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Input Proposal for the Meeting of the Katowice Committee of Experts on the Impacts of the Implementation of Response Measures on 2-3 June 2022 by GIZ

Corresponding to Workplan Activity 11: "Facilitate, exchange and share experiences and best practices on the assessment of the environmental, social and economic co-benefits of climate change policies and actions informed by the best available science, including the use of existing tools and methodologies"

(a) Guiding question 1: Which climate change policy(ies) and actions, informed by the best available science, were assessed for environmental, social and economic co-benefits and what were the co-benefits identified from your assessment?

The global programme on climate resilient economic development (CRED) implemented by GIZ on behalf of the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV) supports Georgia, Kazakhstan and Vietnam in piloting economy-wide assessments of climate change impacts and respective adaptation measures. Country-specific macroeconomic models have been developed, which can be used for scenario analyses. Comparisons of different scenarios provide information on how (1) climate hazards and (2) respective adaptation measures impact e.g. GDP, employment and energy-related CO_2 emissions development on an annual basis up to 2050.

Exemplary **co-benefits of modelled adaptation measures** are as follows:

- Investments in the **deployment of wind power and energy efficiency improvements in the housing sector** in Kazakhstan **increase resilience to climate change** by responding to possible imbalances of energy supply and demand during heatwaves and contribute to **reducing CO_2-emissions**: energy-related CO_2 emissions drop up to 2.4% per year, GDP is up to 0.7% higher annually and up to 35,000 additional jobs p.a. compared to a scenario without adaptation to heat waves.
- Investments in the **rehabilitation and expansion of irrigation systems** in Kazakhstan have a **positive impact on GDP and employment**: GDP is up to 1.2% per year higher and create up to 78,000 additional jobs (respectively 0.8%) per year – both compared to a situation where droughts occur, but no adaptation measures are taken.
- Investing into **windbreaks** as a response to **heavy winds** in Georgia also **positively affects GDP and employment**: GDP grows by up to 1.4% and employment increases by up to 12,000 jobs per year (0.7%) compared to a heavy wind scenario without adaptation action.

Additional modelling results can be found in the sectoral policy briefs and national reports, see links in the section on further information.

(b) Guiding question 2: How such assessment was conducted? Were there any standards used? What are challenges and opportunities, and lessons learnt from these assessments?

Modelling approach

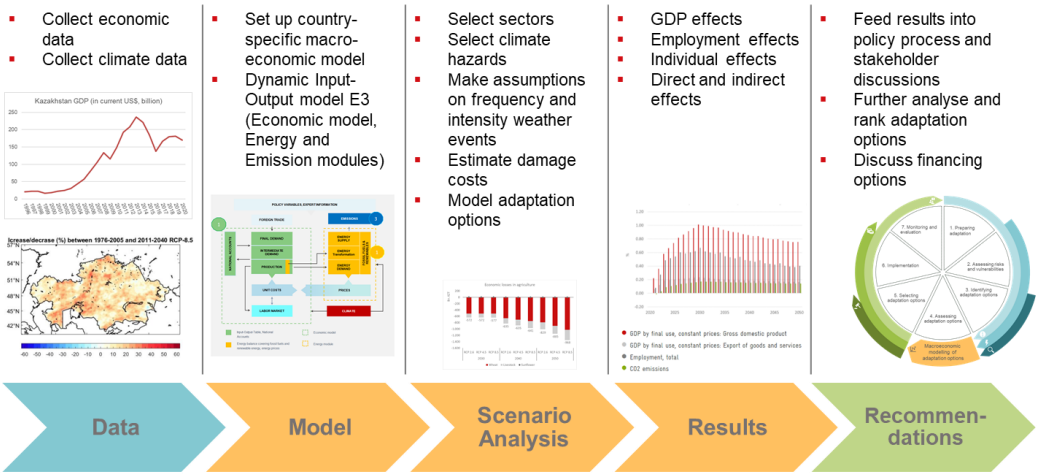
Country-specific macroeconomic models were used for the assessment, jointly developed with national modelling experts from the Ministry of Economy (Georgia) or economic

research institutes (Kazakhstan and Vietnam) as well as with support consultants from the Institute of Economic Structures Reform (GWS) and the Halle Institute for Economic Research (IWH). In the case of Georgia and Kazakhstan these are **macro-econometric Input-Output (IO) models** called E3 as they contain three interlinked model parts, the (1) economy model, the (2) energy module and the (3) emission module. For Vietnam a **dynamic general equilibrium model** has been developed, which builds on previous national experience with this model type.

The macroeconomic analysis is based on **long-term (30+ years[1]) economic models** describing the expected development of the national economy (including GDP, sectoral productivity etc.) and sector specific impacts of climate change. The macroeconomic models allow to identify the **comparative economy-wide effects of adaptation measures** through the comparison between different scenarios. The starting point for such a scenario analysis is a hypothetical reference scenario which assumes climate change is not occurring. Into this reference scenario the economic impacts from regionalized climate change scenarios are integrated to understand the economy-wide impacts of specific climate hazards (e.g. drought events), including inter-sectoral relationships. Subsequently adaptation measures are included in this model as adaptation scenarios.

Figure 1 shows the process of setting up the macroeconomic model in Kazakhstan. First, economic and climate data are gathered. Then the country-specific model is set up. To conduct scenario analyses the most vulnerable economic sectors and most severe climate hazards are selected. Based on a climate hazards analysis, assumptions are made on the frequency and intensity of different extreme weather events. Also damage costs and cost-benefit analyses are integrated in the model. Based on the information fed into the model, the results then provide information not only on GDP and employment, but also on individual, direct and indirect effects. As a last step, these results can then be used for policymaking.

Figure 1: CRED Process in Kazakhstan (Source: own figure[2])



[1] Depending on the purpose, economic models do projections short (monthly, quarterly or a few years), medium (approx. a few to 10 years) - and long-term. In the context of climate change adaptation, long-term simulations are more appropriate.

[2] Pictures taken from GIZ (2022): Supporting Climate Resilient Economic Development in Kazakhstan. Application of the e3.kz model to analyze the economy-wide impacts of climate change adaptation. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), Berlin, Germany.

Benefits

Modelling the macroeconomic impacts of climate risks and climate change adaptation measures combined with effective policy advice support can **pave the way to climate resilient economic development**. Integrating economic impacts of climate change and adaptation into macroeconomic modelling generates insights into broader and inter-sectoral economic impacts. If based on robust national data and climate impact forecasts, such models provide additional country-specific quantitative economic evidence to support and inform the development of policies and strategies that ensure sustainable and resilient economic development.

A key benefit of this approach is **mainstreaming climate adaptation into economic development agendas**: Macroeconomic models enable the inclusion of climate risks into economic development planning by providing insights on the contribution of adaptation measures to key development objectives (GDP, labor productivity, employment). Furthermore, macroeconomic models can integrate existing insights about climate risks for different economic sectors (e.g. agriculture or tourism). They provide a **consistent framework for evaluating intersectoral relationships a**nd generate results for the whole economy. Moreover, such models allow for **comprehensive risks assessments** as they complement existing physical risk assessments by putting effects in economic and social context. Economic models consider future climate change scenarios including extreme weather events (e.g. droughts) and slow-onset events.

Challenges

One of the challenges encountered relates to the **data required as model inputs**: Macroeconomic models integrate comprehensive data sets on economic indicators, climate hazards and expected economic damages, and crucially cost-benefit analysis on planned adaptation measures. All data need to be of sufficient quality and regularly updated. Additionally, **models need time and experts' know-how**: A key challenge is to set up macroeconomic models and enable them to digest all relevant data, constrained by the time of national experts to gain the needed know-how and the challenge to coordinate with a broad spectrum of involved agencies. Generally, any analysis of model results must consider the extent to which these are compromised by inaccuracies in input and quality of assumptions.

(c) Guiding question 3: What actions were/are/will be taken based on the co-benefit assessment and what specific measures taken to maximize the co-benefits if any?

Such macroeconomic assessments allow to decide on those adaptation measures that hold the largest co-benefits e.g. regarding the development of employment, GDP and energy-related CO_2-emissions. The purpose of the exemplarily modelled adaptation measures is to show which kind of information can be delivered to policymakers by such models and to discuss how they can be used in the future to inform national processes like national adaptation plans (NAPs) or long-term strategies (LTS). For example, in the case of Kazakhstan the modelling results also inform the ongoing development of the low-emission development strategy (LEDS).

Further information

All of our publications can be found on the CRED project website.

- Brief on Macroeconomic Models for Climate Resilience
- Sectoral Policy Briefs on Economy-Wide Effects of Adaptation:
  - Sectoral Policy Brief: Economy-wide Effects of Adaptation in Agriculture in Kazakhstan
  - Sectoral Policy Brief: Economy-wide Effects of Adaptation in the Energy Sector in Kazakhstan
  - Sectoral Policy Brief: Economy-wide Effects of Adaptation in Infrastructure in Kazakhstan
  - Sectoral Policy Brief: Economy-wide Effects of Adaptation in Agriculture in Georgia
  - Sectoral Policy Brief: Economy-wide Effects of Adaptation in Tourism and Road Infrastructure in Georgia
- In-depth reports on the approach of modelling economy-wide impacts of climate change and adaptation:
  - National Report: Supporting Climate Resilient Economic Development in Kazakhstan
  - National Report: Supporting Climate Resilient Economic Development in Georgia

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