METHODOLOGICAL NOTE

# Economic Development in Africa Report 2024:

## Unlocking Africa's trade potential
## Boosting regional markets and reducing risks

**Methodological Note to chapter 1 of the *EDAR 2024*:**

**Shocks Exposure and Vulnerability Dynamics across African Countries**

# 1. Objectives

The objectives of chapter 1 of the *Economic Development in Africa Report 2024* (EDAR) are to discuss the risks that African countries face in the context of the polycrisis and to provide an indication of each country's exposure to these risks, as well as their vulnerability to potential damages. Chapter 1 focuses on identifying the potential hazards from the polycrisis - a crisis marked by the interdependence and mutually reinforcing relations between different crises. As such, the polycrisis is partly a manifestation of the hyper-connectivity of countries and their homogenization through globalization processes.

This methodological note provides additional explanation of the methodology and data used to measure various risks, and it will discuss the construction of an index that could compare an exposure to risks between countries. It operationalizes the potential risks associated with the polycrisis by developing a measure of risk. This measure of risk is somewhat novel in that it defines risk as a country's exposure minus its resilience. Consequently, while some countries may be very exposed to a risk, their low vulnerability (and high resilience) may result in an overall lower risk level, and vice versa. The benefit of evaluating risk from both the exposure and vulnerability sides is that, whilst countries may have limited capacity to reduce their exposure to risk in the short to medium term, they can take actions to reduce their vulnerability. The measure constructed allows each individual country to assess where they can most effectively apply limited resources to reduce vulnerability to the risks they are most exposed to.

# 2. Approach

This methodological note follows a two-fold approach: conceptual, and empirical.

## 2.1 Conceptual approach

First, it follows a conceptual, literature-supported analysis to place the polycrisis in the context of Africa's economic development challenges. This literature is, on the one hand, rich in terms of elaborating on the nature and causes of these challenges. However, on the other hand, the literature is still emerging, in terms of how far the relatively recent concept of the polycrisis is concerned. In one of the seminal contributions that brings the understanding of the polycrisis on solid scholarly footing, Lawrence et al. (2024:4) stated, "we believe the polycrisis concept – if defined clearly and translated into a productive program of research and action – can help us pursue this goal. [of preventing the polycrisis from "degrading humanity's prospects]". In this context, the EDAR 2024 makes a conceptually important contribution to the emerging literature by providing insights on how African countries can best build resilience to navigate the polycrisis, which, as Mark et al. (2023) cautions, may be a permanent state of affairs.

The literature review sets forward the following conceptual framework, depicted in diagram 1, which underpins the measurement of risks from the polycrisis:

**Diagram 1: Conceptual Approach**

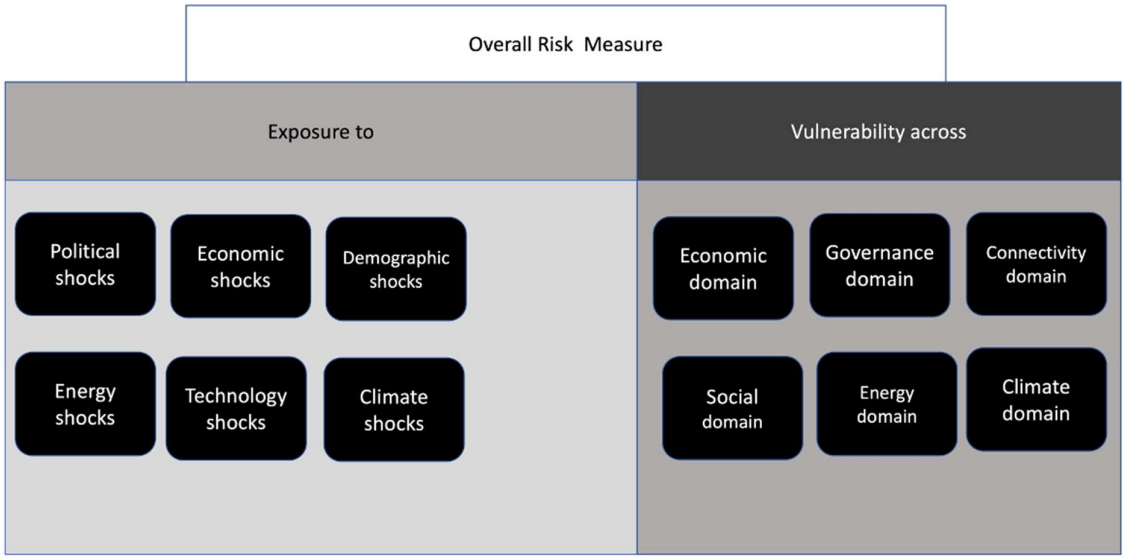



Diagram 1 illustrates how the polycrisis is marked by exposure of countries across six categories of covariate hazards or risks, that is hazards or risk that affect all countries and broad external trends. These include political shocks (e.g. the rise of populism), economic shocks (e.g. trade wars, pandemics, systemic financial crises), demographic shocks (e.g. migration, ageing populations), energy shocks (e.g. the energy transition and decline of fossil fuels), technology shocks (e.g. ongoing digitization of the global economy and advances in AI), and finally, climate shocks (e.g. the impacts of climate change). Again, what has to be emphasised is that these are not exposure to country-specific (idiosyncratic) risks, but global risks affect these six categories in an interrelated manner.

African countries will be affected differently by these broad categories of hazards depending on their level of vulnerability. This is where the ideosyncratic features of each country come into play. The diagram shows that countries are vulnerable across six domains, each of which are where countries can act to reduce their vulnerability. The domains are: economic domain (e.g. a country's level of debt); its governance domain (e.g. the strength of a country's institutions); the connectivity domain (e.g. a country's connection to and interconnection with the rest of the world); the social domain (e.g. the strength of trust and social capital); the energy domain (e.g. a country's dependency on various forms of energy); and the climate domain (e.g. what measures a country is taking to adapt to climate change).

## 2.2 Empirical Approach: Constructing an Index Measure

The empirical approach in this methodological note is to calculate a single measure of risk from the polycrisis across all 54 African countries. This measure is similar to a composite index, although this note does not apply the index measures as is typically done with composite indices that rank countries. In a polycrisis, which presents hazards for all countries, the aim is not to be less affected or impacted than others, but to reduce potential adverse impacts in an absolute sense. Therefore, the resulting measure is

divided into the measure for exposure and the measure for vulnerability (see diagram 1). This allows for a consideration of each country in terms of the combination of its exposure and vulnerability, enabling countries to determine how they can best reduce risk using a matrix of exposure against vulnerability. This process can also then inform policy.

Importantly, even if a country has low exposure and or low vulnerability, it does not mean that it is not at risk - all countries still face risks. An important implication of the interdependence of the polycrisis and the hyper-connectivity of the world is that there will be spillovers - even countries who appear to be at low risk will not only face their own risks, but also those of neighboring countries that are at higher risk. This insight supports the emphasis in the EDAR 2024 on regional integration and cooperation as an important bulwark against the polycrisis.

Since the derived measures (for exposure and vulnerability) are composite indices, the approach towards constructing these indices were based on international best practices, as per the Handbook on Constructing Composite Indicators (see OECD et al., 2008). From this, there are eight desirable attributes of a composite index: accuracy, simplicity, methodological soundness, suitability for international and temporal comparisons, transparency, accessibility, timeliness and frequency, and flexibility.

The indices used in this note are accurate, as they rely on the best data available; they are simple, in that a proliferation of dimensions is avoided, and suitable for international comparisons across Africa, including all 54 countries in all dimensions. The indices are transparent, with the full method of construction and data available; moreover, as all data is in the public domain, the indices can easily be replicated. The indices are also flexible in that, partly, as a result of their simplicity, it is fairly easy to add new components (as long as all 54 countries are covered).

The next section will address the requirement of methodological soundness in further detail.

## 3. Methodological Soundness

To ensure a sound index, the following principles and construction steps were followed:

- **Data driven.** The exposure and vulnerability indices are composed of original data series. While some were obtained from existing indices, individual series were used, and not composite.
- **Parsimony.** The principle of parsimony (related to simplicity) is used to minimize the number of individual data series (or sub-indicators) used. This approach keeps it simple, and avoids "double counting" which could occur if there is a high correlation between series. Therefore, the correlation coefficients between all individual series used were calculated and are available in the appendix. The relatively low correlation rates indicates that redundancy and overlapping information from using too many indicators is avoided.
- **Normalization and inversion.** All indicators used are normalized to lie between 0 and 100, with higher scores indicating higher exposure or vulnerability so as to obtain scale equivalence

between the different types of indicators used (some bounded and some unbounded). The following normalization procedure (min-max transformation) was used:

$$X_{ji} = \frac{(X_{ji} - minX_j)}{(maxX_j - minX_j)} \times 100$$

This procedure also takes care of negative values in the data and inverted them where applicable to ensure that higher values always indicate a higher exposure or vulnerability.

- **Weighing and aggregation.** The category/pillar values obtained are added (unweighted) to produce an overall, single score measure reflecting the countries' exposure to hazards and vulnerability. The aggregate scores are unweighted geometric averages of the category/pillar values. For the weights of the indicators, subjective weights have not been judged appropriate. Rather, each sub-indicator has been given equal weight when calculating the geometric mean. The use of principal components analysis (PCA) has been considered, but given that the sub-indicators selected to construct the measures generally showed low correlation (mostly lower that 0.3), PCA was not deemed useful. Also, the information conveyed by each sub-indicator itself is important.
- **Geometric averages**. For the type of aggregation, a geometric mean is used to aggregate the various sub-indicators to obtain the overall exposure, vulnerability and risk measures from their sub-indicators or pillars. The geometric mean is preferred to an arithmetic mean because it reduces the effect of outlier values and avoids (as the arithmetic mean does) a, "compensation between indicators that are not substitutable for each other" (Mazziotta and Pareto, 2013:69).

## 4. Data

This section outlines the data sources used to construct the exposure and vulnerability indices.

The final data for the two indices are summarised in tables 1 and 2. These tables show that the majority of data comes from UNCTADStat, the World Bank and the African Development Bank (AfDB):

- Wherever possible, relevant data from UNCTADStat was used.
- Where UNCTADStat did not provide for full cover of all 54 African countries, World Bank data were used.
- If neither UNCTADStat nor World Bank data covered the categories that the exposure and vulnerability indices aim to measure, AfDB data were used.
- Other sources included were:
    - For climate change, the Inform CC Risk index, published by the European Union, was used.
    - For migration, the migration data portal of the International Organization of Migration (IOM) was used.

- For governance, the Ibrahim Index of African Government (IIAG) was used in conjunction with the World Bank's World Governance Indicators.
- Data on human rights was sourced from Our World in Data (OWID).

**Table 1: Components (Sub-Indicators) of the Exposure to Shocks Measure**

| Sub-Index | Data Used | Sources |
|---|---|---|
| Political shocks exposure | • Political Stability and Absence of Violence Indicator<br>• Human rights index from V-Dem | • World Bank's World Governance Indicators<br>• Our World in Data (OWID) |
| Economic shocks exposure | • Trade as a share in GDP<br>• External debt stocks in 2021<br>• Export product concentration index | • World Bank's World Development Indicators<br>• UNCTADStat 's Product concentration indices of exports; five-year average 2017-2022. |
| Demographic shocks exposure | • Growth in demographic post-dividend countries<br>• Urbanisation rate, average 2018-2022<br>• International migrant stock, 2020 | • World Bank's World Development Indicators<br>• Migration data portal of the IOM |
| Energy shocks exposure | • Energy imports<br>• Fuel export dependence | • World Bank's World Development Indicators |
| Technology shocks exposure | • Frontier Technology Readiness Index<br>• Government AI Readiness Index | • UNCTADstat<br>• Oxford Insights |
| Climate change shocks exposure | • Agriculture's share of GDP, average 2018–2022<br>• Hazards exposure score<br>• Environmental health pillar score | • World Bank Development Indicators<br>• INFORM CC Risk Index |

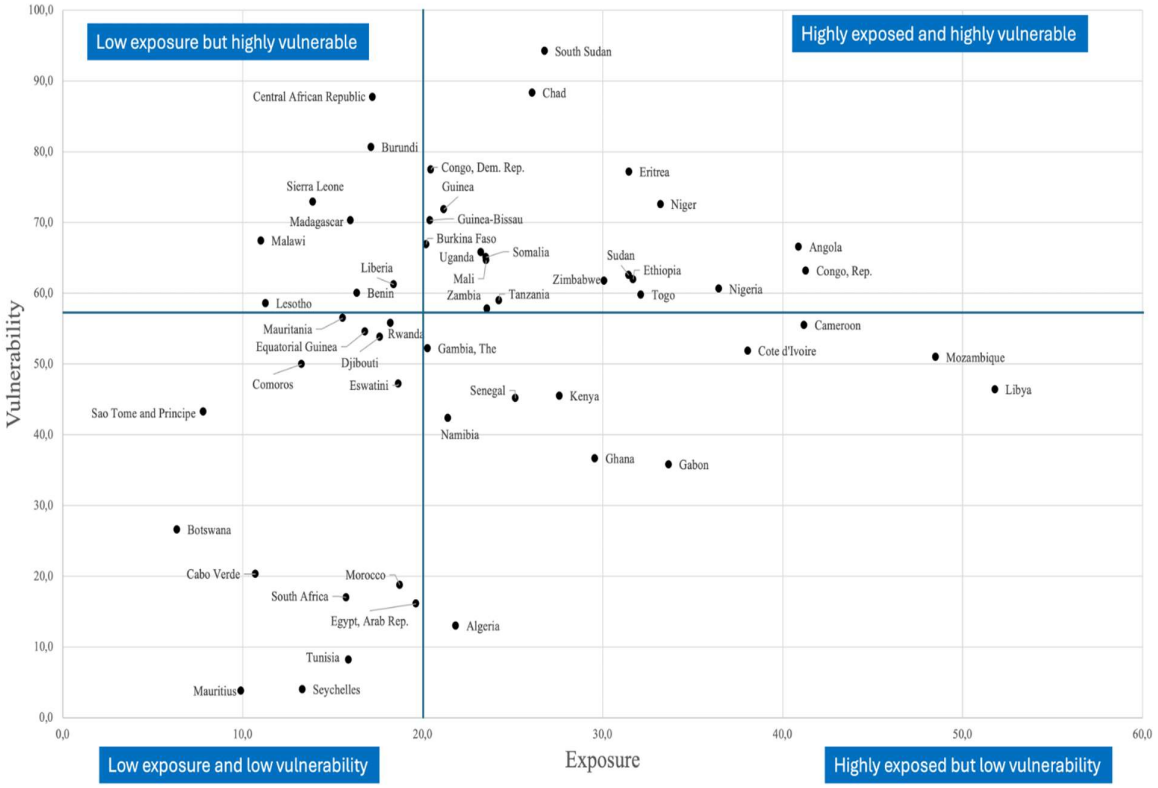
**Table 2: Components (Sub-Domains) of the Vulnerability Measure**

| Sub-Index | Data used | Sources |
|---|---|---|
| Economic vulnerability | • FDI average 2013–2022 per cent net inflows<br>• GDP per capita, 2022<br>• Vulnerable employment, average 2018–2022 | • World Bank's World Development Indicators |
| Governance vulnerability | • Average governance score, 2013–2022 Governance weakness | • World Bank, World Governance Indicators<br>• Ibrahim Index of African Government (IIAG) |
| Connectivity vulnerability | • Liner shipping connectivity index, 2021<br>• Logistics performance index 2022 or closest year<br>• Transport Composite Index 2022<br>• ICT Composite Index 2022 | • World Bank's World Development Indicators<br>• AfDB's African Infrastructure Development Index 2022 |
| Energy vulnerability | • Share of the population with access to electricity, average 2018–2022 | • World Bank's World Development Indicators |
| Social vulnerability | • Social Progress Index scores 2023 | • Social Progress Index |
| Vulnerability to climate change | • GVI Index<br>• GAIN Vulnerability Index | • Global Data Lab's GDL Vulnerability Index<br>• ND-GAIN: Global Adaptation Initiative |

## 5. Interpretation

Using the values of the exposure and vulnerability measures (index values) obtained for all 54 Africa countries, this note does not rank countries — as previously explained. Rather, to allow countries to focus on reducing their risk in absolute terms, a matrix that depicts the combinations of exposure to hazards, and vulnerability to be potentially harmed if these hazards should occur was provided. The cut-off points for demarcating the matrix are based on the median values. This is shown in figure 1 below:

**Figure 1: Identifying African Countries Most at Risk from the Polycrisis**




This matrix should be interpreted as follows:

- Countries in the upper right-hand quadrant, which are highly exposed and highly vulnerable at the same time, are the most at risk from the polycrisis. Over the short-term, by reducing their vulnerability, they can move into the lower right quadrant, where they remain highly exposed, but less vulnerable. Over the long term, through collaborative regional and global efforts (as their exposure is a covariate risk), these countries should work together to reduce their exposure.
- Countries in the lower left-hand quadrant, with low exposure and low vulnerability, are still at risk. Some of these countries are closer to the right cut-off, meaning if the polycrisis worsens, their exposure may become of a greater concern. Similarly, some countries may easily become highly vulnerable. These countries should, over the short term, put in extra efforts into maintaining their resilience.

It is worth noting that the small island states in Africa —Comoros, Cabo Verde, Mauritius, Seychelles and Sao Tomé and Principe — are positioned in the low exposure, low vulnerability quadrant. For some, this

may come as a surprise. However, in recent years, these countries have made significant progress in strengthening their resilience through improved macroeconomic policies, governance, and stability.

## References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# Appendix

### Correlation Matrices for Exposure Measure's Sub-Indicators

| Correlation Matrix: Political Shock Exposure Sub-Indicators | | |
|---|---|---|
| | Human rights indicator, 2022 | Political instability indicator |
| Human rights indicator, 2022 | 1 | |
| Political instability indicator | 0.49 | 1 |

| Correlation Matrix: Economic Shock Exposure Sub-Indicators | | | |
|---|---|---|---|
| | Trade share in GDP | Exposure to external debt stocks 2021 | Export Product Concentration sub-Index |
| Trade share in GDP | 1 | | |
| Exposure to external debt stocks 2021 | 0.29 | 1.00 | |
| Export Product Concentration sub-Index | -0.12 | -0.20 | 1 |

| Correlation Matrix: Demographic Shock Sub-Indicators | | | |
|---|---|---|---|
| | Exposure to growth in demographic post dividend countries sub-index | International migrant stock score | Urbanisation score |
| Exposure to growth in demographic post dividend countries sub-index | 1 | | |

| | | | |
|---|---|---|---|
| International migrant stock score | 0.03 | 1.00 | |
| Urbanisation score | -0.51 | -0.25 | 1 |

| Correlation Matrix: Energy Shock Sub-Indicators | | |
|---|---|---|
| | Energy Import Exposure Index | Fuel Export Dependence Index |
| Energy Import Exposure Index | 1 | |
| Fuel Export Dependence Index | 0.25 | 1 |

| Correlation Matrix: Technology Shock Sub-Indicators | | |
|---|---|---|
| | Distance from frontier technology index | Government AI Readiness (exposure) Index |
| Distance from frontier technology index | 1 | |
| Government AI Readiness (exposure) Index | 0.74 | 1 |

| Correlation Matrix: Climate Shock Sub-Indicators | | | |
|---|---|---|---|
| | Hazards Exposure Indicator normalised | Environmental health score normalised | Agriculture exposure normalised |
| Hazards Exposure Indicator normalised | 1 | | |
| Environmental health score normalised | 0.20 | 1.00 | |
| Agriculture exposure normalised | 0.29 | 0.24 | 1 |

## Correlation Matrices for Vulnerability Measure's Sub-Indicators

| Correlation Matrix: Economic Vulnerability Sub-Indicators | | | |
|---|---|---|---|
| | Lack of Inclusive Growth indicator | Lack of GDP per capita indicator 2022 | Vulnerable employment Index ave 2018-2022 |
| Lack of Inclusive Growth indicator | 1 | | |
| Lack of GDP per capita indicator 2022 | 0.53 | 1.00 | |
| Vulnerable employment Index ave 2018-2022 | 0.39 | 0.80 | 1 |

| Correlation Matrix: Governance Vulnerability Sub-Indicators | | | |
|---|---|---|---|
| | Average governance score, 2013-2022, selected from WGI | Governance weakness, IIAG | |
| Average governance score, 2013-2022, selected from WGI | 1 | | |
| Governance weakness, IIAG | 0.93 | 1 | |

| Correlation matrix Connectivity Vulnerability Sub-Indicators | | | | |
|---|---|---|---|---|
| | Liner shipping connectivity index | Inverse Logistics performance index | Transport composite Index | ICT composite Index |
| Liner shipping connectivity index | 1 | | | |
| Inverse Logistics performance | 0.39 | 1.00 | | |
| Transport composite Index | -0.30 | -0.30 | 1.00 | |
| ICT composite Index | -0.41 | -0.42 | 0.67 | 1 |

| Correlation matrix Climate Change Vulnerability Sub-Indicators | | |
|---|---|---|
| | GVI Index | GAIN Vulnerability Index |
| GVI Index | 1 | |
| GAIN Vulnerability Index | 0.30 | 1 |