Climate Change Policy Brief

Can climate vulnerability and risk be measured through global indices?

September 2017

This policy brief ...

This policy brief addresses the difficulties of determining vulnerability through global indices and gives recommendations on how to use and interpret them including in the international climate policy context. The policy brief is based on a comparison of country rankings of four common vulnerability and risk indices.

Vulnerability indices are not appropriate for identifying particularly vulnerable countries through country rankings

Reducing vulnerability to the adverse effects of climate change is one part of the global goal on adaptation established by the Paris Agreement. Vulnerability is a broad concept with varying conceptualisations and there is no objective way of measuring it. A number of global indices exist which select certain indicators to quantify and compare the vulnerability of countries. However, the results of different vulnerability indices vary strongly and it is practically impossible to determine the most vulnerable countries. One reason is the divergent design of indices, which follows many normative, conceptual and methodological assumptions and decisions. The results, therefore, are a product of the specific choice of indicators and their respective weighting. It becomes obvious that no single index can capture the multiple dimensions of vulnerability completely, but can only provide a preliminary assessment. Consequently, important political decisions should not be based solely on country rankings of vulnerability indices. Due to their conceptual limitations and differing results, they are not appropriate as sole basis for decision making on, for instance, international funding allocations that are supposed to be based on objective criteria. Instead, clustering countries into groups of similar levels of vulnerability or focusing the analysis on specific underlying indicators can provide useful information. Before using any index, it is important to understand its methodology and assess whether it fits the intended purpose.

Adaptation aims to reduce vulnerability, but vulnerability is not clearly defined and it cannot be objectively measured

The Paris Agreement established the global goal on adaptation (Article 7), aiming at enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change. Adaptation is recognised as a key component of the long-term global response to climate change and the needs of developing countries that are particularly vulnerable to the adverse effects of climate change are emphasised. The United Nations Framework Convention on Climate Change (UNFCCC) (Article 4.4) already pledges industrial countries to financially assist these particularly vulnerable developing countries, which is taken up again

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in the Paris Agreement (Article 6.6). However, neither the Paris Agreement nor the Convention specify or propose a mechanism to assess the level of vulnerability and its comparability. Instead, the Convention puts particular emphasis on specific developing country groups, such as least developed countries, small island development states or countries with low-lying coastal areas (Article 4.8 and 4.9). There is no uniform definition of vulnerability in the literature, and its meaning even changed between the Fourth and Fifth Assessment Reports of the IPCC.[i] Still, and also due to its explicit mentioning in the Convention and the Paris Agreement, it is pivotal for political discussions on adaptation and for implementation on the ground.

Results of different vulnerability indices vary strongly and cannot be used to reliably determine the most vulnerable countries

Indices around measuring vulnerability are constantly evolving and being developed for a variety of scales and purposes. A persistent observation when comparing the results of different indices is their strong divergence.[ii] Table 1 shows a comparison of the 20 most vulnerable countries across four different vulnerability and risks indices for the year 2015 (see box 1). The four indices were selected based on a number of criteria including multi-year coverage and open access of methodology and data. They consider a different number of countries. For instance, the Climate Risk Index (CRI) includes 134 countries in its analysis, whereas ND-GAIN comprises 181 countries in total. In its methodology, CRI emphasises an omission especially of small (e.g. Small Island Developing States) or politically unstable countries (e.g. Somalia) due to an insufficient availability of data. However, many of these countries are ranked high on other lists.

A comparison of the rankings shows that:

- Every index lists a different country first.
- No country appears neither on all nor on three of the four lists.
- Among 61 countries mentioned in total across the four lists, 19 appear twice (marked in bold). However, by looking at the top ten, eight countries appear twice, namely, Afghanistan, The Central African Republic, Chad, The Democratic Republic of Congo, Myanmar, Papua New Guinea, Sudan, Vanuatu and Yemen.
- Only The Central African Republic appears twice on the top 3 positions.

In sum, by looking at different vulnerability and risk indices it is not possible to determine which country is the most vulnerable. In contrast, the results show a high variability and a lack of validity across indices, meaning they either measure different things, or they measure a supposedly similar concept in different ways. Either way, the results of table 1 illustrate that the country rankings of the global indices need to be interpreted with care.

Designing indices is methodologically challenging and involves subjective judgements

To explain this divergence a closer look has to be taken on the methodological frameworks behind the different indices. In fact, global vulnerability and risk indices differ in many respects:

1. A variety of **different concepts of vulnerability** are being used, which is reflected in the four global indices named above. For instance, the IPCC has changed its definition of core concepts, such as vulnerability, and neighbouring concepts like resilience, exposure, risks, hazards, sensitivity or adaptive capacity throughout their assessment reports (AR). Many conceptualis-

Box 1: Description of four common Vulnerability and Risk Indices

- The **ND-GAIN Country Index** (University of Notre Dame Global Adaptation Index) measures vulnerability based on a country's exposure, sensitivity and capacity to adapt, and its readiness to leverage investments through a set of global indicators.
- The **Global Climate Risk Index**, designed by Germanwatch, analyses to what extent countries have been affected by the impacts of weather-related natural disasters (storms, floods, heat waves etc.) in a given year and on average since 1995.
- The **Index for Risk Management (INFORM)** is a global, open-source risk assessment index for humanitarian crises and disasters that could overwhelm national response capacity. It aims to support decisions about prevention, preparedness and response, and to measure how the conditions that lead to humanitarian crises and disasters affect sustainable development.
- The **World Risk Index** by a research group of UNU-EHS and partners indicates the risk of disasters in consequence of extreme natural events. It calculates the disaster risk by multiplying vulnerability (comprising susceptibility, coping capacity and adaptive capacity) with exposure to natural hazards.

Table 1: Comparison of top 20 countries of four vulnerability and risk indices for 2015 [1]

	ND-GAIN Country Index [iii]	Global Climate Risk Index [iv]	INFORM - Index for Risk Management [v]	World Risk Index [vi]
1	***Central African Republic***	Mozambique	Somalia	***Vanuatu***
2	***Chad***	Dominica	***Central African Republic***	Tonga
3	Eritrea	Malawi	***Afghanistan***	**Philippines**
4	**Burundi**	India	South Sudan	Guatemala
5	***Sudan***	***Vanuatu***	***Sudan***	Solomon Islands
6	***Yemen***	***Myanmar***	***Yemen***	**Bangladesh**
7	***Afghanistan***	Bahamas	Iraq	Costa Rica
8	***DR Congo***	Ghana	***DR Congo***	Cambodia
9	***Papua New Guinea***	***Madagascar***	***Chad***	***Papua New Guinea***
10	Mauritania	Chile	***Myanmar***	El Salvador
11	**Uganda**	**Pakistan**	Mali	Timor-Leste
12	**Haiti**	Micronesia	Syria	Brunei Darussalam
13	**Guinea-Bissau**	**Philippines**	Nigeria	Mauritius
14	**Niger**	**Zimbabwe**	**Uganda**	Nicaragua
15	Congo	**Burundi**	Ethiopia	**Guinea-Bissau**
16	Liberia	France	**Pakistan**	Fiji
17	**Madagascar**	Oman	Kenya	Japan
18	Angola	FYR Macedonia	**Haiti**	Viet nam
19	**Zimbabwe**	Italy	**Bangladesh**	Gambia
20	Lesotho	Australia	**Niger**	Jamaica
Total	**181**	**134**	**191**	**171**

Explanation: The final row lists the number of countries included by the respective index. Countries in **bold** appear twice among the top 20, countries in **bold** and *italics* appear twice even among the top 10.

ations of vulnerability are based on the Fourth AR definition of 2007 that connects vulnerability to exposure, sensitivity, and adaptive capacity (see ND-GAIN and World Risk Index). In contrast, the Fifth AR from 2014 puts more emphasis on the concepts of risk and resilience, placing vulnerability next to hazards and exposure as a defining category.[2] Both concepts are legitimate, but obviously the different conceptualisations produce different results.

2. **Vulnerability can relate to different problems.** By looking at the four exemplary indices, the first two have a particular climate change focus, whereas the last two include geophysical risks (such as earthquakes and tsunamis) which are unrelated to climate change.

[1] The latest data for all four indices was only available for 2015.

[2] The Vulnerability Sourcebook (GIZ 2014/2017)[xiii] initially based its approach on the AR4 conceptualisation of vulnerability and recently received a supplement[xiv] to also use it based on the AR5 concept.

Box 2: Composition of indicators of the four vulnerability and risk indices:

- **ND-GAIN Country Index:** 45 indicators on six sectorial main categories: Food, Water, Health, Ecosystem Services, Human Habitat and Infrastructure, each containing three subcategories (exposure, sensitivity and adaptive capacity). In addition, one main category on readiness with economic, governance and social subcategories.
- **Global Climate Risk Index:** Four indicators, namely (1) Number of deaths, (2) Number of deaths per 100 000 inhabitants, (3) Sum of losses in US$ in purchasing power parity, (4) Losses per unit of Gross Domestic Product.
- **INFORM - Index for Risk Management:** 48 indicators on three main categories: Hazard & Exposure, Vulnerability and Coping Capacity.
- **World Risk Index:** 28 indicators on four main categories: Exposure, Susceptibility, Coping Capacity, Adaptive Capacity.

3. Indices can be based on **different assessment approaches.** Top-down approaches focus on managerial and institutional capacity by looking on national indicators, whereas bottom-up approaches focus on local development and implementation performances.
4. A **trade-off exists between global comparability and local context.** The Paris Agreement emphasises that 'adaptation action should follow a country-driven, gender-sensitive and participatory approach, guided by the best available science and, as appropriate, including knowledge of indigenous people and local knowledge systems' (Article 7.5). However, most global indices rely purely on indicators for which data is available at the national level. Especially for global comparisons, an integration of different local knowledge systems proposes great methodological challenges.

The design of an index involves many normative, conceptual and methodological assumptions and decisions. Even for a similar definition of vulnerability, the selected indicators and the data in consideration can differ vastly, and so will the results. Therefore, designing an index and selecting indicators involves value judgements and is not an easily quantifiable reflection of a specific system or natural situation.[vii] On this basis, one index cannot per se be considered as 'better' or 'worse' than another. Its suitability greatly depends on the specific context and purpose it is designed or applied for. Full transparency of the methodology of calculating an index is therefore essential. However, many indices lack a sound conceptual framework with a clear focus, a robust methodology, a sensibility to alternative approaches and full transparency of the data used.[viii]

Indices are not appropriate for informing funding decisions

Merging several different indicators to produce one final value of vulnerability entraps to rank countries accordingly. The Paris Agreement, in referring to the UNFCCC, stipulates the assistance and coverage of costs for developing countries that are particularly vulnerable to climate change. Within the international community, there are recurrent calls to use vulnerability indices for a conformable allocation of funds. Although indices are one possibility of informing funding allocations, it is important to keep in mind that there is **no objective way of measuring vulnerability,** so the funding decision (or the choice of an index) will ultimately remain a political one.

No single index can capture the multiple dimensions of adaptation. The determinants of vulnerability are complex, context-specific and dynamic and go far beyond a single measurable value, like tonnes of CO_2-equivalents in the case of climate mitigation.[ix] Vulnerability indices can only capture a small part the multi-dimensional scope of adaptation as it is defined in the Paris Agreement. The results of indices are the product of the specific value-laden choice of indicators and their weighting.

No international climate fund is basing its allocation decisions exclusively on vulnerability indices. No internationally accepted mechanism has been established for allocation of funds according to the level of vulnerability. In fact, important international climate funds such as the LDCF and SCCF under the Global Environment Facility (GEF), the GCF or the Adaptation Fund do not directly base their allocation policy on indicators or vulnerability indices.

An online platform to support adaptation to climate change: AdaptationCommunity.net offers insights into different topics:

- Mainstreaming & NAP
- Climate Information & Services
- Vulnerability and Climate Risk Assessments
- Loss & Damage
- Ecosystem-based Adaptation
- Monitoring & Evaluation
- Private Sector Adaptation

Publications, tools and videos on climate change adaptation are available. Detailed information on the training courses 'NAP country-level training' and 'Adaptation monitoring and evaluation (M&E)' as well as a tool to analyse the adaptation components of NDCs can also be found online. AdaptationCommunity.net is continuously expanding its resources and offering regular webinars to provide users with the latest information, country experiences and adaptation tools.

Indices do not reflect current political situations.
Vulnerability indices do not directly account for current political contexts such as conflicts, but these circumstances are of critical importance for funding decisions. Therefore, an in-depth reflection on the current political situation is vital before taking political decisions.

In their 5th AR, the IPCC concludes that 'both theory and practice have shown indices alone are not sufficient to guide decisions on which adaptation actions to take, [...] or on resource allocation' as no single metric can capture the multiple dimensions of adaptation.[i] In sum, indices cannot replace political discussions and sophisticated qualitative analysis to decide on the allocation of funds.

Recommendations for an appropriate use of vulnerability indices

Due to the challenges and shortcomings mentioned above, indices should be used with caution. The following recommendations should be considered when interpreting indices and integrating them into any kind of analysis.

Clarify the purpose of using an index.
Vulnerability indices can potentially be used for different purposes such as identification of vulnerable populations, communities, regions, etc.; raising awareness; or monitoring vulnerability over time. However, indices cannot meet all purposes the same way.[x] Before selecting an index for any kind of analysis, it is of high importance to clarify the purpose of its use and to become acquainted with appropriate methodolgies and frameworks.

Do not exclusively base analyses on comparative country indices.
Often, vulnerability indices alone are not appropriate as basis for decision-making. No index can ever represent the multi-faced dimensions of vulnerability. Even though vulnerability indices can be useful and give some preliminary information, any assessment needs to be complemented by targeted analysis, taking into account the specific context.

Make use of the underlying indicators.
Looking on the underlying indicators of one index separately can provide valuable information. For instance, on a national scale, indicators on drought, floods & landslides, storms and wildfires can inform governments or organisations on sectoral or particular national challenges. In this way, critical regions or political and economic sectors within a country can be identified.

Limit your analysis to a specific spatial context.
Limiting the analysis to a specific spatial context with similar political and socio-environmental conditions allows for better comparability. For example, country comparisons within one region are more appropriate than between completely different world regions.

Use country groups instead of individual country rankings.
Following the proposal of an expert group from the Pilot Program for Climate Resilience (PPCR), several countries may be placed within country groups instead of using single country rankings. Groups can follow categories such as acute, severe, high, moderate and low[3] without ultimately ranking one country against another[xi]. In addition, country groups can also be compiled with regard to specific sectors or climate impacts.

Overall, global vulnerability and risk indices are facing several conceptual and methodological shortcomings. Whilst they can provide an overview of the distribution of vulnerability and risk, they should not be taken as objective results. There is no single way to measure vulnerability. Decision making should therefore carefully consider the composition and content of an index before applying it. Funding allocations in particular will remain a political one and should not be based solely on any particular index.

[3] Example taken from 'The Climate Vulnerability Monitor' of the Climate Vulnerable Forum.

Endnotes

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About the GIZ Project 'Effective Adaptation Finance – M&E Adapt'

The GIZ project 'Effective Adaptation Finance – M&E Adapt' has developed the **Adaptation M&E Toolbox** which includes innovative methods and approaches for the assessment of adaptation actions at national and local level.[xii] On behalf of the Federal Ministry for Economic Cooperation and Development (BMZ), the project supports developing countries in the design and operationalization of national adaptation M&E systems. It also facilitates learning through international exchange and capacity building.

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