

Modeling climate-resilient economic development: GIZ's approach to supporting sustainable economic growth

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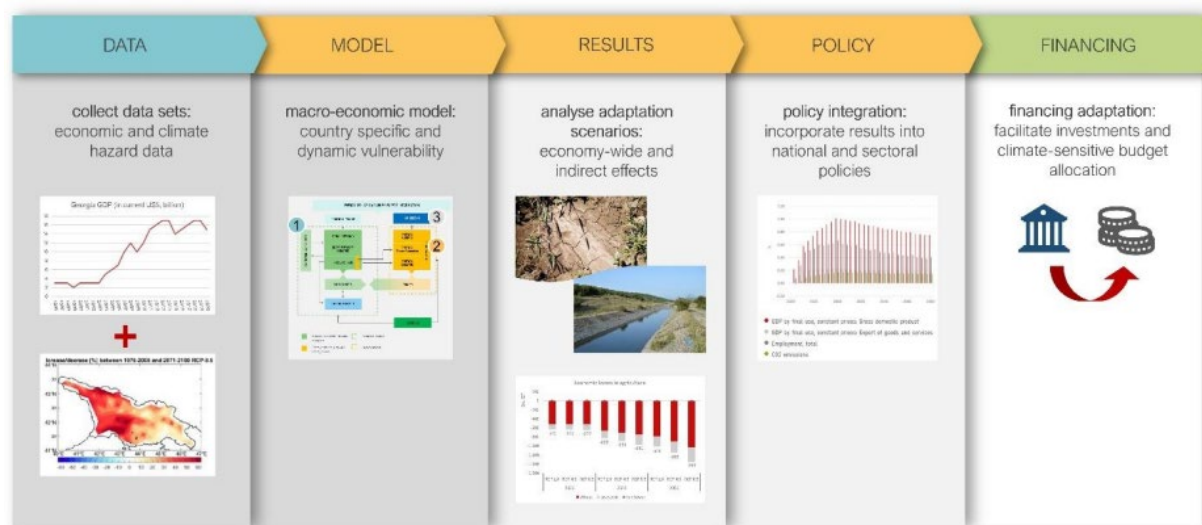
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Climate change is one of the greatest threats facing humanity, with far-reaching and devastating impacts on lives and nature. Therefore, accelerating climate change adaptation is a human, environmental, and economic imperative. Planning and investing in systematic adaptation actions, and in the innovations that come with them, can unlock new opportunities, and provide a triple dividend: they avoid economic losses, support economic growth, and deliver additional environmental and social benefits. Systematic, effective, and growth-aligned adaptation actions require an improved evidence base for assessing the climate-related risks economies are facing. They enable a systematic selection of the most efficient adaptation strategies. Including macroeconomic effects in the assessment and planning of adaptation actions enables policy actors to make the necessary investments for directing the economy toward climate resilience.

Figure 1. Steps for building and using climate-sensitive macroeconomic models



Source: [GIZ \(2024\)](#)

On behalf of the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, and Consumer Protection (BMUV) under the umbrella of the International Climate Initiative (IKI), GIZ, through the Climate Resilient Economic Development (CRED) and DIAPOL-CE¹ projects supports its partner countries in the development of human and technical capacities in the economic and planning Ministries and subordinate sectoral authorities as well as in the institutions in charge of economic modeling. Therefore, GIZ supports the development and dissemination of methods and tools for modeling climate-resilient economic development. It enables partners to independently model the economic impacts of climate change and translate the results into policy advice. Evidence-based adaptation actions can be incorporated into long-term economic, and adaptation planning and thereby unlock climate-resilient economic and job-rich development in the partner countries. Climate data and results from sector models need to be fed into macroeconomic models to map the impacts of climate change on key socio-economic indicators such as prices, income, or employment, and to further identify appropriate adaptation actions.

The cornerstones of GIZ's activities are jointly developed country-specific macroeconomic models: the Dynamic Input-Output Models e3.kz in Kazakhstan, e3.ge in Georgia, e3.mn in Mongolia, and the dynamic general equilibrium (DGE) model in Nigeria and Vietnam. These models enable our partners at Ministries of Economy to model the economic impacts of climate risks. The modeling results are used to create country-specific policy advice and recommendations on implementation options for adaptation policies. Throughout the cooperation, GIZ supports its political partners in the integration

¹ Policy Dialogue and Knowledge Management on Climate Protection Strategies.

of adaptation policies into macroeconomic strategies and policies, such as development, poverty reduction, or green economy strategies as well as strategies for major economic sectors. While the modeling activities presented focus on climate adaptation, climate mitigation aspects such as carbon pricing or energy transition policies can also be integrated into the macroeconomic model. By doing so, GIZ aims at aligning Nationally Determined Contributions (NDCs) goals and National Adaptation Plans (NAPs), as well as economic policy and growth plans. In addition to assessing adaptation actions and integrating them into policies, GIZ supports the identification of appropriate financing options.

Table 1. Climate-resilient economic modeling in partner countries

Country	Kazakhstan	Georgia	Mongolia	Nigeria
Political partner	Ministry of National Economy (MNE)	Ministry of Economy and Sustainable Development (MoESD)	Ministry of Economy and Development (MED)	Federal Ministry of Budget and Economic Planning (FMBEP) and Federal Ministry of Finance
Implementation partner	Institute of Economic Research (ERI)	Economic Analysis and Reforms Department	MED, Ministry of Environment and Climate Change (MECC), Bank of Mongolia (BOM)	FMBEP
Model	Dynamic input-output models (e3.kz model)	Dynamic input-output models (e3.ge model)	Dynamic input-output models (e3.mn model)	Computable general equilibrium model
Software	Excel, EViews	Excel, EViews	Excel, EViews	GEMPACK

Lessons learnt from implementing climate resilient economic modeling

The implementation in Georgia, Kazakhstan, Mongolia, and Nigeria (Table 1) has provided GIZ and partners with valuable insights, encompassing capacity development, model building, and policy support for climate change adaptation planning. These lessons highlight both the strengths and challenges encountered, offering guidance for future applications of the approach in different countries. By reflecting on these experiences, GIZ can identify strategies to enhance coordination, streamline processes, and ensure the long-term success and sustainability of climate resilience initiatives. The following key lessons emerged across all stages of the implementation, providing a foundation for improving future efforts.

Capacity development

The success of capacity development depends on the time and personal resources available to local partners. However, the regular workload at partner institutions often limits continuous participation in training, and there is a risk of skilled project members leaving the institutions, leading to a "brain drain" of the trained staff. It is important to distinguish between model builders and model users, as the time and knowledge requirements differ significantly. Model builders need a higher level of economic modeling knowledge, while model users should understand the impact of climate change and adaptation measures in relevant sectors.

Regular, shorter online sessions are more practical for local partners than extensive on-site training. However, an initial intensive training phase, such as a one-week session, is beneficial for establishing a common understanding and collaborative working mode, which may encourage future collaboration. Intensive, regular capacity development—particularly training of trainers for model builders—is crucial to ensure the sustainability of the model. Assigning responsibility for tasks such as data collection,

model updates, and scenario analysis within the institution's resources is vital for the model's implementation and future updates. Simplified diagrams showing data needs and key partners are useful, and where national data sources are insufficient, international data sources can be utilized. A detailed model handbook, including examples, is essential for capacity development, as it enhances transparency, builds confidence, and clarifies the potential applications and limitations of the model—a “white box” approach.

Data and developing modeling tools

The quality and availability of data are crucial for obtaining accurate and sound results, with national statistical offices playing a major role in this process. Collecting and verifying data is time-consuming and requires support from national partners, and in the case of climate data, international partners as well. It is recommended that the country appoints a contact person in advance to manage data requests internally. Involving the national statistical office directly can also facilitate the process.

To ensure the successful development of necessary capacities among partners, model complexity is optimally kept low. It should be able to address relevant policy questions. Having national and international experts review the model helps in gaining ownership. The Excel-based e3 models offer an advantage by minimizing the technical challenges usually associated with model building and application, as the software is commonly used in day-to-day processes.

Integration of results into the policy process

Effective interdisciplinary discussion and collaboration require a common understanding of methodologies and terminologies. An early presentation of the modeling goals to relevant experts and institutions is essential for data provision, sectoral expertise, and policymaking. Country reports from partner countries can serve as starting points. High-level support for the economic evaluation of adaptation options is critical and should be ensured before the project begins. Regular updates to high-level officials can foster a common understanding, cooperation, and political ownership. In Mongolia, the Ministry of Economy and Development is responsible for the annual planning of overall governmental activities and intends to use model results to support implementation prioritization.

Involving local project partners and internationally renowned scientists raises awareness among various institutions and policymakers. For example, in Kazakhstan, modeling results were discussed with stakeholders, including sector experts and international institutions, during the coaching process. Similarly, in Vietnam, discussions on socio-economic impacts and adaptation strategies were held with various stakeholders. Regular seminars and workshops with multiple stakeholders create opportunities for mutual understanding and exchange during model implementation. Moreover, the continued cooperation and maintenance of networks beyond the project are important, as seen in Vietnam, where the other related projects provided valuable input for the Dynamic General Equilibrium Model for Climate Resilient Economic Development (DGE-CRED) model implementation.

Transferring full ownership of the model to local model builders enables continuous evaluation and monitoring of adaptation options. The institutionalization of the e3.ge-model in Georgia is an example of successful ownership transfer.

Lessons learnt across all stages of the implementation

Early feedback from national partners and a memorandum of understanding between relevant stakeholders are essential to define responsibilities, avoid delays, and align the method. The approach, which integrates model development, capacity development, and policy support for adaptation planning, is complex and time-consuming, requiring careful coordination. Simplifying the process, such as by using templates for data collection or employing a simplified e3 model prototype that utilizes country-specific international data, could expedite model development. Despite these challenges, the approach has proven effective in fostering interministerial collaboration, intensive expert exchange, and evidence-based policymaking.

The approach is valuable for comparing different modeling strategies and collaboration methods across countries. It serves as a strong foundation for transferring the approach to other countries, not just where political structures, modeling practices, and data availability are similar. The proven approach and its prototype allow for faster initial model development based on international data, with the potential for later adaptation to national data. However, country-specific adjustments are necessary for addressing climate change and adaptation scenarios.

At the political level, central domestic strategies are needed as entry points to ensure implementation. Enabling factors should direct the focus toward climate-resilient economic development, with institutionalization being key for long-term success. For projects involving multiple countries, regular meetings with all team members are important for sharing progress, addressing delays, and quickly applying lessons learned across different countries.

Lessons on cooperating with the Ministry of Finance

Early involvement and high-level support: Securing early and explicit high-level support from the respective Ministry of Finance is crucial for the success of economic modeling projects. Given the Ministry's pivotal role in economic policy and budgeting, its involvement ensures that the modeling efforts align with national fiscal strategies and priorities. High-level endorsement also facilitates smoother project implementation by minimizing potential delays in approvals and fostering collaboration across Government departments.

Integration of modeling goals with fiscal policy objectives: The MoF should be engaged early in the process to ensure the modeling goals are clearly linked to fiscal policy objectives. This can be achieved by presenting an overview of the modeling goals at the outset and demonstrating how the models can inform fiscal policy decisions, such as budgeting for climate adaptation, assessing the economic impacts of policy changes, or evaluating long-term financial risks related to climate change.

Distinction between model builders and model users: Within the MoF, a clear distinction should be made between staff who will be involved in building and maintaining models (model builders) and those who will use the models to inform policy decisions (model users). Model builders in the MoF may require more intensive training in the technical aspects of economic modeling, while model users should focus on understanding the implications of model outputs for fiscal policy, climate adaptation, and long-term financial planning.

Participation in capacity development and training: The MoF should actively participate in capacity-development efforts, particularly in training sessions focused on economic modeling. This involvement is essential not only for model builders but also for model users within the Ministry. Training should emphasize the application of modeling results to fiscal policy and budgeting, equipping Ministry staff with the necessary skills to interpret and use model outputs effectively. In Georgia, the MoF participates regularly in GIZ training sessions, which supports close interministerial cooperation.

Cross-ministerial collaboration: The MoF's involvement should also promote cross-ministerial collaboration, particularly with economic Ministries and statistical offices. This collaboration is necessary to ensure the models are informed by comprehensive and high-quality data, and the results are relevant to the broader economic and fiscal policy context. Regular interdisciplinary meetings and workshops can facilitate this exchange of knowledge and ensure the models reflect the priorities of multiple stakeholders.

Regular updates and feedback mechanisms: Establishing regular updates and feedback mechanisms between the MoF and other involved Ministries is essential. These updates should include progress reports on the modeling process, preliminary findings, and discussions on how the results can be applied to fiscal policy. Such a process ensures ongoing alignment with the MoF's objectives and helps in refining the models to better serve policy needs.

Application of modeling results to budgeting and financial planning: Training sessions should emphasize the practical application of modeling results in budgeting and financial planning. The MoF

needs to understand how to use model outputs to make informed decisions about resource allocation, prioritize investments in climate adaptation, and assess the long-term economic impacts of policy choices. This practical focus will increase the MoF's commitment to the modeling process and enhance the relevance of the models to fiscal policy.

By applying these lessons, cooperation with the MoF can be strengthened, ensuring economic modeling efforts are effectively integrated into the country's fiscal policy framework and contribute to informed decision-making in the context of climate change and economic resilience.