Regional Initiative for the Assessment of the Impact of Climate Change on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

RICCAR: Assessing Vulnerability to Climate Change in the Arab Region through Impact Chains

Carol Chouchani Cherfane, Chief, Water Resources Section, SDPD, ESCWA

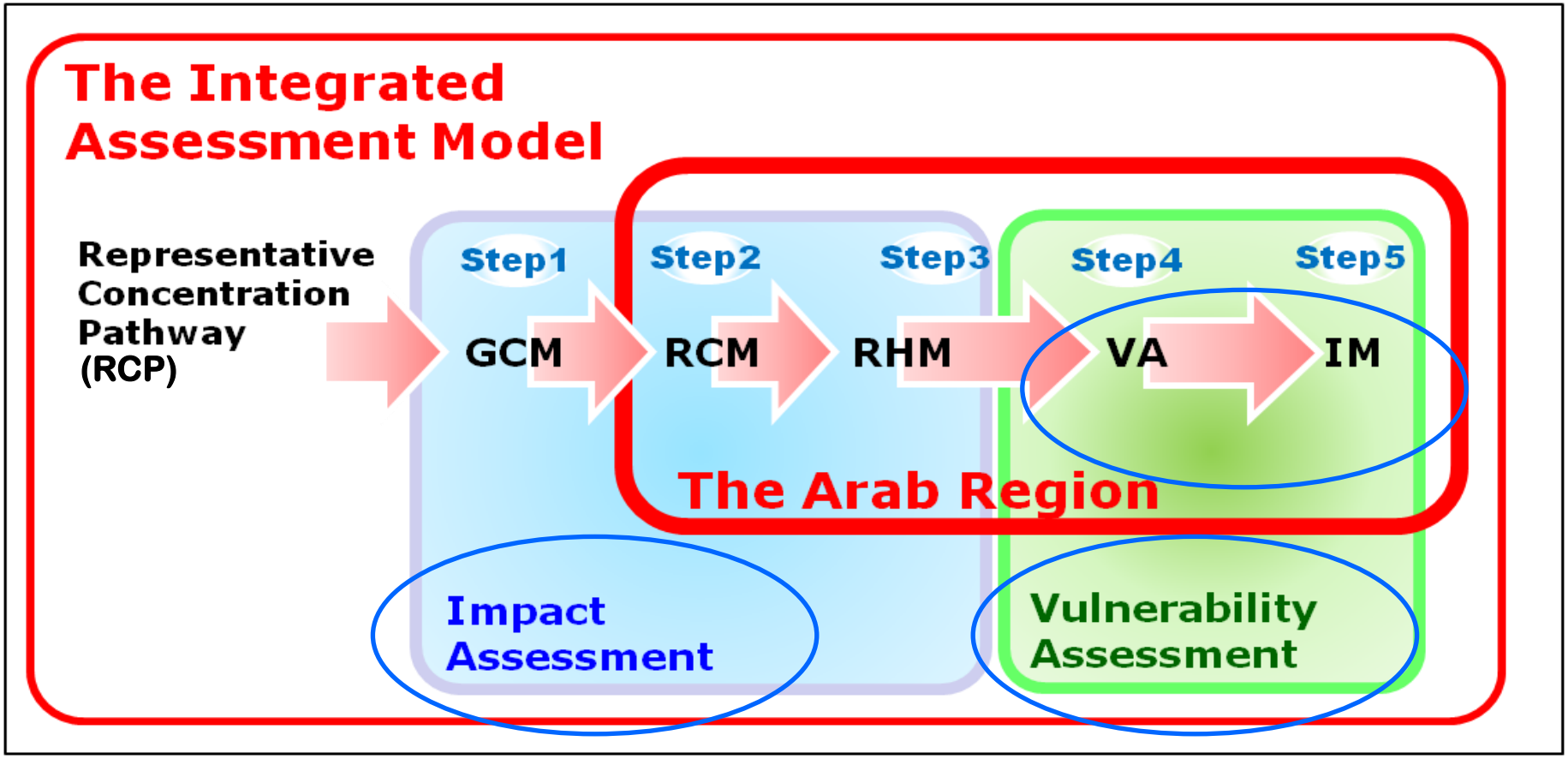
Based on outcome of discussions among members of the:

RICCAR Vulnerability Assessment Working Group

RICCAR Task Force on Sensitivity,
RICCAR Task for on Adaptive Capacity
RICCAR/ACCWaM Training Manual

UNDA Workshop on Climate Change Adaptation in the Economic Development Sector
Using Integrated Water Resources Management (IWRM) Tools
Amman, 25-27 May 20

Integrated Assessment
Methodological Framework



Step 1: Global Climate Modeling using General Circulation Model
Step 2: Regional Climate Modeling
Step 3: Regional Hydrological Modeling
Step 4: Vulnerability Assessment
Step 5: Integrated Mapping

RICCAR Vulnerability Assessment Working

Objective: To support the preparation of the methodology and contribute to the preparation of the vulnerability assessment.

Tasks:

- Define the objectives, scope and deliverables of the socio-economic and environmental vulnerability assessment;
- Agree on the most suitable methodology and tools to be used;
- Contribute to the collection of data and information to support the assessment;
- Assist with the identification of expertise to provide input to the assessment;
- Provide expert review of the assessment products as they become available.

Composition (15 members):

- 4 Arab Governments (Egypt, Libya, Palestine, Tunisia)
- 4 Arab Organizations (ACSAD, AGU, AUB, LAS)
- 4 UN Organizations (ESCWA, UNEP, UNESCO, WHO)
- 3 Expert Organizations (GIZ, ICBA, University of Alexandria)

Duration: January 2013 – September 2014

Meeting 1: January 2013; **Meeting 2:** May 2013; **Meeting 3:** November 2013

VA-WG Meetings

VA-WG1 (Beirut, January 2013)



VA-WG2 (Beirut, May 2013)


VA-WG3 (Amman, November 2013)



THE LEAGUE OF ARAB STATES
THE ARAB CENTER FOR THE STUDIES OF ARID ZONES AND DRY LANDS
ACSAD 1968
ACSAD

UNITED NATIONS
الاسكوا
ESCWA

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

With the support of

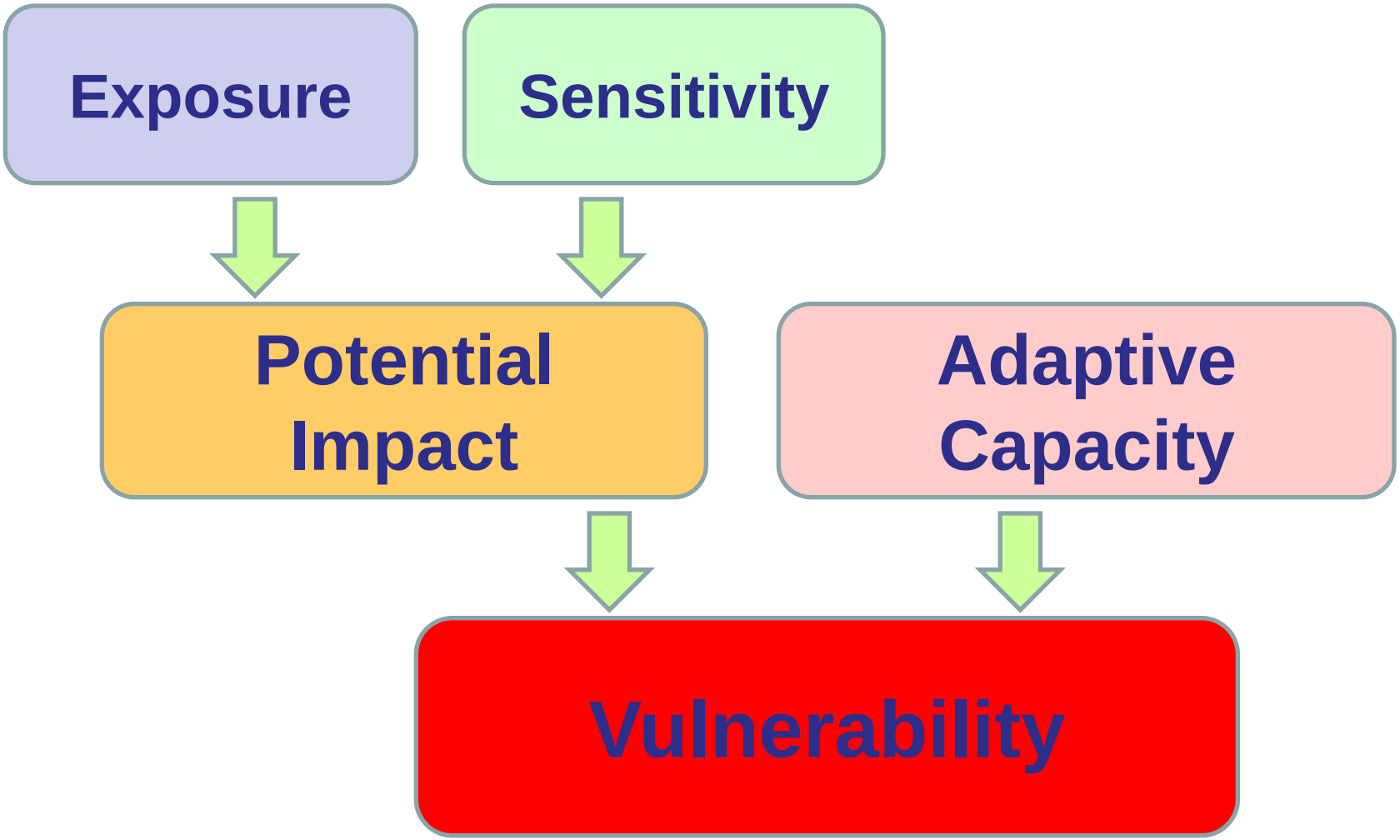
EURAC research

adelphi

Sector & Impacts Selected for Arab Region VA

Sectors	Impacts	(Sub-)Vulnerability
 Water	Change in water availability	V0
 Biodiversity & Ecosystems	Change in area coveredby forests	V1
	Change in area of wetlands/marshes	V2
 Agriculture	Change of water available for crops	V3
	Change of rangeland for livestock	V4
 Infrastructure & Human Settlements	Change in inland flooding area	V5
	Change in coastal flooding area	V6
 People	Change of water available for drinking	V7
	Change in health due to heat stress	V8
	Change of employment rate in the agricultural sector	V9

Vulnerability Assessment Framework



Based on IPCC AR4 conceptual framework

Workshop to Test VA Methodology and Draft Manual using GIS Tools

Workshop on Applying the Climate Change Vulnerability Assessment Methodology in the Arab Region

Beirut, 11-13 May 2014

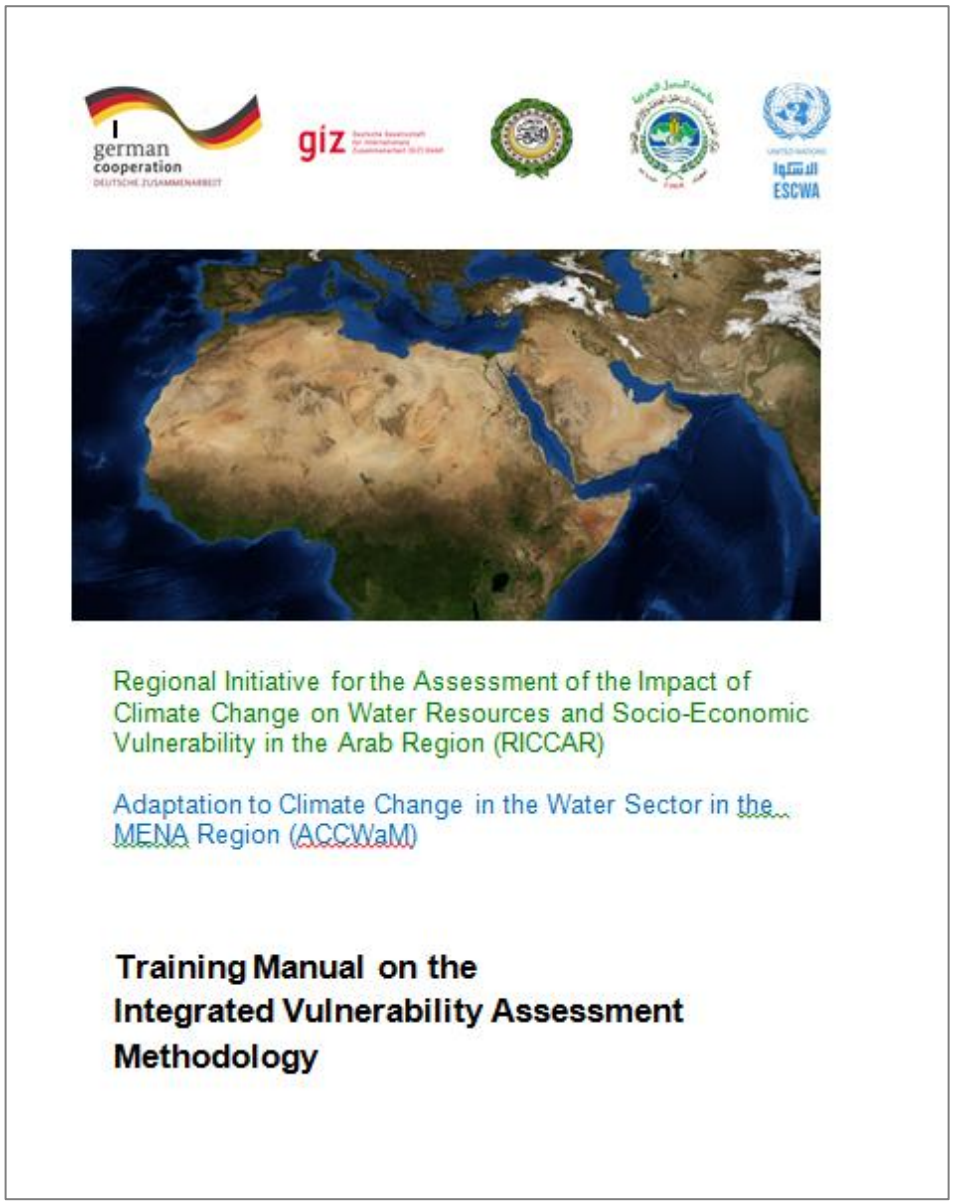
Training GIS Based

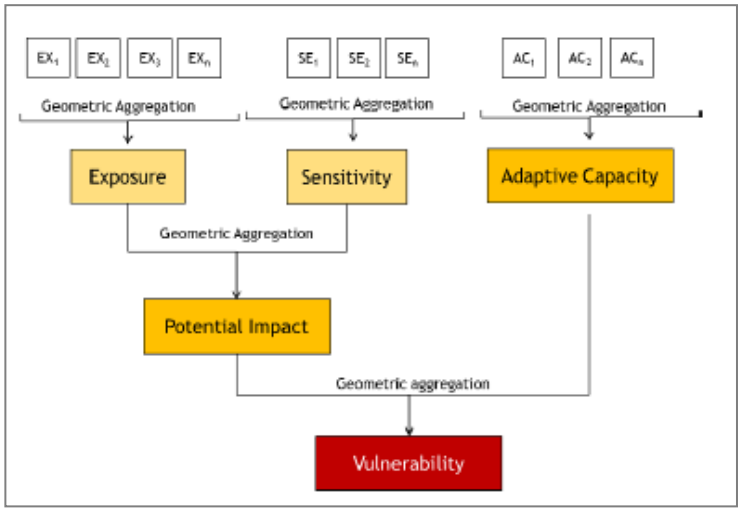
Solicited Expression of Interests from Arab Research Institutes

Needed demonstrate GIS Capacities

Feedback & testing led to extensive vetting of regionally available indicators & aggregation methods

VA Methodology detailed in RICCAR/ ACCWaM Manual





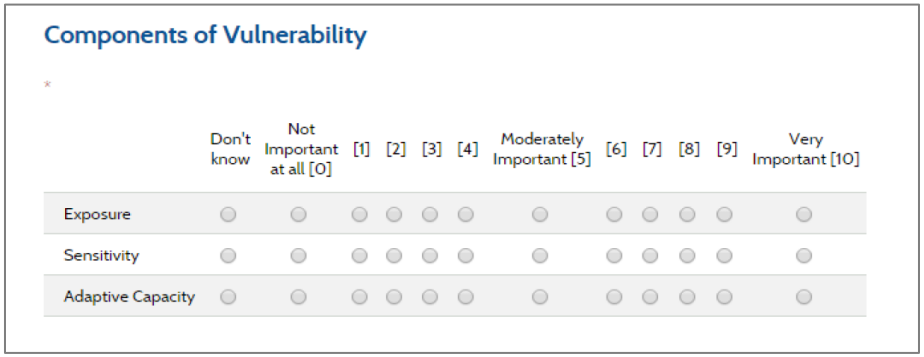
Vetted 2013-2014
Manual issued May 2015
Training held in June 2015

VA Aggregation, Normalization & Weighting Scheme for Overall & Sector Based VA detailed in Training Manual

Final selection of indicators and weighting of indicators based on:

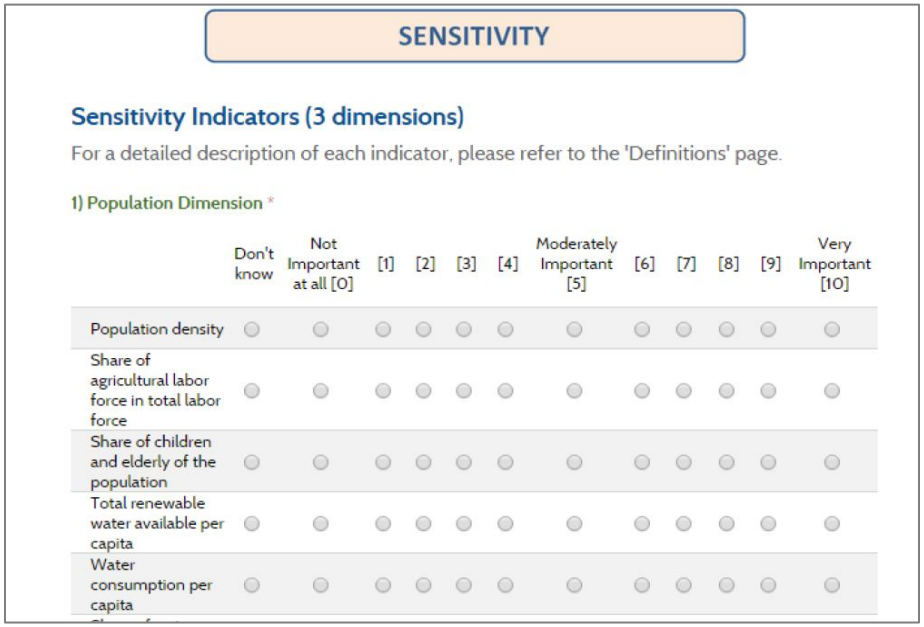
- Extensive review of data available at Arab Regional Level
- Expert inputs and reviews
- Stakeholder consultations, and particularly for weighting scheme

Over 300 Sector Questionnaires Completed by Regional Experts and vetted to support indicator weighting scheme



Components of Vulnerability

	Don't know	Not Important at all [0]	[1]	[2]	[3]	[4]	Moderately Important [5]	[6]	[7]	[8]	[9]	Very Important [10]
Exposure	○	○	○	○	○	○	○	○	○	○	○	○
Sensitivity	○	○	○	○	○	○	○	○	○	○	○	○
Adaptive Capacity	○	○	○	○	○	○	○	○	○	○	○	○



SENSITIVITY

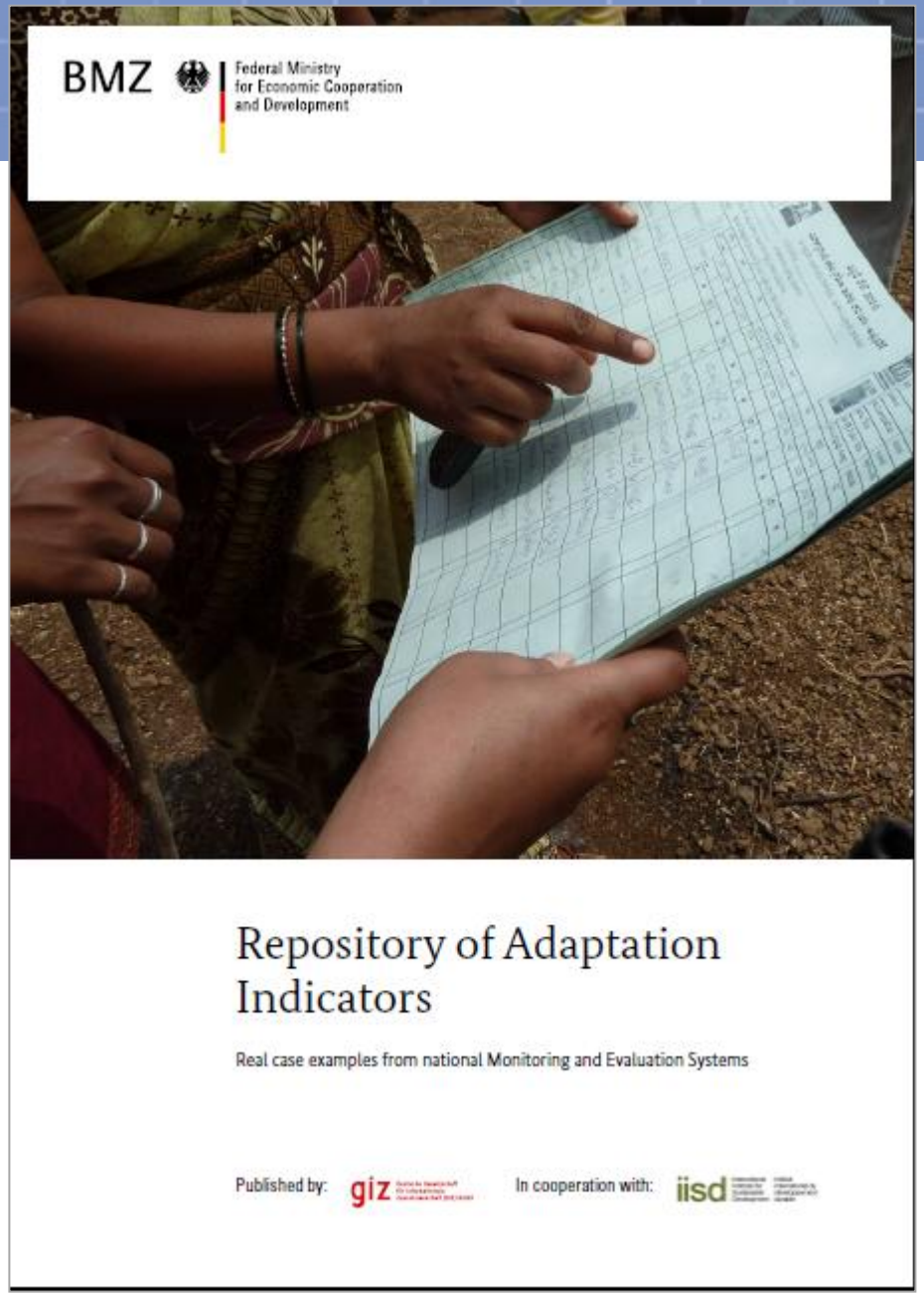
Sensitivity Indicators (3 dimensions)

For a detailed description of each indicator, please refer to the 'Definitions' page.

1) Population Dimension *

	Don't know	Not Important at all [0]	[1]	[2]	[3]	[4]	Moderately Important [5]	[6]	[7]	[8]	[9]	Very Important [10]
Population density	○	○	○	○	○	○	○	○	○	○	○	○
Share of agricultural labor force in total labor force	○	○	○	○	○	○	○	○	○	○	○	○
Share of children and elderly of the population	○	○	○	○	○	○	○	○	○	○	○	○
Total renewable water available per capita	○	○	○	○	○	○	○	○	○	○	○	○
Water consumption per capita	○	○	○	○	○	○	○	○	○	○	○	○

Indicators in mpact Chains Differ from Adaptation Indicators used for M&E



Available at: www.AdaptationCommunity.net under Monitoring & Evaluation

hose provide information for tracking with respect to:

Climate Parameters

-Observed climate conditions

Exposure indicators: change in T, P, EE

Climate Impacts

-Observed impacts of climate variability and climate change

Sensitivity: Number of households affected by drought, number of people living in flood prone area; number of cases of water-borne diseases

Adaptation Action

-Indicators to help track implementation of adaptation strategies

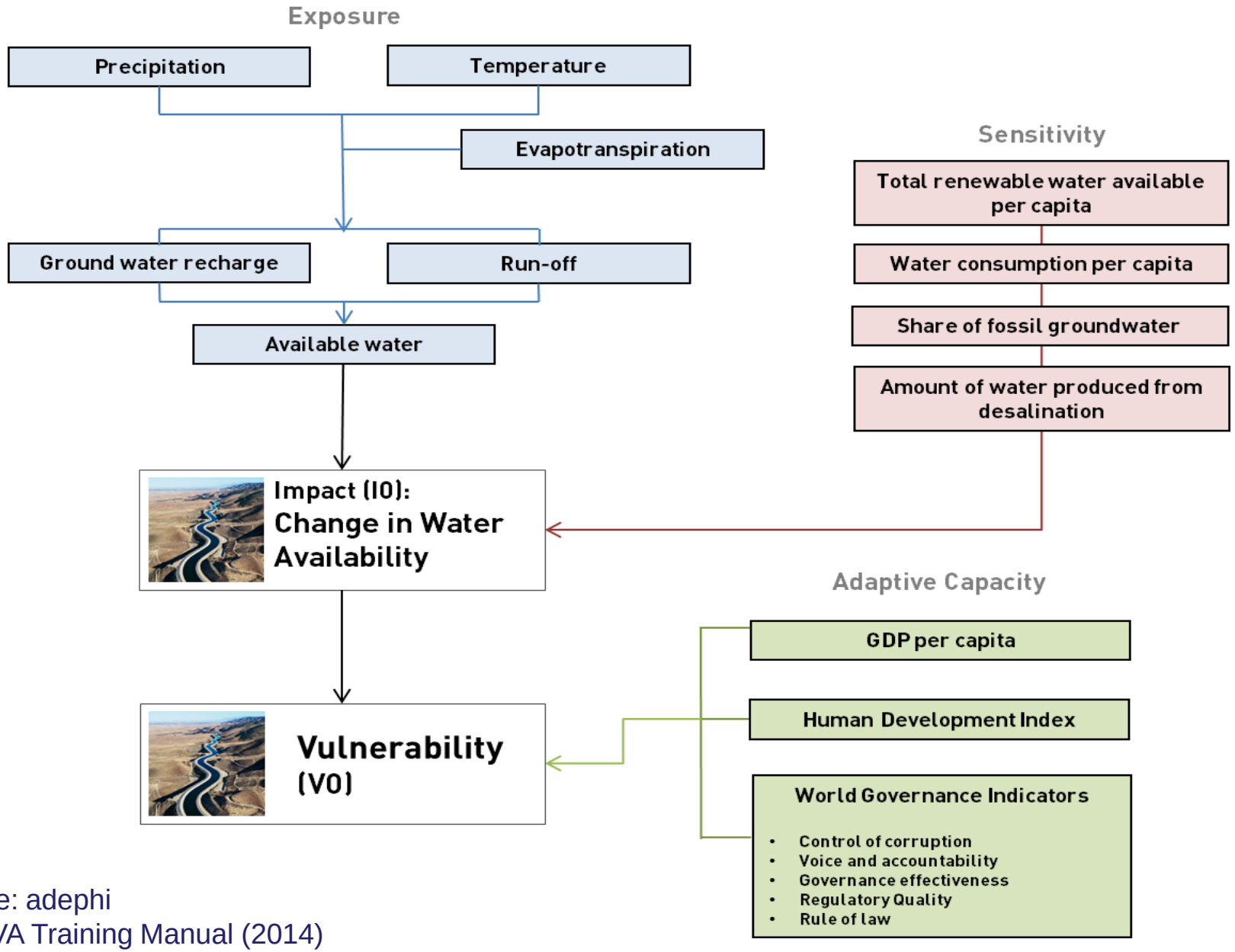
-Number of climate response tools tested, number of visitors to a national climate change adaptation website

Adaptation Results (Outcomes)

-- Indicators to help monitor and evaluate adaptation strategies

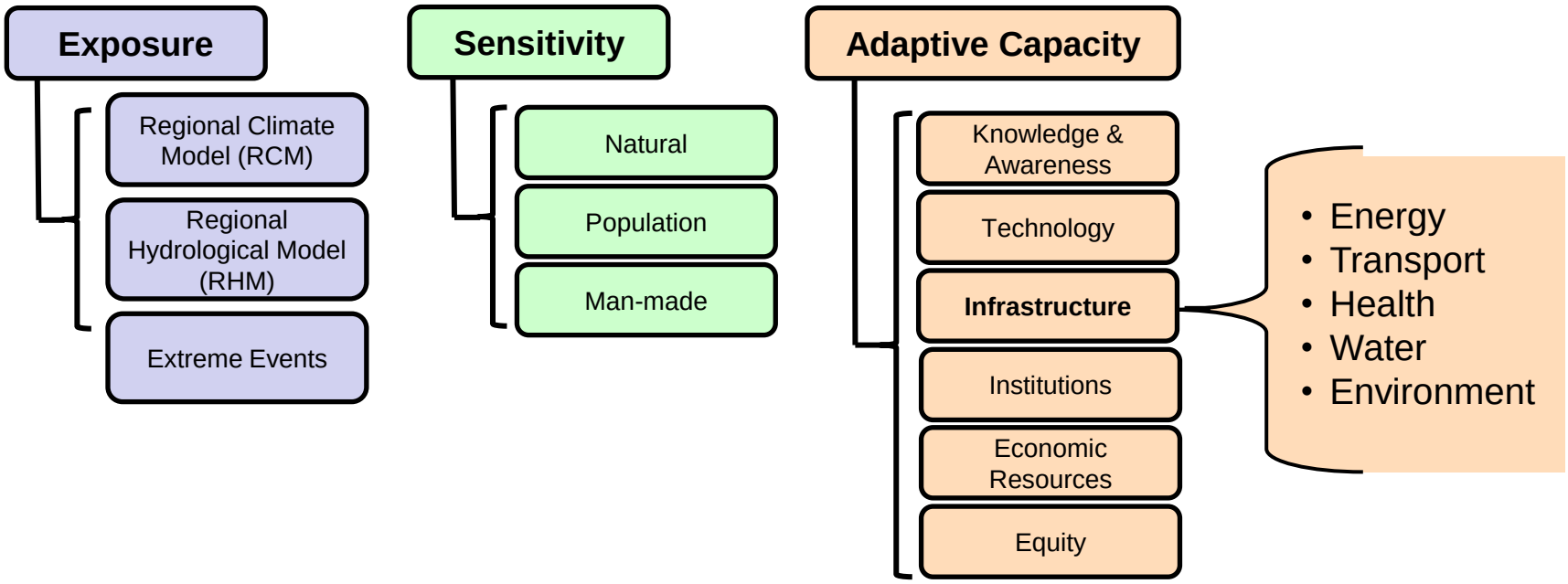
-Percentage of climate resilient roads in a country; Number of cubic meters of water conserved, percentage of households with access to piped water

Initial Impact Chain for Water Availability (2014)



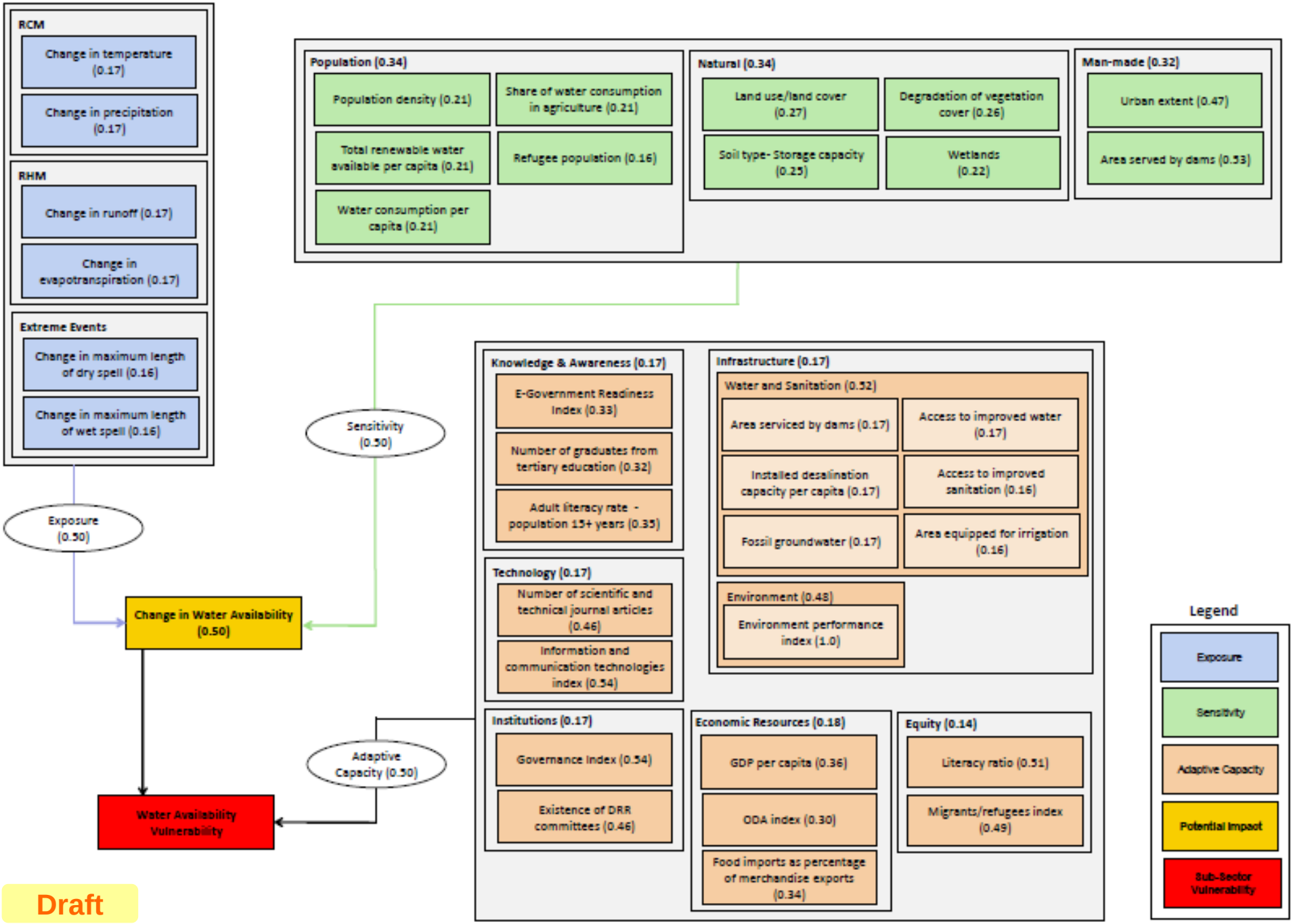
Source: adephi
Draft VA Training Manual (2014)

Impact Chains: Components



Note that Exposure indicators are selected from 1 climate scenario per VA, depending on whether assessing baseline conditions, the absolute change from baseline to 2046-2065 or 2081-2100 for RCP 4.5, or the absolute change from baseline to 2046-2065 or 2081-2100 for RCP 8.5.

Impact Chain for Water Sector, Potential Impact 0: Change in Water Availability

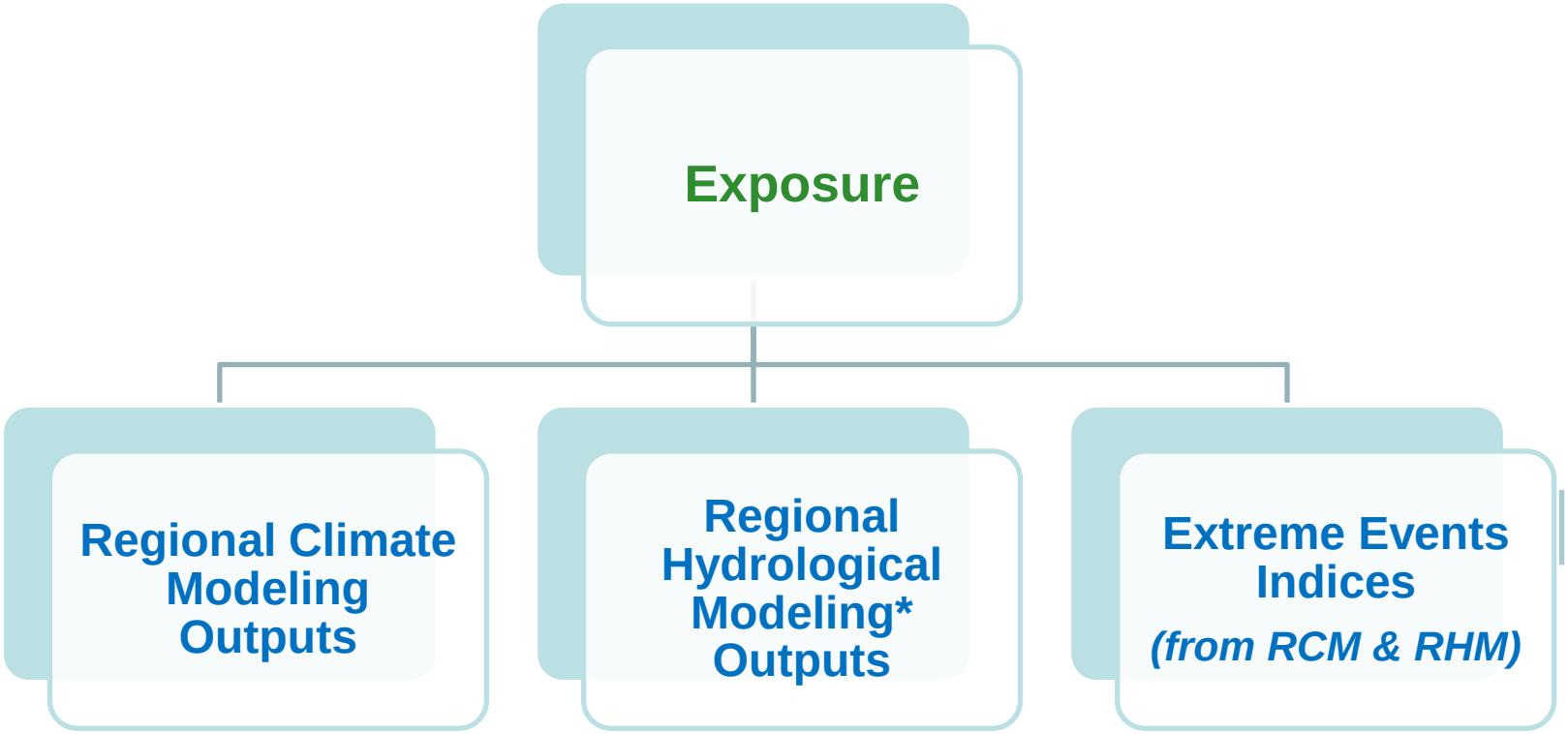


Draft

Exposure

Component

Dimension



** Drawing on Bias-Corrected RCM Outputs used for RHM*

Exposure Indicators

Exposure covers all the outputs generated from regional climate modeling (RCM), regional hydrological modeling (with bias-corrected RCM outputs) as stand alone modeling outputs or extreme events indices.

Modeling Outputs

- Temperature
- Precipitation
- Evapotranspiration (T&P)
- Run-off
- Wind speed
- Etc.

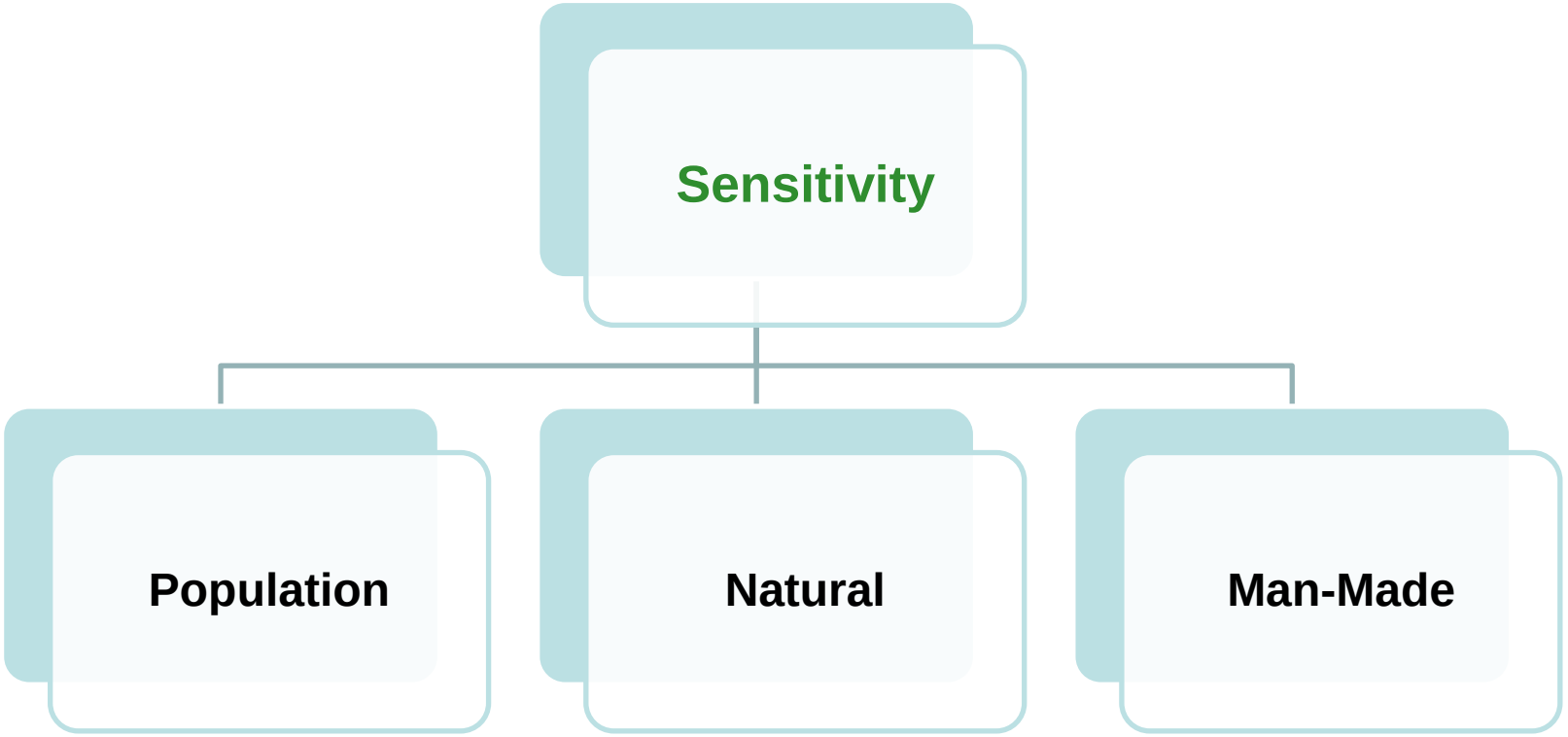
Extreme Events Indices

- Summer days: Number of days with T_{max} above 25^{o}
- Warm spell duration indicator: Number of days with at least 6 consecutive dry days with T_{min} is less than the 10^{th} percentile
- Maximum length of dry spell: Maximum annual number of consecutive dry days (i.e., when P less or equal to 1 mm)
- Etc.

Sensitivity

Component

Dimension

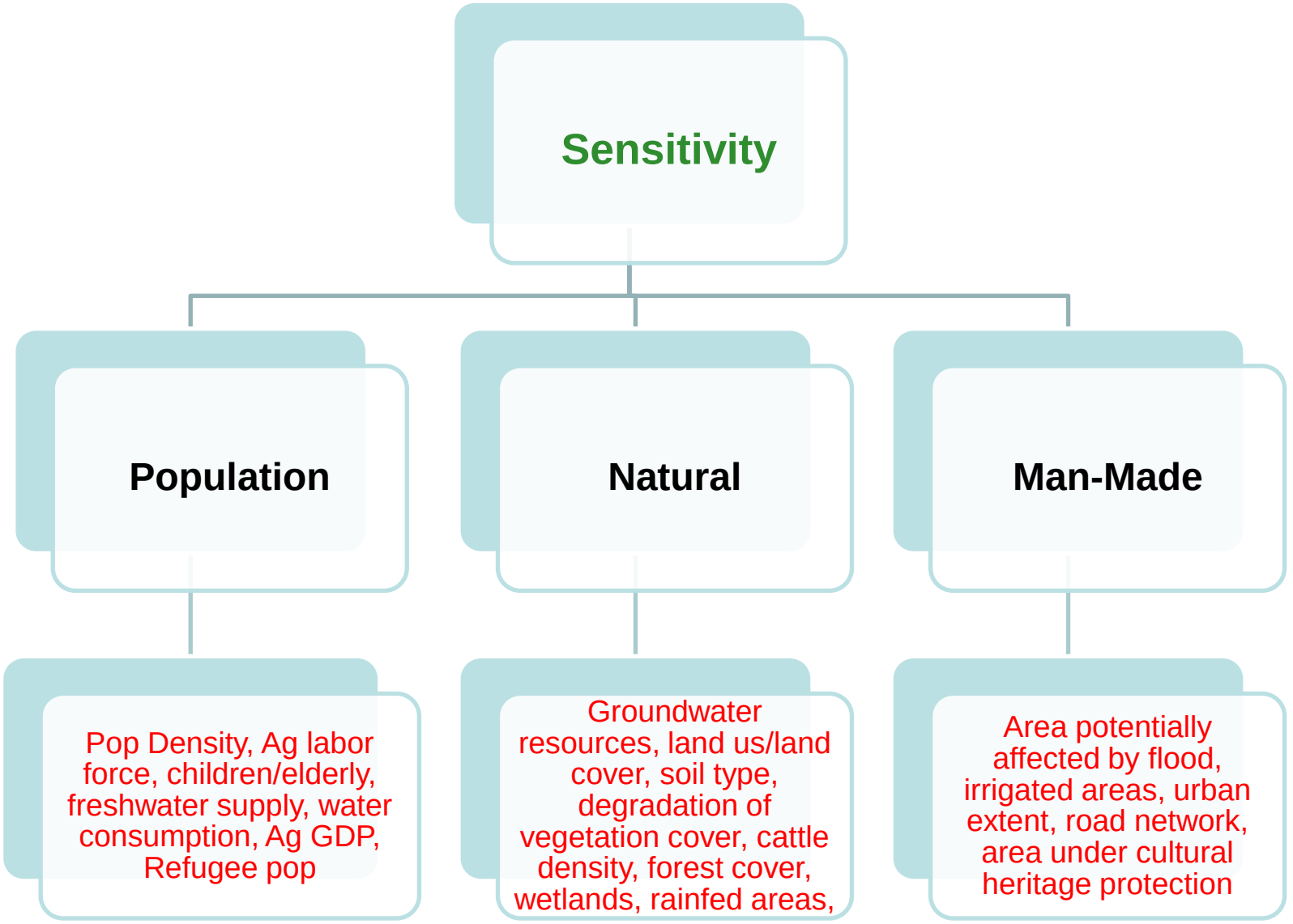


Sensitivity in RICCAR VA

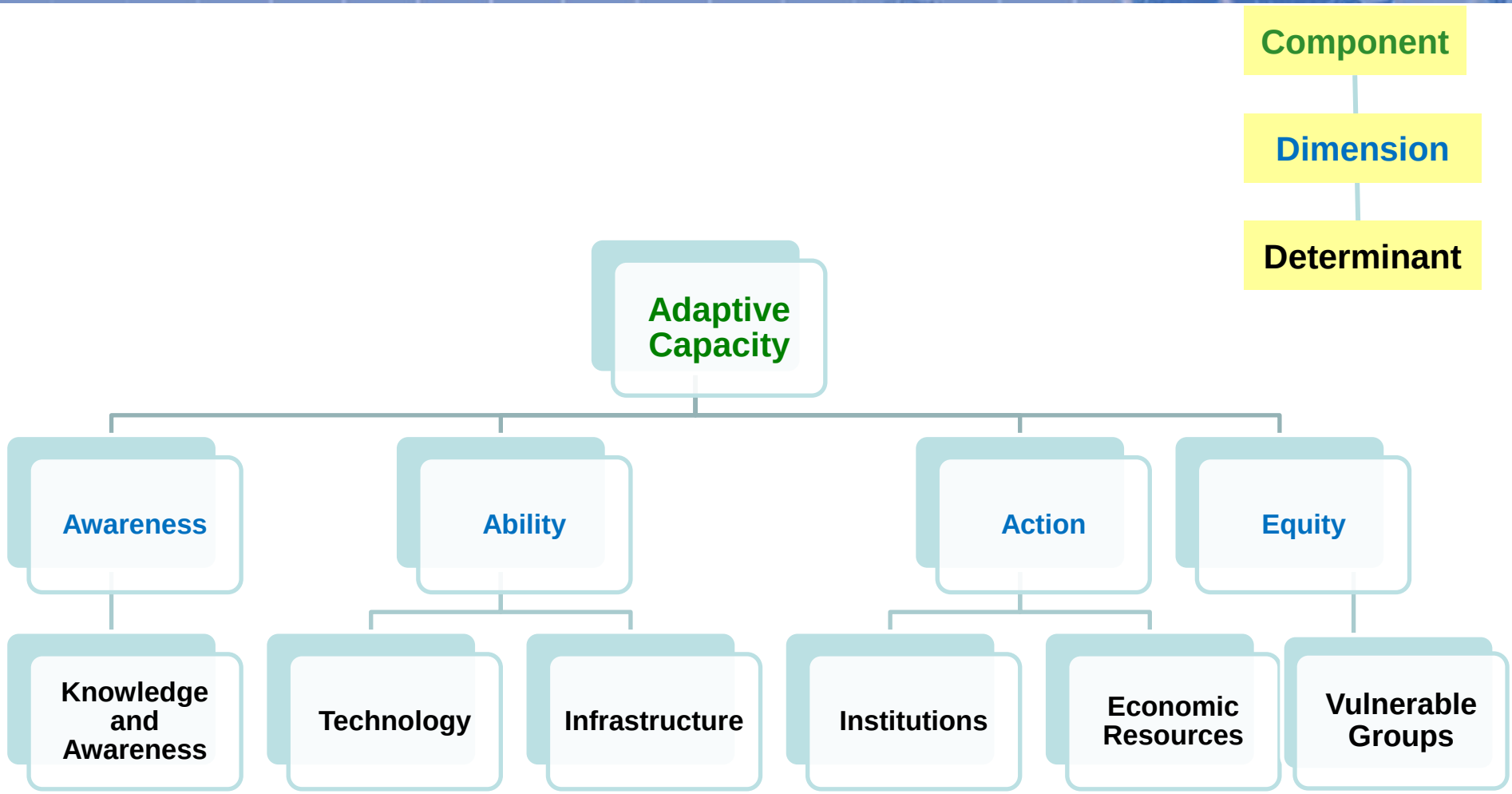
Sensitivity Component consists of 3 dimensions**:**

1. **Population**
   - Indicators that show information related to *population behavior* (labor in agriculture, water consumption, share of children and elderly etc.)
2. **Natural**
   - Indicators that show information about the *natural characteristics* of the region (hydrogeology, soil type, wetland etc.,)
3. **Man-Made**
   - Indicators that describe *anthropogenic impact on the natural environment* (urban area, road network etc.,)

Sensitivity: Dimensions



Adaptive Capacity: Dimensions and Determinants



Adaptive Capacity

- **Exposure and Sensitivity (population, natural, man-made)** determine the **Potential Impacts** of climate change without considering ability of people to act.

Adaptive capacity is "the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behavior and in resources and technologies" - *IPCC (2007)*

- **Adaptive capacity** considers the ***socio-economic, cultural, institutional & technological determinants that characterize*** **the ability to adapt,** including ability:
  - To moderate potential damages,
  - To take advantage of opportunities, and/or
  - To cope with the consequences

- **Adaptation is a response strategy to climate change**, involving **the measures taken to reduce the vulnerability of communities, regions, or sectors to climate change**.
  - Adaptation refers to the ***processes, practices, or structures*** to moderate or offset potential damages or to take advantage of opportunities associated with the changing climate (Smit, Pilifosova 2001).

Adaptive Capacity: Dimensions & Determinants

Adaptive capacity consists of 4 dimensions, with 6 sub-determinants**:**

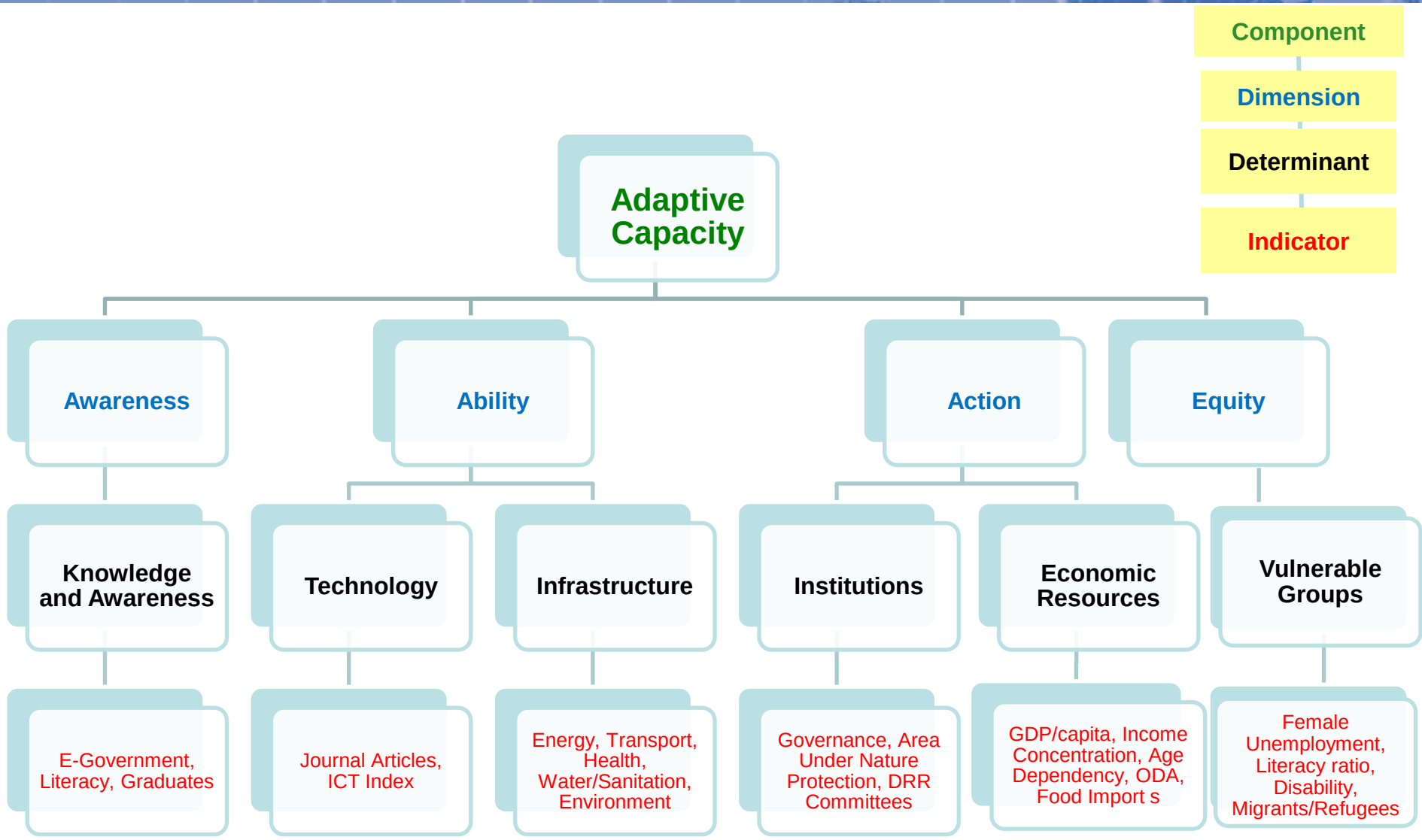
1. **Awareness**
   - **Knowledge and awareness** demonstrates ability of community to access and understand information to enable the identification of adaptation measures
2. **Ability**
   - **Technology and infrastructure** characterizes access to built environment that can support ability of a given society to act.
3. **Action**
   - **Economic resources and institutions** characterize the enabling environment that allows enable a society to carry out adaptation measures
4. **Equity**
   - Considers vulnerable groups, including **gender, socio-economic status and marginalized groups** and transversal dimension

Adaptive Capacity Indicators

- Objective is to develop an **adaptive capacity index** based on a selection of available indicators.
  - **Generic indicators** characterize socio-economic determinants (e.g., income, education, health) because they ***enable adaptation across localities*** and countries irrespective of their location and climate impacts
  - **Specific indicators** are those that characterize the ability to ***respond to a particular climate change i****mpact*, such as floods or droughts (see: IPCC (2007))
- Selection of indicators based on in **principle of parsimony**, i.e., that 'less is more' to not make the index unwieldy
  - **Balance** thus sought between the dimensions and 6 determinants, to ensure AC Index is representative of all the necessary aspects to consider.
  - **Data quality** assessed based on extensive review of available data sources and data sets , with due consideration to ensuring maximum country coverage (Arab States); overcoming data gaps; using national data, and open source data..
  - **Composite indicators** sometimes used to combine proxies with different data gaps to effectively represent a dimension without adding too many indicators
  - **National level data** dominates most datasets, which affects their geospatial representation for the VA. Per capita geospatial distribution possible.

Can help to inform action and M&E for Adaptation by identifying areas where AC could be strengthened

Adaptive Capacity: Dimensions-Determinants-Potential Indicators



1. Knowledge and Awareness

Main Proposed Indicators

- **Public spending on education**, total (% of government expenditure)
- **Expenditure per student**, primary/ secondary/ tertiary (% of GDP/ per capita)
- **Graduates** from Tertiary Education
- **E-Governance Readiness Index**
- **Knowledge Society Index**
- **Youth literacy rate**, population 15-24 years, both sexes
- **Adult literacy rate**, population 15+ years, both sexes
- **Public awareness** about Water Scarcity/ Climate change
- Farmers served by **extension services**

Proposed Indicators

- ✓ **Adult literacy rate** population 15+ years, both sexes (UNESCO Institute of Statistics)
- ✓ **Graduates from Tertiary Education** (UNESCO Institute of Statistics)
- ✓ **E-Government Readiness Index** (UN Public Administration Country Studies)

2. Technology

Main Discussed Indicators

- **Research and development** expenditure (% of GDP/ per capita)
- **Knowledge Economy Index**
  - Innovation sub-index
  - Information and Communication Technology sub-index
- **Scientific and technical journal articles**
- **Fixed-telephone** subscriptions per 100 inhabitants
- Households with a **Computer**
- Individuals using the **internet**
- **Mobile-cellular** subscriptions per 100 inhabitants
- **Patents** Granted by USPTO / Million People, average 2005-2009
- **Telecommunication Infrastructure Index** (E-Governance Index)

Proposed Indicators

✓ **Scientific and technical journal articles**
(in Thomson Reuters, Social Science Citation Index; and other sources)

✓ **Telecommunication Infrastructure Composite**
based on International Communication Union:

- **Fixed-telephone subscriptions** per 100 inhabitants (ITU)
- **Households with a Computer** (ITU)
- **Individuals using the internet** (ITU)
- **Mobile-cellular subscriptions** per 100 inhabitants (ITU)

3. Infrastructure

More than 30 Discussed Indicators; 11 Proposed Indicators

✓ Energy

- Access to **electricity** (IEA)
- **Energy** consumption (IEA)

✓ Transport

- **Road density** (International Road Federation)

✓ Health Composite based on:

- Total **expenditures on health** (WHO)
- Number of **hospital** beds per 1000 inhabitants (WHO)

✓ Water Supply & Sanitation

- Access to improved **water** (WHO/UNICEF JMP)
- Access to improved **sanitation** (WHO/UNICEF JMP)
- **Desalination** capacity per capita (DesalData)
- **Water storage capacity** (ACSAD)

✓ Environment

- Change in **Forest cover**
- Change in **Wetlands**
  - Environmental Performance Index (Yale University)

4. Institutions

Main Discussed Indicators

- **Governance**
- **Spending on Disaster Risk Reduction (DRR)/** DRR Inventory Data Updates
- **Indicator of the size of the informal sectors**
- Number of **NGOs** per million persons
- **Insurance** (% of GDP/ % of service imports)
- **ISO 14001 Certifications**
- **Area under nature protection**
- **Cultural Heritage Sites**
- Number of **agricultural cooperatives**
- **Products that are subject to agricultural grading schemes**

Proposed Indicators

- ✓ **Governance Composite** (from selected World Bank indicators):
  - Government Effectiveness
  - Regulatory Quality
  - Voice and accountability
  - Rule of law
  - Political Stability
- ✓ **Area under nature protection** (UNEP-WCMC)
- ✓ **Cultural Heritage Sites** (UNESCO)
- ✓ **Existence of DRR Strategy** (UNISDR)

5. Economic Resources

Main Discussed Indicators

- **GDP** per capita(UNSTAT)
- Central **government debt** (% of GDP)
- **Government surplus/deficit** (% of GDP)
- Age **dependency ratio** (Total/Youth/ Elderly)
- **Cereal Imports** Dependency
- **Food imports** % of merchandise exports
- **Overseas Development Assistance (ODA)** (Per capita % of Gross National Income (GNI); Net ODA and official aid
- **Foreign Aid** for Climate Change Mitigation/ Adaptation / Desertification

Proposed Indicators

- ✓ **GDP per capita** (SEDAC/ CIESEN)
- ✓ **Age Dependency Ratio** Proportion of dependents, youth and elderly, per 100 in the working-age population (UN Population Division)
- ✓ **Food imports** as a % of merchandise exports (FAO)
- ✓ **Overseas Development Assistance Composite**
  - Net Overseas Development Assistance (ODA)
  - Official Aid/ODA per capita (OECD)

6. Equity

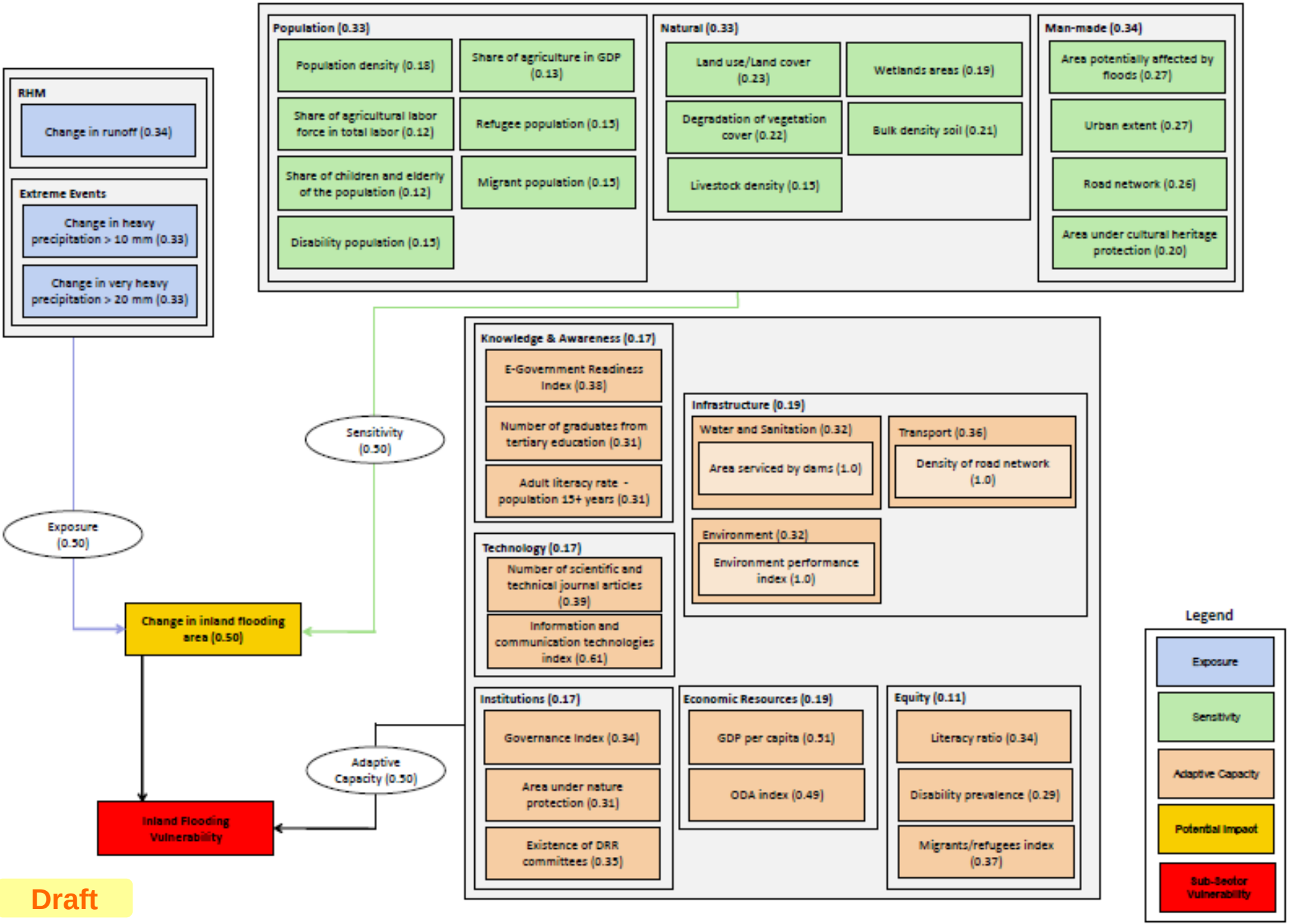
Main Discussed Indicators

- **Gender Inequality** Index
- **Unemployment** Rate (national level)
- **Male/ Female Unemployment rate**
- Youth/ Male/ Female **literacy rate**
- **Rural poverty headcount ratio** at national poverty lines (% of rural population)/ **Rural poverty gap** at national poverty lines (%)
- **Income share held by lowest 20%**
- **Disability** prevalence
- **Slum population** in urban areas
- International **migrants**
- **Refugees/ IDP**
- Male/ Female **Employment in Agriculture**, Hunting and Forestry

Proposed Indicators

- ✓ **Gender Inequality**
  - Female/ Male **Literacy Ratio** (UNESCO Institute of Statistics)
  - Female/ Male **Unemployment Ratio** (ILO)
- ✓ **Slum population** in urban areas (UN-Habitat)
- ✓ **Migrants** (UN Population Division)
- ✓ **Refugee Composite:**
  - Refugees & Internally Displaced Persons (IDP) (from UNCHR)
- ✓ **Disability prevalence** (ESCWA/ National Statistical Offices) – also includes disability caused by military conflicts in region

Impact Chain for Infrastructure and Human Settlements Sector, Potential Impact 5: Change in inland flooding area



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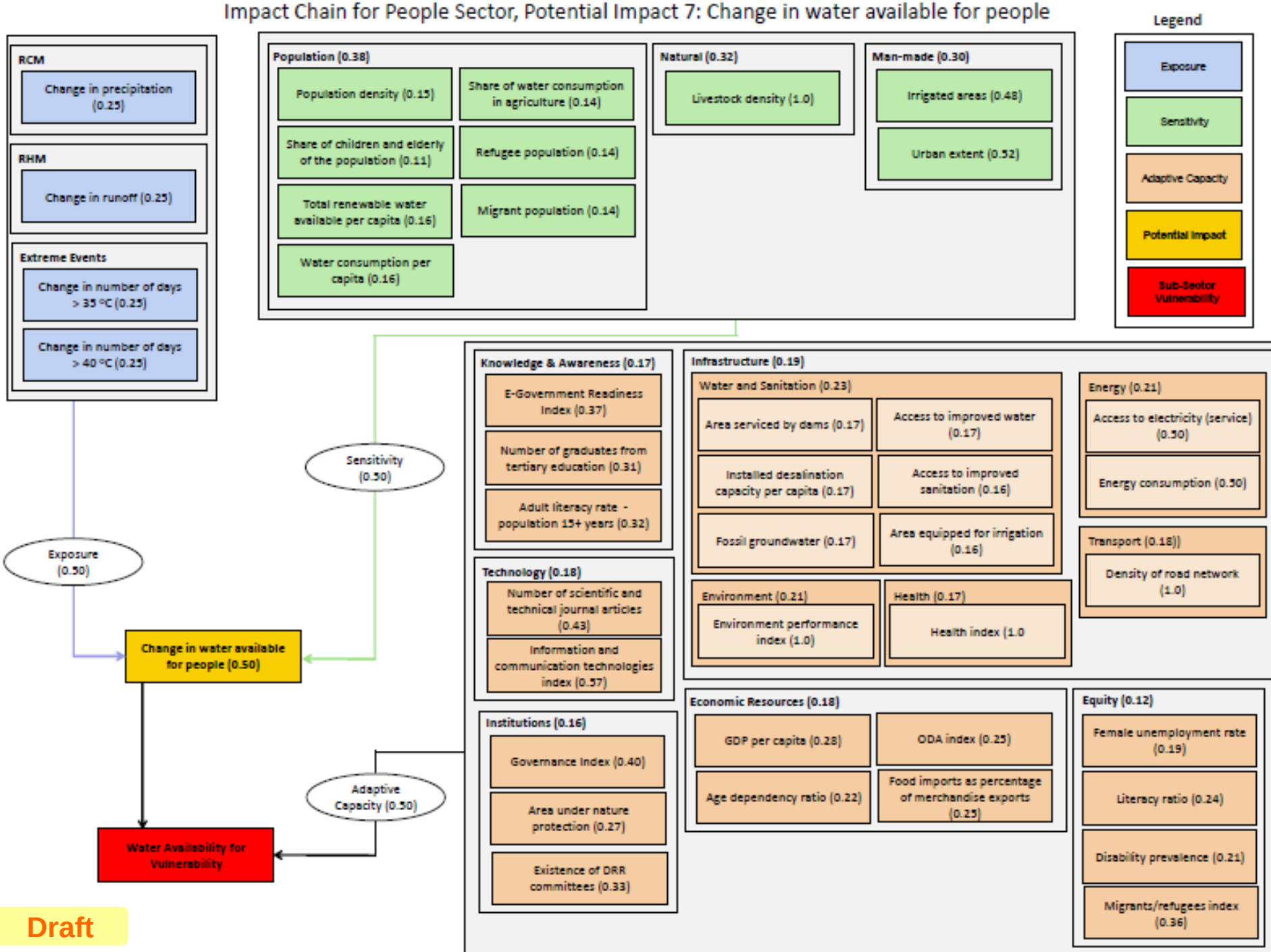
Impact Chain for People Sector, Potential Impact 7: Change in water available for people



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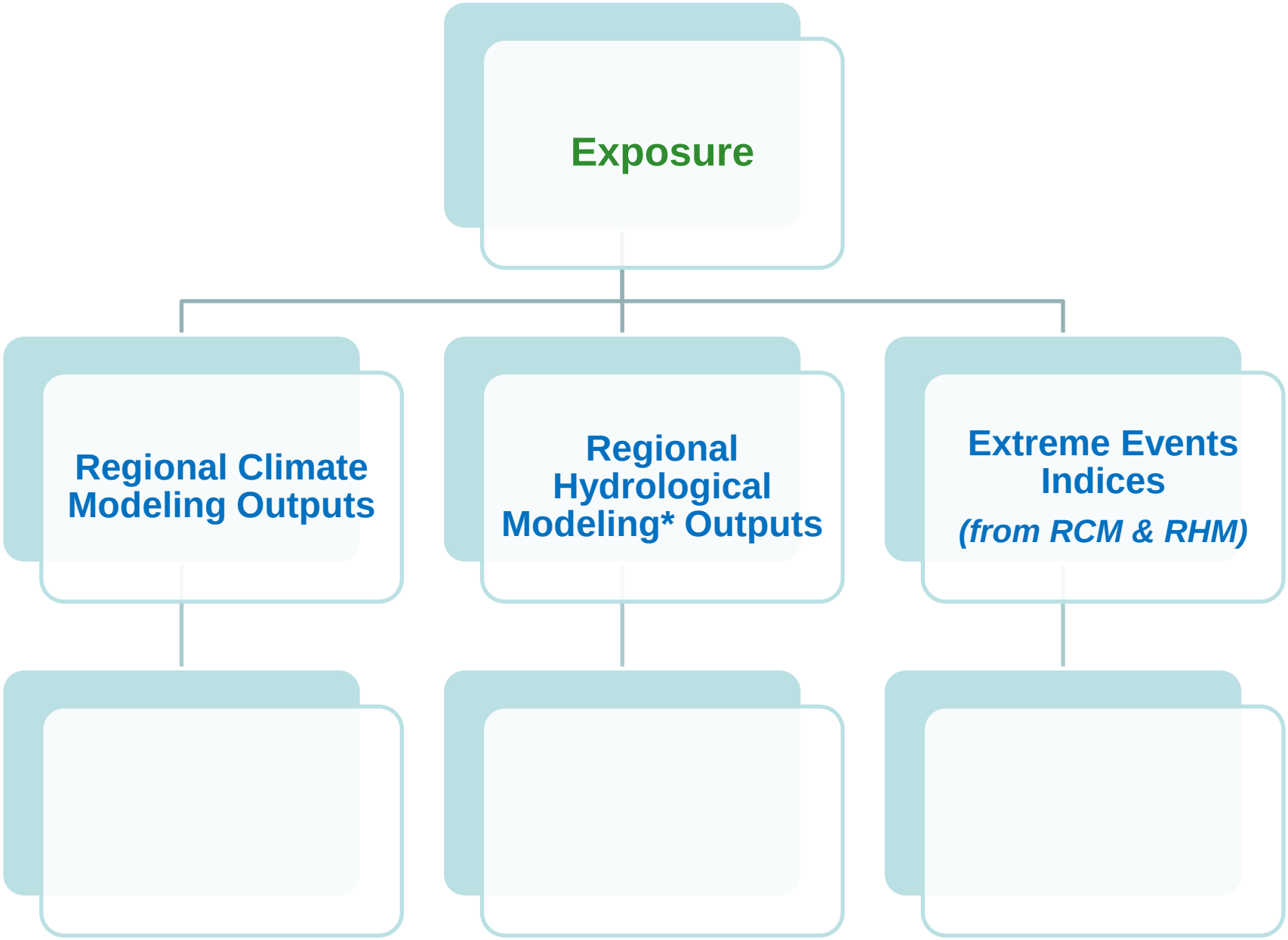
Exercise:

Developing a Vulnerability Assessment Impact Chain

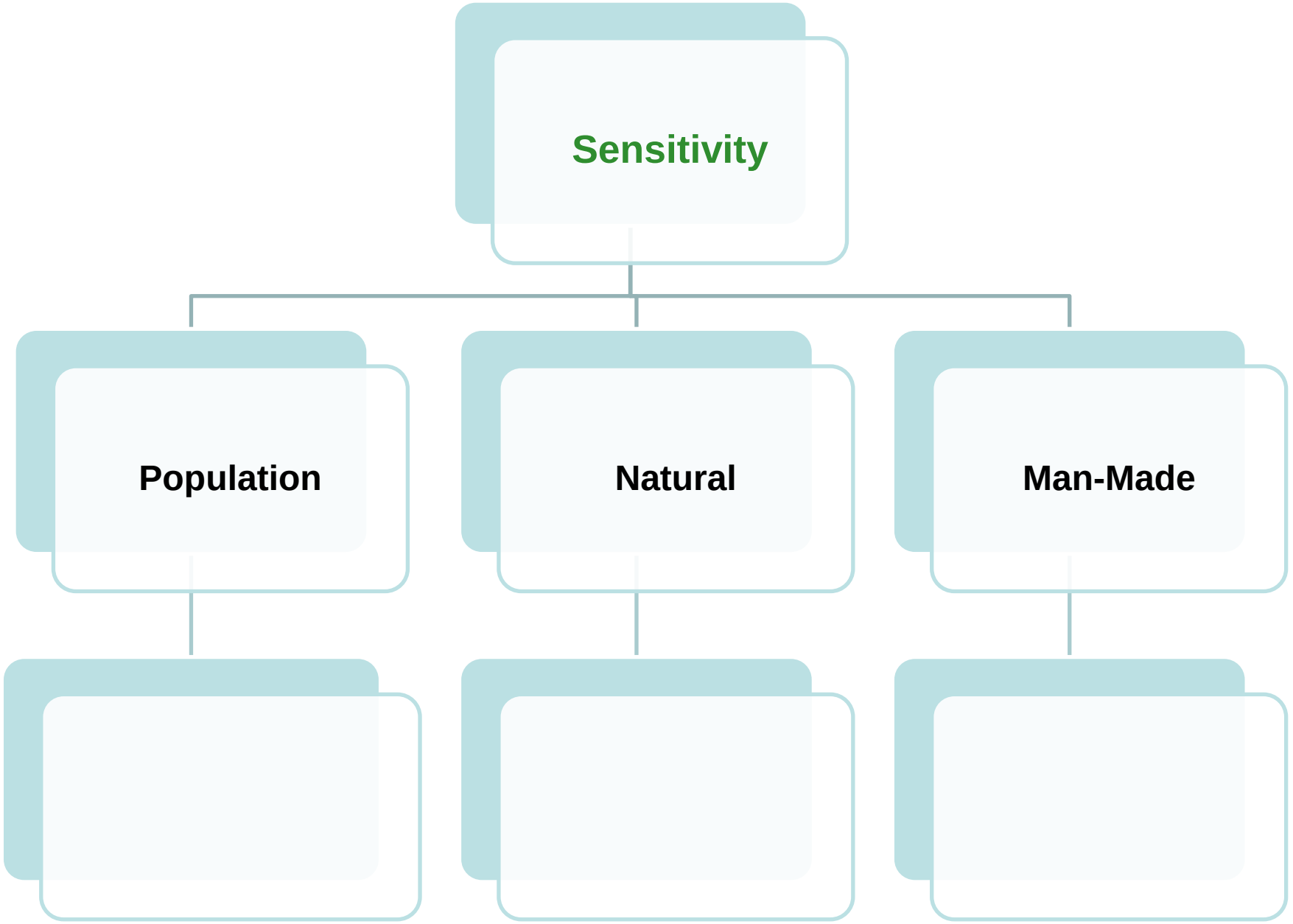
Exercise

1. Pick a Scale of analysis
   (regional, country, local, basin, ecosystem)
2. Pick a Sector
   (e.g., agriculture, tourism, cities, employment)
3. Identify the Exposure, Sensitivity and Adaptive Capacity Indicators that exert the most influence on your sector
   - Consider data availability
4. Weight the indicators within each Component
5. Generate your impact chain

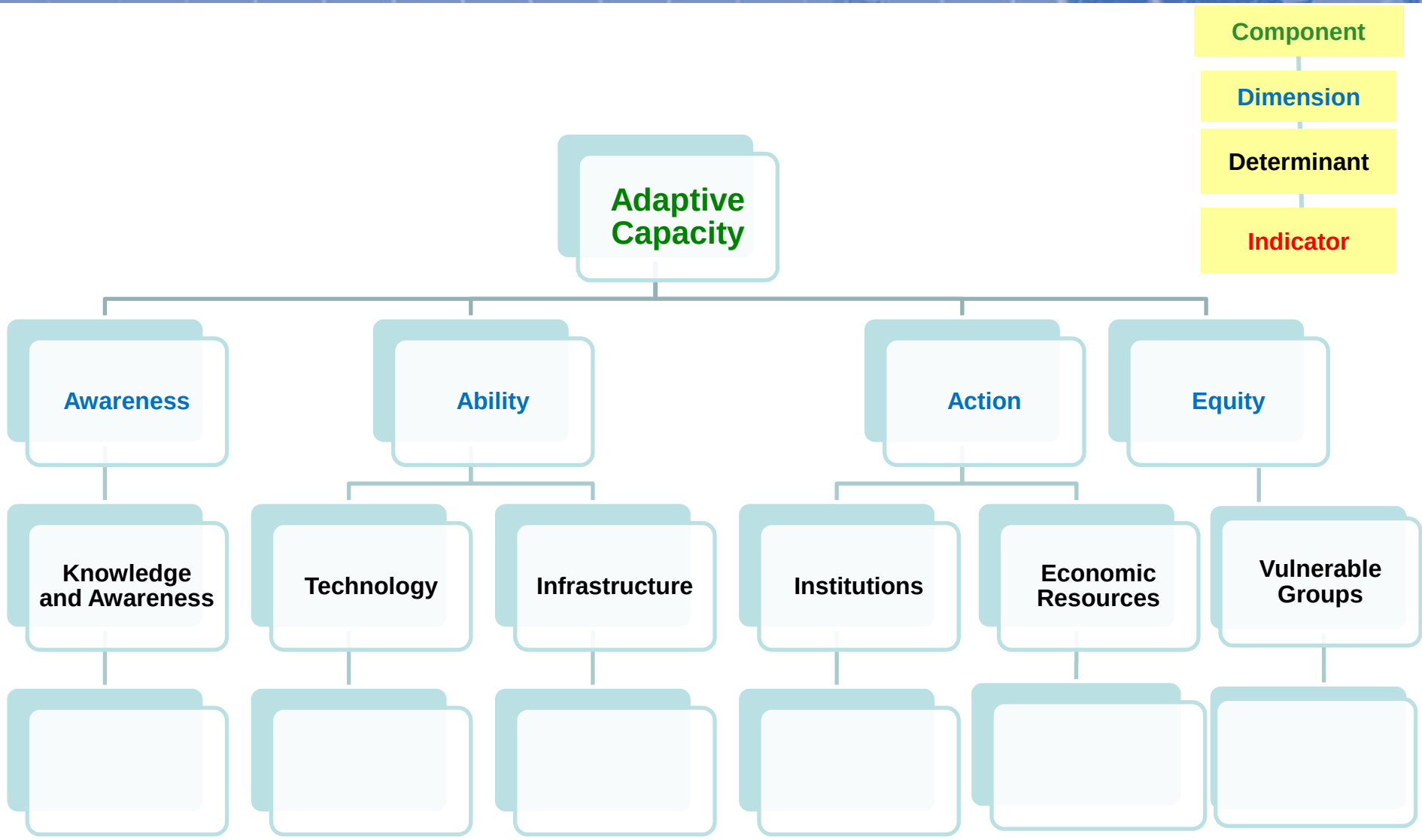
Sector: _____

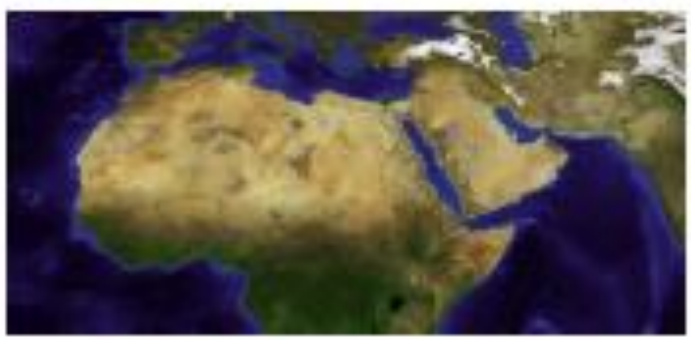

Exposure
Regional Climate Modeling Outputs
Regional Hydrological Modeling* Outputs
Extreme Events Indices
(from RCM & RHM)

Sector: _____



Sector: _____


Component
Dimension
Determinant
Indicator
Adaptive Capacity
Awareness
Ability
Action
Equity
Knowledge and Awareness
Technology
Infrastructure
Institutions
Economic Resources
Vulnerable Groups



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Adaptation to Climate Change in the Water Sector in the MENA Region (ACCWaM) project

Training Manual on the Integrated Vulnerability Assessment Methodology

Thank you!

More information available in VA Training Manual (2015)