

MULTILATERAL DEVELOPMENT BANKS FOR GLOBAL PUBLIC GOODS (MDBS FOR GPGS)

Tool for quantifying GPGs and
externalities

May, 2023





Introduction

Tool for GPG Quantification – Background and Preview

- Global Public Goods (GPGs) are goods of which the benefits of their provision accrue globally, such as climate change mitigation, the preservation of biodiversity, or pandemic preparedness
- Their economic and non-economic returns are immense, and their provision is central to achieving the World Bank's Twin Goals of poverty eradication and shared prosperity
- The World Bank can play a key role in supporting GPG provision in its client countries
- In client countries, there may be synergies of GPG provision with national development goals...
- ...but additional incentives may be necessary to support an efficient GPG provision
- Knowledge products and finance are the two central tools the World Bank has at its hands to support GPG provision
- For both, producing knowledge products and providing additional GPG-specific financial incentives, a better understanding of the economic and non-economic benefits and costs of their provision is necessary
- On the basis of these metrics, for the derivation of which this tool offers guidelines, a clear framework for prioritization and project-specific incentives for GPG provision can be developed

Global Public Goods and the World Bank

- Global Public Goods (GPGs) are goods that are produced, i.e., provided, in any country, but of which the benefits accrue to a relevant extent in other countries (cross-country externalities)
- GPGs often come in the form of global public *bads*, such that there are negative externalities. In that case, the *good* can be viewed as the avoidance of the respective bad
- The current operational, financial, and institutional model of the World Bank does not fully account for the externalities in the provision of GPGs
- In order to incorporate GPG considerations into the business model of the World Bank, it is imperative to determine the relevant metrics of value and costs of GPGs and the externalities involved
- Open questions which this tool to determine GPG metrics can help to answer are:
 - Which GPGs are particularly relevant to achieve the World Bank's Twin Goals?
 - How can GPG provision be captured and supported by the World Bank?
 - What financial support levels are necessary and sufficient to ensure an efficient GPG provision in GPG client countries?

Tool for quantifying GPGs and externalities

- This template provides a coherent framework to determine relevant metrics of GPGs, such as their value and the costs of providing them
- The template is designed to be applied in the context of multilateral development banks (MDBs) and the World Bank in particular
- It can be used for analytical work as well as practically be applied, such as in the context of providing concessional finance on the basis of GPG considerations
- As there exists no market price for GPGs, determining relevant metrics can help to analyse GPGs under economic considerations
- Practical applications and exemplary estimations of GPG metrics are provided towards the end of the presentation

Who can use it (and what for)?

MDB staff to:

- analyse feasible support schemes for GPGs by means of concessional finance
- report on progress in GPG provision
- develop GPG provision instruments for operations
- determine the country's comparative advantages in terms of GPG provision and select avenues for country programming
- incorporate GPG benefits into cost-benefit reasonings and better understand how cross-country benefits might affect the desirability of a project to the borrowing country

Key concepts for metrics of goods

Value (Benefits)

- Monetary equivalent of the utility that is drawn from a good
- For GPGs: Value accrues globally

Price

- Monetary figure for which the actor who possesses property rights transfers these property rights to another actor
- For GPGs: As no property rights exist for cross-country externalities, there can not be a price associated with them, if property rights are not assigned by regulation

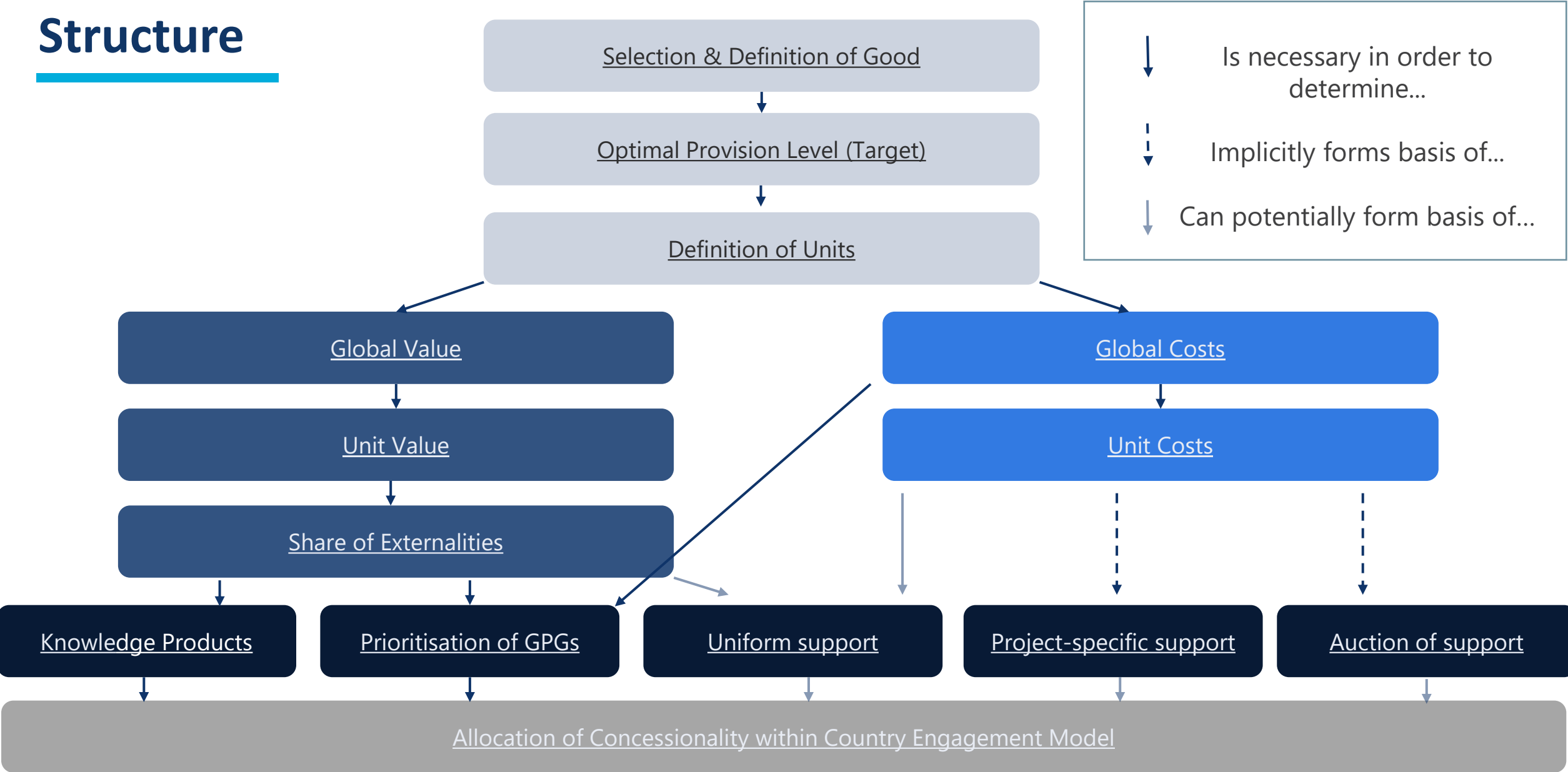
Costs

- Amount of money needed to produce a good and/or the monetary equivalent of the opportunity costs
- For GPGs: Should be understood as the „extra“ cost of producing the cross-country externality



Tool

Structure



Selection of a Global Public Good (1/2)

Characteristics of Global Public Goods:

- They generally produce substantial cross-country externalities.
- They are costly to provide. This includes the opportunity costs of protecting them.
- They generate opportunities for improving welfare through collective action.

[Back to tool](#) ◀

Definition of the Good for Quantitative Classification (2/2)

What is the good from which people benefit?

- What does ultimately generate benefits?
- What are the channels through which benefits are generated?

Example Climate Change Mitigation (CCM):

- Good from which people benefit: non-increase of average global temperature
- Channels: sea-level rise, extreme weather events, refugee flows, production possibilities affected, probability of conflicts

Example Preservation of Biodiversity:

- Good from which people benefit: ecosystem services
- Channels: resources provided, pollination, environmental regulation and control, medicinal potential, genetic diversity, recreational services, etc.

Optimal Provision Level (Target)

What is the goal that the world has/should have with respect to the “production”, i.e., the provision of that good?

- There may be disputes regarding the optimal provision level. Therefore, an international agreement or an accepted strategy is necessary to methodologically base this assessment on.

Example CCM: Goal in Paris Agreement: keep global temperature increase well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

Example Biodiversity: Goal in Kunming-Montreal Framework of CBD: bring the loss of areas of high biodiversity importance close to zero by 2030

[Data Sources
for Unit Measures](#)

[Overview of GPG costs
and benefits](#)

[Back to tool ◀](#)

Definition of Units

Can the overall achievement of the goal be broken down into units / individual contributions?

- The GPG should be measured in **countable units** so that it can be scaled and related to certain projects
- Units of achievement should ideally be as **technology neutral** as possible, i.e., reflect what is valued, without defining how the GPG is provided
- The cost-effective contribution of each project should be attributed to the overall provision of the GPG
- Aggregator technology is central to determining units:
 - If contributions by countries differ in their generation of externalities, units should consider the country's relevance for the GPG provision (example: the global importance of a country's financial stability is determined by its financial interconnectedness with the rest of the world)

Example CCM: Unit: tCO₂eq., can be directly related to predicted temperature increase, independent of where it is emitted

Example CCM: Unit: hectare of habitat area, needs to be differentiated by biome

[Data Sources
for Unit Measures](#)

[Overview of GPG costs
and benefits](#)

[Back to tool](#) ◀

Global Value

What is the value of achieving the overall goal?

- If the goal were achieved, compared to a plausible benchmark (as in not doing anything for the goal, the “status quo”), what would the benefits be, expressed in monetary valuation?
- Expressing a value in monetary equivalents does not mean only capturing economic effects, but in order to make valuations comparable, dimensions of monetary valuations are helpful
- Method: Best to rely on scientific studies, consensus about the dimensions in different studies would be desirable
 - Important: Same set of goal and benchmark in studies, or plausibly transferrable to global setting
 - Also important to make sure that the studies include the same set of channels of valuation as previously assumed, otherwise potentially add up estimations of different channels
 - Monetary equivalents of non-economic values are typically elicited in willingness-to-pay studies, otherwise have to rely on modeling with utility functions

Example CCM: Roughly 10 % of global GDP, or 10 trillion US\$ per year in 2100, likely to increase from that point

Example Biodiversity: The equivalent of more than 50 % of global GDP will be lost yearly within 50 years at current degradation rates

[Data Sources
for Unit Measures](#)

[Overview of GPG costs
and benefits](#)

[Back to tool](#) ◀

Unit Value

What is the value per unit of contribution to the goal?

- Simply divide global value through units, if available
- It might be that global values derive from aggregating unit values, but because of the relation to the overall goal, order should still be this way
- It is pragmatic to assume linearity within the range up to the goal, even though unit values may not be linear even within that range, because the overall goal should be reached, and contributions should be valued equally independent of others' contributions

Example CCM: Harm of temperature increase can easily be broken down to tCO₂eq., there is a range of estimations of SCC, but plausible median range is at 307 US\$ /tCO₂eq.

Example Biodiversity: For the biome of tropical forests, the yearly value is estimated at around 5,000 US\$/ha.

[Data Sources
for Unit Measures](#)

[Overview of GPG costs
and benefits](#)

[Back to tool](#) ◀

Share of Externalities

What is the share of the cross-country externalities in the total estimated global/unit value?

- May or may not be included explicitly in scientific studies
- If not made explicitly,
 - can either be derived from making assumptions about explicit distribution of channels made explicit in studies, or
 - from making an educated guess on the share
- Note, that the benefits of the adaptation to the effects of negative externalities (such as climate change adaptation or treatment of diseases) involve no or only minor cross-country externalities. Vulnerability to the effects of negative externalities, though, may justify the allocation of concessional resources according to different considerations of global justice related to GPGs and external effects.

Example CCM: All (net) benefits from CO₂ emission reduction on climate can be assumed to be global externalities

Example Biodiversity: For tropical forests, analyzing the channels of valuation, ca. 1,500 US\$/ha. can be assumed to be national benefits, and 3,500 US\$/ha. the value of the cross-country externalities.

[Example CBA for South Africa Project](#)

[Data Sources for Unit Measures](#)

[Overview of GPG costs and benefits](#)

[Back to tool](#) ◀

Global Costs (Target)

What is the cost of achieving the overall goal?

- Method: Again, rely on scientific studies
- These need to assume best available technologies
- They will be typically derived from aggregating unit values
- Cost should be expressed in comparison to alternative pathways/projects (“incremental costs”), and
- ...as the costs of providing the cross-country externalities. As costs for providing externalities and those of generating national benefits are often not explicitly distinguished in scientific studies, the latter need to be elicited and subtracted from the overall investment costs to determine the costs of providing externalities.

Example CCM: Roughly 5% of global GDP, or 5 trillion US\$ per year until 2050, then likely decreasing

Example Biodiversity: The yearly global financing gap is estimated at 711 billion US\$, which is less than 1% of global GDP

[Data Sources
for Unit Measures](#)

[Overview of GPG costs
and benefits](#)

[Back to tool](#) ◀

Unit Costs (1/2)

What is the cost of providing one unit of the GPG?

- Unit cost should correspond to the costs of providing the externality, net of national/private benefits and/or costs of alternative projects
- Likely to differ between different projects with same GPG provision level
- Two options for unit cost determination, see also next slide:
 - differentiated by units, which would be ideal to determine actual costs (panel a)), or,
 - the highest cost of the set of cheapest options to achieve the goal or a predetermined subset (panel b)), which corresponds to a (shadow) price to achieve the goal or predetermined subset

Example CCM:

- Marginal Abatement Cost Curve, many options already feasible at 20 US\$ per tCO₂eq.
- Optimal CO₂-price typically calculated as the highest cost of the cheapest set of options, landing at around 40-60 US\$ per tCO₂eq.

Example Biodiversity:

- While restoration and management costs for tropical forest areas are negligible, the opportunity costs of foregone yearly farming income lie at 200-250 US\$/ha.

[Cost-Benefit Analysis](#)

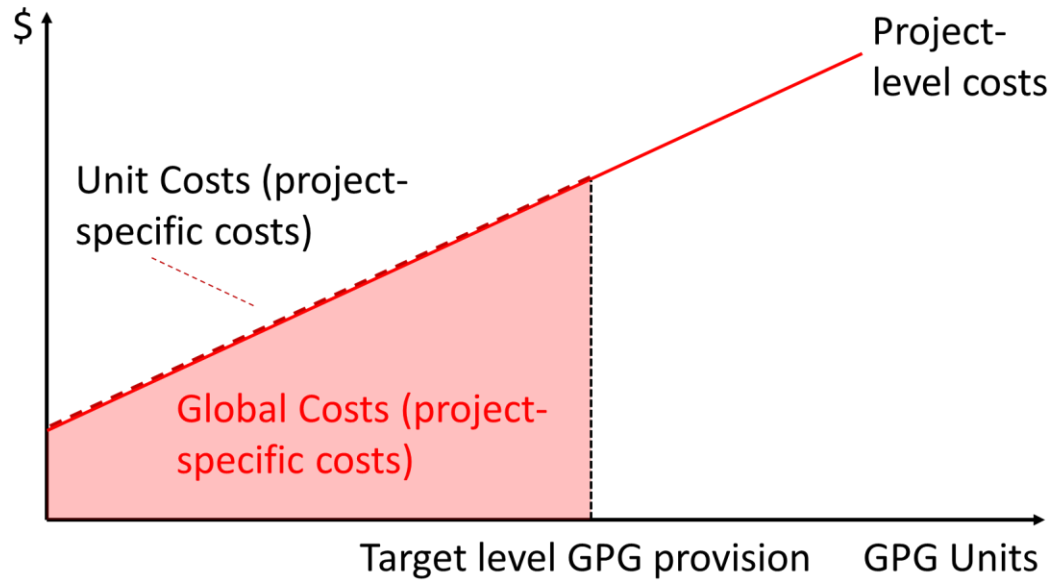
[Example CBA for South Africa Project](#)

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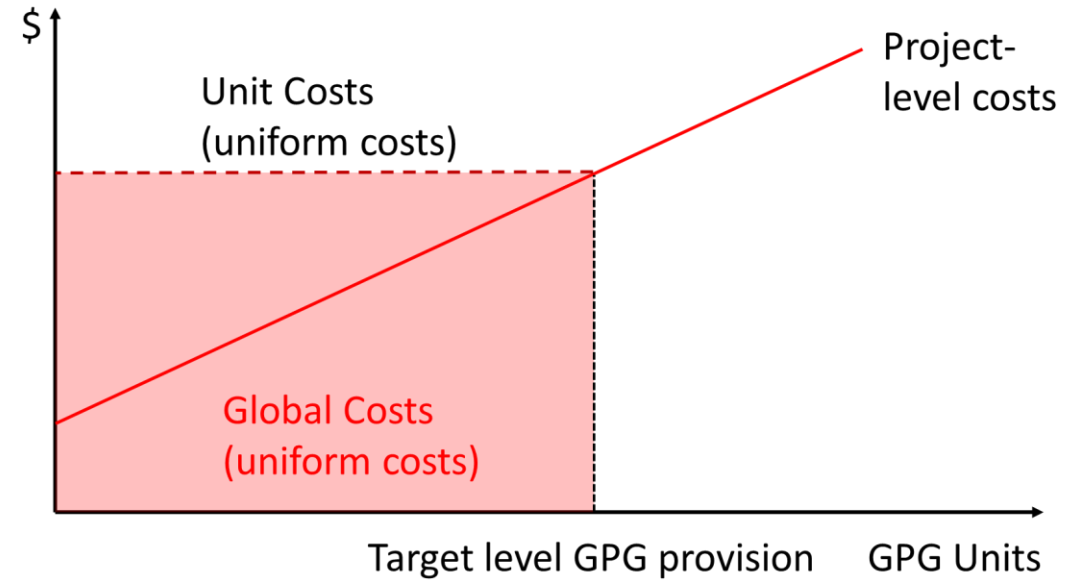
[Overview of GPG costs and benefits](#)

[Back to tool](#) ◀

Unit Costs to Global Costs (2/2)



a) Project-specific cost determination



b) Uniform cost determination

Knowledge Products (1/3)

- To ensure accountability in its efforts towards supporting GPGs, World Bank *reports and advisory services and analytics (ASA)* could include the amount of externalities that were helped to provide through its activities in the respective areas.
- The most important metric to this end should be the *value* of the externalities of the provided GPGs, which can be higher than the costs of the provision. The latter can help contextualize the provision and its impact.

The advantage of reporting the supported (cross-border) externalities applies to

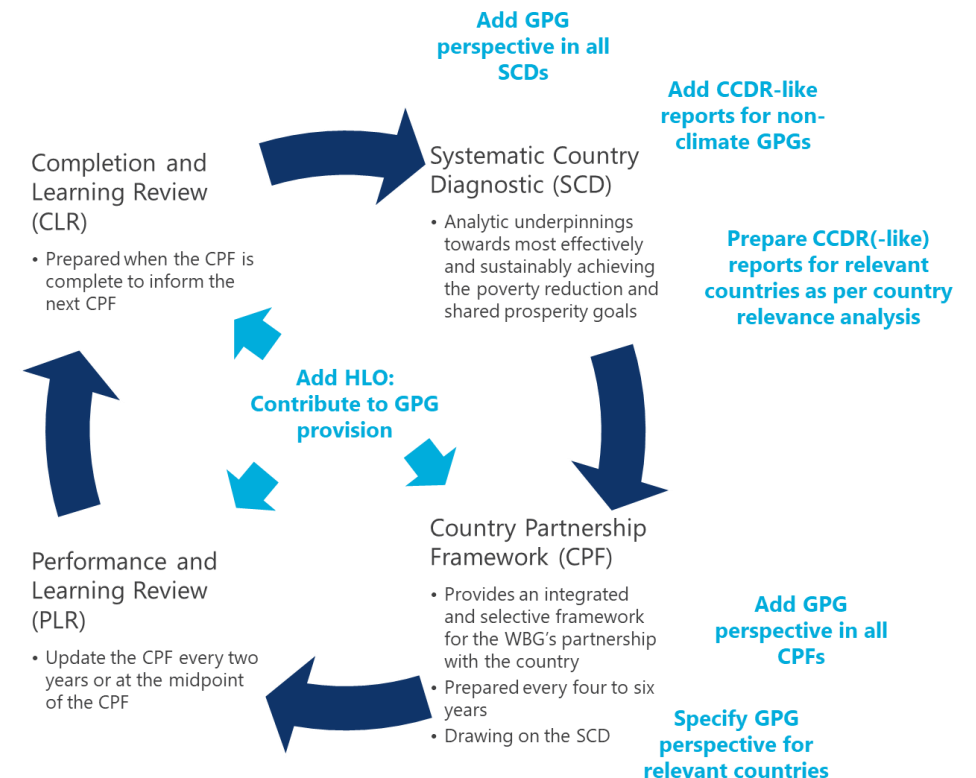
- **Overall reporting** on the achievement of the World Bank such as the World Bank Group's Corporate Scorecards and the IDA RMS
- **Topical reports** with global perspective such as the Changing Wealth of Nations Report, which could consider wealth as pertains to cross-country externalities or other topical reports by the World Bank's Global Practices that publish a wide range of analyses on GPG-related topics, but also reports on operationalising global agreements on the country level could benefit
- **Instrument-specific reports** such as those of the respective trust funds which could potentially be one administrative anchor for GPG-specific support or other instrument-related IEG learning products
 - The GEF, for example, already reports outcomes of its activities in environmental terms in its Monitoring Reports. Underpinning this with actual values that were thereby generated would substantiate the effectiveness even more.

Knowledge Products (2/3)

The advantage of reporting the supported (cross-border) externalities applies to *(continued)*

- **Country-level reports**, such as the SCDs, PLRs, and CLRs, but also topical, such as in CCDRs or similar products for other issue areas to connect global goals to country priorities
 - SCDs and CPFs are central to identify and articulate (i) the overlap between GPGs and national priorities; and (ii) actions that maximise the overlap between country priorities and GPGs as additional high-level outcomes
 - CCDRs can help in convening development partners and private sector to discuss policy and financing priorities and consider global climate goals in local action
 - Data reporting in PLRs and CLRs support the Bank to assess contribution to countries' harmonised learning outcomes (HLOs) and global results frameworks and help country programs to add up to global results

World Bank Country Engagement Cycle



[Back to tool](#) ◀

Knowledge Products (3/3)

The advantage of reporting the supported (cross-border) externalities applies to *(continued)*

- **Project-specific reporting** in project appraisals and cost-benefit analyses as well as in **project-specific Advisory Services and Analytics**
 - Increasingly including assessments of GPG provision, provided externalities, and estimated costs in project appraisals would make the prospective benefits from investment in GPGs more visible
 - Project-level metric of GPG benefits ensures project selection and design factors in GPG priorities
 - Incorporating GPG benefits into cost-benefit reasonings and better understanding how cross-country benefits might affect the desirability of a project to the borrowing country can help design better projects
 - Using valuation of GPG benefits and differentiation between national and cross-country externalities to convince country partners on the desirability of ambitious GPG projects via ASA
 - Understanding the need for concessional funding at project level if a project is desirable from a global perspective but fails to have a positive cost-benefit relation at the national level (see also Allocation of Concessionality in CEM)

[Back to tool](#) ◀

Prioritisation of GPGs

Value and costs of GPG provision can inform the selection of GPGs to be incorporated into procedures at the World Bank and their prioritisation:

- High value at comparably low(er) costs is a necessary condition for action of the World Bank (*profitability*)
- In order to be relevant for the achievement of the World Bank's twin goals, their benefits have to be accruing in developing countries (*mandate*)
- In order for World Bank activities to make a difference, they have to address an existing financing gap in the World Bank's client countries (*client country financing gap*)
- Incorporation of GPG considerations into project selection can be most efficient, the better the World Bank can leverage synergies in GPG provision, through providing background knowledge work, share best practices, and generate cross-country exchange (*convening power*)
- All projects or policies must ultimately be implemented at the country level and create synergies with national development goals, which is why the World Bank best anchors all additional financial support also within its country programmes

[Back to tool](#) ◀

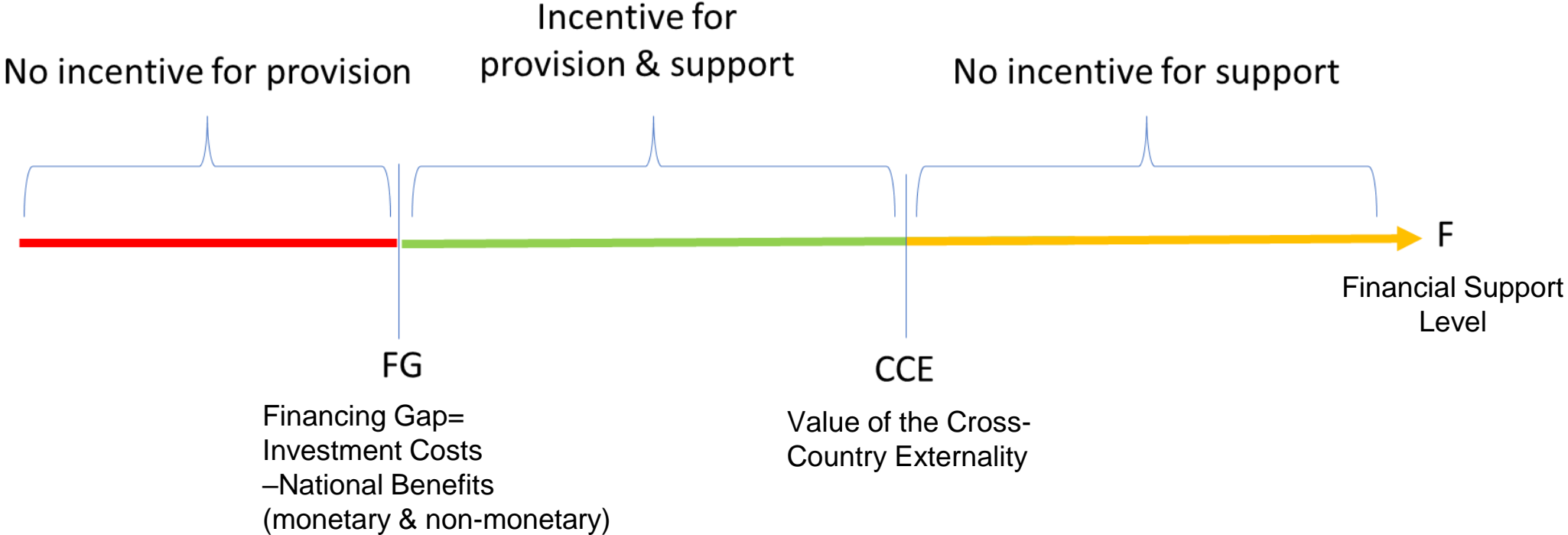
Uniform Support (1/2)

A uniform support level in grants – or the net present value equivalents of other concessional finance – per unit provision of cross-country externalities (CCE) would be a simple and efficient way of having them accounted for in country-level decisions on which projects to implement:

- Any financial support, F , should be warranted per provision of a CCE.
- Any financial support up to the value of the CCE results in a higher value from the generated externality than the support costs, so the World Bank should have an incentive to provide it.
- Any financial support greater than the costs of the provision of the externality (the financing gap, FG) should already be enough to incentivise countries to take GPG considerations into account, and levels close to FG are thus more cost-efficient to the World Bank, see [next slide](#).
- Even lower financial support levels per externality provision than the costs may be sufficient, as countries can have other (non-monetary) benefits and an intrinsic incentive to keep their commitments towards international agreements
- The predicted provision of GPG externalities by a project or policy needs to be assessed for its plausibility. For non-measurable outcomes, the theory of change of a project or policy can give an indication of the impact in terms of GPG externalities, which can in any case only be estimated.

[Back to tool](#) ◀

Uniform Support – Range of Efficient Financial Support Levels (2/2)



For an extensive discussion of the concepts involved and their application in a cost-benefit analysis, see: Oxford Economics, "Multilateral Development Banks for Global Public Goods", available at www.oxfordeconomics.com

[Definition of Effective Financial Support Levels](#)

[Back to tool](#) ◀

Project-specific Support

The costs of provision of the GPG, i.e., the financing gap of a GPG project with externalities, could also be compensated for on a project-by-project basis.

- This would inhibit windfall gains for very efficient projects or policies, which would accrue with uniform support, and would thus be – for a given set of projects or policies – more cost-efficient for the World Bank.
- It would require a detailed cost-benefit analysis, which would have to be controlled by the World Bank.
- However, no prior explicit knowledge of the unit costs or the value of the benefits would be necessary, other than a broad understanding of the maximum values that are still be desirable to finance, as given by the CCE (see [previous slide](#)).
- GPG projects would still be oversubsidized, for the countries have own interest in keeping their international commitments. This could be accounted for by a general rule that only a certain percentage of the actual financing gap is compensated as financial GPG support.
- However, this procedure is not incentive-compatible with most cost-efficient provision of GPGs, as there are equal incentives to propose very efficient and less efficient projects or policies of a very different nature.

Auction of Support

To auction financial support per unit of GPG provision – such that those projects or policies that declare to provide the GPG at the lowest possible cost receive the support – would combine the advantages of uniform and project-specific support, although being potentially more administratively demanding:

- It allows to support projects with the smallest financing gap, which they will declare in order to maximise their chances to receive the support.
- At the same time, it sets incentives to only apply with the most efficient projects or policies.
- If integrated in the Country Partnership Framework programming in an early stage, plannings could be made depending on receiving the support.
- Cost-benefit analysis would be necessary as information for the programming of the client country but does not need to be checked back by the Bank, and no prior knowledge of the true benefits and costs of the externalities is required by the World Bank.
- Also, limited fixed budgets could be accounted for.

[Back to tool](#) ◀

Allocation of Concessionality in CEM (1/2)

- Systematic Country Diagnostics must incorporate GPG perspective, and identify relevant GPGs for client countries
- Country Partnership Framework needs to include GPGs in strategic prioritisation process, and identify GPG-related projects in client countries
- Projects or policies with large national benefits but large funding needs can be eligible for additional standard concessional financing
- Higher levels of concessionality could be available for ambitious GPG projects or policies. The allocation of concessionality could be based on (i) the ambitious GPG project's external benefits and/or avoided external costs, (ii) and/or the national costs of the ambitious GPG project
- Incentives of Country Offices must be aligned with GPG targets

[Back to tool](#) ◀

Allocation of Concessionality in CEM (2/2)

- In addition to the country envelope system, GPG funds (of both standard and higher concessionality) can be allocated on the...
 - Country level: based on relevance of the respective countries for GPG provision
 - Advantages: Close to CEM procedures
 - Disadvantages: Most relevant countries may not be the ones with most cost-effective GPG provision, efficiency through auctioning or uniform support only within, not between countries
 - Project/Policy level: based on funding needs for given provision of GPG
 - Advantages: Ensures efficient allocation of funds for most effective GPG provision
 - Disadvantages: More difficult to implement, funding eligibility potentially unclear in project preparation stage



Appendix

Aggregator Technologies - Examples

GPGs	Aggregator technology	Prognosis	Recommendations
Climate change mitigation	Summation: Overall level of GPG equals the sum of the countries' contributions.	Free-riding tendency stems from the perfect substitutability of contributions. The general tendency is for under-provision.	Multilateral organisations or rich countries need to assume leadership for GPG provision. Multilateral institutions need support supply. Grants and loans are needed to support provision.
Preservation of biodiversity	Weighted sum: Overall level of public good equals a weighted sum of the countries' contributions.	Less of a tendency for under-provision since one country's provision is not a perfect substitute for that of another country. Countries with larger impacts are incentivised to act.	Multilateral organisations need to support efforts (e.g., funds) among only those countries with fewer country-specific benefits. Institutions monitor to gather information on countries' supply influence. Spatial considerations may be essential.
Pandemic preparedness	Weighted sum: Overall level of public good equals a weighted sum of the countries' contributions.	Less of a tendency for underprovision since one country's provision is not a perfect substitute for that of another country. Countries with larger impacts are incentivised to act.	Multilateral organisations need to support efforts (e.g., funds) among only those countries with fewer country-specific benefits. Institutions monitor to gather information on countries' supply influence. Spatial considerations may be essential.
Preventing violent conflict	Best shot: Largest contribution by a country determines the good's aggregate level.	Global income inequality promotes provision. Multiple best shooters result in a coordination problem. Poor regions may not possess the best shooter.	Rich or dominant country fosters provision. Multilateral organisations and others can pool and coordinate actions and put supply efforts where prospects and resources are expected to have the greatest success.
Free trade	Weakest link: Smallest contribution of the world's countries determines the GPG's aggregate level.	Efficient if countries possess the same tastes and GDP. More equal income distribution promotes provision. Matching contributions are desired. There is a need to shore up weakest links, which poses free-riding concerns.	Global institutions, dominant countries, partnerships, and others can assist weakest-links countries. Capacity building in poorer countries is essential. Multilateral organisations can channel funds and direct actions to raise GPG levels to acceptable standards.
Stable financial architecture	Weaker link: Smallest contribution of all countries has the greatest influence on the GPG's aggregate level, followed by the second smallest, etc.	Efficient if countries are sufficiently similar. Matching and non-matching behavioural outcomes are relevant. There is a reduced need to shore up weakest links.	Some capacity building is required. Multilateral organisations should support international standard implementation.

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Data Sources (1/7): Climate Change Mitigation

Indicator	Operationalisation	Level of measure	Data sources	Institution
Total GHG emission (CO2 equivalents), annually	kt Co2e emitted	Country	GHG Emission Data	Climatewatch
Total GHG emission (% change from 1990)	%	Country	World Bank estimates from: EC JRC / NL PBL / EDGAR	World Bank
Co2 emission per capita	Metric tonnes per capita	Country	GHG Emission Data	Climatewatch
Co2 intensity GDP	kg per PPP \$ of GDP	Country	GHG Emission Data	Climatewatch

[Back to tool](#)[Back to Optimal Provision Level](#)[Back to Definition of Units](#)[Back to Global Value](#)[Back to Unit Value](#)[Back to Global Costs](#)[Back to Unit Costs](#)

Data Sources (2/7): Preservation of Biodiversity

Indicator	Operationalisation	Level of measure	Data sources	Institution
Area of protected areas	sqkm / ha	Country	<u>World Database on Protected Areas</u>	UNEP-WCMC / IUCN / WCPA
Area of land cover by type	sqkm / ha	Grid	<u>Copernicus</u>	European Commission
Habitat management	Scorecard	Site	<u>World Database on Protected Areas</u>	UNEP-WCMC / IUCN / WCPA
Biodiversity Habitat Index	Combined Index	Country	<u>Environmental Performance Index</u>	Yale University

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Data Sources (3/7): Pandemic Preparedness

Indicator	Operationalisation	Level of measure	Data sources	Institution
Global Health Security Index	Index	Country	GHS Index	Johns Hopkins Center for Health Security
IHR Monitoring and Evaluation Framework for Annual Reporting Indicators and Joint External Evaluation Reports	Indicators	Country	National self-reporting	WHO
Hospital beds	Absolute number of beds per 1000 people	Country	Data are from the World Health Organization , supplemented by country data.	WHO
Population fully vaccinated	%	Country	Centers for Covid Impact, CDC	Johns Hopkins University

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Data Sources (4/7): Prevention of Violent Conflict

Indicator	Operationalisation	Level of measure	Data sources	Institution
Global Peace Index	Combined index	Country	IEP Data	Institute for Economics and Peace
Battle-related deaths	Absolute number	Country	Uppsala Conflict Data Programm	Uppsala University
Armed conflict and conflict risk	Risk index	Country and sub-national	Conflict Forecast	Institute for Economic Analysis
Global Conflict Risk Index	Risk index	Country	Joint Research Centre	EU
Classification of Fragile and Conflict-Affected Situations	Classification	Country	Combined Sources, e.g., harmonised CPIA score, UN Peacekeeping, ACLED, UCDP, etc.	World Bank

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Data Sources (5/7): Free Trade

Indicator	Operationalisation	Level of measure	Data sources	Institution
Import tariffs	ad valorem	product level or weighted average by country	<u>WTO tariff data</u>	WTO
Trade volume	Trade share of GDP	Country	<u>UN Comtrade</u>	UN
Trade Facilitation Index	Combined Index	Country	<u>OECD Trade Facilitation Index</u>	OECD

[Back to tool](#)[Back to Optimal Provision Level](#)[Back to Definition of Units](#)[Back to Global Value](#)[Back to Unit Value](#)[Back to Global Costs](#)[Back to Unit Costs](#)

Data Sources (6/7): International Tax Cooperation

Indicator	Operationalisation	Level of measure	Data sources	Institution
Corporate tax rates	Tax rate	Country	<u>Corporate Tax Rates Around the World Database</u>	Tax Foundation
Implementation level of Common Reporting Standard	Scale 1-4	Country	<u>Global Forum on Transparency and Exchange of Information for Tax Purposes</u>	OECD
Profits shifted in or out	\$	Country	<u>Missing Profits Database</u>	UC Berkeley, UCopenhagen

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Data Sources (7/7): Stable Financial Architecture

Indicator	Operationalisation	Level of measure	Data sources	Institution
Financial Soundness Indicators	Index	Country	<u>Combined</u> from Macro-economic and Financial Data	IMF
Capital Flows and Stocks	\$	Country	<u>International Financial Statistics</u>	IMF

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Metrics (1/7): Climate Change Mitigation

Optimal Provision Level	Relatable Units of Provision	Global Value of Achieving the Provision Level	Global Costs of Provision	Unit Value and Cross-Country Externalities	Unit Costs
Limiting global warming to below 2 °C from Paris Agreement	Tonnes of CO ₂ eq. emitted	Ca. 10% of global GDP by 2100, likely increasing afterwards	Ca. 5% of global GDP until 2050, decreasing afterwards	US\$307 per tCO ₂ eq., all of which can be assumed to be cross-country externalities	CO ₂ prices of up to US\$100 would likely be sufficient, but many options start from US\$20 per tCO ₂ eq.

For a discussion of the definitions and sources, see: Oxford Economics, "Multilateral Development Banks for Global Public Goods", available at www.oxfordeconomics.com

Metrics (2/7): Preservation of Biodiversity

Optimal Provision Level	Relatable Units of Provision	Global Value of Achieving the Provision Level	Global Costs of Provision	Unit Value and Cross-Country Externalities	Unit Costs
Stop the loss of biodiversity habitats, from Kunming-Montreal Global Biodiversity Framework, Convention on Biological Diversity	Hectare of specific biomes preserved (can be under protection)	At current degradation rates, yearly harm of the equivalent of 50% of global GDP within 50 years is likely	Ca. 1% of global GDP per year	Depending on biome, 1 ha. of tropical forest has yearly value of roughly US\$5,000, of which US\$3,500 are cross-country externalities	Depends on biome, but opportunity costs of farming are about 200- US\$250 per ha. per year, management costs are negligible

For a discussion of the definitions and sources, see: Oxford Economics, "Multilateral Development Banks for Global Public Goods", available at www.oxfordeconomics.com

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Metrics (3/7): Pandemic Preparedness

Optimal Provision Level	Relatable Units of Provision	Global Value of Achieving the Provision Level	Global Costs of Provision	Unit Value and Cross-Country Externalities	Unit Costs
Effective pandemic preparedness, from the International Health Regulations of the WHO	Units can be derived from indices of pandemic preparedness (see Table 28), or as investment in predefined interventions	US\$237 billion equivalent of harm per year on average before Covid, with US\$3.5 trillion of yearly global harm from Covid over 6 years	Between 2 and US\$45 billion per year	<p>Unit Values and Costs of pandemic preparedness cannot be assessed differently from the country level, at which global values can be related to overall gaps in the respective (index) measure.</p> <p>Predefined interventions could be valued at the benefit per investment, which is between US\$10 and US\$100.</p> <p>Preventing the emergence of a global pandemic can be viewed as a cross-country externality completely.</p>	

For a discussion of the definitions and sources, see: Oxford Economics, "Multilateral Development Banks for Global Public Goods", available at www.oxfordeconomics.com

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Metrics (4/7): Prevention of Violent Conflicts

Optimal Provision Level	Relatable Units of Provision	Global Value of Achieving the Provision Level	Global Costs of Provision	Unit Value and Cross-Country Externalities	Unit Costs
Abolish cross-border violent conflicts from UN Charter, but no clearly defined goal for intrastate conflicts	Units can be derived from Indices of Peace (see Table 28), or as investment in predefined interventions	Equivalent to more than 10% of global GDP of harm per year through all conflicts, most through intrastate conflicts, or US\$300 billion in the most conflict-affected states.	Around 20 billion per year would be needed to limit conflicts in the most conflict-affected states of the world	Unit Values and Costs of prevention of violent conflicts cannot be assessed differently from the country level, at which global values can be related to overall gaps in the respective (index) measure. Predefined interventions could be valued at the benefit per US\$ of investment, which is around US\$16. About 40% of the overall benefit of conflict prevention are made up of cross-country externalities.	

For a discussion of the definitions and sources, see: Oxford Economics, "Multilateral Development Banks for Global Public Goods", available at www.oxfordeconomics.com

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Metrics (5/7): Free Trade

Optimal Provision Level	Relatable Units of Provision	Global Value of Achieving the Provision Level	Global Costs of Provision	Unit Value and Cross-Country Externalities	Unit Costs
Reciprocal market access, as outlined in regulations of the WTO, and also trade facilitation, but no quantitative goal set	Import tariffs for market access. Costs of trading for trade facilitation.	Global trade war would lead to reduced global GDP of roughly 2%. Reducing cross-border transaction costs by 50% could result in an increase in global GDP by about 1-2%.	No costs for countries suggested on average for guaranteeing market access, but distributional consequences Costs for reducing cross-border transaction costs by 50% would cost roughly US\$12-48 billion in developing countries.	On the country-level, only national benefits of ensuring market access can be assessed, such that unit values for cross-country externalities can not be attributed. Benefits and costs of trade facilitation measures can be derived from global values as reductions of trading costs in %.	

For a discussion of the definitions and sources, see: Oxford Economics, "Multilateral Development Banks for Global Public Goods", available at www.oxfordeconomics.com

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Metrics (6/7): International Tax Cooperation

Optimal Provision Level	Relatable Units of Provision	Global Value of Achieving the Provision Level	Global Costs of Provision	Unit Value and Cross-Country Externalities	Unit Costs
Abolishing Base Erosion and Profit Shifting as laid out in the OECD BEPS Project Guarantee exchange of tax-relevant information, set forth by the Global Forum on Transparency and Exchange of Information for Tax Purposes by the OECD	Corporate tariff rates Tax transparency/haven scores	No aggregate gains, but US\$646 billion of profits shifted per year, implying a public revenue loss of US\$155 billion	Gains are mirrored by losses in tax havens, although related public revenues are smaller by the factor of the lower tax rates (likely less than US\$80 billion).	Tax rate reductions alone do not hold as GPG provision, but global value can be divided by the aggregate gap in index measures to determine individual country contributions. Benefits are all cross-country externalities.	

For a discussion of the definitions and sources, see: Oxford Economics, "Multilateral Development Banks for Global Public Goods", available at www.oxfordeconomics.com

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Metrics (7/7): Stable Financial Architecture

Optimal Provision Level	Relatable Units of Provision	Global Value of Achieving the Provision Level	Global Costs of Provision	Unit Value and Cross-Country Externalities	Unit Costs
Financial stability should be ensured by adhering to the FSB Standards.	Increase in capital requirements to levels prescribed by Basel III is a central proxy for adherence to the standards, but other composite indicators of financial stability are available	4% of global GDP lost yearly due to financial crisis of 2008/9 over five years after the crisis, with long-run effects of 1.6% of GDP	Tighter banking regulation is estimated to reduce GDP by 0.8%.	Increased GDP through averted crisis already applies in the originating countries, but cross-country externality depends on a country's financial interdependence with the world	Administrative costs are negligible, such that GDP effects are also costs of increased banking regulation (0.32% of GDP per percentage point of increased bank capital requirements)

For a discussion of the definitions and sources, see: Oxford Economics, "Multilateral Development Banks for Global Public Goods", available at www.oxfordeconomics.com

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Cost-Benefit Analysis with Externalities (1/2)

- Without cross-country externalities considered, a project or policy would be pursued if national benefits exceed the investment costs, i.e., if there is a positive national profit, $NP > 0$:

$$NP = NB - IC \quad (1)$$

- When there exist cross-country externalities, the global profit exceeds the national benefits by the value of the cross country externalities:

$$GP = CCE + NB - IC \quad (2)$$

- From a global perspective, the project or policy can be profitable, i.e., $GP > 0$, although the national profit is negative, and the project is not pursued without further incentives

[Definition of Effective Financial Support Levels](#)

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Definitions

Variable	Name	Explanation
NP	National Profit	What remains for a domestic country if it pursues a project's net of all costs
NB	National Benefit	The gross benefit of a project for the implementing country, can be the equivalent of non-monetary benefits
IC	Investment Costs	All investment (and operating) costs of a project for the implementing country (including all extra costs, such as social compensation, etc., and also potentially non-monetary costs)
GP	Global Profit	The net gain from pursuing a project for the world
CCE	Cross-country externalities	The benefits for other countries than the one in which the project is pursued

Cost-Benefit Analysis with Externalities (2/2)

- A project or policy is thus (globally) worthwhile to pursue, whenever its (global) benefits exceed the costs, i.e., if the global profit GP are positive
- The definition of "Costs", and "Benefits" of a project or policy depend on how the above condition is defined, which can take the following forms, which are identical in their implication:

$$\underbrace{CCE + NB}_B > \underbrace{IC}_C \quad (3)$$

$$\underbrace{CCE}_B > \underbrace{IC - NB}_C \quad (4)$$

- According to Equation (3), benefits are national benefits and cross-country externalities taken together, which must then be contrasted with the investment costs
- According to Equation (4), benefits are only cross-country externalities, which have then to be contrasted with the investment costs net of national benefits

[Definition of Effective Financial Support Levels](#)

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Definitions

Variable	Name	Explanation
B	Benefit	The gross benefits of a project, independent of the costs, either only outside the country or all affected, depending on the definition
C	Costs	The costs of pursuing a project can be gross or net of national costs, depending on the definition

Project Example: Eskom Just Energy Transition Project in South Africa (1/2)

- The project aims at the following objectives, which also translate into the project's components: (A) decommission the Komati coal-fired power plant, (B) repurpose the project area with renewables, and (C) create opportunities for workers and communities during the transition process.
- The project costs (IC) sum up to US\$497 million.
- The national benefits of the project, through renewable energy supply and others, are valued at US\$306 million.
- Roughly 5,500,000 tCO₂eq. will be emitted less compared to the alternative if the project were not pursued.
- Taking a value of US\$ 307 per tCO₂eq. – of which all can be assumed to be cross-country externalities, the value of the cross-country externalities, CCE, can be assessed at US\$1,688 million.
- The financing gap, FG of the project is given by US\$497 million - US\$306 million = US\$ -191 million.
- The value of financial support through Trust Funds grants (US\$ 57.5 million) and an IBRD credit (value of concessionality of US\$ 78 million for a US\$ 439.5 million credit) summed to US\$ 135.5 million

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

CBA

Position	Number in US\$ million
IC	497
NB	306
NP	-191
CCE	1,688
FG	-191
F	135.5
PO	-55.5

Project Example: Eskom Just Energy Transition Project in South Africa (2/2)

- Although the financial support level was smaller than the monetary financing gap in this project would have been, the project was conducted nonetheless.
- This implies that there was an additional, non-monetary national benefit from pursuing the project for the South African government, such as that of keeping the commitments towards the Paris Agreement.
- The value of this additional national benefit must have been at least the equivalent of the remaining negative payoff, i.e., US\$ 55.5 million, and would in theory increase the national profit (to more than US\$ -135.5 million), and thus reduced the respective financing gap (to less than US\$ 135.5 million), so that the overall national payoff was greater than zero.
- In the end, one tCO₂eq. emission reduction was externally financed by US\$ 25 (US\$ 135.5 million / 5,500,000 tCO₂eq.).

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

Formal Definition of Effective Financial Support Levels

- In order to incentivise the provision of cross-country externalities, financial support may be granted to implementing countries
- With additional financial support of the value F , the overall national payoff PO for the implementing country is given by:

$$PO = F + NB - IC \quad (5)$$

- It would thus be willing to pursue the project or policy if

$$F > IC - NB \quad (6)$$

- This level can also be defined as the "Financing Gap", FG , of a project or policy

$$FG = IC - NB \quad (7)$$

Definitions

Variable	Name	Explanation
PO	National Payoff	The payoff for an implementing country after all things that are of its direct concern, are accounted for
F	Financial Support	The financial support that is given to an implementing government upon pursuing a project or policy (either explicitly through grants of implicitly through the value of concessional loans)
FG	Financing Gap	The necessary financial support level in order to incentivise the implementing government to pursue the project or policy

[Back to Cost-Benefit Analysis](#)

[Back to Range of Efficient Financial Support Levels](#)

[Back to tool](#)

[Back to Optimal Provision Level](#)

[Back to Definition of Units](#)

[Back to Global Value](#)

[Back to Unit Value](#)

[Back to Global Costs](#)

[Back to Unit Costs](#)

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