TABLE 4. Hypothetical example of application of common qualitative rankings from different indexes

Nations/ Index	Sustainable development	Disaster risk	Food security	Water resources	Biodiversity
A	High	Medium	High	High	Low
B	Medium	Low	Low	Medium	Low
C	High	High	High	High	Medium
D	Low	Medium	Low	Low	Medium
E	Medium	High	Medium	Low	High

In this hypothetical example, nations A and C are relatively better on the indices than the other nations, while Nation D is relatively worse than the others. Nations B and E are in the middle.

IV.2 The road ahead

This section explores how to move ahead on initiating, developing, and improving on the GST. Establishing a comprehensive set of indicators for adaptation is very difficult because there are many possible indicators, national and local circumstances vary considerably, and the mechanisms for gathering and reporting data can be difficult and expensive to implement. Progress on developing a set of indicators for the GST will, likely be slow and incremental. *But progress can be made.*

Some information on adaptation needs and effectiveness is better than no information and more information is better than less. A process that is not overly ambitious in the beginning, has initial successes and works over successive GSTs to expand the coverage of adaptation and reach of the stocktake in measuring progress towards achieving the GGA, is more likely to succeed to produce useful insight on the state of adaptation than a process that attempts to do too much early on. The Adaptation Research Alliance in one of its submissions to the Glasgow-Sharm el Sheikh UNFCCC work programme proposes that the GST be improved incrementally and be used as a learning process (ARA, 2022).

With this supposition, we recommend a two-stage approach to build on the progress made in the first Global Stocktake at COP28:

IV.2.1 For the 2028 GST: Apply a handful of broad well-established indicators

The guiding principle for the 2028 GST is to increase the odds of success by limiting the number of indicators that will initially be used. Even given the five-year period for this GST, there will be limited time to develop many indicators and have them be widely and effectively used. It is also important that the 2028 GST apply some indicators be able to demonstrate success.

Given these considerations, the 2028 GST could use a relatively small set of indicators that are already being broadly applied across the world. This could consist of the following sets of input, output, and outcome indicators.

On inputs:

Three adaptation policy cycle targets in the UAE Resilience Framework (UNFCCC, 2023a) that can be considered as inputs are:

- Conduct impact, vulnerability and risk assessments;
- Development of national adaptation plans including NAPs, strategic plans, and sector plans; and
- Development of MEL systems.

The state of adaptation planning could include:`

- Preparation of NAPs
- Preparation of sector plans
- Integration of adaptation into:
    - National budgeting processes
    - Development plans e.g.,
        - 5-year plans
        - Poverty reduction plans

On outputs:

Following the UAE Resilience Framework (UNFCCC, 2023a), three outputs are identified:

- Number of adaptation projects implemented;
- Installation of EWS; and
- Establishment of climate information services.

The UNEP Gap Report reports the number and sector of adaptation projects (UNEP, 2022a).

Other possible outputs indicators that are currently being tracked by some organizations, such as the AF include:

- Number of beneficiaries from climate change adaptation measures
- Hectares of land protected or improved by climate change adaptation measures.

On outcomes, some candidate indicators for inclusion in the 2028 GST were listed in Section IV.1.1 above and repeated here:

1. Water supply per capita as an indicator of state of water resources aligning with UAE Resilience Framework (9a goal).
2. Percentage of population experiencing malnutrition as an indicator of food security in UAE Resilience Framework (9b goal); and
3. Life expectancy as a general indicator of human health and aligns with UAE Resilience Framework (9c goal) on human health;
4. Income per capita as a general indicator of economic wellbeing[22] and aligns with UAE Resilience Framework (9f goals) on livelihoods; and
5. Percentage of national population living in poverty to indicate access to economic well-being, also aligning with UAE Resilience Framework (9f goal) on poverty.

This limited suite of indicators are already being widely used and could be applied in the 2028 GST to measure progress towards four of the GGA targets.

The UN and other multilateral organizations could coordinate measure of indicators they are already managing. To that end,

- WHO could manage the life expectancy indicator;
- World Bank and IMF could manage income per capita and poverty indicators; and
- FAO could manage food security and water supply indicators.

IV. 2.2 For the 2033 GST and Beyond: cover all sectors and impacts in the Global Goal on Adaptation and apply indices for cross-cutting topics and sectors.

There can be two goals for the subsequent GSTs beginning with the 2033 GST:

First, expand the indicators to include all the UAE Resilience Framework targets, adding those not covered in the 2028 GST, namely ecosystems and biodiversity (9d goal), infrastructure and human settlements (9e goal), and cultural heritage (9g goal). The CBD for example could develop a set of indicators for measuring biodiversity. Broader measures of ecosystem health would take more work. Other important cross cutting Indicators could be added, such as for disaster risk and gender.

Second, as appropriate, develop or apply indices to incorporate a variety of indicators by topic. As discussed, currently the GBD uses DALYs to measure morbidity and mortality.

22. Stadelmann et al. (2011) proposed use of "saved wealth" as a universal economic indicator for measuring the effectiveness of climate change adaptation. Wealth in theory is better than income because it measures the stock of total wealth rather than income. Climate change can reduce income by limiting or destroying livelihoods, but it also can destroy assets such as property and infrastructure, which are part of wealth. Indeed income can rise following disasters because money is spent on reconstruction but does not increase wealth relative to prior to the climate event. Unfortunately, it is more difficult to measure wealth than income.

GBD could replace or be in addition to life expectancy. Indices of disaster risk, food security, water security, ecosystem health or biodiversity, infrastructure, and cultural heritage could be developed by the appropriate international organizations. Each index can then develop criteria for reporting results in a common cardinal framework such as high, medium, and low scores. This would enable a more direct comparison of outcomes by country or if appropriate region.

Research on indicators and their appropriate uses will be needed. The UNFCCC should request that the Intergovernmental Panel on Climate Change (IPCC) issue a special report on indicators for measuring adaptation. Besides analyzing indicators, metrics, and indices to assess vulnerability and the effectiveness of adaptation, a key topic for the IPCC to examine could be how to measure the effect of adaptation outputs on outcomes such as the UAE Resilience Framework targets but also SDGs, Sendai Framework, and CBD targets. To best inform the 2028 GST, such a report could be published by early 2026.

In post 2028 GSTs on adaptation, it may be important to take note and possibly incorporate dynamic changes in vulnerability and adaptation, such as changes in climate, baseline conditions, and adaptation capacity.

IV.3. Conclusions

This paper describes an approach to begin making progress on the Global Stocktake and measure progress towards the UAE Resilience Framework agreed upon in COP28. Measuring progress on adaptation is quite challenging because there is no universal indicator for measuring vulnerability to climate change and therefore, no single indicator to measure adaptation needs and progress. Instead, the state of the art is that there are many indicators for measuring vulnerability and adaptation.

This paper proposes a way to begin measuring adaptation progress, focusing on the second GST that will conclude in 2028, and proposing to expand the coverage of adaptation indicators in subsequent GSTs. It employs a Logic Model emphasizing the assessment of the effect of inputs, such as adaptation planning and finance on outputs, i.e., adaptation measures, and, ultimately, the effect of outputs on outcomes such as human, societal, and natural wellbeing (as expressed in the UAE Resilience Framework).

Building on existing indicators of societal development and health of natural systems including relying on the institutions, such as FAO, WHO, UNESCO, and UNDP, that have developed and support such systems of indicators offers a promising approach to begin building a comprehensive approach to measuring adaptation as part of the GST. In the long run, it will be important for the GST to be able to assess the effectiveness of inputs ultimately on outcomes.

A key principle to increasing the likelihood that the initial rounds of the GST for adaptation are successful is to start small by measuring some aspects of adaptation well and build

on existing and widely used indicators. While not comprehensive, a relatively small set of indicators that are already widely in use can help give insight into climate change adaptation needs and progress. These indicators can include inputs such as national adaption planning and adaptation projects, to outcomes such as number of adaptation projects and EWS implemented, and ultimately to outputs, such as life expectancy, income, poverty rates, food security, and water supply.

The GSTs beyond 2028 can build on this progress by adding indicators on biodiversity, infrastructure and human settlements, and culture and could apply or develop indices that incorporate many measures of vulnerability and adaptation by sector, such as the GBD to comprehensively measure the state of human health. There will never be a single indicator nor a set of Indicators that will effectively and comprehensively measure *all* aspects of vulnerability and adaptation from local to global scales. Instead, this paper offers an approach that can eventually provide useful insight on the state of vulnerability to climate change and effectiveness across many key impacts and sectors. Such an approach can inform the adaptation policy process on the state of adaptation, on where it is making progress, and on where it is lagging.


©UNDP Rwanda/Mucyo Serge

References

Adaptation Committee. 2021. "Approaches to Reviewing the Overall Progress Made in Achieving the Global Goal on Adaptation." United Nations Framework Convention on Climate Change. Bonn. https://unfccc.int/sites/default/files/resource/AC_TP_GlobalGoalOnAdaptation.pdf. Accessed July 5, 2023.

Adaptation Fund. 2022. "Annual Performance Report for the Fiscal Year 2022." Adaptation Fund: Bonn. AFB/EFC.30/3/Rev.1. 29 August, 2022.

Adaptation Research Alliance. 2022. "Submission to the UNFCCC Global Stocktake: Input to Technical Dialogue 1 (SB 56)." 28 February 2022.

Barnett, J., and S. O'Neill. 2010. "Maladaptation". *Global Environmental Change* 20: 211-213.

Bain, N., L. Nguyen, and K. Baboyan. 2019. "Climate Change Knowing What You Spend: A Guidance Note for Governments to Track Climate Finance in Their Budgets." United Nations Development Programme. Knowing What You Spend: A guidance note for governments to track climate change finance in their budgets | United Nations Development Programme (undp.org).

Campbell-Lendrum D, and R. Woodruff. 2006. Comparative risk assessment of the burden of disease from climate change. *Environ Health Perspect* 114: 1935–41.

CBD. 2021. "Proposed Headline Indicators of the Monitoring Framework for the Post-2020 Global Biodiversity Framework." Convention on Biological Diversity. CBD/WG2020/3/3/Add.1. 11 July. https//www.cbd.int/doc/c/d716/da69/5e81c8e0faca1db1dd145a59/wg2020-03-03-add1-en.pdf. Accessed July 19, 2023.

CBD. 2022. "COP-15: Nations Adopt Four Goals, 23 Targets for 2030 in Landmark UN Biodiversity Agreement." Convention on Biological Diversity. https://www.cbd.int/article/cop15-cbd-press-release-final-19dec2022. Accessed June 19, 2023.

Clarke, B., F. Otto, R. Stuart-Smith, and L. Harrington. 2022. "Extreme weather impacts of climate change: an attribution perspective." *Environmental Research: Climate* 1 (1). https://doi.org/10.1088/2752-5295/ac6e7d.

Climate Policy Initiative. 2018. "Implementing the EBRD Green Economy Transition: Technical Guidance for Consultants: Reporting on projects performance against the Green Economy Transition Approach." European Bank for Reconstruction and Development. https://www.ebrd.com/documents/climate-finance/implementing-the-ebrd-green-economy-transition.pdf. Accessed May 26, 2023.

Climate Policy Initiative. 2020. "A Snapshot of Global Adaptation Investment and Tracking Methods." Climate Policy Initiative. https://www.climatepolicyinitiative.org/publication/a-snapshot-of-global-adaptation-investment-and-tracking-methods/. Accessed May 26, 2023.

Dai, A. 2021. "Hydroclimatic trends during 1950–2018 over global land." *Clim Dyn*. https://doi.org/10.1007/s00382-021-05684-1

DCC. 2022. “Monitoring and Evaluation Manual for Climate Change Adaptation Activities in Viet Nam.” Vietnam Ministry of Natural Resources and the Environment. Department of Climate Change. https://napglobalnetwork.org/wp-content/uploads/2023/05/napgn-en-2023-monitoring-evaluation-manual-climate-change-adaptation-activities-vietnam-1.pdf. Accessed September 28, 2023.

DCC. 2023a. “Vietnam’s Approach to Monitoring and Evaluation (M&E) of the National Adaptation Plan.” Vietnam Ministry of Natural Resources and the Environment. Department of Climate Change. https://napglobalnetwork.org/wp-content/uploads/2023/05/napgn-en-2023-vietnam-approach-m-e-nap.pdf. Accessed August 7, 2023.

DCC. 2023b. “Monitoring and Evaluation Manual for Climate Change Adaptation Activities in Viet Nam.” Vietnam Ministry of Natural Resources and the Environment. Department of Climate Change. napgn-en-2023-monitoring-evaluation-manual-climate-change-adaptation-activities-vietnam-1.pdf (napglobalnetwork.org). Accessed August 8, 2023.

Distefano, E., N. Rai, and J. Wolf. 2023. “Using Metrics to Assess Progress Towards the Paris Agreement’s Global Goal on Adaptation: Transparency in Adaptation in the Agriculture Sector.” Food and Agriculture Organization of the United Nations: Rome.

European Commission. 2023. “INFORM REPORT 2023; Shared evidence for managing crises and disasters.” Interagency Standing Committee and the European Uniont. Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/073809, JRC134138

FAO. 2022. Food and Agricultural Organization and UNDP. 2020. “Guatemala´s progress in developing a national monitoring and evaluation system for adaptation in the agriculture sector.” https://www.fao.org/documents/card/en/c/CB2454EN/. Accessed June 19, 2023.

FAO. AQUASTAT. Undated. “AQUASTAT – FAO’s Global Information System on Water and Agriculture.” https://www.fao.org/aquastat/en/. Accessed June 19, 2023.

FAO. FIES. Undated. “The Food Insecurity Experience Scale: Measuring Food Insecurity Through People’s Experiences.” https://www.fao.org/3/i7835e/i7835e.pdf#:~:text=The%20FIES%20is%20a%20metric%20of%20severity%20of,brief%20questions%20regarding%20their%20access%20to%20adequate%20food. Accessed June 26, 2023.

FAO and UNDP. 2020. Guatemala’s progress in developing a national monitoring and evaluation system for adaptation in the agriculture sector. Rome. https://www.fao.org/in-action/naps/resources/detail/en/c/1366085/.

FAO, IFAD, UNICEF, WFP and WHO. 2022. “The State of Food Security and Nutrition in the World 2022. Repurposing food and agricultural policies to make healthy diets more affordable.” Rome, FAO. https://doi.org/10.4060/cc0639en

Frankfurt School. 2020. “Number of beneficiaries as an indicator for adaptation: do the numbers add up?” Frankfurt School. FS-UNEP Collaborating Centre for Climate & Sustainable Energy Finance. GCF Monitor, Edition 2. April. https://www.fs-unep-centre.org/wp-content/uploads/2020/04/GCFMonitor-edition2-final.pdf#:~:text=On%20paper%2C%20the%20GCF%20and%20the%20AF%20distinguish,medium%20and%20high%29%20of%20support%2Feffort%20provided%20per%20person.

GCF. 2021. “Integrated Results Management Framework.” Green Climate Fund. https://www.greenclimate.fund/document/integrated-results-management-framework. Accessed June 20, 2023.

GCF *et al.* Undated. "Adaptation Monitoring and Evaluation Framework: Viet Nam National Adaptation Plan Development and Operationalization Support Document (NAP-SUP)." Green Climate Fund, Vietnam Ministry of Natural Resources and the Environment. Department of Climate Change, and United Nations Development Programme. Report on Adaptation monitoring and evaluation framework| United Nations Development Programme (undp.org).

GEF. 2022. "GEF Programming Strategy on Adaptation to Climate Change for the Least Developed Countries Fund and the Special Climate Change Fund for the GEF-8 Period of July 1, 2022 to June 30, 2026 and Operational Improvements." Global Environment Facility: Washington D.C. GEF/LDCF.SCCF.32/04/Rev.01. June 23, 2022.

Heshmati, A. 2007. The Relationship between Income Inequality, Poverty and Globalization. In: Nissanke, M., Thorbecke, E. (eds) The Impact of Globalization on the World's Poor. Studies in Development Economics and Policy. Palgrave Macmillan, London. https://doi.org/10.1057/9780230625501_3.

Institute for Health Metrics and Evaluation. Undated. "Global Burden of Disease." University of Washington. https://www.healthdata.org/gbd. Accessed June 23, 2023.

IMHE. 2023. "GBD Compare." Institute for Health Metrics. University of Washington. https://vizhub.healthdata.org/gbd-compare/#. Accessed September 8, 2023.

International Platform on Adaptation Metrics. 2023. "IPAM Statement on Adaptation Metrics for Global Goals." November. https://adaptationmetrics.org/sites/default/files/2023-11/VC4-IPAM-Statement_0.pdf.

IPCC. 2021: Annex VII: Glossary [Matthews, J.B.R., V. Möller, R. van Diemen, J.S. Fuglestvedt, V. Masson-Delmotte, C. Méndez, S. Semenov, A. Reisinger (eds.)]. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 2215–2256, doi:10.1017/9781009157896.022.

Klein, R. J. T., N. Canales, and B. Macura. 2023. "Reporting on Climate Adaptation is a Mess – And Here's How to Fix It." Climate Home News. 26 April. https://www.climatechangenews.com/2023/04/26/reporting-on-climate-adaptation-is-a-mess-heres-how-to-fix-it/. Accessed June 5, 2023.

Leiter, T. 2023. "Submission on the Glasgow–Sharm el-Sheikh work programme on the 22Global Goal on Adaptation." London: Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy, London School of Economics and Political Science

Leiter, T., Olhoff, A., Al Azar, R., Barmby, V., Bours, D., Clement, V.W.C., Dale, T.W., Davies, C., and Jacobs, H. 2019. "Adaptation metrics: current landscape and evolving practices". UNEP DTU Partnership. Rotterdam and Washington, DC. Available online at www.gca.org.

Mathers, C. D. 2020. "History of global burden of disease assessment at the World Health Organization." *Archives of Public Health*. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7443850/. Accessed June 2, 2023.


©UNDP Viet Nam

Mechler, R., Singh, C., Ebi, K. *et al.* "Loss and Damage and limits to adaptation: recent IPCC insights and implications for climate science and policy." *Sustain Sci* 15, 1245–1251 (2020). https://doi.org/10.1007/s11625-020-00807-9.

NAP Global Network. 2023. "NAP Trends. Trends in NAP Documents. Monitoring and Evaluation." https://trends.napglobalnetwork.org/search-by-trend/monitoring-evaluation. Accessed September 8, 2023.

ND-GAIN. 2023. "University of Notre Dame Adaptation Initiative: Country Index Technical Report." Notre Dame Global Adaptation Initiative. https://gain.nd.edu/our-work/country-index/. Accessed March 26, 2024.

Nguyen, V. T. *et al.* 2023. "Viet Nam's Approach to Monitoring and Evaluation (M&E) of the National April 2023 Adaptation Plan." NAP Global Network. napgn-en-2023-vietnam-approach-m-e-nap.pdf (napglobalnetwork.org). Accessed August 8, 2023.

Partnership on Transparency in the Paris Agreement. Undated. "PATPA Webinar Series. It's BTR Time: The Importance of BTRs in 2024." https://transparency-partnership.net. Accessed February, 2024.

Patton, M. Q. 1997. *Utilization-Focused Evaluation*. London: Sage Publications

Quang Dao, M. (2008), "Human capital, poverty, and income distribution in developing countries", Journal of Economic Studies, Vol. 35 No. 4, pp. 294-303. https://doi.org/10.1108/01443580810895590.

Roser, M., H. Ritchie, and F. Spooner. 2021. "Burden of Disease." *Our World in Data*. https://ourworldindata.org/burden-of-disease. Accessed June 2, 2023.

Schipper, L., M. Scoville-Simonds, K. Vincent, and S. Erikson. 2021. "Why Avoiding Climate Change 'Maladaptation' is Vital." Carbon Brief. https://www.carbonbrief.org/guest-post-why-avoiding-climate-change-maladaptation-is-vital/.

Stadelmann, M., A. Michaelowa, S. Butzengeiger-Geyer, and M. Kohler. 2011. "Universal metrics to compare the effectiveness of climate change adaptation projects." Paris: OECD.

United Nations. 2022. "COP27: $3.1 billion plan to achieve early warning systems for all by 2027." UN News. United Nations. https://news.un.org/en/story/2022/11/1130277. Accessed July 13, 2023.

United Nations. Undated a. "Sendai Framework for Disaster Risk Reduction." Sendai Framework for Disaster Risk Reduction 2015 – 2030 (preventionweb.net), Accessed June 22, 2023.

United Nations. Undated b. "Sustainable Development Goals: Goal 11." https://www.un.org/sustainabledevelopment/cities/. Accessed February 29, 2024.

United Nations. Climate Change. Undated. "National Adaptation Plans." https://unfccc.int/topics/adaptation-and-resilience/workstreams/national-adaptation-plans. Accessed March 25, 2024.

United Nations. Climate Change. State of Adaptation. Undated. "Preview: State of Adaptation Action by Parties – new interactive portal by the Adaptation Committee." https://unfccc.int/adapatation_actions_parties. Accessed April 2, 2024.

UNCTAD. 2023. United Nations Conference on Trade and Development. “Global Port Infrastructure Sufficiency Index: Results of the Pilot Phase: Technical Report.” UNCTAD: Geneva. https://unctad.org/system/files/official-document/tcsdtlinf2023d2_en.pdf.

UN DESA. Undated. “SDG Indicators: Metadata Repository.” United Nations Department of Economic and Social Affairs Statistics Division. https://unstats.un.org/sdgs/metadata/. Accessed September 8, 2023.

UNDP and GCF. 2020. “Supporting the Achievement of National Development Policies by Building Climate Adaptive Capacity and Planning in Guinea.” United Nations Development Programme. Green Climate Fund. Signature Page Prodoc PIMS 6044 GCF NAP Signed.pdf (undp.org). Accessed August 9, 2023.

UNDP. Undated. “Goal 1: No Poverty.” https://www.undp.org/sustainable-development-goals/no-poverty. Accessed February 23, 2024.

UNDRR. 2023. “Global Status of Multi-Hazard Early Warning Systems: 2023.” United Nations Office for Disaster Risk Reduction. https://www.undrr.org/reports/global-status-MHEWS-2023. Accessed February 22, 2024.

UNDRR. Undated. “Monitoring Sendai Framework.” https://www.undrr.org/implementing-sendai-framework/monitoring-sendai-framework. Accessed February 23, 2024.

UNEP. 2022a. “Adaptation Gap Report 2022: Too Little, Too Slow – Climate adaptation failure puts world at risk.” United Nations Environment Programme. Nairobi. https://www.unep.org/adaptation-gap-report-2022

UNEP. 2022b. “Decision 15/4. Kunming-Montreal Global Biodiversity Framework.” Convention on Biological Diversity. CBD/COP/DEC/15/4. 19 December 2022.

UNEP. 2022c. “Decision 15/5. Monitoring framework for the Kunming-Montreal Global Biodiversity Framework.” Convention on Biological Diversity. CBD/COP/DEC/15/5. 19 December 2022.

UNESCO. 2019. “Culture | 2030 Indicators.” United Nations Educational, Scientific and Cultural Organization. Paris. https://whc.unesco.org/en/culture2030indicators/.

UNFCCC. 2015. “Adoption of the Paris Agreement.” FCCC/CP/2015/L.9/Rev.1.

UNFCCC. 2018. “Decision 9/CMA.1.” FCCC/PA/CMA/2018/3/Add.1. 15 December.

UNFCCC. 2019. “Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on the third part of its first session, held in Katowice from 2 to 15 December 2018 Addendum Part two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement.” FCCC/PA/CMA/2018/3/Add.2. 19 March.

UNFCCC. 2021. “National Adaptation Plans.” https://unfccc.int/topics/adaptation-and-resilience/workstreams/national-adaptation-plans. Accessed June 28, 2023.

UNFCCC. 2022. “Methodologies for Assessing Adaptation Needs and Their Implementation.” United National Framework Convention on Climate Change. https://unfccc.int/sites/default/files/resource/J0160_Adaptation%20Needs%20Technical%20Report%20final.pdf. Accessed February 22, 2024.

UNFCCC. 2023a. "Glasgow–Sharm el-Sheikh work programme on the global goal on adaptation referred to in decision 7/CMA.3." https://unfccc.int/documents/636595.

UNFCCC. 2023b. "Outcome of the first global stocktake." FCCC/PA/CMA/2023/L.17. 13 December, 2023. https://unfccc.int/event/cma-5?item=4.

UNFCCC. 2023c. "Report of the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement on its fourth session, held in Sharm el-Sheikh from 6 to 20 November 2022 Addendum Part two: Action taken by the Conference of the Parties serving as the meeting of the Parties to the Paris Agreement at its fourth session. "FCCC/PA/CMA/2022/10/Add.1. March 17, 2023.

UNFCCC. Undated. "Global Stocktake." Presentation. United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/resource/The%20Global%20Stocktake.pdf

UNFCCC. Undated. "Adaptation Communications." United Nations Framework Convention on Climate Change. https://unfccc.int/topics/adaptation-and-resilience/workstreams/adaptation-communications

UNFCCC. Undated. "Adaptation and Resilience." United Nations Framework Convention on Climate Change. https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/introduction. Accessed September 19, 2023.

UNFCCC. Undated. NDCs. "Nationally Determined Contributions: The Paris Agreement and NDCs." United Nations Framework Convention on Climate Change. https://unfccc.int/process-and-meetings/the-paris-agreement/nationally-determined-contributions-ndcs. Accessed June 28, 2023.

UNICEF. Undated. United Nations International Children's Emergency Fund. "Using data to achieve the
Sustainable Development Goals (SDGs) for children." https://data.unicef.org/sdgs/. Accessed July 5, 2023.

WHO. Undated. World Health Organization. Global Health Observatory. https://www.who.int/data/gho/data/themes/mortality-and-global-health-estimates/ghe-leading-causes-of-death. Accessed March 25, 2024.

WMO. 2022. World Meteorological Organization. "Early Warnings for All: The UN Global Early Warning Initiative for Implementation of Climate Adaptation: Executive Action Plan: 2023-2027." WMO: Geneva. https://library.wmo.int/viewer/58209/download?file=Executive_Action_Plan_en.pdf&type=pdf&navigator=1. Accessed March 26, 2024.

World Bank. 2016. "Principles and Practice in Measuring Global Poverty." The World Bank. https://www.worldbank.org/en/news/feature/2016/01/13/principles-and-practice-in-measuring-global-poverty. Accessed July 6, 2023.

©United Nations Chad

Appendix I: Stakeholder interviews

Table II-1 lists the stakeholders who were interviewed for this project.

TABLE II-1. Stakeholders Interviewed for the UNDP GST Collaborative Paper

Organization	Individual(s)	Date of Interview
Food and Agricultural Organization	Elisa DiStefano (on agriculture metrics)	June 7, 2023
	Patricia Mejias Moreno (on AQUASTAT)	July 13, 2023
Convention on Biological Diversity	Trystan Tyrrell	June 26, 2023
Adaptation Fund	Saliha Dobardzic	June 26, 2023
	Mahamat Abakar Assouyouti	July 17, 2023
International Centre for Climate Change and Development	Saleemul Huq[23]	July 4, 2023
Government of Ecuador, Ministry of Environment, Water and Ecological Transition	Nicolás Zambrano	July 5, 2023
Global Environment Facility	Cyril Blet	July 7, 2023
	Jason Spensely	"
	Aloke Barwal	"
Institute for Health Metrics and Evaluation	Katrin Burkart	July 13, 2023
	Michael Brauer	"
	Jeffrey Stanaway	"
	Charlie Ashbaugh	"
Adaptation Research Alliance	Suzanne Carter	July 17, 2023
United Nations Industrial Development Organization	Patrick Nussbaumer	July 19, 2023
	Rashmi Jawahar	"

23. On a personal note, Dr. Huq passed away on October 28, 2023. My interview with Saleem was the last conversation I had with him. I had the honor and pleasure and knowing and working with Saleem for over 30 years. As he was through the entire time I knew him, he was gracious and provided very helpful input in the interview. I was very saddened by the news of his passing and miss my good friend and colleague very much.

United Nations Development Programme
www.undp.org
𝕏 @UNDP
adaptation-undp.org
𝕏 @UNDPClimate