Measuring Vulnerability: The Caribbean Development Bank’s Approach and its Application

Presented by:
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AGENDA

1. CDB’s mandate
2. Measurement of Vulnerability
3. Application
4. Takeaways
**Purpose:** Reducing poverty and transforming lives through sustainable, resilient and inclusive development.

CDB embraces the Sustainable Development Goals and is working to facilitate their attainment for the people living in BMCs.

### Borrowing Members Countries (BMCs)

<table>
<thead>
<tr>
<th>Country</th>
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<tr>
<td>ANG</td>
<td>ANT</td>
<td>BAH</td>
<td>BAR</td>
<td>BVI</td>
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<td>BZE</td>
<td>CAY</td>
<td>DOM</td>
<td>GRE</td>
<td>GUY</td>
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<td>HAI</td>
<td>JAM</td>
<td>MON</td>
<td>SKN</td>
<td>SLU</td>
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<tr>
<td>SVG</td>
<td>SUR</td>
<td>TCI</td>
<td>TT</td>
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### Non-borrowing Members Countries

<table>
<thead>
<tr>
<th>Country</th>
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<tbody>
<tr>
<td>BRA</td>
<td>CAN</td>
<td>CHN</td>
<td>COL</td>
<td>DEU</td>
</tr>
<tr>
<td>ITA</td>
<td>MEX</td>
<td>GBR</td>
<td>VEN</td>
<td></td>
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</tbody>
</table>
Strategic Plan 2020-24
1. CDB’s mandate
2. Measurement of Vulnerability
3. Application
4. Takeaways
Objective:
• To quantify an index that captures the relative vulnerability of CDB BMCs to external shocks.

Why is this important?
• It gives further legitimacy to the challenges in BMCs.
• It supports evidence-based policy formulation.
• It can guide the allocation of concessional resources.
• Updates the CDBs vulnerability index.

VULNERABILITY
the inherent, permanent or quasi-permanent features of a country which render that country exposed to forces outside its control.

Birkmann, 2005
Multidimensional Sustainable Development

Speed of Disaster

Scale Dependent

(Source: UNISDR)
## Literature Review

<table>
<thead>
<tr>
<th>Environment</th>
<th>Category</th>
<th>Indicators</th>
<th>Sub-Indicators</th>
<th>Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social</td>
<td>Demography</td>
<td>Age</td>
<td>Old Age</td>
<td>Population 65 years and older</td>
</tr>
<tr>
<td></td>
<td>Health</td>
<td>Practitioners</td>
<td>Doctors</td>
<td>Doctors per population</td>
</tr>
<tr>
<td></td>
<td>Education</td>
<td>Attainment</td>
<td>High School</td>
<td>Population 25 years and older with high school diploma</td>
</tr>
<tr>
<td></td>
<td>Civil Society</td>
<td>CBOs</td>
<td>Participation</td>
<td>Number registered volunteers</td>
</tr>
<tr>
<td></td>
<td>Government</td>
<td>Functioning</td>
<td>Social Services</td>
<td>Existence of social safety nets</td>
</tr>
<tr>
<td></td>
<td>Services and Infrastructure</td>
<td>Water</td>
<td>Access</td>
<td>Population with access to improved water source</td>
</tr>
<tr>
<td></td>
<td>Housing and Household Assets</td>
<td>Housing</td>
<td>Tenure</td>
<td>Population of renters</td>
</tr>
<tr>
<td>Economic</td>
<td>Economy</td>
<td>GDP</td>
<td>GDP per capita</td>
<td>GDP per capita</td>
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<tr>
<td></td>
<td>Labour Market</td>
<td>Employment</td>
<td>Unemployment</td>
<td>Unemployment Rate</td>
</tr>
<tr>
<td></td>
<td>Livelihoods</td>
<td>HH finances</td>
<td>HH income</td>
<td>Per capita income</td>
</tr>
<tr>
<td></td>
<td>Geographical Position</td>
<td>Land Use</td>
<td>Agricultural Programs</td>
<td>Percentage of land used for agriculture</td>
</tr>
<tr>
<td>Natural</td>
<td>Environment</td>
<td>Protection</td>
<td>Programs</td>
<td>Existence and compliance rate to environmental policies</td>
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<tr>
<td>Disaster</td>
<td>Disaster Hazards and Impacts</td>
<td>Exposure</td>
<td>Flood Hazards</td>
<td>Frequency of Flood</td>
</tr>
<tr>
<td></td>
<td>Disaster Resilience</td>
<td>Community DRR</td>
<td>Awareness</td>
<td>Proportion of households that trust and know warning system</td>
</tr>
<tr>
<td>Indices</td>
<td>Indices</td>
<td>IHDI</td>
<td>HDI</td>
<td>Human Development Index</td>
</tr>
</tbody>
</table>

Source: Beccari (2016)
Vulnerability Index

**Previous Work**

Economic Vulnerability Index
- Crowards (2000)
- Hartman (2011)

**Recent Work**

Multidimensional Vulnerability Index
- Working paper published in 2019

Basic Criteria
- Simple
- Comprehensive
- Comparable

Categories:
- Economic
- Social
- Environmental
The proxy indicators in the Vulnerability Index are as follows:

\[ \text{Vulnerability} = \text{average} \left( E^3, O \right); \left( D^3, T^3 \right); \left( F_d, F_l \right); \left( R, I_f \right); \left( C, U, P \right); \left( ND_a, ND_d \right); \left( CE, CP \right) \]

\( E^3 \) = the proportion of total exports of goods and services represented by the top three export categories.

\( O \) = total exports of goods and services as a percentage of GDP.

\( D^3 \) = the proportion of total exports of goods converging on the top three export destinations.

\( T^3 \) = the proportion of total tourists from the top three source countries.

\( F_d \) = Food imports as a percentage of total imports.

\( F_l \) = Fuel imports as a percentage of total imports.

\( R \) = the ratio of annual remittances to GDP.

\( I_f \) = the ratio of the annual flow of FDI to GDP.

\( C \) = the number of intentional homicides per 100,000 population.

\( U \) = the rate of unemployed persons in the labour force.

\( P \) = the rate of persons living in poverty.

\( ND_a \) = the number of persons affected by natural disasters, as a proportion of total population.

\( ND_d \) = the number of deaths resulting from natural disasters, as a proportion of total population.

\( CE \) = the economic losses or gains of climate change (Dara Climate Index).

\( CP \) = the economic losses or gains of carbon (Dara Climate Index).
RESEARCH OBJECTIVES?

To support evidence-based policy formulation within CDB.

To assist BMCs’ assess vulnerabilities.

Update vulnerability component of formula for financial resource allocation.

Explore innovative financing mechanisms.

OBJECTIVE

To quantify BMCs’ vulnerability to external shocks.
Vulnerability Index Construction

01. Determine the risk factors

02. Compile proxy indicators

03. Data normalization methodology
   \[ X_{ij} = \frac{(X_{ij} - \text{Min } X_j)}{(\text{Max } X_j - \text{Min } X_j)} \]

04. Compute sub-indices

In combining the indicators, a number of studies have recommended and embraced the assignment of equal weight to the different items (Briguglio, 1995; Crowards and Coulter, 1999; Morris, 1979; UNDP, 1991; Commonwealth (2014); St. Bernard (2007) and Ogwang, 1994).
Framework: EVI and MVI (2019)

**UN EVI**
- Exposure Index (1/2)
  - Size sub-index (1/8)
  - Location sub-index (1/8)
  - Economic structure sub-index (1/8)
  - Environment sub-index (1/8)
  - Trade shock sub-index (1/4)
  - Natural shock sub-index (1/4)
- Economic sub-index (1/8)
  - Population (1/8)
  - Remoteness (1/8)
  - Merchandise export concentration (1/16)
  - Share of agriculture, hunting, forestry and fishing (1/16)
  - Share of population in low elevated coastal zones (1/8)
  - Instability of exports of goods and services (1/4)
  - Victims of natural disasters (1/8)
  - Instability of agricultural production (1/8)

**CDB MVI**
- Economic (66.68%)
  - Export concentration (16.67%)
  - Dependence on strategic imports (16.67%)
  - Dependence on foreign capital (16.67%)
- Social (16.67%)
  - Social susceptibility (16.67%)
- Environmental (16.67%)
  - Natural hazards & Climate change (16.67%)
  - Economic losses of carbon
  - Economic losses of climate change
  - Number of deaths (% of total population)
  - Number affected (% of total population)

**EVI**
- Shock index (1/2)
- EVI
- UN EVI
- CDB MVI
Preliminary Framework: Revised MVI (2021)*

- Economic (33.3%)
  - Exposure (16.65%)
    - Openness*
    - Merchandise export concentration*
    - Strategic imports*
    - Remoteness*
    - Debt stock
    - External finance*
    - Share of agriculture in GDP
  - Volatility (16.65%)
    - Instability of real GDP growth (20-year trend)
    - Instability of exports of goods and services (20-year trend)
    - Volatility of tourist arrivals (20-year trend)
    - Volatility of financial flows (20-year trend)

- Social (33.3%)
  - Exposure (16.65%)
    - Years of schooling (Education) SDG 4.3
    - FLFPR (Gender) SDG 5
    - Homicides (Public safety)*
    - Life Expectancy; NCDs; Out-of-pocket health expenditure (Health) SDG 3.8.2
    - Population 65+ (Demography)
    - Unemployment*, Poverty* (Economic capability)
    - Mobile broadband & Access to internet (Technology) SDG 9
  - Volatility (16.65%)
    - Volatility of current health expenditure (20-year trend)
    - Instability of agricultural production (20-year trend)

- Environmental (33.3%)
  - Exposure (16.65%)
    - Natural disasters deaths/affected* SDG 1.5.1
    - Population in coastal zones
    - Share of population living in drylands
  - Volatility (16.65%)
    - Instability of agricultural production (20-year trend)

* New blended approach
## What’s New?

### Proxy Indicators

<table>
<thead>
<tr>
<th></th>
<th>Social</th>
<th>Economic</th>
<th>Environmental</th>
<th>Total</th>
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<tr>
<td><strong>2019 MVI</strong></td>
<td>3</td>
<td>8</td>
<td>4</td>
<td>15</td>
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<tr>
<td><strong>2021 MVI</strong></td>
<td>12</td>
<td>13</td>
<td>7</td>
<td>32</td>
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</table>

### Social Dimension

<table>
<thead>
<tr>
<th></th>
<th>Education</th>
<th>Public Order/Safety</th>
<th>Health</th>
<th>Demography</th>
<th>Economic Capability</th>
<th>Technology</th>
<th>Gender</th>
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</thead>
<tbody>
<tr>
<td><strong>2019 MVI</strong></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2021 MVI</strong></td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
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### Environmental Dimension

<table>
<thead>
<tr>
<th></th>
<th>Natural Hazard</th>
<th>Climate Change</th>
<th>Biodiversity and Habitat</th>
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<tbody>
<tr>
<td><strong>2019 MVI</strong></td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td><strong>2021 MVI</strong></td>
<td>x</td>
<td>x</td>
<td>x</td>
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Access to Special Development Fund is based solely on per capita income. Only then, are concessional resources allocated using a number of metrics, including the vulnerability index score.

The vulnerability index score is one of several criteria that is used to determine the size of the allocation of each country that has access to Special Development Fund.
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<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td><strong>Takeaways</strong></td>
<td><strong>MVI provides a holistic perspective on exposure to risk.</strong></td>
<td><strong>MVI supports evidence-based policy formulation</strong></td>
</tr>
<tr>
<td>CDB’s approach seeks to consolidate the diverse vulnerability literature into a composite index well suited to the mandate of the bank, relevant to our BMCs and diverse in its application.</td>
<td>CDB and BMCs can utilize the MVI alongside other available information to support evidence-based policy formulation.</td>
<td><strong>MVI has potential role in CDB’s Financial resource allocation framework</strong></td>
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<td></td>
<td>Pending the completion of this research consideration will be given to how the MVI can be used to improve the allocation of financial resources.</td>
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