Policy Dialogue and Knowledge Management on Climate Protection Strategies in Nigeria

DIAPOL-CE Project

Abuja - Berlin | 2025

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Supported by:

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

based on a decision of the German Bundestag

IKI INTERNATIONAL CLIMATE INITIATIVE

Agenda

1. Background information
2. Brief Information about the Model and Data
3. Economic Diversification Scenario

Project overview

DIAPOL-CE

“Policy Dialogue and Knowledge Management on Climate Protection Strategies”

Commissioned by the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV)

03/2014 – 06/2025

Purpose

- Approaches to the development of a climate friendly, resilient and nature-compatible economy are transferred to partner countries and are disseminated on a supra-regional level

Partner countries

- Georgia, Mongolia, Oman, Uzbekistan, **Nigeria**, Rwanda, Senegal, Uganda

Workstreams in Nigeria

Federal Ministry of Finance

- Economic Advisory on Climate Protection

Federal Ministry of Budget and Economic Planning

- Climate Economy Modelling

Enhancing the Nigerian Computable General Equilibrium Model for Climate Sensitive Analysis

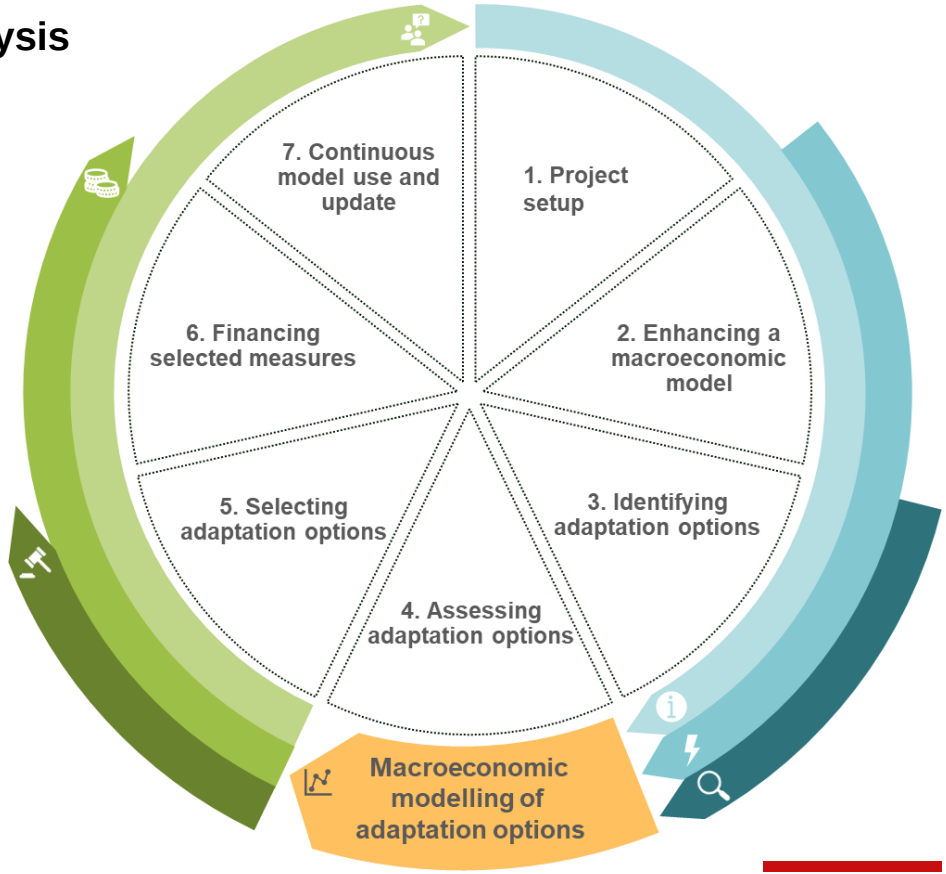
Objectives

- Support **climate sensitive economic planning** (1 – 7)
- Improve **quantitative evidence** of economic **costs and benefits** of climate action (3 + 4 + 5)
- Increase **capacity** on use and application of the model (2 + 7)
- Prepare implementation of selected adaptation measures by **identifying financing options** and **drafting bankable projects** (6)

Two policy scenarios have been prioritized, defined and will be simulated :

(1) Diversification of the Economy

(2) Agricultural Adaptation



Nigerian Case Study Tasks

Topic	Details
Review literature	▪ Review relevant national policies, economic plans, and previous studies on economic diversification. ▪ Collaborate with key stakeholders, including government institutions, academia, and international partners to validate the identified sources

Develop case study	▪ Document the methodology used in the CGE modelling, including scenario assumptions, data sources and disaggregation.
	▪ Analyze key policy measures pertaining to investment and trade, and non-oil sectors, e.g.:
	  ▪ Investment in climate-resilient infrastructure.
	  ▪ Leveraging the African Continental Free Trade Area.
	  ▪ Increased government expenditure in non-oil sectors.
	  ▪ Tax reforms and non-oil revenue mobilisation

Report	▪ Prepare a report of the case study incorporating feedback from stakeholders

CGE model for Nigeria

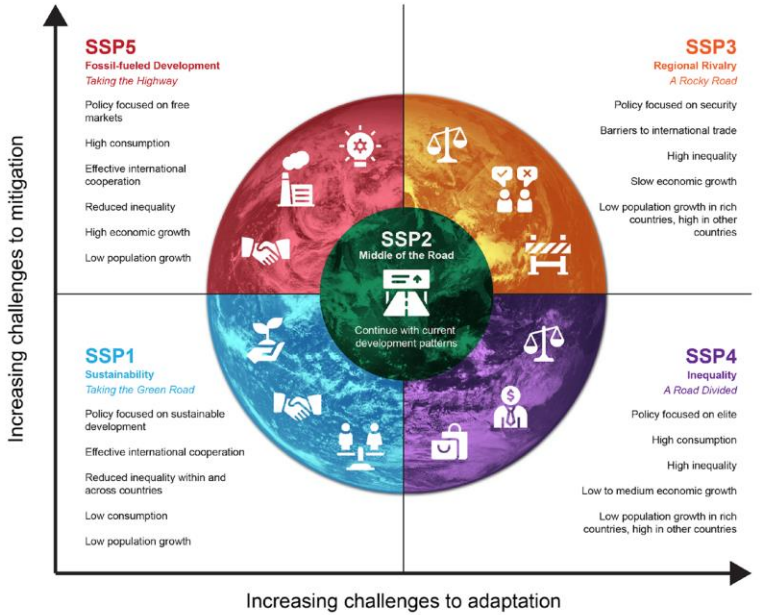
- Detailed mathematical representation of an economy designed to capture the disaggregated nature of economic interrelationships.
- This representation covers
  - the behavior of domestic agents that **supply** goods and services (industries)
  - domestic agents that **demand** goods and services (industries, the government, households and investors).
- It also covers **international trade** with explicit modeling
  - of global demand for the economy's production (i.e., for its exports)
  - of global supply to the economy (i.e., of its imports).
- **Flows of capital and labour** are accounted for both as
  - income (wages and profit)
  - items of industry costs (labour and capital-used).
- **Database:** Social Accounting Matrix (SAM) based on the 2019 Supply and Use Table (SUT) provided by the Nigerian Federal Government
- **Software:** GEMPACK Software (see http://www.copsmodels.com/gempack.htm)

Baseline Scenario

Calibration year: Statistical data (i.e., SAM)

Projection years: Use the International Institute for Applied Systems Analysis (IIASA) forecasts for GDP, Value-Added, Employment and Population by main sector for:

- **Shared Socio-economic Pathways (SSP)**
- SSP1 ;
- SSP2 ; and
- SSP3



Economic Diversification Scenario

Targets from Key Variables from Agenda 2050

- How do we reach these targets?
- What investments are required?
- What are the projected emissions based on these economic targets?

	Baseline	Projections / Targets	
	2020	2030	2050
Real GDP at Basic Prices (₦'billion)	70,014 37	129,158.67	569,407.09
Per capita GDP (US$)	2,084.05	6,223.23	33,328.02
Government Revenue Shares:			
Non-Oil Government Revenue (%)	49.10	64.40	95.00

Economic Diversification Scenario

		Share of Gross Domestic Product (2020-2050)					
Sectors	2020	2025	2030	2035	2040	2045	2050
(a) Agriculture	24.45	23.76	21.96	19.58	16.49	12.57	7.6
(b) Industrial Sector	28.58	30.21	32.42	35.22	38.71	43.04	48.4
(c) Manufacturing	12.83	12.93	14.91	17.18	19.8	22.82	26.3
(d) Oil & Gas	6.69	7.56	4.92	2.6	1.4	0.79	0.46
(e) Services	46.97	46.03	45.61	45.21	44.8	44.4	44
Total (%) (Gross)	119.52	120.49	119.82	119.79	121.2	123.62	126.76
Net Total (%) (b-c-d)	100	100	99.99	100.01	100	100.01	100

Economic Diversification Scenario (Contd.)

Commodity/Sector	Share of Gross Domestic Product (2020-2050)						
	2020	2025	2030	2035	2040	2045	2050
Solid Mineral in GDP	0.33	1.11	1.89	2.67	3.44	4.22	5
Solid Mineral Share in Manufacturing/Industry	0.33	2.61	4.89	7.17	9.44	11.72	14
Oil Refining Share in GDP	0.1	0.11	0.12	0.13	0.13	0.14	0.15
Petrol-Chemical Share in GDP	<1	1.17	1.33	1.5	1	1.17	2
	Share of Exports (2020-2050)						
	2020	2025	2030	2035	2040	2045	2050
Agricultural Products	3.07	5.15	8.62	14.43	14.19	13.2	12.2
Fuels & Mining Products	87.17	81.05	66.6	41.09	28.42	24.02	19.62
Manufactures	7.69	13.81	24.78	44.48	57.39	62.79	68.18
ICT Goods Exports Share in Total Goods Exports	0.002	0.84	1.67	2.5	3.33	4.17	5
ICT Service Exports Share in Total Service Exports	4.09	5.08	6.06	7.05	8.03	9.02	10

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Thank you

Do you have any questions?

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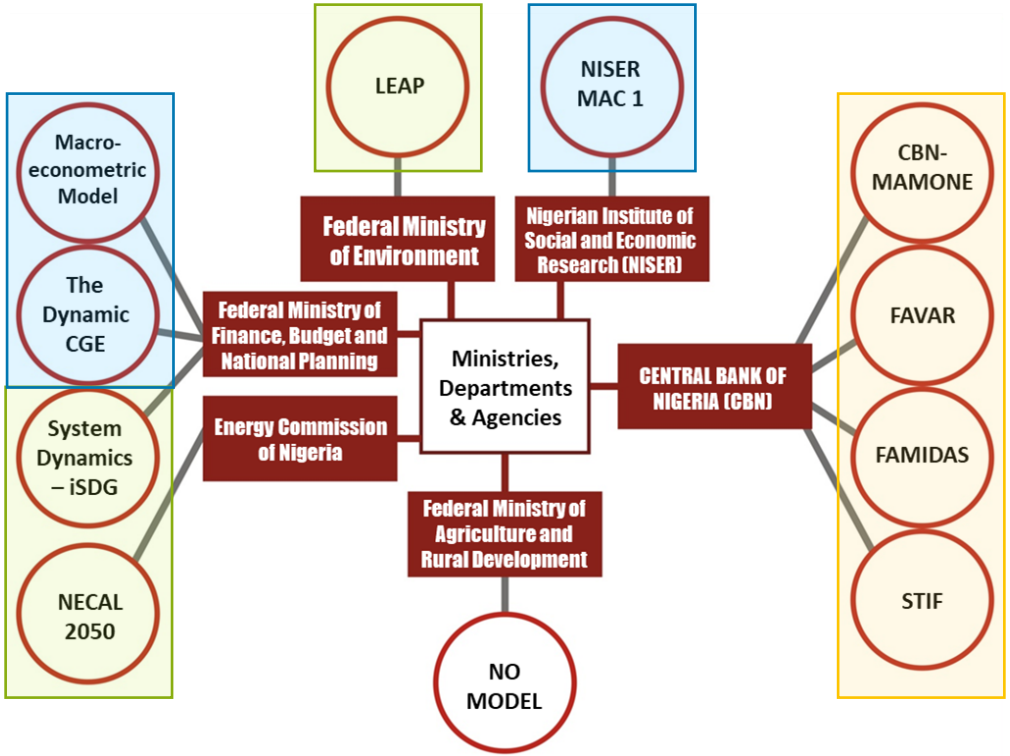
Backup materials

Initial Assessment of existing Models in the Nigerian Government



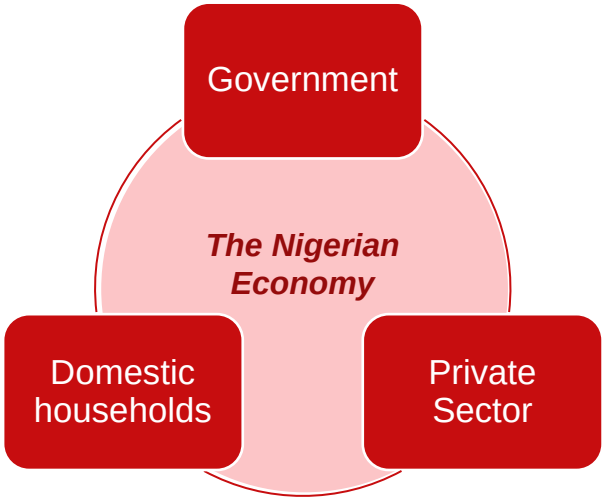
(Mostly) non-economic modelling tools, focusing on emission accounting, energy planning, and system dynamics.

Macroeconometric and Computable General Equilibrium (CGE) models, generally suited to inform policymaking. No previous work on climate or environmental matters (apart from some analyses on the energy sector).

Different timeframes, detailed representation of financial sector, and allowing for simulation of monetary shocks. No previous work on climate or environmental matters (apart from some analyses on the energy sector).

Model Assessment Report conducted by Dr Bright Eregha (2022) [Made available upon request]

Rationale: Using a macroeconomic model to support evidence-based policymaking with *What If* analyses



- Simplified framework that represents how an economy or several interdependent economies work:
- Equations describe how the agents (government, households, and firms) interact and behave under specific assumptions
- Provides insights on key indicators such as economic development, employment, output in key sectors, etc.
- **Tool for conducting *What If* analyses:**

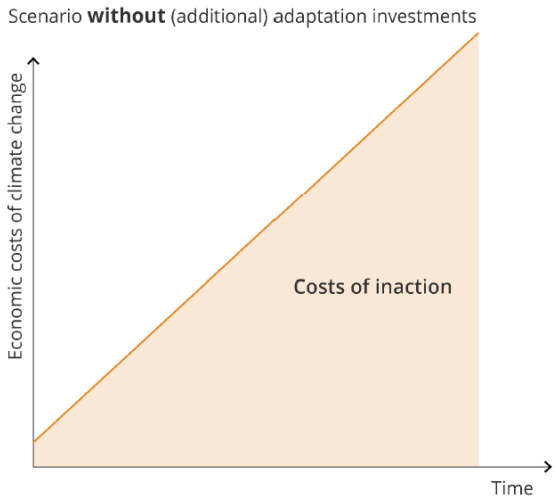
  What is the impact on economic development, employment, the trade balance, …

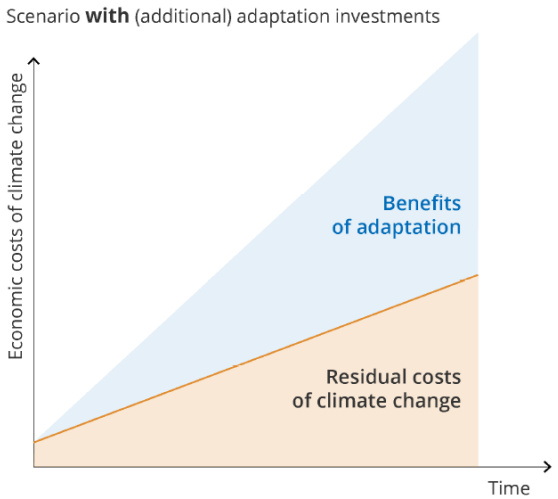
  - *… if we increase the use of climate resistant crops and invest in improved irrigation technologies?*
  - *…if we introduce a CO_2 price?*
  - *…if we invest in flood protection / tide barriers / windbreaker?*

Combining Economy and Climate Impacts

Model Components

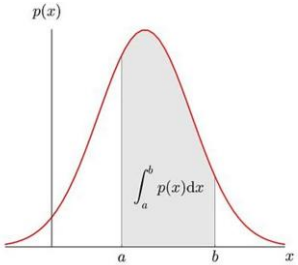
Economic Model	Risk and Damage Scenarios	Cost and Benefits of Adaptation
GDP		
Labour Market		
Trade		
Sectoral Analysis		



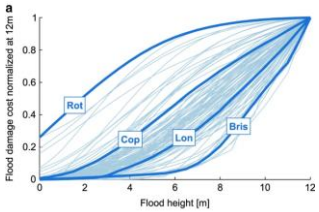


Implementation of the Climate Resilient Economic Development (CRED) Approach

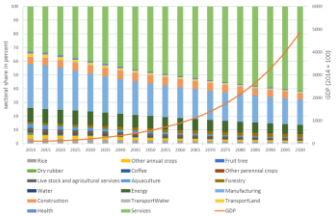
The climate-sensitive macroeconomic model allows to integrate hazard scenarios and economic vulnerability



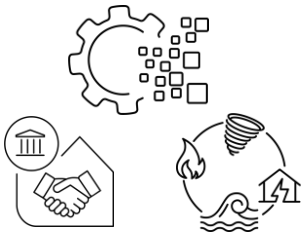
Future climate hazards



Past economic damages



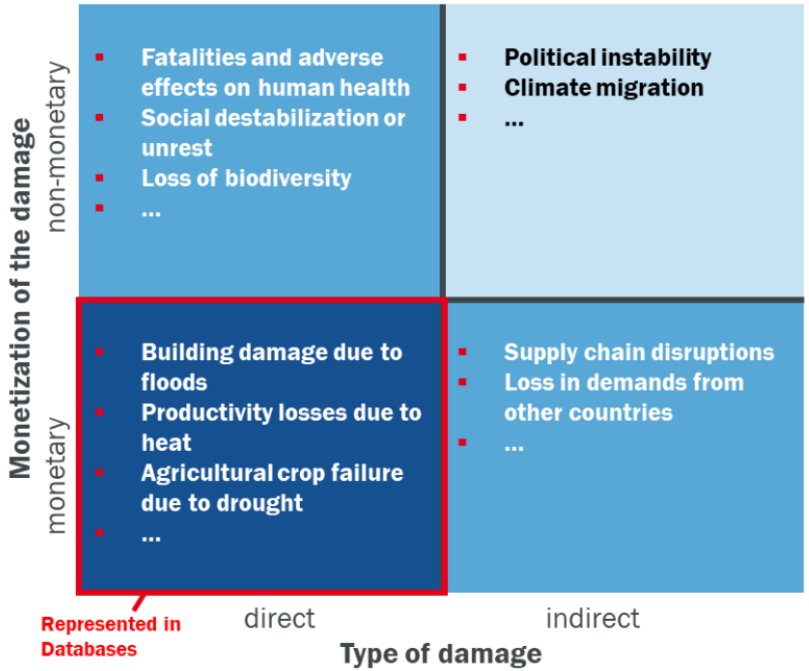
Economic growth



Climate Economy Model

Approach to Systemize Climate-induced Damages

Figure 2: Systematization of climate-related loss and damages



- Capture impact of climate with dynamic general equilibrium model that includes „damage functions“
- Damage function specification depends on physical impacts of climate on the economy.
- Annual averages might not be sufficient to model all potential physical impact chains.
- Impact chains for different regions and economic sectors need to be identified to calibrate the damage functions.
- Damage functions regarding weather extremes require loss and damages data for Nigeria.

Prognos AG. (2023). *Figure 2: Systematization of climate-related loss and damages* [Graph]. In J. Trenczek, J. Droste, L. Eiserbeck, V. Leuschner, & O. Lühr (Eds.), *Estimation of Costs Resulting from Climate Change in Germany*. German Federal Ministry for the Environment & German Federal Ministry for Economic Affairs. Retrieved from https://www.prognos.com/en/project/estimation-costs-climate-change-germany

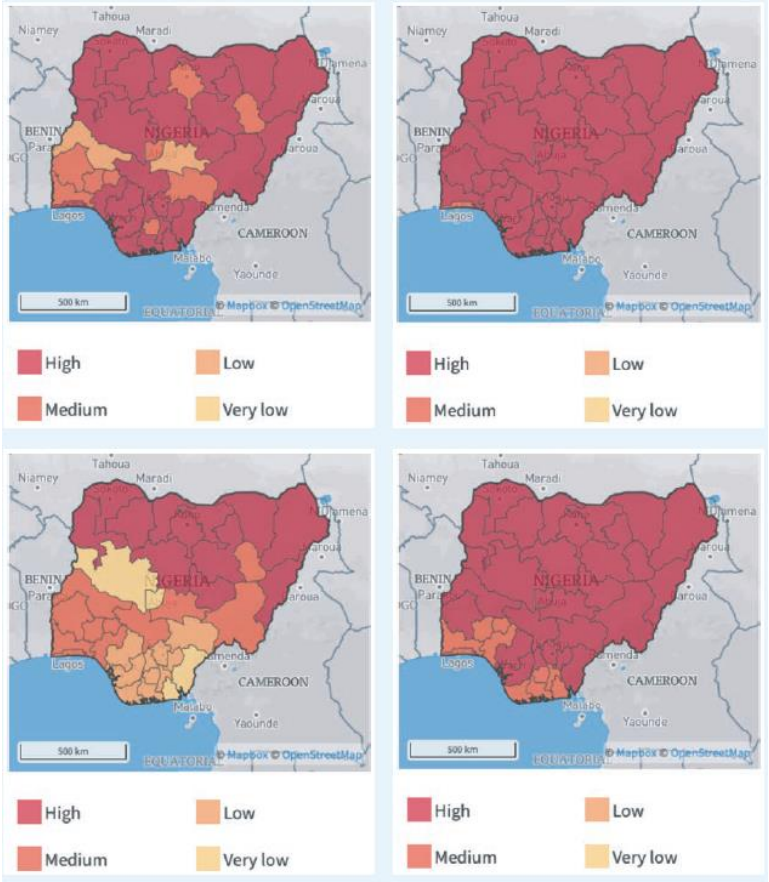
Climate Hazard Data

Starting from the economic relevance of hazards: what are the most relevant hazards?

Shortlist of hazards

- Heat waves
- Floods
- Extreme precipitation
- Drought events
- Strong winds
- Other relevant hazards…

FIGURE 9. Risk of Urban Flood (top left); Risk of Wildfire (top right); Risk of Water Scarcity (bottom left); Risk of Extreme Heat (bottom right).[54]



The World Bank Group. (2021). *Climate Risk Profile: Nigeria.* p.14, Washington: The World Bank Group.

Losses and Damages from Floods

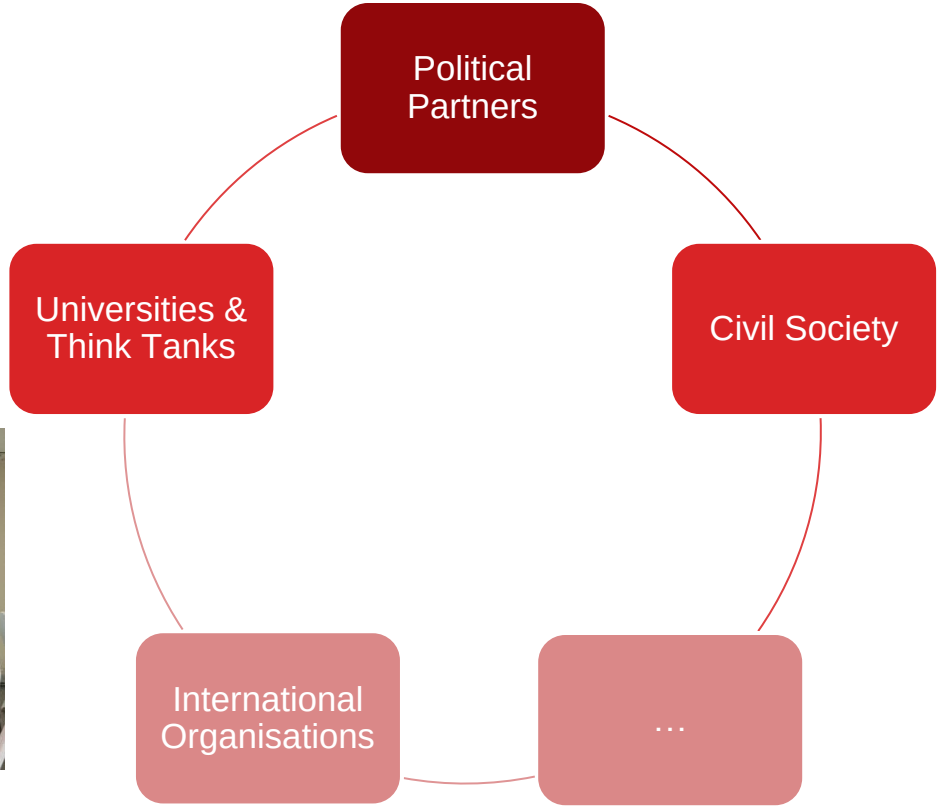
- **2012:** 17 billion USD in damages and losses in the 12 most affected states;1.4% of real GDP growth; Seven million people affected, economic losses at approx. 500 million USD
- **2015:** One million people affected and economic losses at approx. 25 million USD
- **2022:** Deaths of over 600 people and displaced 1.3 million from their homes; 200,000 houses and 266,000 acres of farmland have been completely or partially damaged; total direct economic damages are in the range of US$3.79 billion to $9.12 billion, with the best (median) estimate at $6.68 billion

Expert Group (Inter-agency committee on modelling and data sharing)

Ensuring national ownership and a close fit of the model to the national economic and sector conditions as well as available policies.

Continuous involvement on

- Data collection and selection
- Discussion on policy questions
- Definition of scenario assumptions
- Capacity building



Mainstreaming Climate Considerations in Mathematical Models

- Assessment of existing models at different Ministries, Agencies and Departments (MDAs) ✓
- Inter-agency committee on modelling and data sharing (Expert Group) ✓
- Capacity Building on Mainstreaming Climate Considerations in Mathematical Models ✓
- Review of CGE-Model for possible extension with environmental component ✓
- Enhancement of CGE model with environmental concerns ●
- Update of the Social Accounting Matrix ●
- Development of Cost-Benefit Analysis (WRI) ●
- Defining Policy Scenarios ●
- Simulating Scenarios on Climate Related Impacts for Policy Influencing
- CGE Modelling Training for Model Use ●
- Handover of the Model to the Department of Macro-Economic Modelling
- Identifying climate finance options for selected adaptation measures ●
- …

Scenario Prioritisation

Diversification of the Economy

What?

- Decrease in Agriculture and Fossil Fuel Production
- Increase in Services, Commerce, Entertainment, Technology

How?

- Government Subsidies to Target Industries
- Private Investments

Who pays?

- Public Private Partnerships
- State Budget (Tax Increase)

Agricultural Adaptation

What?

- Using stress/flood/drought resistant crops and varieties
- Crop rotation, diversification, mixed crops

How?

- Government Subsidies to Farmers
- Insurance to Farmers

Who pays?

- Government Support to Farmers for their investments

Flood Management

What?

- Construction / Maintenance of Drainage Channels
- Vegetated banks to absorb floods (peatlands, mangroves)
- Dams

How?

- Building codes, limited building allowances
- Regulation and enforced protection of mangroves

Who pays?

- Small investment: municipal level
- Large investment: national or foreign financing

Diversification of the Economy

Which industries will grow, and which industries will decrease output?

Increase in Climate Smart Agriculture	**Increase in Agric. Value Chain**	**Decrease in Oil Production**	**Increase in Services, Commerce, Entertainment, Technology**	**Increase in Gas**

How will this occur?

Government Incentives (e.g., Tax Credits, Input Subsidies, Insurance Outputs)	**Private Investments**	**Training to Farmers**	**Performance Bonds**	**Market-Based Instruments**

Who pays?

Public Private Partnerships	**State Budget (Tax Increase)**	**Build, Operate and Transfer**	**Concessional Funding**	**Crowdfunding / Philanthropy**	**International organisations**

Testimonial from Political Partners

Mainstreaming Climate Change

“The knowledge [on climate change] is important. It has put me in a better position to discuss issues of climate change with confidence. I am in position to be able to interact and, also see how it can fit into my work including the model we are developing.”

Dr. Philip Obasi – Assistant Director, Macroeconomic Analysis – Federal Ministry of Finance Budget and National Planning (FMFBNP)

Continued Capacity Building

1) Model User Skills

- Modelling framework
- Scenario analysis
- Evaluation of results

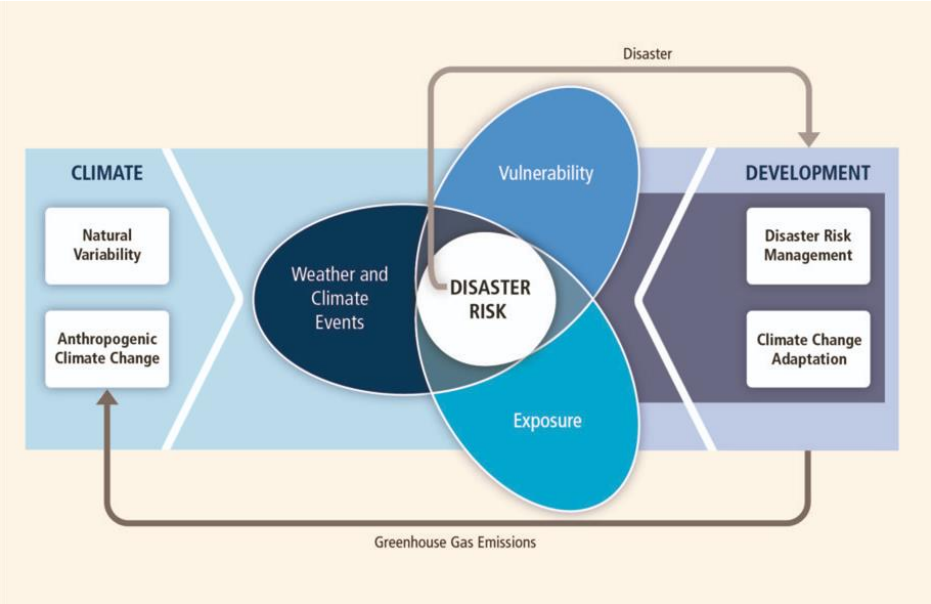
2) Model Builder Skills

- Programming languages and code behind the model
- Data types and declarations
- How to update and extend the model

3) Enhanced understanding on Climate Change

- Environmental effects of climate change in Uganda
- Possible adaptation and resilience measures
- Socio-economic effects of climate change and adaptation measures

Five (5) Levels of Data and Quantitative Analysis



5 Financing Demands

4 Adaptation Scenarios

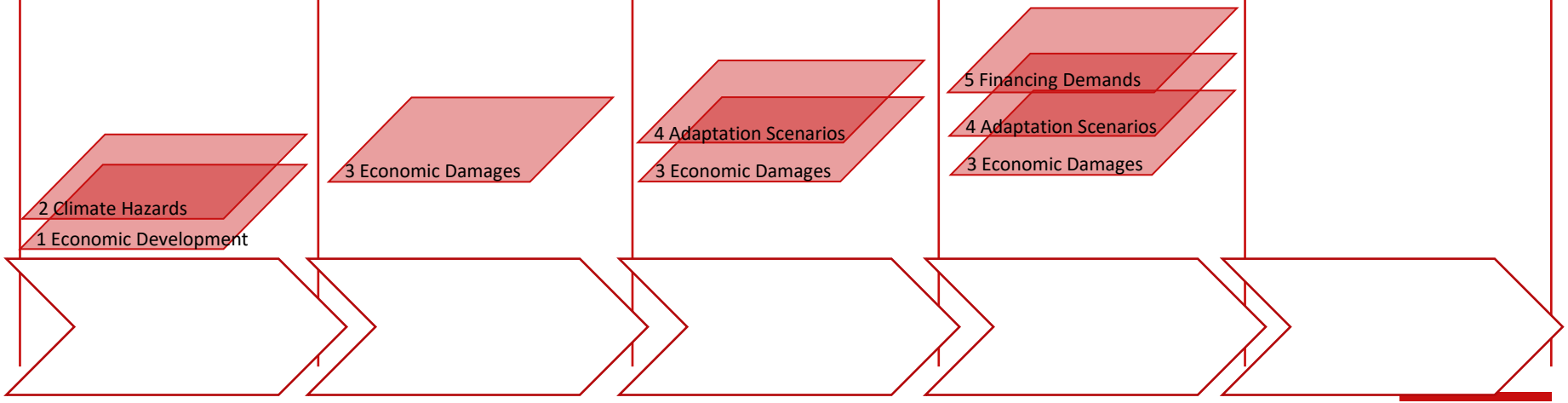
3 Economic Damages

2 Climate Hazards/Past Damages

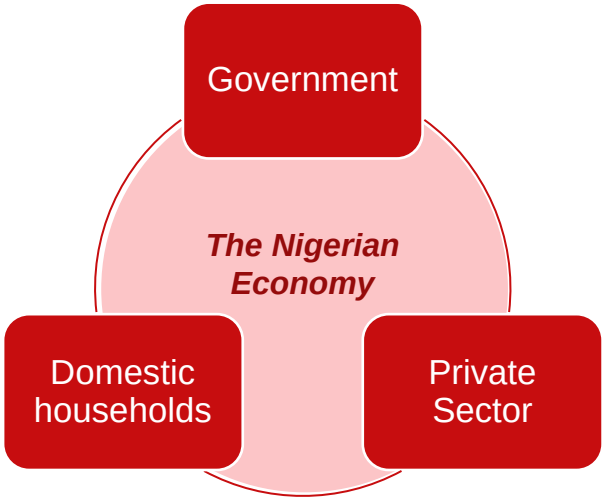
1 Economic Development

Key steps of building the climate-economy model

Collect data sets: economic and climate hazard data	**Macro-economic model:** country specific & dynamic vulnerability	**Analyse adaptation scenarios:** economy-wide & indirect effects	**Improve results:** integrate non-economic aspects	**Policy integration**: facilitate access to climate and disaster risk financing
1 + 2	3	3 + 4	3 + 4 + 5	



Rationale: Using a macroeconomic model to support evidence-based policymaking with *What If* analyses



- Simplified framework that represents how an economy or several interdependent economies work
- Set of mathematical equations that describe how the agents (most importantly the government, individual households, and firms) behave under specific assumptions
- Provides insights on key indicators such as economic development, employment, output in key sectors, etc.
- **Tool for conducting *What If* analyses:**
  - *What is the impact on economic development, employment, the trade balance, … if we increase the share of renewable energies?*
  - *…If we increase the population with access to electricity*
  - *…if we introduce a CO_2 price?*
  - *…if set incentives for a low-carbon development in the transport, industrial, tourism, … sector?*

Key Modelling Principles

Adapted from "Key principles for improving the support to strategic energy planning in developing and emerging economies", Energy and Economic Growth Programme

(1) National ownership. Support country-led planning processes that work in partnership with key stakeholders to achieve broad consensus on strategic objectives and plans. Help empower the relevant authorities at regional, national and subnational level to rally stakeholders to implement the plan and push back on proposals that do not align.

(2) Coherence and inclusivity. Assist Governments to ensure that strategic decisions taken in the any specific sector are coherent with broader economic, social and environmental goals (including Sustainable Development Goals and Nationally Determined Contributions under the Paris climate change agreement) by committing to evidence-based, integrated and inclusive planning processes that lead to fair and technically sound development programmes.

(3) Capacity. Support Governments in the definition of priority capacity building activities which strengthen the capability of national institutions to take the lead on strategic planning. Incorporate plans and evidence into decision-making and implementation processes. Commit to coordination of Development Partners in line with the Government's vision, requests for support and goals, and avoid fragmentation and duplication of efforts.

(4) Robustness. Promote the use of models, analysis and decision-support tools that have strong technical and economic foundations, are fit-for-purpose to deal with rapidly changing circumstances in the affected sectors, are able to support flexible and adaptive approaches to sector planning, and can be easily and regularly updated.

(5) Transparency and accessibility. Promote open access to and review of planning inputs (data, model design and assumptions) and encourage the accessibility of planning outputs to key stakeholders, subject to government restrictions and commercial confidentiality constraints.

Data and Knowledge Management Standards (U4RIA)

For further information, see scientific paper "Energy system analytics and good governance - U4RIA goals of Energy Modelling for Policy Support"

- **Ubuntu / community.** To whom should the effort be accountable, and to what degree?
- **Retrievability.** Can we find and access the data, models, processes which have been used?
- **Reusability.** Can already existing work efforts be reused as a whole or in parts for new projects?
- **Repeatability.** Can the data, model, processes be repeated? (E.g. in-detail documentation of used model version and technical specifications of the machine; etc.)
- **Re-constructability.** Can the input data, analyses, processes be reconstructed, i.e. “re-made” using the same data and processes? (E.g. sophisticated data and knowledge management; back-up of used data, analyses, processes; etc.)
- **Interoperability.** Are the data, methods, processes compatible with other analysis tools and can complement them? (E.g. standardized descriptions of meta information; well-defined and categorized data, analyses, processes; etc.)
- **Auditability.** Are data, models, processes as well as related financial flows sufficiently well documented to ensure accountability?