Planning Policy Impact Assessments and Choosing the Right Methods:

Manual for Development Practitioners

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Friedrich Ebert Allee 36 + 40
53113 Bonn, Germany
T + 49 228 4460-0
F +49 228 4460-1766

Dag-Hammarskjöld-Weg 1-5
65760 Eschborn, Germany
T +49 (0) 6196-79-0
F +49 (0) 6196-79-7291

E info@giz.de
I www.giz.de

Programme/project description:
Sector Project Sustainable Economic Development

Authors:
Anett Großmann, Dr. Ulrike Lehr, Dr. Christian Lutz,
Anke Mönnig, Sabrina Kleissl

Design:
Diamond media GmbH, Neunkirchen-Seelscheid

On behalf of
German Federal Ministry for Economic Cooperation and Development (BMZ)
Division 114 Cooperation with the private sector; sustainable economic policy
Contact person at the ministry
Andreas Beckermann, Berlin

Printing and distribution:
Druckriegel, Frankfurt Main

Printed on 100% recycled paper, certified to FSC standards.

Eschborn, 2016

Planning Policy Impact Assessments and Choosing the Right Methods:

Manual for Development Practitioners

Table of Contents

Abbreviations

3E	Economy-Energy-Environment
ANME	Agence Nationale pour la Maîtrise de l'Energie, National Agency for Energy Management
BMZ	German Federal Ministry for Economic Cooperation and Development
CBA	Cost-Benefit-Analysis
CGE	Computational General Equilibrium
CL	Checklist
CSP	Concentrating Solar Power
CS	Case Study
DFID	Department for International Development
DM	Delphi Method
DSGE	Dynamic Stochastic General Equilibrium
EC	European Commission
EE	Energy Efficiency
EEG	Renewable Energy Sources Act
EM	Econometric Model
GAMS	General Algebraic Modelling System
GDP	Gross Domestic Product
GEM-E3	General Equilibrium Model for the Economy-Energy-Environment
GFCF	Gross fixed capital formation
GHG	Greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GTAP	Global Trade Analysis Project
GTAP-E	Energy-Environmental Version of the GTAP Model
GWS	Institute of Economic Structures Research
IA	Impact Assessment
IAB	Institute for Employment Research
IEA-RETD	International Energy Agency-Renewable Energy Technology Development
IECON	Instituto de Economía de la Universidad de la República
IMF	International Monetary Fund
IO	Input-Output
IOT	Input-Output Tables
IWRM	Integrated Water Resources Management
JEDI	Jobs and Economic Development Impact
LFA	Logical Framework Approach
MAMS	Marquette for MDG Simulations
MCA	Multi-Criteria Analysis
MDG	Millennium Development Goals
MM	Micro-Macro Model
MNE	Multinational Enterprises
MSM	Microsimulation Model
MW	Megawatt
NGO	Non-Governmental Organisation
NICE	aNother Integrated Climate Economy
NPV	Net Present Value
OECD	Organisation for Economic Co-operation and Development
PIK	Potsdam Institute for Climate Impact Research
PREM	Poverty Reduction and Economic Management
PSIA	Poverty and Social Impact Analysis
PV	Photovoltaic
RCA	Result Chain Analysis
RE	Renewable Energy
SAM	Social Accounting Matrix
SD	System Dynamic
SDG	Sustainable Development Goals
SMART	Specific, Measurable, Accepted, Realistic, Timely
SME	Small and Medium Enterprises
STEG	Société Tunisienne de l'Electricité et du Gaz
T21	Threshold 21
TSP	Tunisian Solar Plan
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations International Children's Emergency Fund
UNU	United Nations University
VAT	Value Added Tax
VBA	Visual Basic Application

LIST OF TABLES

LIST OF FIGURES

LIST OF BOXES

Executive Summary

Policy making happens in an increasingly complex and interdependent reality. Taking climate and demographic change as an example, their impacts are complex, far-reaching and concern various actors in society in different ways. In order to ensure our future liveli-hoods in the light of overuse of natural resources and increasing environmental degradation, policy makers are faced with the task to fundamentally alter current economic structures. Policy makers and other decision makers need to understand the underlying drivers of growth and development as well as potential (conflicting) impacts of policies on future economic development, social parameters and on environmental aspects to be able to develop effective policies and instruments to foster sustainable development. Given the complexity of today's world, political decision making is often aggravated by opposing political interests and thus by resistance of specific actors or the public fearing losses due to a planned policy. In this context, evidence-based policy making increases transparency of political decision making and bases the decision making process on a solid and verifiable ground. Increasingly, evidence-based policy making is gaining importance. A Policy Impact Assessment (hereinafter referred to as IA) is one instrument that contributes to evidence-based policy making. While IA is regularly used in industrialised economies, it has not yet penetrated the decision making process in developing countries.

Development organisations are increasingly approached by their partners requesting assistance in conducting an *ex-ante* IA. In order to accommodate such requests, development practitioners need an in-depth understanding on how to conduct an IA, i.e. on the steps to take and on which methods to use. This manual aims to strengthen development practitioners' capabilities to initiate, conduct and finalise an IA on their own or to effectively support partner institutions in doing so. By building up skills, know-how and capabilities to perform an IA and by assisting partner institutions in constructing, maintaining and developing economic models, this instrument can be increasingly anchored in political decision making processes in developing countries.

> “In order to ensure our future liveli-hoods in the light of overuse of natural resources and increasing environmental degradation, policy makers are faced with the task to fundamentally alter current economic structures

Overall, a well-structured ex-ante IA provides valuable input for decision makers and may improve environmental, economic and social sustainability. But an IA can only function as a means of advice. The decision whether the findings from an IA result into active policy intervention depends on factors such as policy coalitions, election cycles etc. However, the constant use and application of IA contributes to an increasing awareness of evidence-based policy making and leads to a wider acceptance and usage in developing countries.

This manual is divided into two main parts: The first part addresses the process of conducting an IA. The second part provides an overview of the most commonly used quantitative and qualitative methods within an IA.

The first part of the manual provides definition, scope, content and timing of an IA and discusses its strengths, limitations and weaknesses. An ex-ante IA is defined as a process helping policy makers to think through and to fully understand the consequences of government intervention in the future. It assesses or identifies policy measures with their respective *direct, indirect* or *induced impact* on single groups or parts of the economy in the short, medium or long run. The time needed to conduct an IA depends on the complexity of the issue and on the methods used. An IA is helpful to provide information for decision makers, but it also promotes transparency, explains policy decision and increases public participation. However, an IA exists within limits. Limits can be technical in terms of resource availability (financial, human, technical and institutional resources). But an IA is also constrained in its explanatory power of future developments by the choice of *methodology* used.

Keeping all this in mind, an IA follows detailed procedural and analytical steps: planning, execution and evaluation. In the planning phase, a *roadmap* and a timeline are produced, indicating the further course of action. Problem, objective and policy options are defined. *Stakeholders* are identified and invited to participate. An early stock taking of data availability and resource capacities is part of the planning phase as well. The execution phase comprises the actual impact assessment. By applying either qualitative or quantitative methods, the analysis discloses if the predefined problem and objective are sufficiently addressed by using the defined policy options. The impact assessment should reveal who is affected, the magnitude and the cause of effects. The evaluation phase, at last, summarises the findings and disseminates the results in form of an IA report and policy recommendation briefing to the relevant stakeholders and decision makers. It is this phase which is most important for leading the IA process to success. A clear and precise writing of the final documents and especially of the policy recommendations facilitates the acceptance of the policy advice distilled from the IA.

The second part of the manual concentrates on the methodology part alone. It distinguishes between quantitative and qualitative methods to be used during the IA process. Whereas qualitative methods can be applied during the three different phases of the IA, quantitative methods are usually only tools for conducting the actual impact assessment in the execution phase. Qualitative methods are usually used in research areas that are new, not well explored yet and offering only little empirical evidence. Quantitative methods, however, are usually used to test a *hypothesis* by applying statistics and empirical evidence. Especially in countries with low data availability, qualitative methods may be the superior choice of methodology.

In order to facilitate the decision making process of choosing the right method, the manual offers three lines of assistance:

- (i) a decision diagram that arranges the quantitative models according to data and time availability, know-how capability and complexity;
- (ii) two decision-trees that specify the decision according to data availability and field of research (complexity);

(iii) a tabular overview on all methodologies summarising the key features of each method.

The fields of application, requirements and limitations of each model and *method* are presented including time requirements and degree of stakeholder involvement for preparing and using the particular model/method. Very sophisticated modelling approaches may require up to one year of preparation.

In order to ease the understanding especially for the quantitative *methodology* part, additional background information on economic modelling, economic theory and economic models in general are provided. By utilising the *roadmap* idea of economic modelling, the approach towards economic modelling becomes less abstract. This explains why two separate sections highlight the importance of *model variations* and model modularisation: economic models are adaptable to specific cases and should be seen as a flexible framework open to be adjusted to individual needs and requirements. The issue of modularisation is of particular importance: embedded in a macroeconomic surrounding, it allows the analysis of specific aspects – like environmental or social aspects – in greater detail.

1 INTRODUCTION

"Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all" is one goal of the new set of Sustainable Development Goals (SDG) of the United Nations (UN). To achieve this goal, governments and public administrations have to take action by implementing new or altering existing policy measures. In order to determine "what works, what doesn't, where and why" (Garbarino & Hooland 2009: 3), authorities worldwide increasingly opt for evidence-based policies instead of ideologically-driven politics.

Embedded in such a formal and evidence-based procedure, an Impact Assessment (IA) is used to evaluate the impacts of public policy measures on economy, society and environment. Its objective is not only to improve the quality of policies and to inform about public policy ramification, but also to improve the decision-making process by increasing policy transparency and public participation and to explain policy decisions and procedural steps to be taken. Hence, an IA is more than only a formal exercise on quantifying policy impacts. It also functions as a communication tool between public administration and *stakeholder* groups and reflects on the pros and cons of policy intervention.

For these reasons, IA has become an important tool for assisting policy makers in their decision-making process. Its wide application by national governments and public administrations as well as international organisations like the United Nations Development Programme (UNDP), the World Bank, the European Commission (EC) or the Organisation for Economic Co-operation and Development (OECD) reflects the usefulness of IA. Development agencies or governmental departments responsible for development assistance use IA to ensure "maximum impact from

(…) development assistance" (DFID 2007). It also gives indication for developing countries to "improve the way they manage aid" (UNICEF 2008: 16).

In industrialised economies – especially in OECD countries – IA has become a standard instrument for analysing cost and benefits of new legislations before they are implemented (Jacob et al. 2011: 8). However, the degree to which IA is institutionalised differs among countries (Jacob et al. 2004, 2011; Prognos 2008). Accordingly, the extent, the duration and the requirements of an IA vary across countries.

In developing or emerging economies, awareness and use of regulatory impact assessment exist, but „methods are (…) incomplete and rarely applied systematically" (OECD 2008: 26). Due to limited financial, human or technical resources in many countries, IA has not yet penetrated the policy decision-making process (Kirkpatrick et al. 2004, Zhang 2009, LIAISE 2014). Still, IA initiatives and action plans are run – often assisted by foreign agencies such as Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), the World Bank or the International Monetary Fund (IMF) (Gebert et al. 2011, World Bank 2012, Robb 2003). IA has been mostly applied in the context of the Millennium Development Goals (MDG) as the MDGs' precise and quantitative formulation is suitable to be IA-evaluated. The MDGs' replacement by the SDG in 2015 gives room for a new range of targets for which IA can be helpful for monitoring and evaluation purposes.

An IA can be either forward (*ex-ante*) or backward looking (*ex-post*). An ex-post IA is a counterfactual analysis, asking "what would have happened if the policy measure had not been imposed". An ex-ante IA, instead, produces projections on the future impact of policy measures (independent on whether already enacted or not). This manual concentrates on ex-ante Policy Impact Assessment.

Ex-ante analysis normally has two objectives: either forecasting developments like economic growth, unemployment or CO_2 emissions, or analysing the future economy under different policy settings like for example a *scenario* with and without minimum wages, health care subsidies or trade barriers. The methodological approach for ex-ante IA can comprise qualitative and/or quantitative methods. Qualitative methods are usually applied to get a first insight into likely impacts. This rough estimate exposes the direction and magnitude of effects. Quantitative methods are applied to compute impacts based more precisely on quantitative information and range from simple econometric models to complex multi-region, multi-industry models. The choice of *methodology* implies different advantages and risks and has to be balanced cautiously.

Altogether, an IA is a complex process that comprises the conceptualisation of the problem, the collection of relevant data and other information, the choice of appropriate methods and *models* as well as the evaluation and dissemination of the results – including the feeding-in of the results into the policy making process. Beyond that, an IA always requires the involvement, participation and cooperation of different *stakeholders* (project partners, statistical units, other institutions).

This manual shall serve as a guide for GIZ practitioners and their governmental partners on how to structure and organise an IA. It provides guidance on and sequence of the procedural steps to take, for the things to do and the aspects to think about. The manual aims to give assistance for GIZ's advisory work with respect to carrying out and institutionalising IA in partner institutions, including aspects of capacity development and stakeholder involvement. Along the manual, statistical terms and terminologies are written in italics and are hyperlinked to the glossary. Furthermore, warning signs indicate typical traps and pinpoint important issues to think about. The technical description is illustrated with the help of two sorts of practical examples that are presented in separate text boxes.

- The steps of the IA will be explained using an already completed IA as an example. The following case study describes an IA assessing employment, qualification and economic effects caused by measures to increase the share of renewable energy (RE) sources and energy *efficiency* (EE) in Tunisia (Lehr et al. 2012). The analysis was commissioned by GIZ in the framework of the project "Promotion of Renewable Energy and Energy Efficiency in Tunisia" financed by the German Federal Ministry for Economic Cooperation and Development (BMZ) and was conducted by a consortium consisting of a local consultancy (Alcor, Tunisia) and an external expert (Institute of Economic Structures Research (GWS), Germany). The study was conducted for the Tunisian Agency of Energy Management (ANME).
- Along the manual, experiences from GIZ practitioners are integrated. These were obtained from interviews with GIZ staff members working in relevant projects abroad and they illustrate specific challenges faced by projects seeking to support partner countries with Policy Impact Assessment and macroeconomic modelling. In total, five interviews were conducted with representatives from projects in Tajikistan, Rwanda, Uruguay, Uzbekistan and Benin.

The manual is divided into two main blocks: The first part describes the procedural steps for performing an *ex-ante* PA. It describes the three main phases: planning, execution and evaluation. Separate sections refer to the role of *stakeholders*, capacity development and data and information collection in the IA process. The second part concentrates on the description of qualitative and quantitative methods that can be applied in the different phases of an IA. The methods introduced are by no means exhaustive. The methods presented here are a selection of the most commonly applied methods. Separate sections are dedicated to *model variations* and *mixed methods*.

2 PROCEDURAL AND ANALYTICAL STEPS IN POLICY IMPACT ASSESSMENT

2.1 OVERVIEW

2.1.1 DEFINITION OF AN IA

An IA can be characterised as a continuous process and as a tool to assist policy making. The following definition summarises the main features:

> *„Both a continuous process to help the policy-maker think through fully and understand the consequences of possible and actual government interventions in the public, private and third sectors; and a tool to enable the Government to weigh and present the relevant evidence on the positive and negative effects of such interventions, including by reviewing the impact of policies after they have been implemented.“* (DBIS 2015: 85)

An IA can be either forward (ex-ante) or backward looking (*ex-post*). An ex-post IA is a counterfactual analysis, asking "what would have happened if the policy measure had not been imposed". An ex-ante IA, instead, produces projections on future impacts on the economy, environment or society of already enacted or yet to be implemented policy measures. Both concepts are complimentary and in most cases an *ex-ante* assessment is followed by an ex-post evaluation. The forward-looking concept of an *ex-ante* IA has the nature of having to deal with a lot of unknowns (e. g. future economic growth, natural disasters etc.). Hence, the predicted impacts of a policy measure are only valid within a certain framework or set of assumptions about the future. The complimentary part of the *ex-post* approach is to test whether the *ex-ante* assessment was correct or if other factors have altered the outcome. In both cases, an IA allows decision-makers to pass judgement on the *effectiveness* and *efficiency* of a planned or implemented measure by balancing the effects against intended policy targets and expectations.

Box 1: The World Bank's Poverty and Social Impact Analysis (PSIA)

The World Bank's PSIA is one important example for an IA. The PSIA is thematically focused on evaluating distributional and social impacts of public policy reforms on the poor. But it shares the evidence-based approach on assisting the decision-making process of politicians. A user's guide to PSIA "introduces the main concepts (...), presents key elements of good practice approaches to PSIA, and highlights some of the main constraints and operational principles for PSIA" (World Bank 2003: vii). Practical guidance is offered through e-book and online training courses. Furthermore, the World Bank provides a large set of different tools and techniques applicable for PSIA studies ranging from micro- to macroeconomic techniques and covering qualitative as well as quantitative approaches, *ex-ante* as well as *ex-post* analysis (Bourguignon & Pereira da Silva 2003).

2.1.2 SCOPE, CONTENT AND TIMING OF AN IA

The scope and content of an IA can vary considerably, depending on the requirements and objectives:

- An IA can be applied for estimating the effects of a given set of policy options, but it can also be used for identifying/finding suitable policy measures or an optimal policy mix.
- An IA may focus on single groups (types of firms, households, income groups), but may also be extended to the entire economy.
- An IA may be used for identifying direct effects of a regulation, but may also include *indirect effects* or *induced effects*.
- It can be used for estimating short-term, medium-term or long-term effects.

An *ex-ante* IA is a forward looking analysis of the *effectiveness* and *efficiency* of already implemented or yet to be implemented policy measures.

The starting point of an IA depends on its scope. The more sophisticated the IA, the more time is needed and the earlier the kick-off of an IA should take place.[1] Figure 1 shows an ideal timing of an IA in the decision-making process.

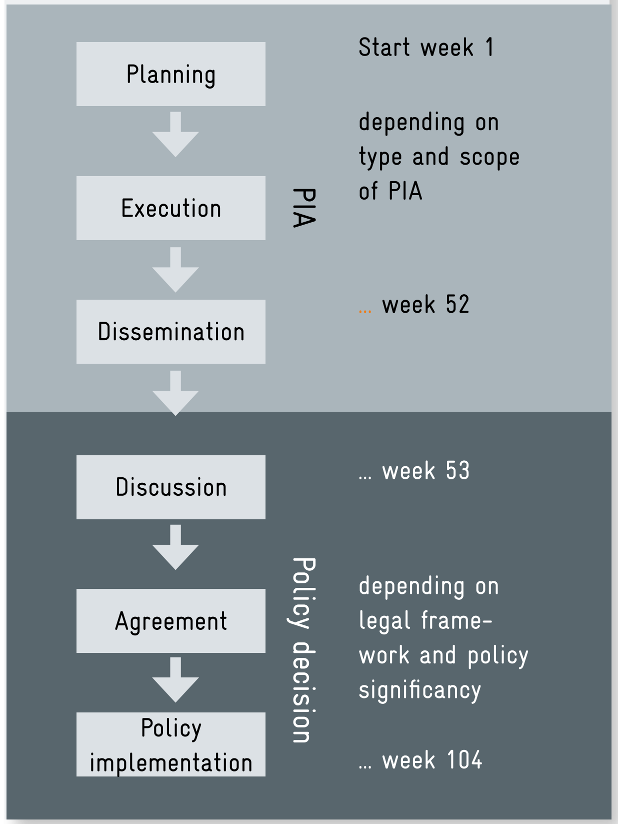
The kick-off of an IA should also consider the time required for the policy decision-making process.

[1] *IA conducted for the EC may have to be finalised up to one year prior to the decision of the Commission (EC 2009: 9). In case of a sophisticated IA requiring approximately one year of work, an IA should start around two years before a policy decision takes place.*

Box 2: Scope: Example Tunisia – IA on Measures to Increase RE and EE

Lehr et al. (2012) estimated the effects of a given policy instrument, namely the Tunisian Solar Plan. The analysis covers the entire economy with special focus on employment effects. Direct and indirect employment effects spurred by the Tunisian Solar Plan are estimated. The ex-ante impact analysis projects impacts until 2030.

Figure 1: Timing of an IA within the Policy-Making Process



Source: OECD 2008: 34 – own illustration

Box 3: Timing – Challenges concluded from the Interviews with GIZ Practitioners

The interviewees coincide in their statement that bureaucratic difficulties and/or delays (for instance delays in approval of budgets) exist that can influence the execution phase of IA, but are usually not unexpected to development practitioners. However, additional time should be scheduled for such effects while planning the IA. GIZ advisors often faced the situation that the timing of the outcome of an ex-ante IA was overtaken by political decisions and a quick implementation of policy measures. This was especially the case when policy measures were popular.

2.1.3 PURPOSES, REASONING, STRENGTHS, LIMITATIONS AND WEAKNESSES OF AN IA

The purpose of an IA is defined through its users. Mostly, an IA is used by administrative bodies like the government itself, ministries or by other federal offices and bureaus. Yet, also international organisations, non-governmental organisations (NGO), employers' associations, labour unions, foundations, or even multinational enterprises (MNE) may use the tools and techniques of an IA for evaluating new or existing policy measures and their future impact on the economy, society and/or environment.

The purpose of an IA varies according to its users.

Box 4: Purpose – IA on Measures to Increase RE and EE in Tunisia

The purpose of the IA is to identify development opportunities and prospects for the creation of highly-skilled employment out of renewable energy and energy efficiency strategies such as the Tunisian Solar Plan. Furthermore, employment served as an important indicator for the decision on the future energy mix of the country.

Figure 2 summarises specific reasons why to use an IA in a policy-making process: First of all, it provides information about possible future consequences of a planned or existing policy measure. Impacts are categorised and ranked. The exposure of different groups (households, companies, state etc.) caused by different policy measures is disclosed. Based on such an analysis, policy decisions are prepared, formulated and translated into legislation.

Reasons for conducting an IA are manifold but it mainly aims at facilitating the decision-making process.

Figure 2: Reasons for Conducting an IA

The provision of information contributes to the promotion of transparency. The logic of an impact assessment explains why a policy measure may be useful for reaching a policy target or why not.

The line of reasoning is traceable and the explanation of policy decisions to the public is bolstered with information and a transparent process.

This increases public participation and support. Policy decisions are discussed publicly and the implementation phase of policy instruments is facilitated.

An IA discloses procedural steps and methods that can be used for follow-up projects. It offers a systematic framework in which the decision-making process can take place.

Box 5: Reason – IA on Measures to Increase RE and EE in Tunisia

Tunisia faces several challenges, among them shortages in energy supply and a growing unemployment – in particular among young people and in the central and southern region. Investment in renewable energy and energy efficiency can help to address these problems.

However, an IA may absorb financial, human or technical resources that may be (better) used for other purposes. Therefore, an IA should only be conducted when it is useful – which must be decided case by case (EC 2015b: 33).

If little or no choice for a policy decision exists – for instance, if international agreements have to come into force –, the results of an IA cannot be used for designing policy measures. Still, if reasons exist (e. g. utilisation of results for opposing or for fostering the decision) an IA can be conducted, but its usefulness should be weighed against its costs.

An IA is difficult to perform if policy measures are not sufficiently specified. The actual impact assessment becomes more complicated as the *transmission mechanism* remains unclear.

An IA gives "what if"-statements about possible impacts under certain assumptions.

If the impacts evoked by a policy measure are likely to be small, an IA may be unnecessary. However, what is important is the overall impact and not the impact on a certain group only. What may have a marginal impact on a certain group at first sight, may end up evoking a large impact on other *stakeholders*.

An IA results in a "what if"-statement about possible impacts under certain assumptions and offers guidance for (policy) orientation – no more, no less.

Policy impact assessments require financial, human, technical and institutional resources (section 3.2). In general, the requirements on monetary budget, human capacity as well as technical endowment and data availability increase with the complexity of the IA concept.

An IA – conducted on one and the same subject (e. g. job effects *induced* by RE technologies) – can produce different outcomes. This depends not only on the choice of *methodology* (chapter 3), but also on the basic understanding of how the economy is functioning (see section 3.5.2 on an overview of economic theory).

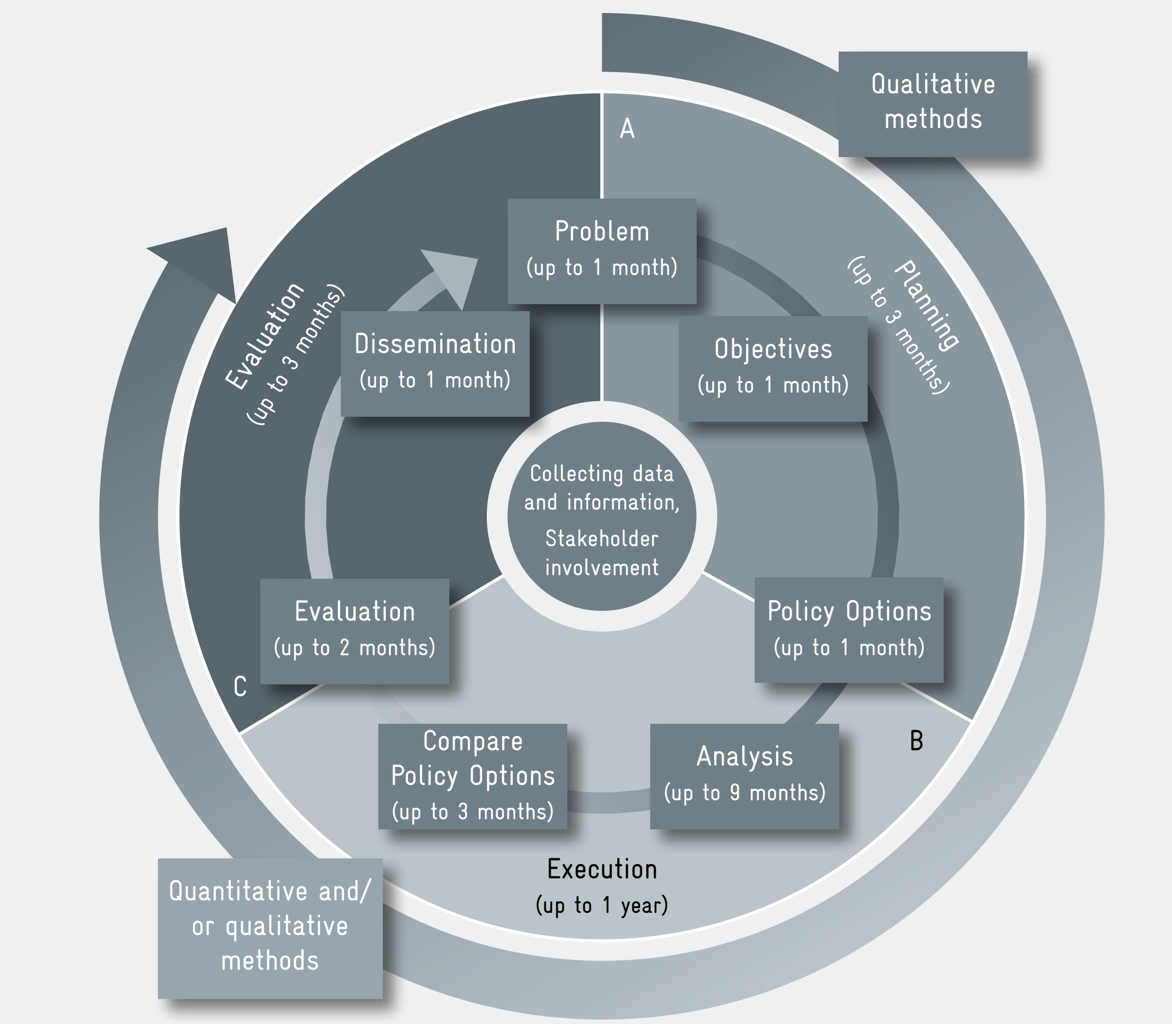
A major challenge is the possible abuse of IA by politicians or other users for the purpose of *window dressing*. In that case, an IA merely functions as a confirmation tool for policy measures, but not as a decision-making tool.

2.1.4 KEY STEPS FOR CARRYING OUT AN IA

The key steps for carrying out an IA are shown in Figure 3. In general, each IA is divided into three main parts: planning – execution – evaluation. A thorough and sophisticated IA process may take up to 1.5 years, whereby the amount of time necessary depends on the scope of the IA itself. All three parts of the IA are equally important and they all influence the success or failure of an IA. The cyclical arrangement of the steps indicates that an IA is not necessarily finished with the evaluation phase. Moreover, the evaluation phase may disclose a gap between the planned target and the achieved result. A new or a partially adjusted IA with newly defined policy targets and/or options may have to be conducted. The core of each IA – represented in the middle of Figure 3 – is data and information as well as stakeholder involvement.

Each step of the IA should be performed – albeit the extent of time and effort used may depend on resources, targets and choice of *methodology*.

Figure 3: Key Steps for Policy Impact Assessment



Source: adopted from DBIS 2015: 57 and EC 2015: 6 – own illustration

Planning: Be as precise as possible and take as much time as possible for preparing the IA. Do forward planning.

Good planning (up to three months) helps to ease the process of the entire IA and to facilitate the subsequent steps. The planning phase comprises the definition of the problem, the setting of the objective and the definition of policy options to be assessed. A *roadmap* and a timeline should be produced. The more accurate and precise the work at that early stage of the IA, the easier it will be to perform the execution and the evaluation phase. The amount of time needed for the planning phase depends on the degree of coordination with different *stakeholders* and the effort to collect data and information for formulating the problem and the policy objective. An important part of the planning phase is the formulation of *a priori* hypotheses.

The execution phase is the phase where the actual work is done (up to one year). It comprises the analytical work of the impact assessment, the choice of *methodology* (section 2.2.2.3), the construction of the *model* and the application of the different *scenarios* (including the *no-policy scenario*). The consistency of the model is checked.

Execution: Be sensitive about the choice of methodology – the subject at hand, available resources, data and time should be leading indicators.

The evaluation phase (up to three months) includes the evaluation of results as well as their dissemination. The results are evaluated against the a priori *hypothesis* stated in the planning phase and policy recommendations are formulated. Dissemination includes strategies of how to feed the IA results into the policy process. This includes the compiling and publishing of a IA report and Policy Recommendation Briefings.

Evaluation: Core outcome are policy recommendations to be fed back into the policy decision process.

If the IA results disclose a mismatch between objective and policy options or if the results are not satisfactory, an IA can be restarted. Either a new IA can be set up, or parts of the IA can be adjusted (e. g. definition of policy options, choice of method).

2.1.5 KEY OUTCOMES OF AN IA

Any IA should have at least the following four outcomes: (i) a roadmap, (ii) a timeline, (iii) an IA-Report, and (iv) Policy Recommendation Briefings.

A roadmap is used for planning the "route" for reaching a set target. That includes the problem to be solved and the objectives to be reached. It gives reasons for taking action and sets out the possible benefits of an IA. The roadmap outlines the policy options to be considered and it states which *method* is used for impact assessment. The roadmap identifies the stakeholders and announces the strategy of stakeholder involvement (who is consulted when, why and to which extent). A roadmap is usually formulated during the planning phase (section 2.2.1). Commonly, *roadmaps* are published and circulated among all interested parties (e. g. donors, customers, policy authorities, consultants etc.) (EC 2015: 7).

Minimal outcomes of an IA are: roadmap, timeline, IA-Report and Policy Recommendation.

The timeline briefly summarises the upcoming working steps of the entire IA in a timely order. It may also indicate which working steps are prerequisites for other work packages. The purpose of an IA report is to document the entire IA process. The IA report presents the impact results of the policy assessment. It should clearly describe who is affected, how and to which extent. It should end with policy recommendations. The IA report may be supplemented with other dissemination techniques and tools like journals, conferences or other public media.

Policy Recommendation Briefings should be published separately. The aim is to provide quick and effective information for decision-makers. The challenge is to convey complex results from the IA process into a short and well-structured document. Usually, most important information comes first: (i) issue of the IA, (ii) policy recommendation, (iii) summary of the IA process. Its format resembles briefing notes: short, concise and to the point:

- **Conciseness:** A focused and straight writing that clearly transports the necessary messages. Consider that politicians mostly work under time pressure and have to read a lot anyhow.
- **Readability:** Plain language should be used, regardless of the issue's complexity. Keep in mind to use a clear and succinct wording.
- **Accuracy:** The policy recommendation should be based on the most recent, accurate and complete information available.

Box 6: Outcome – IA on Measures to Increase RE and EE in Tunisia

The final report gives a review of internationally implemented concepts on RE and EE measures and summarises experience gained in other countries. It further describes methods used and results from the ex-post and ex-ante analysis as well as key recommendations. The report is available free of charge on the webpage of GIZ (Lehr et al. 2012).

2.2 KEY PROCEDURAL AND ANALYTICAL STEPS FOR CARRYING OUT AN IA

This section goes into more details by describing the key process steps of an IA. One (or more) *methodology*(ies) is (are) proposed that can be used at each step (with cross-referencing to section 3 and Annex II).

2.2.1 PLANNING PROCESS

The planning phase sets the fundaments of the actual impact assessment. Questions beginning with who, how, what, why and when are posed and answered. The timeline for the entire IA is set. The set-up of an IA process requires forward planning. It is conducted by the managing team that has been commissioned to perform the IA.

The planning process includes the collection of data and other information as well as the identification of relevant stakeholders.

The planning process comprises the definition of the problem, the policy's target and the policy options that are to be investigated during the IA. It also includes the collection of relevant information and data (section 2.2.6) to get a proper understanding about what has to be done and what can be done. This encompasses the formulation of an a *priori hypothesis*, which helps to evaluate and place the results of the IA in the overall context (see section 2.2.2.6 on results of the execution phase). Also, the planning process comprises the identification of IA-relevant *stakeholders* (section 2.2.4). During the planning process, a *roadmap* and a timetable are drafted (section 2.1.5). These documents should be provided to relevant parties, stakeholders, public, donors etc. They function as a guide for the upcoming working process and as a pattern on when to do what in which order.

Box 7: Planning – Challenges Concluded from the Interviews with GIZ Practitioners

In most cases, no special pre-request on the IA (e. g. choice of *model*) was expressed from governmental bodies. In some cases, efforts for convincing policy authorities to conduct an IA were necessary. Mostly, concerns about possible negative drawbacks (e. g. deterioration of foreign relations) had to be calmed. In some cases, needs assessments were conducted (questionnaires, interviews with young economists and heads of department) to identify existing local capacities. Subsequently, a screening of external experts capable in developing and training local staff on economic modelling was conducted and invitations for application were sent out. The planning also included the cooperation with other projects active in the same area in order to prevent duplication.

2.2.1.1 Definition of the Problem

A clear definition of the policy problem gives the rationality and reason for government intervention and justifies the necessity for action. This increases transparency and raises public acceptance of policy intervention. It is essential for defining the *scenarios* and *status quo*.

Possible key questions may be: What are the drivers and causes of the problem? How has the problem developed? What are the symptoms? How significant is the problem? Where is it located and who is affected?

Key questions: What are the drivers and causes? What are the symptoms? How significant is the problem? How has the problem developed?

Box 8: Problem – IA on Measures to Increase RE and EE in Tunisia

Data existed neither on the effects already achieved nor on future employment from the Solar Plan. The impacts from a strategy such as the Tunisian Solar Plan (TSP) and the related support mechanisms were yet unknown, in particular with respect to employment and qualification needs. For further development of the Solar Plan and the design of respective training programmes, this information was needed.

Part of the problem definition are aspects like legal obligation (e. g. international agreements) or policy constraints like majority seeking among opposing parties, bargaining for compromise, searching for support and legitimacy (Jacobs et al. 2011: 8) that may influence the scope of IA.

It is helpful to identify the prominence of the issue in the governance policy agenda. In most cases, the higher it is ranked, the easier it is to perform the IA. High policy interest in a subject will ease the access to financial, technical or human resources. At the same time, policy prominence can also be a pitfall to IA. Politicians under pressure may tend to act fast and will not wait for IA results to support reasonable action. In both cases, it is important to know timing and urgency of the problem and, accordingly, start early enough with the IA (compare section 2.1.2 on timing of an IA). If the problem is significant, fast action is required, which in turn demands a quick IA process.

For conducting the problem definition process of the IA, a number of – mostly qualitative – methodologies can be used:

- Case study (section 3.4.1)
- Result Chain Analysis (section 3.4.2)
- Delphi Method (section 3.4.4)
- Logical Framework Approach (Annex II)
- Interviews (Annex II)

2.2.1.2 Definition of the Objective

A precise definition of the IA's objective is important in order to make sure that it does correspond to the defined problem.

An easy *method* to reflect the definition of objectives is to use the checklist method (Annex II) and apply the SMART concept (Doran 1981). Check whether the targets are specific, measurable, accepted, realistic and timely. By following this concept, targets become clear, quantifiable and controllable. They fulfil the transparency criteria of IA and allow easy evaluation of the results.

Be SMART with your objectives: Specific, measurable, accepted, realistic and timely.

The more vague the definition of the target, the more difficult it is to define policy options (section 2.2.1.3) and to evaluate whether the target can be reached.

If more than one objective is pursued, the objectives should be ranked. This is important, because different targets may lead to conflicting results.

For conducting the objective definition process of the IA, a number of – mostly qualitative – methodologies can be used:

- Simple checklist method (Annex II)
- Logical Framework Method (Annex II)
- Expert interviews (Annex II)
- Survey (Annex II)

Box 9: Objective – IA on Measures to Increase RE and EE in Tunisia

Three goals were pursued by the IA: (i) Learning from international experiences to identify a successful policy design and strategy (Part I of the IA report), (ii) Identifying jobs created and future prospects in terms of job creation arising from the TSP (Part II and III of the IA report); (iii) Capacity building and training of the use of a quantitative tool for forecasting *direct* and *indirect* employment effects.

2.2.1.3 Definition of the Policy Options

Policy options can range from regulatory to market-based measures or can be a combination of both. It is important to be as precise as possible in the definition of policy options in order to clearly distinguish the policy from the *no-policy scenario*.

Policy options should be checked with respect to their feasibility. *Stakeholders* (section 2.2.4) should be included in the decision-finding process. This increases the success of the policy intervention. A lacking acceptance on the part of the stakeholders gives an early indication for possible difficulties in the dissemination phase of the project.

The objectives should be doublechecked against possible restrictions, requirements and limitations as described in sections 2.1.3 and 3.2.

Box 10: Policy Option – IA on Measures to Increase RE and EE in Tunisia

The Tunisian Solar Plan provides a framework for the increase of renewable energy and energy efficiency until 2016 and beyond.

Check policy options against their feasibility by involving stakeholders. The list of policy options may depend on their legitimacy, suitability, necessity and adequacy.

If more than one policy option is identified, policy options should be listed and narrowed down by checking the *proportionality principle* (EC 2009: 30) along the four criteria legitimacy, suitability, necessity, adequacy and by screening for technical and institutional constraints (compare section 3.2).

The remaining policy options may be integrated into the analysis. This could lead to a comparison not only of policy to *no-policy scenarios*, but also of *scenarios* with differently designed policies.

A wide range of different – mostly qualitative – methods can be applied.

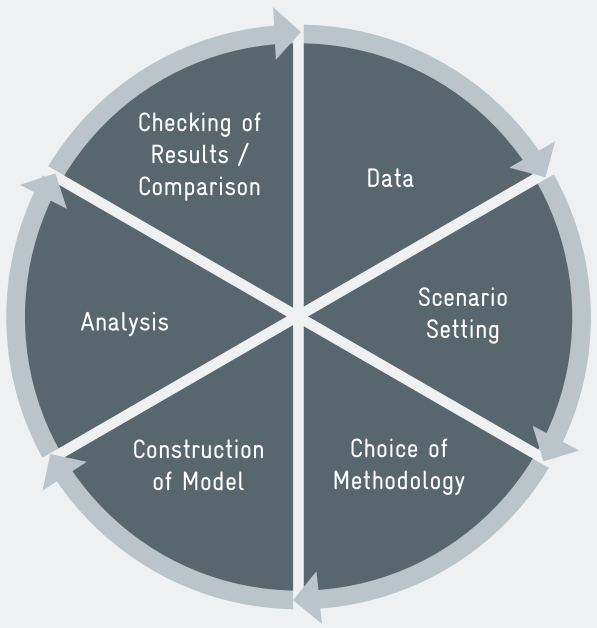
- Multi-Criteria Analysis (section 3.4.3)
- Quantitative scenario analysis (section 3.5)
- Cost-Benefit Analysis (section 3.5.11)
- Simple checklist method (Annex II)
- Logical Framework Method (Annex II)
- Expert interviews (Annex II)

2.2.2 EXECUTION PROCESS

This part includes the actual performance of an impact analysis. Figure 4 summarises the different steps: The impact analysis starts with stock taking of relevant data. It continues with the definition of the scenarios. Then a *methodology* is chosen, a *model* is constructed and applied. The results are checked and compared.

Comparison of different single scenarios with each other will only be possible if the baseline is the same.

Figure 4: Steps in the Execution Process



2.2.2.1 Data

See section 2.2.6

2.2.2.2 Scenario Setting

The scenarios are set by the choice of policy options (section 2.2.1.3). The number of different policy options corresponds to the number of scenarios. Always, a *no-policy scenario* is included to form the baseline for comparison.

Most of the work concentrates on the formulation of the baseline scenario. All other scenarios are variations in one or more aspects (e. g. tax rates, subsidies etc.) while all the other *specifications* remain the same as in the baseline (or no-policy) scenario. Depending on the methodology used, the specification may take a lot of time. In case of quantitative methods, *behavioural functions, exogenous variables* or *definitions* have to be determined.

2.2.2.3 Choice of Methodology

The choice of *methodology* is a selection of an instrument, a decision about the technical foundation of the analysis. The choice of instrument defines the framework of the analysis, sets the requirements on data (section 2.2.6) as well as on necessary technical and human capacities (section 3.2). It defines the application possibilities and determines the explanatory power of the analysis. Feedback loops to data requirements (section 2.2.6) and scenario setting (section 2.2.2.2) are likely.

Box 12: Methodology – IA on Measures to Increase RE and EE in Tunisia

The *ex-ante* impact analysis was conducted by combining a simple input-output (IO) model with energy-technology-specific tables. The IO model was used in order to include *indirect* employment effects. An exogenous Gross Domestic Product (GDP) growth path was taken from national statistics. All other variables were determined *top-down*. A global cost structure of renewable energy technologies (Lehr et al. 2011) was included to identify indirect effects.

The choice of methodology depends on data availability, time capacity, local know-how and skills as well as on the degree of complexity of the analysis.

The choice of methodology is challenging – different influencing factors have to be considered. In most cases, a gap between "want to do's" and "can do's" exists. One way to facilitate the choice of methodology is to group the different methods according to specific criteria:

Box 11: *Scenarios* – IA on Measures to Increase RE and EE in Tunisia

Two scenarios and one *sensitivity analysis* were conducted. The scenarios were formulated by an external party, the German Wuppertal Institute, and were the result of the decision-making process for the future energy mix of Tunisia. They consider nuclear, fossil and renewable energy dominated pathways for the energy mix until 2030.

- Scenario 1: High renewable energy penetration scenario that reaches 30 % renewable energy in electricity generation.
- Scenario 2: Low renewable energy penetration scenario with 15 % renewables in electricity generation.
- Sensitivity analysis: higher domestic value creation from higher integration in the wind industry

Beyond the electricity sector, solar water heaters were included in the scenarios.

- **Data availability:** Refers to data needs and availability for performing the IA (see section 2.2.6 on the issue of data availability).
- **Time capacity:** Refers to the time available for performing IA (see section 2.1.2 on timing of an IA).
- **Local know-how for developing and/or using a method:** Refers to the human resources available for performing an IA (see also section 3.2 on human resources) and the efforts to undertake capacity development (see section 2.2.5).
- **Degree of complexity of the analysis:** Refers to the kind of impacts to be analysed (direct, *indirect* or *induced impacts*). It can also refer to the number and sort of variables under observation (income distribution, emissions, resources, material flows etc.).

Box 13: Choice of Methodology – IA on Measures to Increase RE and EE in Tunisia

The choice of *methodology* was based on recommendation given by IEA-RETD (International Energy Agency-Renewable Energy Technology Development (*http://iea-retd.org/*) – a platform for enhancing the international cooperation on policies, measures and market instruments to accelerate the global deployment of renewable energy technologies) guidelines for measuring employment effects of renewable energy (Breitschopf et al. 2012). Adjustments were made with respect to data availability and time capacity.

Figure 5 summarises these four criteria in a two-dimensional diagram, displaying on the x-axis the demand for data, time and local capacity, and on the y-axis the degree of complexity. The upper-right corner of the diagram shows the most complex methods introduced in this manual. The closer the methodology is placed to the origin, the lower are the requirements on data, time, capacity and complexity. The various methodologies' positions in the diagram are based on the pure form of each type of methodology.

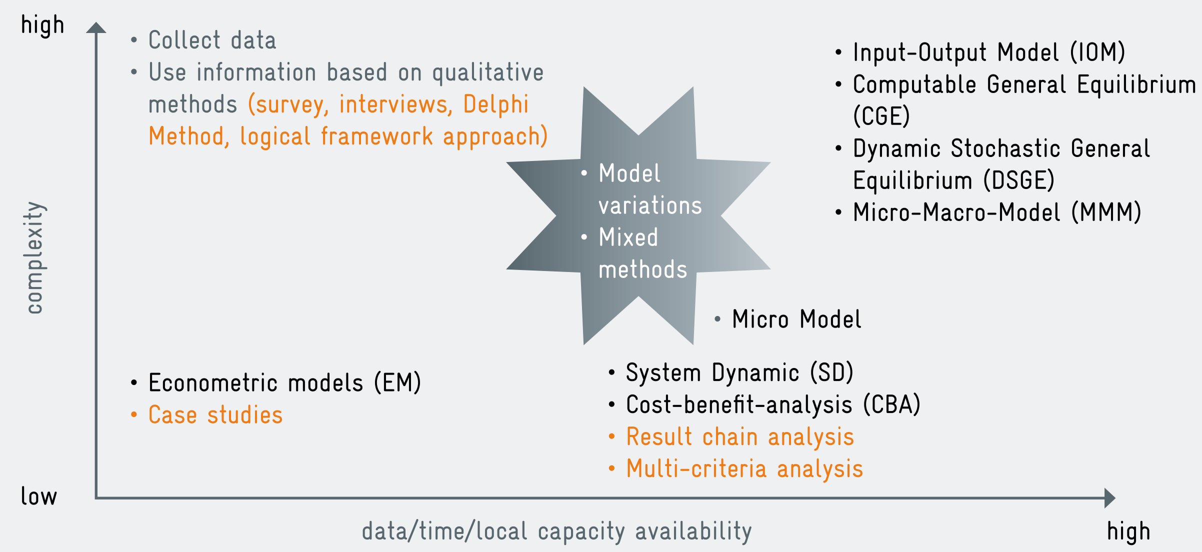
In the context of an IA it is essential to be aware of the possibility to apply *model variations* (section 3.6) or *mixed methods* (section 3.7). They can be either more or less complex, and need more or less time, data or know-how than the method in its original version. Accordingly, these two methods are positioned in the middle of the diagram with a circular star indicating their possible positions in the diagram.

The decision in favour of a methodology should be in accordance with the least common denominator that determines the position on the x-axis.[2]

Check and balance your resources, data, time and local capacities. A simple analytical instrument may be superior to a sophisticated modelling approach.

[2] *This means, for instance, that in case of a complex IA, where data endowment is rich, know-how is sufficient, but time is scarce (= limiting factor), a qualitative methodology should be the right choice, otherwise fitting* model variation *can be another possibility.*

Figure 5: Choice of Methods



Source: World Bank 2003: 19
Legend: orange writing: qualitative methods; black writing: quantitative methods; grey writing: recommendation

Box 14: Choice of Models – Challenges Concluded from the Interviews with GIZ Practitioners

The interviewees from all GIZ projects focused on the development of quantitative models. Different types of models were developed: SD Model, Time Series Model, CGE Model, DSGE Model. The choice of models depended on different factors. Formal requirements were often put forward by governmental bodies or donor institutions like the United Nations Environment Programme (UNEP), the World Bank or the IMF, which limited the potential model options.

2.2.2.4 Construction of Model

If a *quantitative methodology* shall be applied, a *model* has to be constructed. Section 3.5 describes eight quantitative methods most suitable for performing *ex-ante* impact assessment. Detailed information on construction requirements (software, know-how, data etc.) are given in the respective subchapters as well as time requirements for setting up a model.

In case of a decision in favour of a qualitative methodology, the preparatory measures have to be started. Section 3.4 describes four qualitative methods most suitable for performing ex-ante impact assessment.

2.2.2.5 Analysis

Following the construction of a quantitative model, the actual analysis can be performed. First, the baseline (no-policy) scenario is calculated. Then, the different *scenarios*, defined in section 2.2.2.2, are employed. For each policy and *no-policy scenario*, the results are saved and stored in a separate folder.

In case of a qualitative *methodology*, the actual assessment is launched in form of, for example, workshops or interviews, or writing a case study.

2.2.2.6 Checking of Results and Comparison

In case of a quantitative approach, the consistency and correctness of the *model* has to be checked in this phase. The more sophisticated the applied model, the easier it is to create bugs in the programming code, in data processing, in regression functions etc. It is important to check and balance the model before further elaborating and disseminating the results (see evaluation phase in section 2.2.3). The checking of a model comprises the following steps:

- **Verification of *definitions*:** Checking definitions (e. g. definition of GDP, consistency of *national accounts* etc.) on their correctness.
- **Verification of *behavioural functions*:** Using *sensitivity* simulations to test whether the model reacts in the expected way (*transmission mechanism*, impact areas, magnitude, direction):
  – The **transmission mechanism** ("storyline"): The transmission mechanism describes the logical impact chain of the IA which should be reflected in the results. For instance, a sudden increase of the oil price (for oil-importing countries) should lead to higher import prices, to an increasing overall price level, to a decline in private consumption and a decline in import demand. Higher production cost should lead to a decline in production and increasing unemployment. Wages should adjust accordingly. If the results do not correspond to such a storyline, the model has to be readjusted.
  – **Impact areas** ("who is affected"): According to the storyline and in line with the transmission mechanism, the results should identify all impact areas. If impact areas are identified that should not have been affected (or vice versa), the model has to be readjusted.
  – **Magnitude and direction:** According to the transmission mechanism, magnitude and direction of the impact have to be checked. In case of the oil price shock scenario previously described, a decline of the overall price level is an indicator for an incorrect *model specification*. Accordingly, if the impact on the overall price level is larger than the initial oil price shock, the model specification has to be rechecked.

The results should be checked against their storyline, who is affected and the magnitude of the impact.

Results should be evaluated against an *a priori hypothesis*. This can be a result of "thoughtful thinking" or a double check against other publications or projects performed on the same issue.

- **Check the results against an a priori hypothesis:** If significant deviations exist, the reasons should be tracked. Two options exist: either the *hypothesis* is wrong, or the results of the impact assessment are wrong:
  – In case of quantitative methods, false results could be caused by an incorrect model (see section 2.2.2.6 on how to check a quantitative model).
  – In case of qualitative methods, a bias e. g. in the group of people being interviewed (whether experts, *stakeholders* or other randomly chosen persons) may lead to different results.
  – The hypothesis at the beginning did not include certain aspects that entered the analysis at a later stage of the IA process (e. g. through stakeholder input etc.).

2.2.3 EVALUATION PROCESS

The evaluation phase serves two purposes: First, to evaluate the impact against its *effectiveness* and *efficiency* and to formulate policy recommendations and, second, to disseminate the results to target groups – mainly policy decision-makers – via the IA report and a Policy Recommendation Briefing (see also section 2.1.5 for outcome of an IA).

2.2.3.1 Evaluation of Results and Policy Recommendation

The evaluation of results is not to be mistaken with section 2.2.2.6 of the execution phase. While in section 2.2.2.6 the consistency of the *model* is checked, here results are used to evaluate the effectiveness and efficiency of the predefined policy options in order to tackle the defined problem.

Whilst effectiveness indicates whether the policy option has met its expectation – hence, if the policy option serves its objective –, efficiency provides evidence on which policy measure is more cost-efficient.

Box 15: Results I – IA on Measures to Increase RE and EE in Tunisia

The results were checked and balanced against the no-policy scenario, which was a scenario without additional investments *induced* by the TSP.

Decentral technologies have higher impacts on employment than large central power plants. This influenced the decision by the Tunisian Government in favour of renewables as opposed to a scenario based on nuclear power.

The analysis identified industries that were mostly affected by additional investments into renewable energy technologies and energy efficiency measures. Additional employment of between 7,000 and 20,000 people can be expected – considering the underlying productivity assumption and accounting for additional employment effects through *indirect effects*.

The results should be compared to the *no-policy scenario* and to alternative policy *scenarios*. The comparison will be easier if a quantitative approach has been chosen. The numeric contrast of the different impacts allows for a quick referencing and judgement on the effectiveness and magnitude of different policy options.

If a qualitative *method* has been used, it is essential to remain consistent in the string of arguments in each scenario. The weighing up of positive and negative impacts for each option should be carried out on the basis of criteria that are clearly linked to the objective.

Once the evaluation of the results is finalised and the results are approved, policy recommendations are drawn. The consideration of policy recommendations leads to the formulation of a Policy Recommendation Briefing.

Box 16: Evaluation – IA on Measures to Increase RE and EE in Tunisia

Lehr et al. (2012) concluded that renewable energy and energy efficiency measures generate between 7,000 and 20,000 additional jobs per year until 2030. Given the current production structure, the largest employment effects are generated in installation, operation and maintenance of renewable energy capacities. In the long run, increasing domestic production and better export opportunities contribute to additional growth.

2.2.3.2 Dissemination – Feeding the Results into the Policy Process

After an IA has been conducted, feeding the results into the political process is a challenging task. As listed in Sutcliffe & Court (2005: 9), several factors such as time pressure, depth of the approach, public perception or scientific ignorance can hinder the access of evidence-based analysis into the decision-making process. Moreover, technical and methodological difficulties, lack of resources and lack of institutional demand (see section 3.2 for a summary on required resources for conducting an IA) impede this process (Jacob et al. 2011: 8).

Box 17: Dissemination I – Challenges Concluded from the Interviews with GIZ Practitioners

Outcomes and results of the projects were generally published in form of reports or other forms of paper publications. Other dissemination strategies via webpage, Facebook or personal contacts were also pursued.

In order to avoid these potential pitfalls, some measures should be considered:

- IA results should be presented in a clear and easily understandable form (OECD 2008b: 22).
- Clear and practical policy recommendations should be formulated. They should be broken down into short- to long-term effects and should include budgetary implications (Baker 2000: 39).

Adequate timing of the IA, the IA report and the Policy Recommendation Briefing are essential for a successful transmission of IA results back into the policy decision-making process.

- IA results should be provided to decision-makers in time – early enough to influence decisions (OECD 2008b: 22). This requires considering events like elections, end of pilot projects, or mid-term reviews of regulations when launching an IA (Baker 2000: 39).
- IA results should be published also to inform *stakeholders*. That should promote the support of new policy measures (OECD 2008b: 22).
- Commitment of policy-makers to "own" IA results should be claimed (Sutcliffe & Court 2006: 7). If ministries or other public authorities show ownership of an IA, it increases the chances that they commit to using the IA results.
- Building institutional frameworks for using an IA as means of quality control and establishing mechanisms to review IA reports increases the use and acknowledgement of an IA as a tool for decision-making (Jacob et al. 2011: 9).

Distilling from the above list, the timing of the IA, the IA report and the policy recommendation are essential elements for a successful transmission of IA results back into the policy decision-making process. Making policy-makers claim the ownership of IA results significantly enhances their commitment to using them.

Box 18: Dissemination II – Challenges Concluded from the Interviews with GIZ Practitioners

The usage of the IA results by policy decision-makers was only sometimes successful. In those cases in which the ministry was closely involved in the IA process, the usage of the *model* was accepted and its results were being published in own publication series.
In other cases, feeding IA results into the decision-making process was not successful due to lack of interest or because the political partner was not satisfied with the results. In other instances, IA outcomes were presented to and discussed with policy authorities. Comments and doubts were picked up and entered the final documentation.

Box 19: Evaluation II – IA on Measures to Increase RE and EE in Tunisia

The following policy recommendations (examples) – stated in the final IA report – were given:

- Policy continuity matters! Reliable support towards more renewable energy yields employment opportunities.
- Energy efficiency increase in buildings generates most employment followed by solar water heaters and photovoltaic (PV) installation.
- Wind energy does not generate as many additional jobs, but component manufacture leads to additional demand for inputs from other production sectors.
- A stable policy framework and a transparent support mechanism are most important for a successful development of renewable energy and an energy efficiency sector.

2.2.4 STAKEHOLDER INVOLVEMENT

A *stakeholder* can be a person or a group of persons or representatives of institutions affected by or – directly or indirectly – involved in a policy measure or the respective IA.

One important reason to include stakeholders in an IA is to ease communication with different interested parties and to strengthen their understanding for policy intervention. Open, latent or unknown resistance towards a policy measure is disclosed at an early stage. The IA analysis and consequently the IA results themselves are subject to changes and can be adapted to the stakeholder's input. Stakeholders may also contribute to the success of the IA in form of preliminary work such as data preparation or collection.

Box 20: Stakeholders – Challenges Concluded from the Interviews with GIZ Practitioners

In all GIZ projects, stakeholders such as ministries, national banks and national institutes of statistics were involved throughout the entire IA process. Stakeholders were also needed for capacity development measures. These external international experts were identified by desk research and were invited to take part in the project.

Figure 6 lists different types of *stakeholders* and groups them according to their role in the IA project. Actively involved stakeholders are people directly involved in the IA process – either as persons responsible for the project or as members of the project team. Capacity development (see section 2.2.5) is especially important for this type of stakeholder as it forms the basis of the stock of human resources (section 3.2). Accompanying stakeholders are persons indirectly involved in the IA by keeping track of the IA process (e. g. scientific boards or steering groups). Influenced stakeholders are those affected directly or indirectly by the policy options. Depending on the specific project, this group of stakeholders can vary (Small and Medium Enterprises (SME), employees, civil society, communities etc.). Contributing stakeholders generate input such as data or knowledge to the IA.

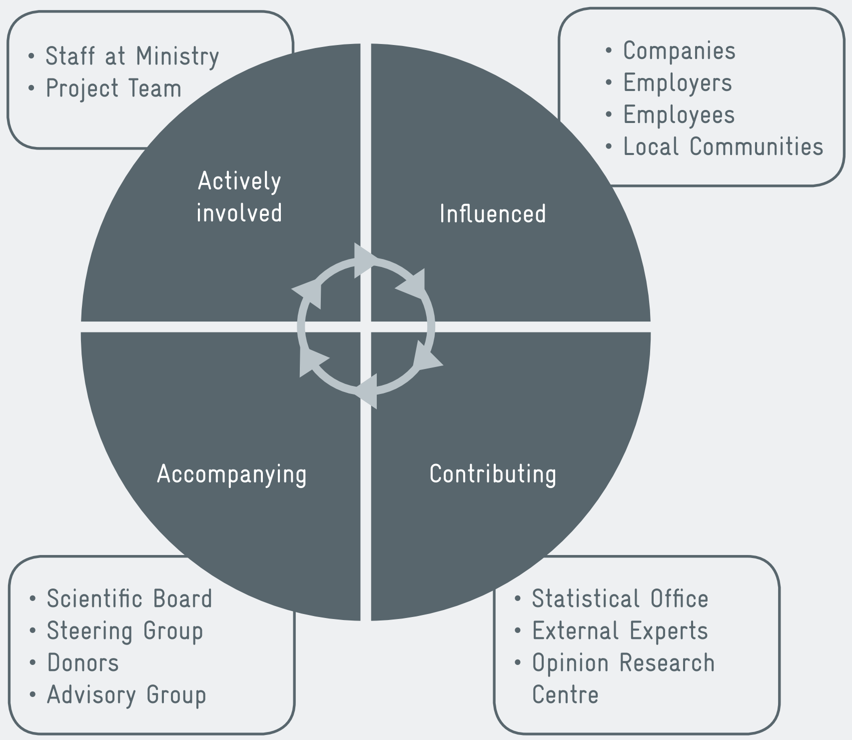
The process of selecting stakeholders should be performed carefully and in close collaboration with the local project partners. It requires a cautious assessment of each stakeholder's capabilities to contribute to the IA process. Consideration should include each stakeholder's respective role within the IA as well as their interest in supporting or hindering the policy intervention (OECD 2007).

Box 21: Stakeholders – IA on Measures to Increase RE and EE in Tunisia

The consultancies GWS and Alcor formed the project team for conducting the IA. The study was commissioned by GIZ. The Tunisian Energy Agency (ANME) was the user of the economic model. External stakeholders were invited for workshops in which the *scenarios* and results were discussed. Their feedback was used in the actual impact assessment. Stakeholders came from a variety of affected groups, such as the Société Tunisienne de l'Electricité et du Gaz (STEG, national utility), local communities, and employees and employers. These stakeholders were chosen and invited based on desk research results and contact lists from the project team and the advisory group.

The selection process may be facilitated by conducting a stakeholder analysis. This helps categorising *stakeholders* according to Figure 6 in order to classify different types of stakeholders. A stakeholder analysis helps to identify and decrease potential opposition towards the proceeding of the IA and the entailed policy options. It generally consists of four steps (World Bank 2003: 10):

Figure 6: Types of Stakeholders



1. **Identify** stakeholders: position, role in project, relation to other stakeholders, contribution to project (expert knowledge, methodological skills etc.).

2. **Rate** stakeholders according to their influence and the degree to which they are affected (high, middle, low) as well as their attitude (positive, negative, neutral) towards the policy intervention.

3. According to 1. and 2., consider whether and how the IA could be jeopardised.[3]

4. **Organise** stakeholder involvement: how, when and with which purpose/task should stakeholders be involved?

Although some feedback of the stakeholders may seem counterproductive for the IA at first because they might delay or even prevent the process, their feedback may be the most helpful one in leading the IA to success. In the context of an IA, such negative feedback may give impulse to formulate new ideas or forms of policy options, reconsider the usage of different methods, the inclusion of further information, data, etc.

2.2.5 CAPACITY DEVELOPMENT

Capacity development is the core objective in development work. According to UNDP, capacity is "the ability of individuals, institutions and societies to perform functions, solve problems, and set and achieve objectives in a sustainable manner." (UNDP 2009: 53).

Box 22: Capacity Development – IA on Measures to Increase RE and EE in Tunisia

The ANME has been trained to operate the *ex-ante* IA tool which allows for adjustments of estimates in the future by local stakeholders depending on new information and data collection.

[3] *Some stakeholders might have strong resentments towards policy measures or methods and may act strongly against them. Large disagreements or opposing opinions in the stakeholder process may delay the IA process or prevent the formulation of policy recommendation.*

Capacity development requires capacity assessment and tools to build up and sustain capacity.

In order to achieve capacity development through an IA, a capacity assessment should be performed at a very early stage of the IA. A list of existing and desired capacities should be established and respective gaps identified.

Available local capacity is identified to determine in which areas capacity development is needed. Desired capacities are defined by the requirements of the chosen *methodology*. The following list points out some issues to be considered:

- Training on economic modelling
- Training in maintaining/updating quantitative *models*
- Training in model application
- Training on Excel usage
- Training on economic theory/economic thinking
- Institutionalisation of knowledge
- Documentation of knowledge, processes, procedures
- Setting-up of formal, properly designed guidelines and training programmes (OECD 2008: 53)

Capacity development often needs external assistance and/or local partners who teach economic modelling (programming, software) or economic theory. Such experts are necessary, but a clear exit strategy has to be included in order to allow for strengthening local capacities and to strengthen local accountability (UNDP 2009: 29).

Capacity development needs exit strategies for external assistance.

Box 23: Capacity Development – Challenges Concluded from the Interviews with GIZ Practitioners

Capacity development mostly concentrated on building up economic background knowledge, trainings on how to build, maintain and apply economic models, on how to use Excel and other software as well as basic training on econometrics. Capacity development was conducted by invited external, mostly international experts for teaching and training local staff of partner institutions. In some cases, study tours to countries with similar economic conditions were organised.

In order to institutionalise local capacities, different options were taken. In most cases, a full documentation of training courses was established and special departments were put in charge of knowledge transfer. Furthermore, local networks or web-forums, for example for staff of partner institutions responsible for modelling, were established in order to stimulate discussions, the exchange of ideas or to provide internet-based learning. Capacity development was a major activity in each project.

2.2.6 DATA AND OTHER INFORMATION

Data and other information are two important input factors for any IA. Data requirements vary considerably according to the methodological choice (qualitative versus quantitative methods; type of quantitative method). In general, an IA cannot be carried out without any numerical facts or statistical inputs. A *status quo* description (section 2.2.1.1), for instance, is predominantly performed by using data. The use of reliable data has the advantage of providing precise, objective and comparable results.

Box 24: Data – Challenges Concluded from the Interviews with GIZ Practitioners

In most cases, data was sufficiently available. Sometimes, data sources lacked in quality or organisation. Sometimes, data was confidential and not accessible. Yet, data endowment is improving. In some countries, long time series of data are not available due to geopolitical or geographical breaks, for example in Eastern Europe for the beginning of the 1990s.

In a first step, mapping of necessary (data that is essential) and sufficient ("nice to have") data is required. The data needs to correspond to the pre-defined problem and policy option (section 2.2.1.1 and 2.2.1.3), to the choice of *methodology* (section 2.2.2.3) and the choice of *scenarios* (section 2.2.2.2).

First, map data needs, then take stock of available data. Match both and identify possible data shortages. If mismatches occur, think about the options you have (collect new data, adjust *methodology*, use *mixed methods*).

In the next step, available data has to be identified. Various data sources exist. However, official data from statistical offices (national or international ones) are preferable, as they usually offer the most reliable, complete and unbiased data sets. However, it might be necessary to include additional data sources (e.g. private institutions, (national) banks, insurance companies).

In a subsequent step, desired and existing data are matched and data shortages are assessed. Especially mismatches in required data present a challenge for the IA. There are various ways of how to deal with poor data availability and data limitations:

1. New data can be researched or collected. Statistical offices have the expertise and infrastructure to produce, collect or extract new data. If the IA is data-intensive, it is sensible to involve members of the statistical office as *stakeholders* (section 2.2.4). Alternatively, new data can be collected from other sources. Data collection methods like surveys, polls or interviews (see Annex II) are common tools to be used.
2. Depending on time availability and financial, technical or human resources (section 3.2), collection of new data may be limited. In that case, data needs to be re-evaluated. Alternatively, the methodology used can be changed (section 2.2.2.3 and section 3.3).
3. Instead of choosing a different methodology, a *model variation* (see section 3.6) or a mixed approach (see section 3.7) can be adopted.
4. Postpone the analysis until necessary data is available.

If data is available, time should be spent on evaluating data quality – especially if data reliability is doubtful. Three basic methods are available:

- **Data matching with different sources:** Such a validation of data only works if the same data, e. g. GDP can be withdrawn from different statistical sources (World Bank 2003: 16).
- ***Time series analysis:*** Strong amplitudes may be an indicator for false data or false data classification – especially if they cannot be explained with real time events like natural disasters, stock market crash etc.
- **Coherence with related data:** For example, GDP has to equal the sum of consumption, investment, changes in inventories and foreign trade balance.

Box 25: Data: IA on Measures to Increase RE and EE in Tunisia

Country-specific IO (Input-Output) tables and additional statistics describing the labour market in Tunisia were available. Technology specific cost structures and labour demand for RE were missing. As a proxy, information from Germany was used (cf. Lehr et al. 2011).

An IA may require qualitative or other supporting information, especially in the context of formulating an a priori *hypothesis* (section 2.2.1). Such information includes desk research on related studies or projects conducted in the country under review or in other countries. This information can help to gain an overview of likely results, methods used elsewhere for similar cases or possible problems in the analysis.

Box 26: Other information – IA on Measures to Increase RE and EE in Tunisia

Other information comprised desk research on other studies conducted on the same issue and on the methodologies applied elsewhere. The Alcor team carried out stakeholder interviews to confirm or improve estimates of trade shares taken from related literature.

3 METHODOLOGICAL APPROACHES

This chapter describes various methodological approaches that can be used during an IA. The term "*methodology*" stands for a planned and systematic approach in order to reach a set target. By using methodological approaches, the cause of action can be explained, is transparent and comprehensible, as opposed to ad-hoc or gut decisions. The tools, techniques or processes used for conducting a methodological approach are referred to as "*methods*".

In Annex I, Table 7 and Table 8 summarise the main features of the different qualitative and quantitative methods. The tables also indicate linkages to other methodologies.

3.1 OVERVIEW

One way to distinguish between types of methodologies is by classifying them into qualitative and quantitative methods. The distinctive feature between these two is the type of data or information used. While quantitative methods are based on numbers, qualitative methods use and produce information in textual form (Garbarino & Hooland 2009: 7). Figure 7 illustrates the general differences as well as the connection between both approaches.

Usually, qualitative methods are used to describe complex phenomena in great detail based on individual cases. Qualitative methods are inductive, meaning that particular observations lead to general abstraction. Qualitative approaches mostly result in the formulation of a hypothesis (Mayring 2003).

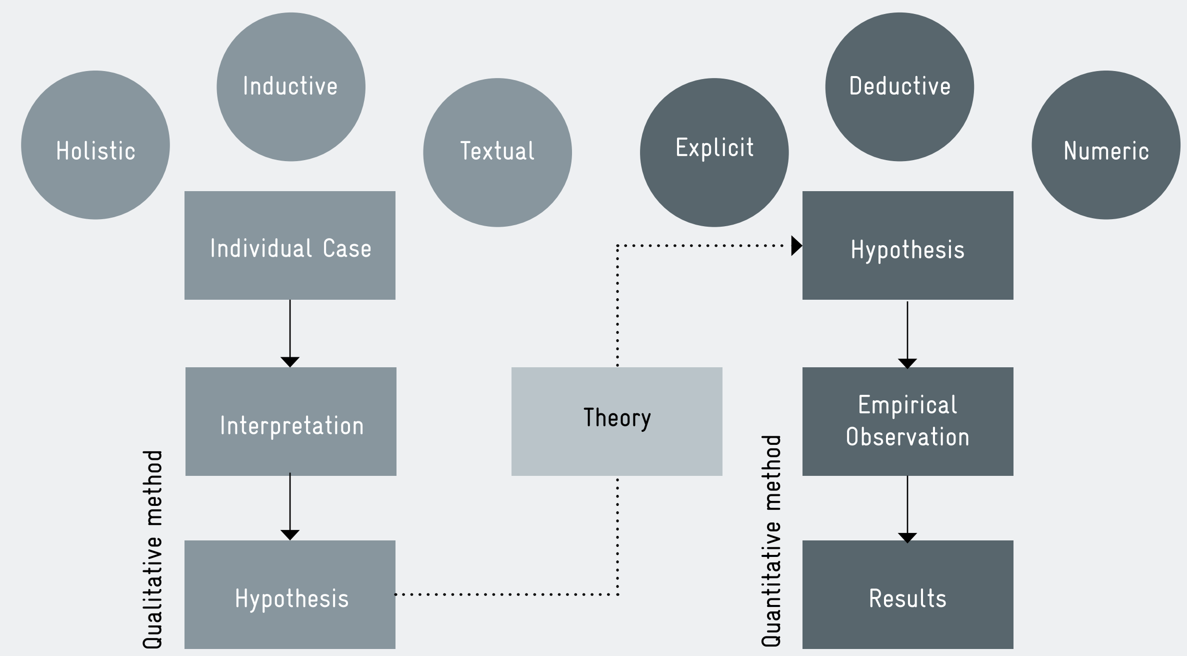
Often, qualitative methods are used in research areas that are new, not yet well explored, with only little empirical evidence and/or a missing *hypothesis*. In these cases, qualitative methods are used for formulating a theoretical construct that forms the basis for subsequent quantitative methods. Especially in countries with low data availability, qualitative methods can be a superior choice of *methodology*.

However, a precise separation between both types of methods is not always possible. This is especially the case as qualitative methods can also be used as a *method* to collect data for quantitative approaches. For example, an interview – classified as a qualitative methodology in this manual – can be either used for questioning experts in detail on a specific subject – leaving room for detailed answers. Likewise, an interview can be structured as a multiple choice questionnaire that produces numeric results to be used in quantitative *models* (see section on interviews in Annex II).

In contrast, quantitative methods use empirical observation in order to describe single features systematically. They are deductive approaches that check hypotheses on specific cases. Quantitative methods are explicit in their results (Lamnek 2005: 494). The data set is evaluated and tested against an a priori hypothesis.

Qualitative methods are used if little or no empirical evidence or hypotheses are available. They can also serve as means of data collection.

Figure 7: Distinction between Qualitative and Quantitative Methods



Source: https://www.ph-freiburg.de/quasus/einstiegstexte.html - own illustration

3.2 RESTRICTIONS, REQUIREMENTS AND LIMITATIONS

The application of quantitative and qualitative methods is subject to certain restrictions, requirements and limitations. They can be summarised by the different types of resources available for policy assessment (Figure 8). Resources are ways and means to initiate action. Before deciding on an analytical tool, it is important to take stock of the financial, human, technical and institutional resource endowment.

Financial resources determine the budget of the IA. They also influence the circle of people involved (human resources), the acquisition of external knowledge (human resources) or technical endowment (technical resources).

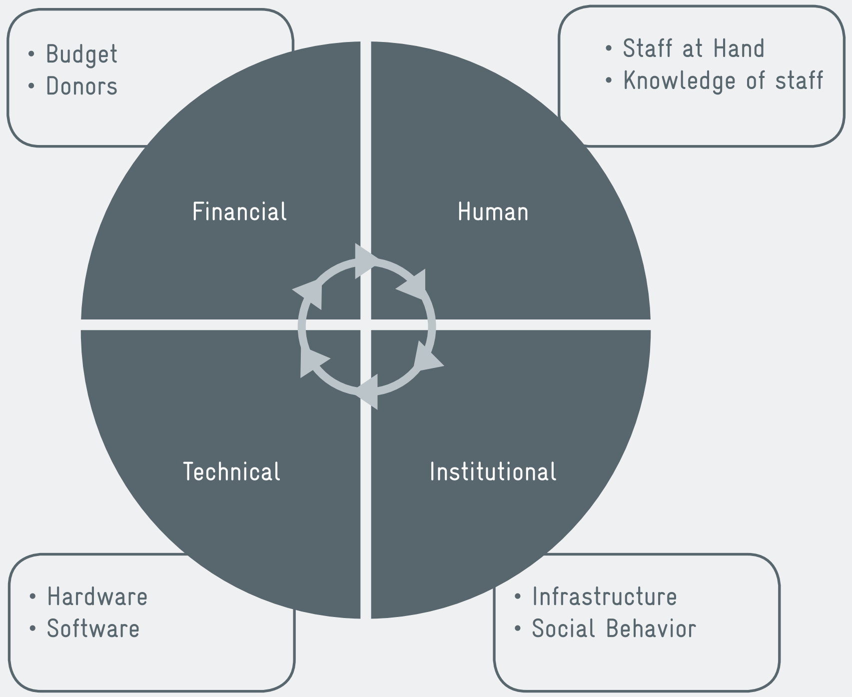
Financial resources determine the scope of action.

Box 27: Financial Resources – Challenges Concluded from the Interviews with GIZ Practitioners

In most cases, the GIZ projects interviewed did not face any financial constraints. In one case, the project stagnated shortly due to budget constraints imposed by the government. In that case, other funding opportunities were used. However, low payments of the local staff often reduce their motivation for training.

Human resources are the biggest challenge: It is important to get an early overview of available knowledge in order to prepare the upcoming tasks. An early stock taking of knowledge endowment is important for preparing upcoming tasks.

Figure 8: Type of Resources



Box 28: Human Resources I – Challenges Concluded from the Interviews with GIZ Practitioners

The interviews revealed that the biggest challenges for conducting an IA related to the partner institutions involved in the project. A lack of incentives (lack of promotion, low payment, and lack of responsibility) often led to low motivation and interest in the project. Time constraints, as a direct consequence of work overload, frequently delayed the progress of the PI. All interviewees identified lack of knowledge either in economic background or in usage of software tools, programming or *regression analysis* as obstacle to maintaining, updating and applying the economic model. A lack of skills in foreign languages was also recognised as an obstacle for transmitting know-how. To create incentives, more opportunities for promotion, publication and projects should be initiated. That would lower the fluctuation of personnel and raise motivation. Knowledge deficits can be overcome by offering workshops, trainings or study tours – just to name a few.

Box 29: Human Resources II – Challenges Concluded from the Interviews with GIZ Practitioners

The majority of interviewees identified the institutionalisation of knowledge as additional big challenge. In most cases, capacity is personalised, meaning that knowledge leaves with the person. Know-how does not remain within the institution, leading to a never-ending demand for capacity building. Solutions to overcome this challenge were to increase efforts in documentation of capacity building measures. Furthermore, feedback rounds or round tables were initiated in order to spread knowledge within the institution.

Technical resources include hardware and software. Balance between the purchases of licensed software against freeware.

Human resources relate to the number of people involved in the project and to their level of knowledge. If financial resources are sufficient, external experts with the required availability and capability can be bought in.

Technical resources refer to computer hardware and software requirements which are necessary to perform an *ex-ante* IA. Concerning software issues, the purchase of licensed software has to be balanced against the usage of freeware or open source software. A list of useful software is given in Table 4 in Annex. I

Institutional resources relate to the “cultural system” of a country which subsumes aspects of social behaviour (e.g. ways of communication, attitudes towards work, social interaction etc.) and action of individuals, groups and communities. Institutional resources also refer to infrastructure

Box 30: Technical Resources – Challenges Concluded from the Interviews with GIZ Practitioners

The technical endowment with hard- and software was usually not a problem. However, the choice of software was sometimes not given. One project reported of being requested to use EViews, because the software was funded by other donor partners.

and facilities such as public administration, court or educational systems. The institutional setting determines the framework in which an IA can produce successful results: development and maintenance of capacities, transmission of policy recommendation or enforcement and implementation of policy measures.

The institutional setting determines the framework in which an IA can produce successful results.

Box 31: Institutional Resources I – Challenges Concluded from the Interviews with GIZ Practitioners

An IA was conducted to assess whether the refund of tuition fees for girls could be a suitable policy option for enhancing enrolment in primary education. The IA signalled a positive impact. The policy measure was introduced. However, the real-life results were disappointing.

The *ex-post* analysis revealed that other reasons than tuition fees were preventing girls from going to school (e. g. work, assistance in household, resentments towards education of girls etc.). A more in-depth analysis of the problem could have helped to bring the IA to success.

Other restrictions, requirements and limitations of using analytical tools as described in the following subchapters relate to issues like assumptions, theory, data requirements, area of application, explanatory power etc. These aspects differ according to the *method* under focus (see respective sections in chapter 3).

3.3 CHOOSING THE RIGHT METHOD – NAVIGATION TOOL

The choice of *methodology* has already been addressed in section 2.2.2.3. A classification of different methods depending on time, data and resource availability and on the aspect of complexity was indicated.

Keeping these parameters in mind, this section introduces a navigation tool (Figure 9 and Figure 10) for selecting a specific method/*model* according to data availability and fields of application (economic, social, and environmental). Table 7, Table 8 and Table 9 in Annex I provide a summary on qualitative and quantitative methods and models discussed in this manual.

Starting point of the decision tree in Figure 9 is data availability. Data may not be available or it may not be usable because of either quality matters or a lack of knowledge to handle datasets. Sometimes, a data-based IA is rejected for reasons like resentments towards quantitative approaches in general.

If data issues are of no concern or can be solved, quantitative methods are an option. From there, three further paths can be taken which indicate the types of data in focus: Key indicators such as GDP, inflation, unemployment or total energy demand refer to aggregated or macro variables that are used for the purpose of describing fields of interest. In contrast, industry data describes developments in specific branches of the economy like the textile, food or agriculture industries Data on such an aggregation level of industries is referred to as meso data. Last, micro data are usually observations on individual level, e. g. characteristics of single households.

The box at the bottom in Figure 9 indicates which method/model corresponds to which type of data. The majority of quantitative methods can be used for more than one data type. Basically, most of the methods/models can be adjusted in accordance to data availability (refer to section 3.6.1 on modification of models) – with the exception of micro models, which only work with micro data or IO models based on IO tables.

If a data-based IA is not possible, a range of qualitative methods can be used. Four methods are especially recommendable for impact analysis: case study (CS), Result Chain Analysis (RCA), Multi-Criteria Analysis (MCA) and Delphi Method (DM). Surveys or interviews can also be an option, although these tools are more suitable for producing input for follow-up quantitative approaches (e. g. data collection or for establishing hypotheses).

Models can be differentiated according to their data *specifications*: macro, meso or micro data.

Figure 9: Decision Tree on Methodology – DATA

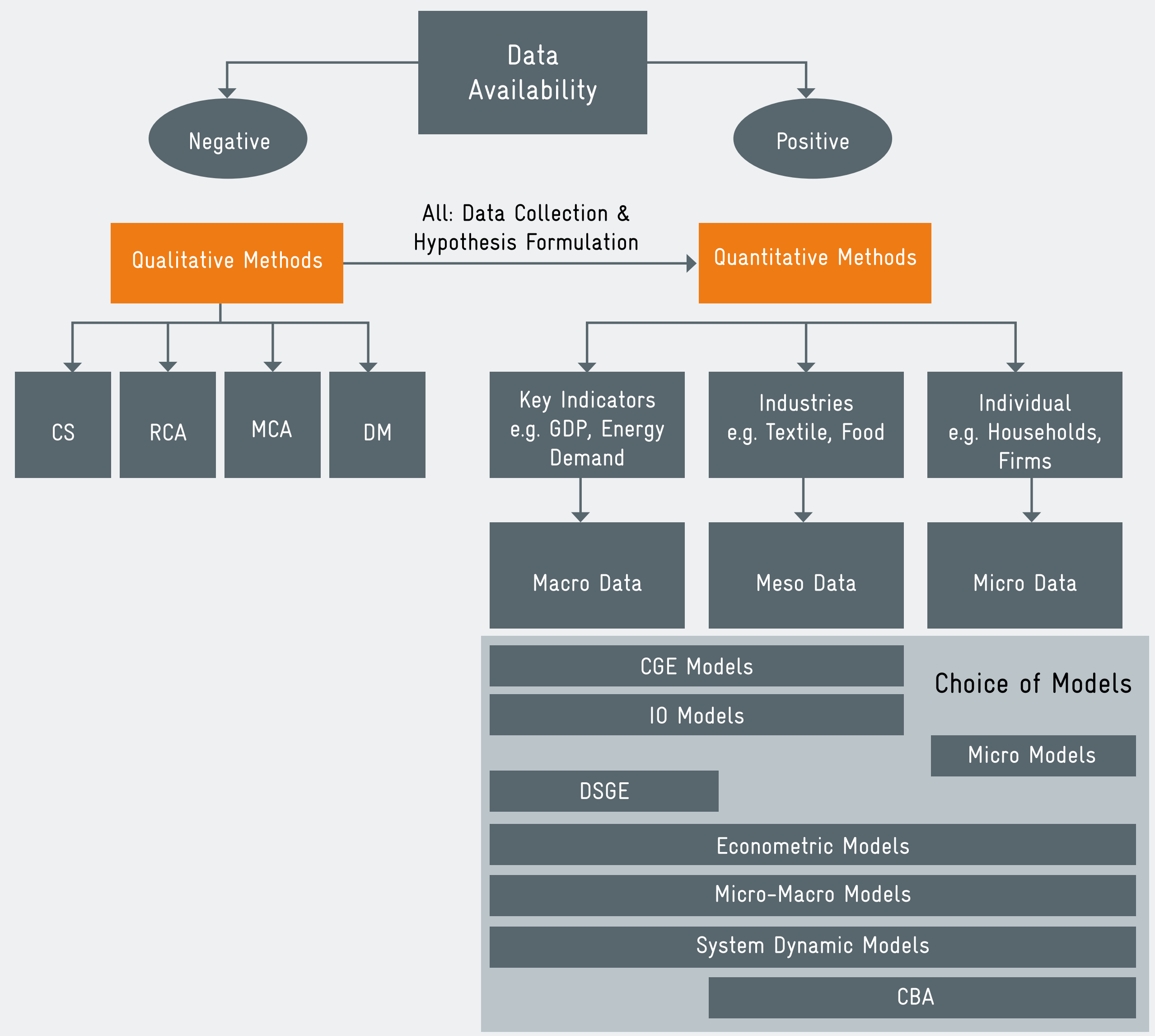


Figure 10 approaches the choice of *method* starting from the field(s) of interest. Fields of interest relate to environmental, economic or social matters. It is important to notice the central position of the economy. Environmental or social issues are usually extensions of pure economic models (see section 3.6.2 on modularisation of *models*). These extensions – often referred to as *modules* – can be very sophisticated, but are usually no stand-alone solutions.[4] They offer the possibility to address questions or policies related to environmental protection or green economy by using the methods indicated in the box.

Environmental and social aspects can be extensions of an economic model.

[4] *Environmental (natural science) models, which are not correlated to economic models, exist. For instance, the PIK (Potsdam Institute for Climate Impact Research) employs a number of climate and impact models that focus on climate impact analysis on agricultural crops, water use, vegetation or urban climate. These kinds of models are not considered in this manual.*

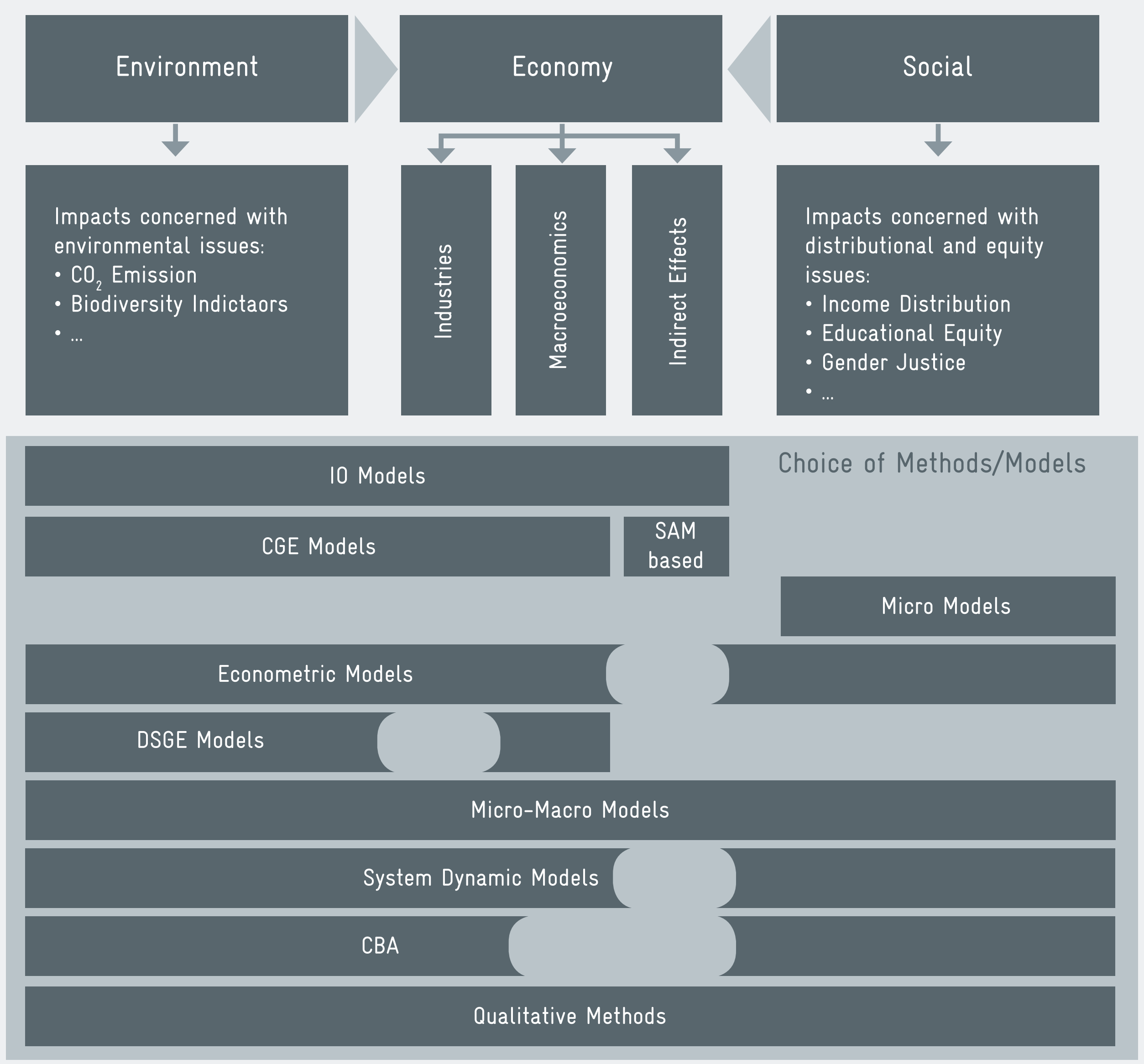
An economic-based analysis can focus on structural change, developments of key indicators or the assessment of *indirect impacts*. Each field may require a different model. Indirect impacts, for instance, are analysed by applying IO tables. Hence, IO models or Social Accounting Matrix (SAM)-based Computable General Equilibrium (CGE) models are suitable tools. For the analysis of structural changes different *models* can be applied such as IO models, CGE models, System Dynamics (SD) models and econometric models.

Topics like income distribution, educational equity or gender justice refer to social questions and are mostly concerned with distributional and equity issues. They require a very detailed analysis on a very low level of aggregation. Usually micro data form the basis of impact assessments incorporating social aspects.

3.4 QUALITATIVE METHODS

The qualitative methods introduced in this section are limited to four methods which can be applied for impact assessment in the execution phase of an IA (section 2.2.2). Other qualitative methods usable for data and information collection and/or for planning purposes are described in Annex II.

Figure 10: Decision Tree on Methodology – FIELD(S) OF APPLICATION



The subsequent subchapters on qualitative methods all follow the same structure:

- They start with a short description,
- state the field(s) of application and
- describe the expected results/outcome of the method,
- inform on the localisation within the IA process,
- highlight obligatory and optional requirements for using this method,
- point out advantages and limitations of the *method*,
- finalise with an example and
- provide references for further readings.

3.4.1 CASE STUDIES

A case study (CS) is a qualitative research method to conduct an in-depth analysis of a certain situation (= the case). Case studies can either focus on geographical areas or on a specific, clearly defined group of individuals. They show and disclose real-life phenomena in a detailed context (Zainal 2007: 2). Case studies also work with data, but on a very low aggregation level and within a contextual framework. Case studies try to illustrate what has been accomplished, worked well or which problems have occurred. They can give suggestions and additional elaboration on specific issues of interest. A case study generates a *hypothesis* on a particular issue and helps improving the understanding of complex subjects

Fields of application

A case study should be considered, if questions like "how" and "why" are the focus of the task, if contextual conditions are explored, if behavioural modification is of interest or if the context of the objective is not yet explicit (Baxter & Jack 2008: 545). Usually, case studies build upon different methodologies like desk research, field studies, interviews or surveys. Different types of case studies (Table 5 in Annex I) exist.

Results/outcome

A case study results in a report that expresses an idea about possible impacts of a policy option. Usually, it also contains a descriptive part, which is built around the data-based part. A case study can be designed as shown in Figure 11. If a multi-case study is performed, a cross-case comparison has to be included.

Position in the IA process

In the planning process: description of *status quo* or formulation of first hypothesis. Case studies alone can also represent the actual execution phase of an IA. In such a case, the evaluation phase is integrated as well.

Requirements (obligatory and optional)

In general: medium in terms of technical, human or financial resources, but high in terms of time. A well-conceived plan and design of a case study facilitate the actual task: collecting relevant data and other information that are concise and focused on the subject of the study.

Time requirements: high (up to one year)

Stakeholder involvement: low to medium depending on the scope of the case study. A case study built upon desk research needs no further stakeholder involvement. If interviews or surveys are included, the circle of stakeholders will extend.

Advantages and limitations

The advantage offered by case studies is that they provide "holistic and in-depth explanations of the social and behavioural problems" (Zainal 2007: 1). Data analysis is performed within a contextual setting (Zainal 2007: 4), i.e. both quantitative and qualitative aspects are combined for explaining real-life complexities.

However, case studies are limited by their lack of precision – (e. g. if biased views or equivocal findings enter the study). That is why a (scientific) generalisation of the findings obtained by a single case study is not possible. Moreover, case studies are in general long reports, therefore time-intensive.

Figure 11: Design of a case study

Box 32: Case Study: Poverty Impact Assessment – Case Study Ghana (African Cashew Initiative)

The interviews revealed that the biggest challenges for conducting an IA related to the partner institutions involved in the project. A lack of incentives (lack of promotion, low payment, and lack of responsibility) often led to low motivation and interest in the project. Time constraints, as a direct consequence of work overload, frequently delayed the progress of the PI. All interviewees identified lack of knowledge either in economic background or in usage of software tools, programming or regression analysis as obstacle to maintaining, updating and applying the economic model. A lack of skills in foreign languages was also recognised as an obstacle for transmitting know-how. To create incentives, more opportunities for promotion, publication and projects should be initiated. That would lower the fluctuation of personnel and raise motivation. Knowledge deficits can be overcome by offering workshops, trainings or study tours – just to name a few.

References

- Baxter & Jack (2008) give an overview of the types of case study designs.
- In Soy (1997) you find steps to take for a case study as research method.
- ACI (2010) offers a country case study on Ghana.
- Zainal (2007) discusses several aspects of case studies as a research method.
- An introduction to design and methods of case studies is given by Yin (2003).

3.4.2 RESULT CHAIN ANALYSIS

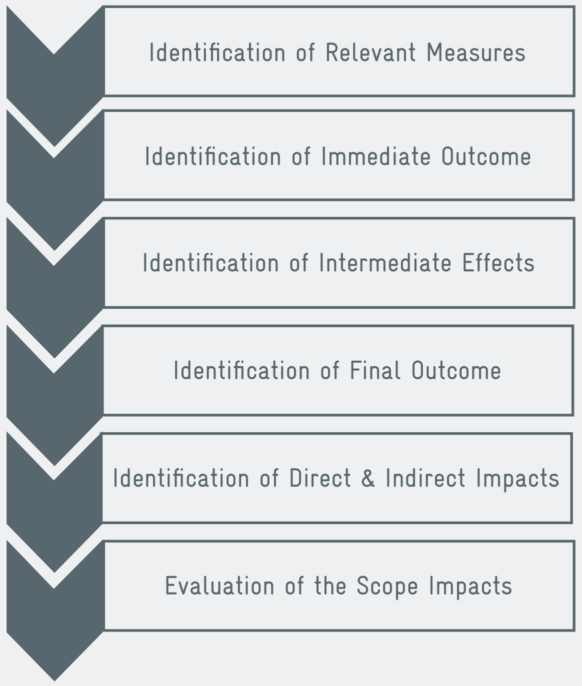
Result chain analysis (RCA) can be used to draft first ideas on how the planned measure can contribute to defined objectives and targets and what impacts are likely to occur (Ferretti et al. 2012: 53). It can also highlight the need for in-depth analysis or point out knowledge gaps (Ferretti et al. 2012). The procedural steps of a RCA are shown in Figure 12.

Fields of application

RCAs are applied for rethinking linkages between policy measures and impacts. They help to establish hypotheses that can later on be used in quantitative methods (section 3.5). Often, a RCA is used in combination with the logical framework approach (LFA, see Annex II). The LFA is used in the planning phase of an IA; the RCA in the execution phase.[5]

[5] The LFA as planning tool can also be replaced by the GIZ results model (GIZ 2015). Both tools are used during the preparation and planning phase of an IA.

Figure 12: Procedural Steps in a RCA



Source: Ferretti et al. 2012: 11 – own illustration

Results/outcome

The result of a RCA indicates the direction of causalities and cause-effect relationships. A RCA begins by portraying the planned measures and their inputs, outputs, outcomes (also immediate outcomes). RCAs are often presented in horizontal or vertical order with arrows indicating the cause of results. The results of a RCA can also be presented in narrative form.

Position in the IA process

In the execution process: for formulating an *a priori hypothesis* in the planning phase.

Requirements (obligatory and optional)

The RCA can be performed as a desk-exercise or as a participatory exercise in the form of workshops. Whereas the former one requires only little input (literature review), the latter one needs time, space and participants/*stakeholders*. When performed as a multi-person brainstorming session, experts and/or stakeholders have to be chosen, invited and instructed. Auxiliary means like (coloured) paper, post-its, pens etc. are useful.

Time requirements: low (up to three months)

Stakeholder involvement: low to medium; Stakeholder involvement (national/international experts, affected persons, NGOs etc.) will increase if participatory exercise is included.

Advantages and limitations

The advantage of a RCA is its usefulness for creating explicit assumptions and hypotheses. It highlights linkages between the measure and its intended and unintended impacts. Also, a RCA facilitates consensus building among *stakeholders*, which leads to transparency and accountability of the IA. A RCA is most useful as a starting base for further in-depth analysis.

A RCA is constrained by its disability to illustrate the quality or scope of the impacts in all their significance. It cannot disclose *non-linear* dynamics of reality – meaning that behavioural changes or the real world's complexity cannot be fully captured by a RCA. Therefore, false assumptions may lead to false results and expectations.

References

- Ferretti et al. (2012) provides an overview of existing approaches and methods used for ex-ante IA.

3.4.3 MULTI-CRITERIA ANALYSIS

A Multi-Criteria Analysis (MCA) is a decision analysis tool that aims at establishing preferences between policy options related to a specific objective (DCLG 2009: 20). With the help of a decision-making team (stakeholders), judgements on objectives, criteria, weights and assessment of each option's contribution to reaching the objective are made. In general, a MCA is founded on the experts' individual judgements, albeit objective statistical data can be integrated into the analysis. Key steps to be considered are shown in Table 6 in the Annex.

Fields of application

A MCA is applied if time and budget are limited. The tool is especially useful if monetary values cannot be allocated (UNFCCC 2005: 3–24).

Results/outcome

The result of a MCA is a ranking of options and possibilities suitable for achieving a set target (UNFCCC 2005). A MCA produces a performance or consequence matrix "in which each row describes an option and each column describes the performance of the options against each criterion" (DCLG 2009: 21). A performance matrix in its simplest form could look like the one in Table 1. Different weighting tools can be applied, like a tick for indicating yes/no judgements, or a traffic light system that weighs the criteria in relation to the option. The final decision has to include a weighting between the criteria.

Table 1: Performance Matrix in a MCA – Example

	Criterion 1	Criterion 2	Criterion 3
Option 1	✓	–	●
Option 2	✓	–	●
Option 3	–	✓	●

Source: adapted from DCLG 2009: 22 – own illustration

Position in the IA process

In the execution process: includes the evaluation process as it leads to the best decision.

Requirements (obligatory and optional)

The requirements of a MCA are fairly low in terms of time, budget and data availability. If *stakeholder* involvement (section 2.2.4) is required, experts and/or stakeholders have to be chosen, invited and instructed on the MCA procedure. Auxiliary means like (coloured) paper, post-its, pens etc. are useful.

Time requirements: low to medium (if stakeholders are involved)

Stakeholder involvement: low to medium; Stakeholder involvement (national/international experts, affected persons, NGOs etc.) increases if participatory exercise is included.

Advantages and limitations

The advantage of a MCA is that it is an explicit, open and simple approach to provide orientation and structure in complex situations. The basis on which the criteria are chosen is straightforward, comprehensible and defined by the group in charge of the analysis.

The MCA is limited by the subjectivity of the group in charge of the analysis. The MCA cannot assess explicit welfare effects. It cannot take behavioural change into account. The real world's complexity cannot be fully accommodated. False assumptions may lead to false results and expectations.

Box 33: MCA – Use of MCA in Air Quality Policy

The study explored the usage of MCA in the setting of air quality standards on the example of SO2 policy options. As preparatory steps, first contacts with interested parties were made, case studies on the air quality issue were reviewed and expert interviews were held. Subsequently, specific benefit and cost criteria were developed. During several workshops, stakeholders expressed their perspectives on the issue. Information relevant for the workshop was sent to the participants beforehand. In groups, the criteria were discussed relative to the options and based on the participants' experience and literature review. Then, scoring and weighting of the criteria were discussed (DEFRA 2003).

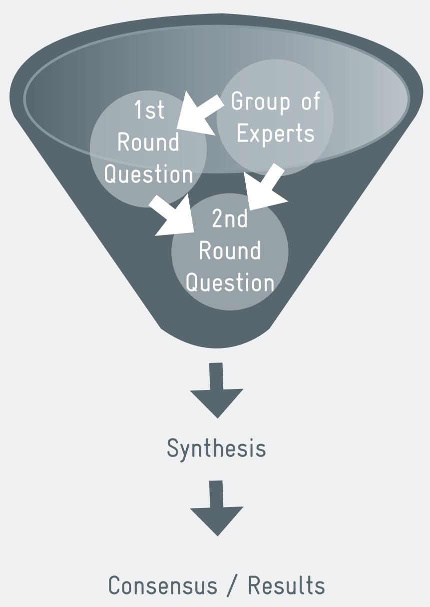
References

- DCLG (2009) offer a manual on how to conduct Multi-Criteria analysis.
- UNFCCC (2005) is a compendium on methods and tools to evaluate impacts of and vulnerability and adaptation to climate change.
- A report on the use of Multi-Criteria analysis in air quality policy is provided by DEFRA (2003).

3.4.4 DELPHI METHOD

The Delphi Method (DM) consists of two or more rounds of structural, but anonymous surveys of experts. The whole process is based on the repetition of survey rounds. In every new round, the results of the previous round are being discussed. Experts of the second round answer under the influence of their colleagues' judgement (UNIDO s.a.). Figure 13 illustrates the procedural steps of a Delphi survey.

Figure 13: Delphi Method



Fields of application

The Delphi Method can be applied when the survey's questions are simple and when a quantitative prognosis of probable impacts of an intervention is needed.

Results/outcome

It delivers a synthesis of the participants' opinions (Gordon 1994). Results can be both qualitative and quantitative.

Position in the IA process

In the planning, executing and/or evaluation phase.

Requirements (obligatory and optional)

In general, low, but a minimum amount of two rounds per survey take time (preparation of the survey content, instruction of the participants). The selection criteria for participants are most important. Participants are usually identified via literature or online research (Gordon 1994: 8).

Time requirements: medium (up to six months)

Stakeholder involvement: high; outcome depends on the invited experts.

Advantages and limitations

The Delphi Method identifies variables of interest and enables the creation of prepositions (Okoli & Pawlowski 2004). It is recognised as a rather simple approach for finding consensus (Yousuf 2007). The structured and anonymous two-round approach aims to eliminate subjective input of the participants.

The method is limited by its high demand on time, the need for experts and the difficulty in assessing the participants' expertise. Despite its effort to exclude subjectivity, the results still depend on the input and knowledge of the *stakeholders*/experts involved.

References

- EC (2013) summarises why and when to use the Delphi Method as well as main steps.
- Gordon (1994) describes the method and how to do it and provides examples of applications.
- Examples, design considerations and applications of the Delphi Method as a research tool are given by Okoli and Pawlowski (2004).
- Yousuf (2007) provides an overview of forms, process and characteristics of the Delphi technique.

Box 34: Delphi Method – UNU Millennium Project: Feasibility Delphi Study on Environment and Population

The Millennium Feasibility Project included a Delphi survey to investigate future trends and policies which are able to affect world population growth and the environment in the next 25 years. Before the questions were sent out to the participants, a small planning committee helped to define and concretise the questionnaire. Questions for the second round were sent out to those who had replied in the first round.

A preliminary list with historical trends and future developments was included in the questionnaire. The questionnaire for the first round was sent to 76 experts, who had been recommended for this field – 42 replied.

In the first round, the experts were asked:
- to extend the list and comment on historical and future importance of the listed trends,
- to estimate the population and growth rates for predefined areas in 2018,
- to rate some drivers that caused the world population growth to decline (2.06 % in the late 1960s and 1.7 % in 1993) and their development in the following 25 years,
- to provide other drivers that might have an impact on historical changes,
- to advise on other drivers that could influence population growth.

Evaluating this information, the researchers found two future events (unlikely, but with huge impact if they occur). In round two, the participants were asked to suggest new policy approaches that might be practical and would support the feasibility of these suggestions. Additionally, the experts were asked for other areas where policy intervention could help (Gordon 1994).

3.5 QUANTITATIVE METHODS

In the next subsections, a selection of quantitative methods and *models* is presented. The description of the quantitative methods follows the same structure as the descriptions in section 3.4 "Qualitative Methods". A short description is followed by fields of application, mandatory and optional requirements, advantages and limitations of the method, examples and references for further information. In contrast to the qualitative methods, the position within the Impact Assessment (IA) process is the same for all quantitative models. They may be applied in the *execution phase* of the IA process and results are used in the *evaluation process*.

First, a general overview of economic modelling and economic theory is introduced in section 3.5.1 and 3.5.2. The reader should gain a fundamental understanding of what economic models can do and how they should be interpreted.

3.5.1 GENERAL COMMENTS ON ECONOMIC MODELLING

Economic modelling is a term used by economists referring to the construction of a simplified map (i.e. the *model*) of an economy and the interaction between economic actors. A model can vary in detail and scope, but it still represents a simplified version of reality.

Generally, economic models are quantitative models. They illustrate which action causes which effects and in which dimension (monetary value). Each of these economic models contains the following items: Variables, equations, coefficients (parameters) and a solution algorithm.

Economic models are a simplified version of reality, leading the way through the maze of economic interaction and interdependencies.

A variable represents a unit such as GDP, energy consumption or population size. The description of linkages between different actors (e. g. households, government) and economic flows (e. g. consumption, export) is given either exogenously or endogenously. *Exogenous* means that variables are determined "outside" the model, as they are not dependent on the rest of the model. In forecasting models, exogenous variables such as population and tax rates are predetermined until the end of the projection period. They remain unchanged whatever happens "inside" the model.

Quantitative economic modelling is the simplified representation of the real economy by a set of variables and their relationships stated in equations.

Endogenous variables are determined "inside" the model. Interrelations of variables are expressed by mathematical equations where the right-hand side (independent) variable(s) determine(s) the left-hand side (dependent) variable of the equation. Such equations are either identities or behavioural equations. An example for an identity equation is the determination of the gross domestic product (GDP): The GDP is the sum of private and government consumption, gross fixed capital formation, changes in inventories and trade balance. This identity is always true, both in the model and in reality. Behavioural equations result from statistical estimations. An example is the estimation of the linkage of private consumption to income. There is no identity relation between those two variables, because income does not equal consumption (it equals consumption and savings) and the relation is different between countries and income groups and may change over time. There is a positive relation which is shown in the *coefficient* (parameter) that is the result of the estimation, though. The coefficient shows the direction and magnitude of the relation of dependent and independent variables. Coefficients can be estimated based on model data or can be taken from literature.

The model can comprise many equations or only a few, depending on the questions to be answered and the degree of complexity desired.

Quantitative *models* may need a solution algorithm or rule. In simulations, one or more variables are adjusted exogenously ("shocked"). The impact on other model variables can only be seen if the model is solved. This can be done either explicitly or iteratively. An explicit solution does not need repetition because relations between variables are unique. Any repetition would result in the same solution. Iterative solutions provide approximations to calculations which cannot be solved explicitly. The solution gets more precise with each iteration. The iteration process is ended once a given criterion is reached and the solution is deemed exact enough.

The construction of a quantitative model requires three things: data, a computer and software able to do calculations. Data and software requirements can be different depending on the model (refer to the individual subsections of the models for more detail).

In summary, three fundamental things are important to keep in mind when it comes to economic modelling:

- It is a decision between complexity and simplicity.
- It is not only a mathematical exercise. Instead, a lot of "economic thinking" is required in order to be able to map the economy realistically.
- Economic modelling is human work with human ideas and ideologies. At the end, a model can always be only as good or as bad as the input given by statisticians and the model builder.

3.5.2 OVERVIEW OF DIFFERENT ECONOMIC THEORIES

Economic models are influenced by social science and are usually formulated based on a specific economic theory. Two main streams with quite opposing ideas on economic interaction can be distinguished: the Classical School – subsuming Neo-Classical School and Monetarism – and the Keynesian School. Further theories have developed from these schools that tried to combine elements of both streams: the Neo-Classical Synthesis and the New-Keynesian Theory. In the following, these four schools of economic theory are introduced. Table 2 summarises the main characteristics and gives the implication for policy intervention. Other theories are not dealt with in greater detail (for an overview see for example *www.cee-portal.at/Econ/Economics-Watermark.jpg*, January 2016).

The table also indicates which model is generally applied within which theory. This mapping is only indicative. The basic models can be altered with respect to some theoretical assumptions that may reposition the model in its theoretical context.

Figure 14: Static and Dynamic Models – a Graphical Explanation

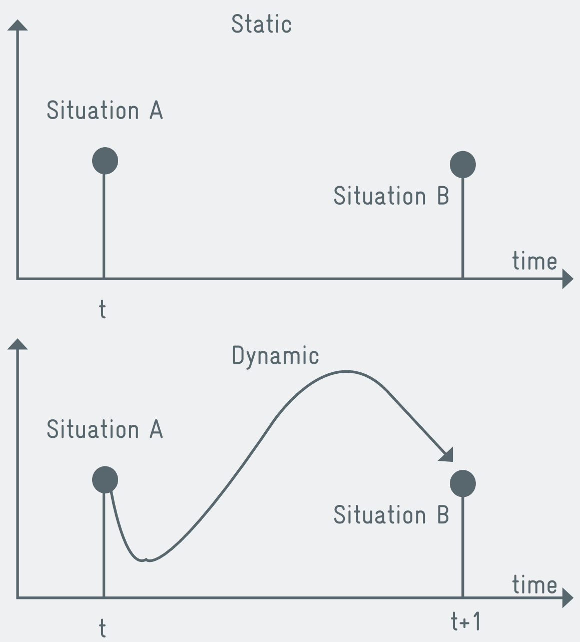


Table 2: Overview of Leading Economic Schools

	Leading Thinkers	Developed around	Micro-foundation	Prices	Supply / Demand	Investment	Expectation	Money Demand	Labour Market	Markets	Policy Implications	Applied Models
Classical-Neo-Classical Theory	A. Smith, D. Ricardo, J.S. Mill, V. Pareto, L. Walras, F.A. v. Hayek, R.E. Lucas	1780, 1870	yes (economic behaviour is explained by utility and profit maximisation functions)	Flexible prices: demand and supply are always equal	Say'sch Theorem: Supply determines demand	Savings = investment	Rational expectations (forward-looking expectations); perfect information	Neutrality of money: Money supply only influences prices, no effects on output	Real wages determine labour supply and demand	Perfect competition	No means for state action; system finds full employment balance on its own ("general equilibrium"); no disturbances in real business cycles; flexible prices absorb shocks any time State intervention means crowding-out of private investments Monetary intervention has no real term effects	CGE, DSGE models
Keynesian Theory	J.M. Keynes	1930	no	Price rigidities: demand and supply can be in mis-balance; rigid nominal wages	Demand determines supply; effective demand („ex-post demand")	Depends on interest rates AND future expected earnings	Expectations remained unexplained; imperfect information	Money is not neutral. It has effects on nominal output	"Money illusion": nominal wages determine labour supply not real wages	Imperfect competition	Means for state action exists: system may remain in imbalance; Real business cycles may be distrubed; price mechanism is distracted Discretionary fiscal and monetary policy can help to bring system in balance Anti-cyclical state intervention can affect aggregate demand Monetary policy can produce higher output	IO models
The Neo-Classical Synthesis	J. Hicks, F. Modigliani, P. Samulson	1950-1970	yes (economic behaviour is explained by utility and profit maximisation functions)	Price rigidities, fix prices only in short-term		Depends on interest rates AND future expected earnings	Rational expectations (forward-looking expectations)	Money is not completely neutral	Real wages determine labour supply and demand; sticky wages		Means for state information exist despite rational expectation	(DSGE models)
New Keynesian Theory		1970/80	yes (economic behaviour is explained by utility and profit maximisation functions)	Price rigidities: demand and supply can be in mis-balance			Rational expectations (forward-looking expectations);	Non-neutrality of money	wage rigidities exist (longterm wage contracts)	Monopolistic competition (firms can set prices)	Means for state information exist despite rational expectation: fiscal and monetary policy can be as effective as in pure Keynesian Theory.	DSGE models

Source: Baßeler et al. 2002; Bessau & Lenk 1999

3.5.3 OVERVIEW OF QUANTITATIVE MODELS

This section provides an overview of quantitative *models* described in the next subsections. The models are classified with respect to their time dependency (static vs. dynamic), level of analysis (micro, macro, meso), economic theory, the use of econometric methods and application (forecast vs. impact analysis).

Basically, quantitative models can be distinguished with respect to their time dependency. Economic models are either static or dynamic. Static models are time-invariant and describe a specific situation. By altering an element of the model (e. g. the tax rate), another situation is created. Both situations (A and B) may be compared (*comparative-static* analysis). Static models do not contain an adjustment process; only the situation before and after a shock can be described. The adjustment process can be observed and analysed by dynamic models because they account for time-dependency. Figure 14 illustrates the differences.

Dynamic models apply econometric methods or make use of assumptions or theories to describe the evolution of agents' behaviour over time. That makes them useful for analysing future developments. In static models, it is assumed that agents' behaviour does not change. These models can only be used for impact analysis. Dynamic models such as System Dynamic (SD) models and dynamic Input-Output (IO) and Computable General Equilibrium (CGE) models can be used for both forecasting and impact analysis.

Econometric methods are the basis for econometric (dynamic) models. Depending on the underlying theoretical foundation they are called e. g. dynamic IO or dynamic CGE models. They use econometric methods to test different theories against the reality displayed in the data. With respect to the dataset, the level of analysis can be micro, meso or macro. Econometric models can be used for short- to long-term forecasting depending on data availability over time.

Another basic characteristic is the level of data and analysis. Micro models use surveys and examine the behaviour of individuals or household types whereas macro models analyse the economy as a whole based on macro data such as GDP, consumption and investment. For example, Dynamic Stochastic General Equilibrium (DSGE) models are macro models. They are used for short-term analysis often based on quarterly or even monthly data. Such up-to-date data are usually not available at industry level.

Table 3: Classification of Quantitative Models – An Overview

Quantitative Models	Time Dependency	Level of Analysis	Economic Theory	Applying Econometric Methods?	Application	Short- (<=3 years) Medium- (>3 and <5) Long- (>5 years) Term Forcasting
Econometric Models	Dynamic	Micro, meso, macro	Empirical evidence	Yes	Forecasting	Short to long
Static IO Models	Static	Meso	Keynesian Theory	No	Impact analysis	-
Dynamic IO models	Dynamic	Meso	New-Keynesian Theory	Yes	Forecasting, Impact analysis	Medium to long
Static CGE Models	Static	Meso	Classical-Neo-Classical Theory	No	Impact analysis	-
Dynamic CGE Models	Dynamic	Meso	Classical-Neo-Classical Theory	Yes	Impact analysis, forecasting	Medium to long
DSGE Models	Dynamic	Macro	New-Keynesian Theory, Classical-Neo-Classical Theory	Yes	Impact analysis, forecasting	Short to medium
SD Models	Dynamic	Micro, meso, macro	Empirical evidence	Yes	Impact analysis, forecasting	Medium to long
Micro Models	Static	Micro	Microfoundation	Yes	Impact analysis	-
Micro-Macro Models	Static, (dynamic)	Micro, meso, macro	Microfoundation, Keynesian Theory, Classical-Neo-Classical Theory	Yes	Impact analysis, forecasting	Short to long

Meso models are often macro models endowed with more industry detail usually given by IO tables. Therefore, IO models and CGE models are classified as meso models. *Models* considering data on industry level can be used for structural analysis to show the different impacts on industries. A shock or a policy will not have the same effect on each industry. For example, introducing a CO_2 tax will definitely affect industries depending on fossil fuels more than others.

Regarding the underlying economic theory, quantitative models described here are differentiated between Keynesian and New-Keynesian Theory based models as well as Classical and Neo-Classical Theory based models. Static IO models belong to the Keynesian Theory (for details see section 3.5.2). This kind of model is useful if the impacts of changes in demand are to be analysed with respect to changes in production at industry level given a fixed production technology. They should be used for short-term impact analysis because technological progress and therefore *substitution* processes between capital and labour as well as other inputs (e. g. fossil fuels and renewables) are not considered. For longer term processes with substitution in market economies and industries, dynamic IO models or dynamic CGE models are more appropriate. CGE models belong to the Classical-Neoclassical theory (for details see section 3.5.2). This kind of model can be used to analyse price shocks and the response in the economic system.

3.5.4 ECONOMETRIC MODELS

Econometrics is the field of economics that applies mathematical statistics and the tool of statistical inference to measure relationships postulated by economic theory and assertions (Greene 2003). Statistical inference tests hypotheses and derives estimates by analysing data. Econometric models (EM) build upon past behaviour and forecast them into the future while taking into account cause-effect relations.

The simplest model is a one equation model, where one characteristic is explained by another over time. More complex econometric models consist of a set of equations which are mutually dependent. The aim is to include all relevant information while keeping in mind that a model is only a simplified description of the real economy.

Equation [1] shows an example of a simple econometric model that describes private consumption *C* which is solely dependent on income Y. α represents the estimated *coefficient* stating the factor with which income influences consumption. α is supposed to be positive. An α larger than 1 is associated with a disproportionally high expected effect of income on consumption, whereas an α smaller than 1 is associated with a disproportionally low expected effect of income on consumption.

ε, usually referred to as the "error term", refers to a stochastic element, denoting a certain *randomness* in the variables, to account for small deviations. *t* indicates time-dependency of the equation:

[1] $C_t = \alpha \cdot Y_t + \varepsilon_t$

Econometricians apply statistical methods (*regression analysis*) to specify the *parameter* α that shows the strength of the relation between the variables. There are many different estimation methods, e. g. *least square estimation*s or *maximum-likelihood estimations*.

Another analytical tool is the analysis of the development of a quantity over time called *time series analysis*. A time series is a set of data points recorded over a period of time for one variable. From the analysis of the historical behaviour, certain patterns (e. g. cyclical developments, S-curves) can be identified and used to forecast future values. According to equation [2], consumption C only follows a time trend and grows linearly over time.

[2] $C_t = \alpha \cdot TIME + \varepsilon_t$

Often both approaches (regression and time series analysis) are combined in more complex *models*. More complex econometric models can be described as structural econometric models. These models get their structure (*specification*) from the interrelations of model variables usually derived from a certain economic theory. For example, Keynesian models are demand-side driven models where output is derived from domestic (public and private sector demand) or foreign demand. Aggregate demand does not necessarily match the overall economic capacity (supply) and e. g. overproduction and unemployment are possible. In Neo-Classical theory, individuals behave according to their own preferences and market prices. They offer their manpower and/or capital in the markets. Labour and capital stock are the influencing factors in the production process and thus determine output. Markets are usually in equilibrium (supply equals demand).

The future is like the past. Econometric methods are based on the assumption that past reaction patterns recur in the future.

Fields of application

Econometric methods and models are widely applied by central banks, governments and research institutes to analyse historical developments, evaluate policy measures and to forecast short-term to long-term developments. They can be applied to all fields such as economic, environmental or social questions.

Time series analysis is accurate in short-term forecasting if trends are clear and relatively stable. For long-term forecasting it is more appropriate to use *causal regression analysis*. Cause and effect relations are more stable over a longer time horizon. Causal regression analysis is used for predictive models as well as for models that are used to answer 'what-if'-questions.

Econometric models project possible future developments based on past observations. Additionally, the analysis of historical data gives a better understanding of the impacts of past developments e. g. policy measures.

Requirements (obligatory and optional)

The most important prerequisite for applying these forecasting techniques is the availability of historical data. For *time series* and *regression analysis*, time series of data are necessary. Econometric methods usually require software (see also Table 4) such as STATISTICA, R or EViews, developed for easy use and for providing the *goodness of fit measures* for the respective applications. Even Microsoft Excel can do simple regressions. Most software solutions require qualified personnel to apply forecasting techniques. Most of the software is not available for free. For an overview on software and costs, please refer to Table 4.

At least basic skills in econometric methods are a prerequisite for building econometric (dynamic) models. Trainings by experts may be essential.

Sometimes courses are offered to learn the handling of specific software. For example, EViews staff offers webinars, onsite training and online tutorials. Tutorials are free of charge. Costs for public webinars range from 150 US$ to 250 US$ (*www.eviews.com/Training/webinars.html*). More complex econometric *models* can be built within a timeframe ranging from six months to one year, this may include training by experts, study tours and/or workshops on forecasting methods. It is recommended to institutionalise the acquired knowledge to ensure its sustainability.

Advantages and limitations

Econometric models are approximations to (past) reality. Using available historical data to derive future development is a good approximation. However, it is important to keep in mind that past relations are not always valid in the future (IRENA 2014).[6] Data quality[7] and the model *specification* (number and form of regression functions) are essential success factors for the forecasts' quality. Supplementary forecasting techniques (e. g. *judgemental forecasting* (Lawrence et al. 2006), *Delphi Method* (see section 3.4.4)) may help to avoid errors stemming from econometric techniques or bad data quality. Furthermore, monitoring the forecasted results helps to identify the differences between reality and prediction as well as reasons for these.

Time series analysis considers historical values for any given variable and tries to identify and forecast certain patterns (trend and seasonality). *Regression analysis* is appropriate for explaining causes and effects of certain developments. Collecting data, applying statistical methods to data and building structural econometric models are labour and time intensive tasks.

References

- Almon (2012) gives an introduction to econometrics and economic model building.
- Dougherty (2011) introduces econometrics using a non-technical language.
- Pindyck & Rubinfeld (1997) describe econometric models and forecasts.
- Greene (2003) provides a very comprehensive introduction to applied econometric analysis and the theoretical background.

[6] *For alternative solutions, please refer to section 3.7 on* mixed methods. *One possibility is to integrate results from qualitative methods (e. g. DM, RCA, CS, MCA or interviews) in order to overcome the limitation of past-dependency of econometric models.*

[7] *Data quality refers to how good the data suits the needs. In the IA context that means whether the data is good enough to describe the problem at hand (accuracy of data). Data quality can be also measured in terms of completeness (some years are not covered with data information, for instance), timeliness (last year of data availability), consistency (data from different sources), and reliability (data source and data collection).*

Box 35: Econometric Models – Challenges Concluded from the Interviews with GIZ Practitioners

In most developing countries, knowledge of econometric methods is limited. Although projects include training for staff of partner ministries by experts (econometricians), knowledge often disappears over time because of high fluctuation. Additionally, personnel capacities are rather limited and/or overstrained.

To overcome these problems, it can be helpful to institutionalise a working group at the ministry exclusively dealing with econometric and forecasting methods or to establish a cooperation with econometricians at a national university. Instead of consulting external experts, a regular exchange of research and results is recommended, as it helps to spread knowledge and build capacity within the country.

Training on econometric methods should be accompanied by practical applications (on-the-job training) and sufficient documentation. It should be noted that training conducted by foreign experts can be impaired by insufficient knowledge of foreign language.

Box 36: Macro-Econometric Model for Vietnam – Example

Le Anh (2006) analysed the economic impacts of short-term macroeconomic policies such as fiscal policies and exchange rate policies. The Vietnamese *model* is based on macroeconomic time series data. It considers households, firms, government, aggregate data representing the rest of world and financial institutions as well as their behaviour. *Parameters* are derived from historical data using EViews. Applying the model shows that economic growth can be promoted by either government investments or devaluated exchange rates.

The Vietnamese model is a simple macro-econometric one. It is demand-side driven and therefore assigned to the Keynesian Theory. For analysing short-term impacts of macroeconomic policies, it is a good practice, especially if time and human capacity are limited. The model is not highly complex, compared e. g. to the Economy-Energy-Environment (3E) models (see section 3.5.5). The Vietnamese model does not show the economic structure and is therefore not able to answer questions related to industries. Furthermore, it cannot be applied to evaluate social and environmental impacts.

3.5.5 INPUT-OUTPUT MODELS

Input-output tables (IOT) are the basis of any input-output (IO) *model* that can be described as a special case of Social Accounting Matrices. An IOT describes in a very condensed form the interdependencies of an economic action that takes place within an economy and with the rest of the world: Industries produce goods and services for other industries and for final consumption and, at the same time, use other goods and services to be able to produce their own goods and services. The idea of grouping these kinds of IO flows in a systematic and symmetric table goes back to Wassily Leontief and was awarded the Nobel Prize in Economics in 1973.

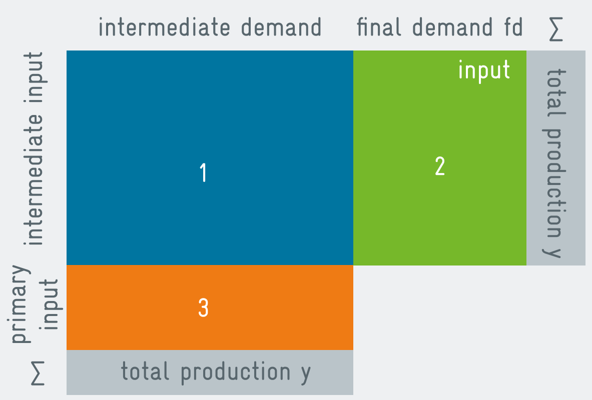
Figure 15 illustrates the three quadrants of each IOT in a simplified version. The arrows indicate the "direction" for reading the inputs (=demand for "doing something") and outputs (=costs for "doing something").

The first quadrant (1=blue quadrant) represents the intermediate demand matrix. This matrix cumulates all input and output flows between different industrial sectors for means of production. For instance, the agriculture industry supplies to itself (producing crops for feeding animals), to the food industry (producing crops for food processing), the construction sector (producing wood for construction) or the energy sector (producing plants as means for energy resources).

The second quadrant (2=green box) represents final demand components. In contrast to intermediate demand, products used for final demand purposes such as private and government consumption as well as investments or exports are not further used for production purposes. E. g. agricultural products are directly exported or consumed by private households. All input factors represented in a row across quadrant 1 and 2 cumulate to total production.

The third quadrant (3=orange box) represents primary inputs. These are the costs initiated with production: gross value added and intermediate demand. Gross value added is mainly determined by wages (=labour costs) and costs of capital. All output/cost factors represented in a column across quadrant 1 and 3 cumulate to total production. It is important to note that the sums along the rows equal the sums along the columns.

Figure 15: Schematic Presentation of an IO Table



Source: own illustration

IO Tables are the core of every IO model but also part of CGE models with industry structure.

IO Tables are not only the basis of IO models but also of CGE models (see section 3.5.6).

The Leontief-*production function* represents the relations previously described. Equation [3] shows the reduced form whereby production y is determined by final demand *fd* and the *Leontief multiplier* ($(I - A_t)^{-1}$) which incorporates the input *coefficient*[8] matrix A and the identity matrix I.

[3] $y_t = (I - A_t)^{-1} \cdot fd_t$

Equation [3] also represents the so-called Leontief (or output) multiplier of an IO model. It captures the *direct* and *indirect effect* on production for each unit of final demand. The direct impact stems from initial changes in demand (e. g. building a house). For building a house, concrete and other materials, machinery and planning are needed (intermediate inputs) as well as construction workers (primary input). Indirect effects are related to the supplier industries, e. g. concrete production. The direct and indirect effects are referred to as first-round effects, because they are directly related to the initial shock.

Following West (1995), a distinction can be made between static IO models and dynamic (econometric) IO models. Static IO models are time-independent; *model* relations will not change over time. Inputs required in the production process stay constant (*limitational production function*). In static IO models, only the output is calculated endogenously by using the relations given in Equation [3]. Final demand such as household consumption is given exogenously. In enhanced static IO models, households become an *endogenous* component and effects of income changes are modelled, whereas supply constraints and prices are not taken into account. Static IO models can show the direct and indirect impacts of final demand changes but not the adaptation process.

In contrast, dynamic (econometric) IO models are able to show adjustment processes. Dynamic *models* combine IO calculations and *econometric methods* which have

[8] *Input coefficient matrix A is the share of each element of the intermediate demand matrix V (in Figure 15 quadrant I) to the respective value of production y:* $A_{i,j} = {}^{V_{i,j}}/_{y_j}$. *An input coefficient shows how much of product i is necessary to produce product j (Holub & Schnabl 1985: 152).*

the advantage that past observations of economic interdependencies on industry level can be projected into the future. Elaborated dynamic IO models have a high degree of endogenisation of final demand components and usually incorporate *national accounts* to show the monetary flows from production to consumption as well as prices (Almon 1991, West 1995). The complete economic circuit is shown: consumption influences production and income. Both prices and income affect household consumption. Direct, indirect and *induced effects* can be shown.

Fields of application

IO models are useful tools for *ex-ante* and *ex-post* analysis.

Static IO models can be used to analyse the structure of an economy and the dependency on imported products and energy inputs. By applying *single-factor analysis*, counterfactual results can be retrieved. If time series of IO tables are available, the structural change of an economy can be observed over time and technical change can become traceable. Static IO models may be applied to investigate the consequences of changes in certain sectors on output and income throughout the economy (Miller & Blair 1985). The initial change involves a change in final demand such as e. g. new construction projects, an increase in government purchases, or an increase in exports (Bess & Ambargis 2011). They have been most widely used in planned economies and in developing countries.

Results have to be interpreted with care. Static IO models (e. g. JEDI – Jobs and Economic Development Impact) calculate gross effects which only include direct and indirect effects caused by the initial impact. They neglect any negative effects in other parts of the economy. For example, deployment of renewable energy does not only increase production: In case of Germany, energy prices increase due to the Renewable Energy Sources Act (EEG) surcharge. A higher electricity price may reduce demand for electricity. Price, income and *substitution* effects are not taken into account either. The calculation of net effects requires a comprehensive economic model such as dynamic (econometric) IO models or CGE models.

Gross effects show higher effects on output and employment. *Net effects* include substitution effects and therefore negative effects and impacts are possibly lower. Policy makers tend to cite studies with gross effects (Meyer & Sommer 2014).

Dynamic (econometric) IO models can be used – besides the fields of application mentioned above – for sophisticated impact analysis if price effects and technological change are important and impacts of an initial shock should be presented on an annual basis. Due to the time dependency, they may be used for forecasting.

Static and dynamic IO models can be extended to assess 'Green Economy' and social policies. For this, additional resources (e. g. data, know-how) are required (see also section 3.6). Following IRENA (2014), data on technology-specific costs and cost structures are essential and have to be allocated to the industries of an IO table. It might be necessary to split standard industries by introducing "green industries". Economic and environmental effects (CO_2 effects) of an increased production or new technologies (ILO 2011) as well as of "green jobs" (Ferroukhi et al. 2013) can be estimated. An example of how to integrate social impacts is shown by Kim et al. (2014). The authors present the extension of an econometric IO model by age and income parameters to account for distributional effects instead of having a representative (average) household.

Requirements (obligatory and optional)

An IO table is a prerequisite for the establishment of an IO model. If no IO table is available, the use of business *surveys* or *employment factor analysis* can be an alternative (Ferroukhi et al. 2013).

Users should have at least basic knowledge of IO analysis. Static IO models can be built in Microsoft Excel, e. g. IMPLAN (IMPact analysis for PLANning). For this, at least one IOT is required. Building an own IOT needs expert knowledge on how to construct an IOT, demands various data and is very time consuming. Prerequisites are data on intermediate consumption by industries, on final consumption of households, government, on investment, exports and imports as well as on trade and transport margins, Value Added Tax (VAT) and other taxes and subsidies. Time requirements depend on the size of the IOT (number of sectors) and the desired quality. It takes around 17 months to build an IOT on a two-digit level (according to the statement of an interviewee).

Dynamic IO *models* need additional software (Interdyme/G7[9], MATLAB). A software package that provides matrix algebra to calculate the IO *coefficient* matrices for future years is preferable.

Building a static IO model requires up to six months. Dynamic IO models are more complex and therefore more time-consuming. Building a dynamic IO model may take up to one year.

[9] *http://www.inforum.umd.edu/software/interdyme.html*

Involvement of IO experts can be very important for capacity building. They may facilitate and accelerate the learning process in building IO models or applying appropriate software. Furthermore, contact to the statistical office may be helpful if questions concerning the compilation of the IOT arise

IO experts may help if the method is introduced for the first time. This can facilitate a faster and more goal-oriented learning process.

Advantages and limitations

The advantage of IO models is that industry structure and relations are clearly described and transparent. It should be noted that the degree of detail is highly dependent on the availability of reliable primary data.

Static IO models have the advantage of being easy to use and of providing a straightforward analysis. This analysis should be complemented by e. g. Cost-Benefit-Analysis (*CBA*) to evaluate costs and benefits. IO analysis shows the impacts on other industries, but not whether resources are made use of in a reasonable way.

Limitations of IO models consist in the assumption that the input structure is fixed (so-called *limitational production function*). There is no *substitution* of inputs across industries. Future technological changes and innovations are neglected and therefore static IO models cannot be used for analysing structural changes. Dynamic IO models introduce technological change and vary input *coefficients* if appropriate (for example the German *model* PANTA RHEI and the Russian model e3.ru; Schleich et al. 2006, Lutz et al. 2015, Großmann et al. 2011).

For (short-term) impact analysis it is important to have an up-to-date IO table reflecting current production technologies. Dynamic (econometric) IO models are time dependent and can show developments over time. They can be applied for medium- to long-term impact analysis.

Static IO models do not consider supply constraints for e.g. employment or energy. Sophisticated IO models include prices to indicate scarcity and price-dependent substitution (Ahlert et al. 2009). An increase in demand with unchanged supply leads to higher prices and reduces the multiplier effect. Part of the demand for goods and services has to be satisfied by imports instead of more expensive domestic production.

Box 37: Jobs and Economic Development Impact (JEDI) Model

JEDI models are static IO models that are used to estimate *direct, indirect* and *induced* employment and economic effects of e. g. construction projects (wind or photovoltaic plants). These models calculate *gross effects*. Possible price effects and their impact on consumption are not reflected.

The models are based on U.S. statistics but can be adjusted to other national statistics. Output and employment multipliers are derived from current U.S. data used in the IMPLAN software. JEDI model results do not provide a precise forecast. Results can be used to compare different technologies with respect to their effects on regional employment and production.

The models are provided by the National Renewable Energy Laboratory and do not incur any costs (*http://www.nrel.gov/analysis/jedi/about_jedi.html*).

References

- Almon (2011) describes IO models and how to build them with Interdyme software.
- Eurostat (2008) explains in detail the IO framework, concepts and methods as well as examples of extended IO tables and applications.
- Fraunhofer et al. (2012) show methods on how to estimate employment impacts of using renewable energy.
- ILO (2011) assesses the green job potential in developing countries.
- Kim et al. (2014) proposes an extension of an econometric IO model with age and income parameters.
- Holub & Schnabl (1994) provide a detailed overview on the basics of IOT and IO analysis including single-factor analysis, dynamic IO models, employment multiplier etc.

3.5.6 COMPUTABLE GENERAL EQUILIBRIUM MODEL

Computable General Equilibrium (CGE) models are popular at universities and other research institutions, because they are easily implemented with off-the-shelf packages and in accordance with the dominant Neo-Classical Theory and its microeconomic foundation. In their most simple form, they assume that all agents rationally optimise their behaviour under perfect information: firms maximise their profits, households their utility and all markets are in equilibrium, a situation which defines the solution of the algorithm. The economy is assumed to work like an ideal market economy. CGE models are meso models usually based on SAM (Social Accounting Matrix). A SAM and an IOT comprise all economic activities within an economy and with the outside world in a comprehensive accounting framework.

Box 38: PANTA RHEI – A Macro-Econometric 3E Model for Germany

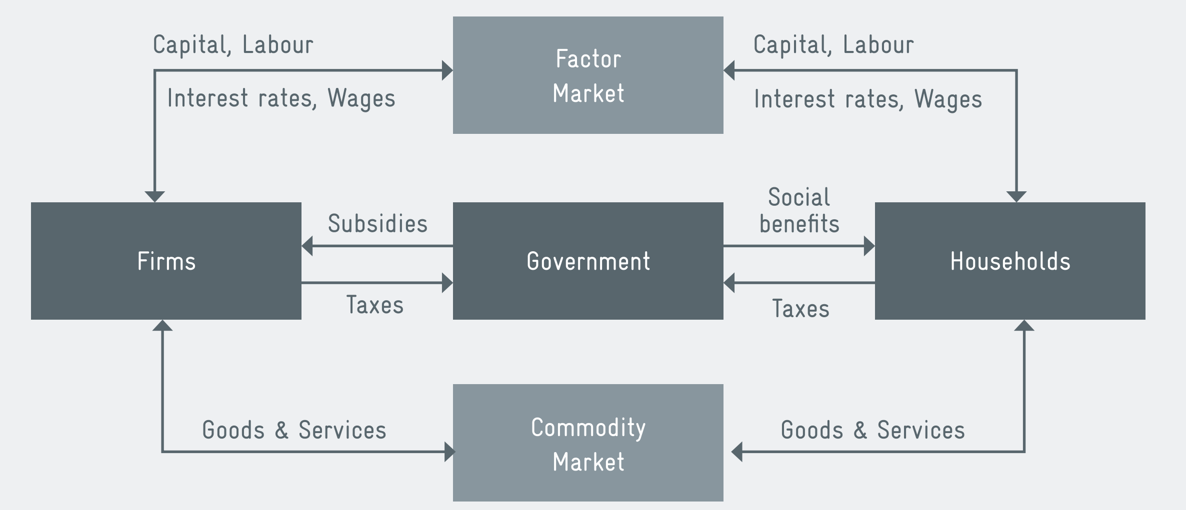
PANTA RHEI is a dynamic macro-econometric IO model for Germany that represents the complete economic circle (from production to consumption) and the economic agents (e. g. households, firms and government) involved. The model incorporates the economic activities and products (from agriculture to services) in detail as stated in the input-output-tables. PANTA RHEI is classified as "input-output", but it is rather "econometric" plus "input-output", as *parameters* are econometrically estimated and input-output structures are flexible (West 1995).

PANTA RHEI is a simulation model. It is used for impact assessment studies and to evaluate macroeconomic effects of different policies (GWS, EWI & Prognos 2014, Lehr et al. 2014). This type of *model* is proven to be adequate to answer questions related to economy and environment (Eurostat 2008: 530).

Building a macroeconomic 3E model is time-consuming. Depending on the degree of detail, it takes some months up to several years to develop such a model. Staff with skills in econometrics and economics as well as field experts are required. Financial resources can be huge at the initial phase of model development. However, maintenance and further improvement of the model are less resource-intensive. Once the model is developed, it can be applied to many questions.

Macro models analyse the economy as a whole based on aggregated data. **Meso** models are macro models with more industry detail usually provided by IO tables. **Micro** models examine the behaviour of individuals, households, companies and their respective markets.

Figure 16: Schematic of a CGE Model (simplified)



Source: own illustration

In contrast to IOT, a SAM displays the monetary flows between economic agents (e. g. households, firms) and describes the interdependence between income, production and consumption and back to production. Each agent may be both a seller and a buyer. Households and firms are treated as homogeneous and all households/firms show the same characteristics and behaviour. Figure 16 shows the relationships between the main economic agents in a simplified chart. Households consume and pay for goods and services which are supplied by firms. They provide their labour and capital which are, in turn, used by firms in the production process.

Some CGE models do not include industry data. In this case, they are treated as macro models. The term "macro" refers to aggregated quantities of goods, services, income, prices etc.

Typically, CGE models rely on data from a base year, mostly the year of the last available SAM. CGE models do not usually include econometric functions (see section 3.5.4) and are therefore static. Moreover, the relation between the quantities – *parameter* α in equation [1] and [2] in the last subsection – is taken from the literature and remains constant. Instead of using econometric *specification*, CGE models are mostly calibrated to the base year. The *calibration* method is a *deterministic* procedure which assumes that the base year is in equilibrium: on each market, a price (wages, interest rates, commodity price) exists that balances supply and demand. Besides that, a "*closure rule*" has to be chosen. This rule "closes" the *model* system and determines how equilibrium is reached after a "shock". An example of a macroeconomic closure rule is the balance of savings and investments or a labour market closure such as flexible wages and full employment or fixed real wages and unemployment (Carry 2008). Depending on which variable (either savings or investments) is specified exogenously, the other variable is calculated endogenously. Eventually, the selected parameters and the closure rule solve the model based on the model *specification* and data.

There are also dynamic CGE models which apply econometric methods to derive parameters instead of taking them from the economic literature. The choice depends on the costs and resources available (see e. g. Bergs & Peichl 2006: 22). An example for a dynamic environmental CGE model is the General Equilibrium Model for the Economy-Energy-Environment (GEM-E3, Capros et al. 2013). DSGE models are closely related to dynamic CGE models. Both model types are based on microeconomic theory. However, DSGE models combine Neo-Classical long-term growth models with sticky prices and wages that influence demand (see section 3.5.7). In contrast to most other CGE models, a return to the equilibrium after a shock does not occur immediately (Wolters 2013: 11). Furthermore, compared to CGE models, DSGE models are highly aggregated (see section 3.5.7).

Some CGE models introduce extensions such as environmental aspects (e. g. the Energy-Environmental Version of the Global Trade Analysis Project (GTAP-E), see example below), imperfect competition and *non-market clearing prices* (e. g. Roson 2006). These *models* may be more "realistic", but transparency is often lost (Bergmann 2005).

Fields of application

CGE models are useful for impact assessment, but not for forecasting. They are typically used for measuring impacts of policy measures that are expected to have significant effects on the economy as well as on the environment and the society (IDB s.a.a.). They are often used for international or even global analysis, if relative prices change significantly. A CGE model which is enhanced by environmental aspects is described by e. g. Burniaux & Truong (2002). Bergmann (2005) gives an overview of other CGE models that are able to assess environmental policies. Poverty impact analysis can be carried out, for example, when linking micro models and CGE models (please refer to section 3.5.9).

Requirements (obligatory and optional)

CGE models need large datasets and expert knowledge to build and maintain them. The most prominent CGE model is the Global Trade Analysis Project (GTAP *https://www.gtap.agecon.purdue.edu/*) which provides a model and data for many countries including developing countries[10].

MATLAB (*http://de.mathworks.com/products/matlab/*) and the General Algebraic Modeling System (GAMS, *http://www.gams.com/*) are other software that can be used for building CGE models (see also Table 4). GTAP data bases are available at costs ranging from 460 USD to 5,940 USD (*https://www.gtap.agecon.purdue.edu/databases/pricing.asp*).

Preconfigured models are often complex and hold the risk of being used without fully understanding assumptions. Correct adjustment to country characteristics is hardly possible. Involvement of experts and on-the-job training may help.

[10] *https://www.gtap.agecon.purdue.edu/databases/dev_countries.asp*

Depending on its complexity, building a CGE model may be very labour-intensive. Static CGE models are easier and faster to construct than dynamic CGE models. The development can take up to one year. Using preconfigured software such as GAMS and GEMPACK as well as prepared data (e. g. GTAP) speeds up model building, but is more costly. Robinson et al. (1999) describe how to build a small CGE model for an African country with GAMS.

The GTAP data base and GEMPACK are used by many CGE model builders. Users facing problems may find it helpful to exchange their difficulties in meetings and discussion rounds, where more experienced users can give useful hints e. g. on which impact a *closure rule* and other assumptions can have on model results. Sometimes there is more than one *model* available within an institution. In this case, the coordination of working groups is important to share the same assumptions and *parameters* in the models applied. Otherwise predicted impacts of the same "shock" will differ.

Advantages and limitations

CGE models can be very complex and their mechanisms are not easily understood by a layperson in terms of economics. Interpretation of results becomes difficult because results cannot be traced back to the input parameters (IDB s.a.b.) in a meaningful way. Many feedback linkages, complex mathematical structures and the solving algorithms impede understanding. Thus, many CGE models face the problem of being considered a "black box". The involvement of *stakeholders* is thus important to improve the acceptance of model results. The discussion of model assumptions and their impacts on model results will raise the acceptance.

Results rely on assumptions and (estimated) parameters. Results are as good as the model itself.

To check the influence of assumptions, carry out a *sensitivity analysis* and compare results.

The CGE approach is suitable for both simple and complex modelling tasks. Sophisticated dynamic CGE models are built upon large data sets. Setting up and updating these models is time consuming and labour intensive, especially if parameters are estimated. Therefore, most CGE models use parameters from literature for *calibration, which means that* the model has no empirical validation. In this case, parameters should be adjusted to see the impacts on other model

Box 39: Marquette for MDG Simulations (MAMS)

MAMS is an open economic multi-sector dynamic CGE model developed by the World Bank (Lofgren et al. 2013, MAMS website[11]). In contrast to simple CGE models, MAMS contains information at the industry level. It is used for analysing policies on the World Banks goals (promotion of shared prosperity and poverty eradication). The analysis is carried out for individual countries (to date 50 country models exist) and with a focus on medium- and long-term impacts.

Uganda uses the MAMS model to analyse the effects of macroeconomic changes on poverty (Uganda's Ministry of Finance, Planning and Economic Development 2014). The model shows the complete economy; the industry structure (SAM) and different household groups are incorporated. The CGE model for Uganda was enhanced by a microsimulation model to conduct poverty analysis (please refer to *Micro-Macro models* in section 3.5.9).

The advantage of using the MAMS model is that it is preconfigured and only needs to be calibrated to Uganda's economy. Time and personnel requirements are not that high compared to building a CGE from scratch. The model comes with an Excel interface (ISIM-MAMS) for running simulations. Thus, there is no need for understanding the GAMS software in detail. The disadvantages stem from the general limitations of non-empirical founded models and Neo-Classical assumptions such as competitive markets, which has to be taken into account by impact analysis. This kind of *model* should not be used for forecasting.

[11] *http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTDECPROSPECTS/0,,contentMDK:21403964~menuPK:4800417~pagePK:64165401~piPK:64165026~theSitePK:476883,00.html*

Box 40: GTAP-E: An Energy-Environmental Version of the GTAP Model

As the name implies, GTAP-E is based on the GTAP models. One extension is the modelling of the various linkages between energy, environment, economy and trade. In addition, GTAP-E introduces carbon emissions and international emission trade mechanisms. GTAP-E is a static, global CGE model and therefore not able to consider time dimensions explicitly (Burniaux & Truong 2002).

In standard CGE models, energy *substitution* is not considered. In GTAP-E a simple *top-down* approach is used, i.e. energy demand by production sector is derived from outputs and a cost function. Substitution is modelled at an aggregate level between energy and other primary factors (such as labour and capital) on the one hand and alternative fuels (gas, oil etc.) on the other hand. On the consumption side, energy substitution is also possible.

The GTAP-E model can be applied for analysing the impacts of different *scenarios* such as greenhouse gas (especially CO_2 emissions) mitigation. Three scenarios regarding alternative implementations of the Kyoto protocol were calculated: (1) no emission trade and all Annex 1 countries meet their CO_2 targets, (2) emission trade among Annex 1 countries and (3) emissions are traded worldwide.

All scenarios are compared in a *comparative-static* way to a baseline scenario without any emission constraints. As a result, abatement costs are highest in scenario (1) and lowest in scenario (3). The same holds true for traded emissions. When emissions are traded worldwide, the emission trade volume is on its highest level and costs on their lowest level. The emission reduction ranges from 20 % to almost 40 %. The welfare effect is highest in a world with worldwide emission trading. Prerequisites for this kind of model are the GTAP database and the GEMPACK software (for costs please refer to Table 4). Requirements on time and human capacity are high due to the complexity of the model.

variables (*sensitivity analysis*). The importance of other assumptions, e. g. *closure rules*, should be analysed. Closure rules may have strong implications for model characteristics (e. g. Carry 2008).

Neo-Classical assumptions are sometimes subject to criticism: perfect information and rationality of economic actors and market equilibriums cannot be considered as given factors, and are especially doubtful for any economy/market that is either centrally planned, far away from market equilibrium (e. g. no involuntary unemployment) or regulated by the government. The assumption of efficient (timeless) allocation of resources can lead to problematic results with regard to energy and climate change policies. The assumption of representative households instead of having different household types is a strong limitation especially for an analysis with a focus on poverty (Orcutt 1957, Deaton 1997). To overcome this limitation, CGE models are combined with micro models (see section 3.5.9).

References

- Bergmann (2005) gives a short overview on CGE models and environmental CGE modelling.
- Hertel (2013) provides an insight into the GTAP database and CGE modelling.
- Robinson et al. (1999) give a short introduction on how to build a small CGE model based on a SAM.
- Sen (1996) describes SAM and its implications for macroeconomic planning.
- Bergs & Peichl (2006) introduce CGE-based analysis as method for ex-ante evaluation.

3.5.7 DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM MODELS

Dynamic stochastic general equilibrium (DSGE) models belong to the general equilibrium type of models (section 3.5.6). Like CGE models, DSGE models are founded on microeconomic principles by assuming that households maximise utility while companies maximise profits. Unlike CGE models, DSGE models usually work on a very aggregated level by using macro data. Two developments differing according to their price *specification* in DSGE modelling are prominent:

- While the Neo-Classical approach assumes market clearing prices ("general equilibrium prices"),
- the Neo-Keynesian approach accounts for partially sticky prices.

DSGE models are path dependent and well-suited to analyse exogenous shocks on the economy. Often, time periods shorter than one year are reflected in DSGE models.

The differences can be striking especially in a dynamic view: wage adjustments – price for labour – are either instantly adjusted to changing market conditions (like e. g. sudden fall in demand for cars), or wages adjust with a time-lag of a couple of months or years. The results on unit labour costs are fundamentally different in both approaches: the Neo-Classical approach of market clearing prices leads to no additional costs for firms, whereby the Neo-Keynesian approach leads at least to a temporarily increase in unit labour costs.

In contrast to (static) CGE models, DSGE models differ in the attributes dynamic and stochastic. Dynamic models are *models* with path dependency that explicitly address changes and adaptation processes over time (compare Figure 14). The time dependency of DSGE models (or any dynamic model in general) is obtained by using *behavioural functions* on time series of given variables. Behavioural functions set two or more variables in relation. The *parameters* can be estimated by either using econometrics (refer back to section 3.5.1) or taking the parameters from literature.

Stochastic models include a random variable that follows a probability assumption. In other words, random variables imply effects that are difficult to predict, have a certain probability to occur and thus change the outcome of an impact considerably. For instance, natural disasters or stock market shocks are such random variables.

Fields of application

DSGE models are applied for both forecasting and impact analysis.

DSGE models are often used for periods of less than one year – quarterly or sometimes even monthly. Especially Central Banks use them for short-term to medium-term forecasting. This kind of model is not appropriate for analysing industry structure, because DSGE models are based on macro data. Structural data is usually not available up to date and intra-year.

Due to the stochastic characteristics, DSGE models are well suited for evaluating the effects of external shocks on the economy.

Requirements (obligatory and optional)

Know-how about estimation and solving procedures is required for applying DSGE models. Many different approaches have evolved for solving and estimating DSGE models. Accordingly, time and resource capacities (refer back to Figure 8) may vary significantly. Estimation procedures range from *calibration* to advanced estimation techniques. Calibration requires less time, financial, technical and human resources compared to estimation procedures. The usage of solving procedures often requires programming skills. Econometric know-how is essential for processing an estimation function (compare 3.5.4 on econometric models and section 3.6.1 on the modification of models). Involvement of field experts may be helpful.

Time requirements are medium to high and range from six months to one year.

Advantages and limitations

The advantage of DSGE models is their suitability for forecasting economic behaviour by single economic actors (households, enterprises, state etc.) and to predict their reaction to *exogenous* economic shocks. That makes them especially useful for impact assessment exercises. As CGE models, DSGE models provide a fully integrated framework in which economic action takes place. The circular flow within the economy and to foreign countries is included. Above that, the shock responsiveness is displayed over time which discloses time-dependent adaptation processes of trade, production or consumption.

As DSGE models are dynamic, these *models* are – as any other dynamic model – resistant towards the Lucas critique, meaning that forecasting models are often based on correlations between different variables (e. g. between investment and interest rates) which have been observed and validated in the past. But future changes may disturb these correlations and they may no longer be valid. Dynamic models such as DSGE models can account for these changes in the future by adjusting the exogenous impact variables or by altering the *behavioural functions*. DSGE models can also be extended to analyse environmental (e. g. Annicchiarico & Dio Dio 2015) or social impacts (e. g. Kumhof et al. 2012). DSGE models are limited by the difficulty in constructing them. Time, data and good modelling know-how is required. Similar to CGE models (section 3.5.5), DSGE models are often exposed to their rational expectation assumption (DeGrauwe 2008), which is a major characteristic of the Neo-Classical School of thought. This assumption allows only frictional unemployment on labour markets – it provides no room for long-term misbalances, as flexible prices (and wages) outbalance everything. Rational expectation requires all economic agents to possess total information. DSGE models are usually aggregated models which do not process information on industry level. This narrows their scope of usage in terms of structural analysis requirements. Due to their complex nature, DSGE models are often referred to as a "black box", which implies the notion that "no one except the model builder really knows what's going on". This results in limited acceptance among policy-makers and in difficulties in communicating results to the public.

Box 41: DSGE based analysis of different environmental policy regimes

Annicchiarico & Dio Dio (2015) used a quarterly DSGE model to investigate the impact of emission regulations on the business cycle to find out to what extent rigidities have an influence on the economy and to learn about optimal policy responsiveness. The *parameters* were derived from literature. The *model* was calibrated to a steady state equilibrium.

The results of the DSGE analysis can be summarised in short:

- Emission caps lower the responsiveness of macroeconomic variables to shocks
- Rigidities significantly alter the effects of environmental policy regimes
- Welfare is higher with an emission tax than with an emission cap

References

- DeGrauwe (2008) describes a DSGE model without rational expectation assumption.
- Annicchiarico & Dio Dio (2015) give an example of a DSGE model that embodies pollutant emission and environmental policies.
- Kumhof et al. (2012) investigate the impact of income inequality on the current account by applying a DSGE model.

3.5.8 MICRO SIMULATION MODELS

A Micro Simulation Model (MSM) is a model that simulates the behaviour of small (micro) units, e. g. different household types or individuals. Micro models are based on very detailed economic (e. g. income) and socio-economic (e. g. household size, gender) information and are usually applied for evaluating distributional effects of policies predominantly on households. In contrast to CGE models (here: assumption of representative agents), the heterogeneity of agents plays an important role. The characteristics of every household type are described in detail including the age of household members, employment status, income either from being employed or supported by government or other transfers, taxes and transfers as well as place of residence (rural or urban areas).

The behaviour of the micro units is simulated by linking household characteristics: Employment status influences income, income has an impact on consumption. In static MSMs, behaviour of individuals does not change. At any point in the future, an individual will spend exactly the same amount of income on consumer goods. A dynamic MSM assumes that individual behaviour may change. In this case, relationships between variables are modelled using *econometric methods* at the level of different household types (Figari et al. 2014). Time dependent behavioural equations allow for changing household characteristics such as household size (1, 2 or more persons per household), income and expenditures.

Micro models are usually partial models. They focus on certain aspects (e. g. composition of households), but do not represent the complete economy. For poverty analysis it is important to have a closer look at household characteristics. It is essential to know the households' structures to make distributional policies successful. For example, depending on the employment status of household members, poverty reduction policies have to be adjusted accordingly to reach their intended objective. If household members are employed and still considered poor, the wage rate might not be sufficient or income taxes might be too high.

Fields of application

Micro models can be applied for 'what-if'-questions rather than forecasting. They may be appropriate for short-run impact analysis. For long-run analysis, micro models should be combined with macroeconomic *models* such as *CGE models* in order to determine the interrelations of labour supply, income, consumer prices and consumption. Micro models should be used if distributional impacts are expected or in focus of a study. Households can be positively or negatively affected by policies, e. g. a labour market reform. Other applications are the evaluation of implementing or restructuring pension and social security systems, (eco-social) fiscal reforms or poverty reduction strategies. Micro models can be either static or dynamic. Static MSMs can be used for *comparative-static analysis*. Such models are especially suitable if the time adjustment path plays no important role, effects on behaviour are small and distributional impacts upon individuals occur immediately (Li 2013). EUROMOD is an example of a static MSM. This kind of model is used for tax-benefit simulations in European countries (*https://www.iser.essex.ac.uk/euromod*). A dynamic MSM may be applied to estimate the future behavioural development of households.

It is important to mention that *indirect effects* cannot be considered in stand-alone MSMs due to the fact that micro models are partial models. Micro models should only be used if impacts are expected to be restricted to a certain part of the economy or if the expected impact on other parts of the economy is not that high. If policy measures do not only have an impact on the individuals considered, these effects cannot be shown. In contrast, CGE and IO models comprise the whole economy and the feedback linkages between all economic agents and show indirect as well as *induced effects*. To overcome this shortcoming of micro models, they are combined with macro or meso models such as IO and CGE models.

Using preconfigured models such as PovStat or DAD may require an introductory course on how to use them.

Requirements (obligatory and optional)

A representative sample of e. g. household *survey* data is a prerequisite for micro models. Such a survey may contain a huge amount of data which needs to be pre-processed using, for instance, STATA or other suitable software packages. The resulting condensed dataset becomes part of the micro model which then can be built using Microsoft Excel.

A prerequisite for a dynamic MSM is survey data over a longer time period. For European countries, respective household *panel data*[12] sets exist, but usually not for developing countries.

Time requirements are low to high (ranging from a few months to one year) depending on the complexity of the *model*. There are some preconfigured software programmes (e. g. PovStat, DAD provided by World Bank) that can facilitate and speed up model building and conducting micro simulations (Araar & Duclos 2009, Datt & Walker 2002). Important *stakeholders* can be data providers (statistical office), micro modelling experts at universities or other research institutions and software providers.

Advantages and limitations

Micro models are valuable tools if detailed information about a certain part of the economy needs to be investigated. They take heterogeneity of economic agents into account by focussing intensively on a limited number of markets or economic agents (e. g. household types, labour market). MSMs can discover unexpected distributional effects not "seen" by macro models. They are limited with respect to *indirect effects*, because they do not consider the whole economy. Micro models are partial models by nature and therefore not suitable for evaluating macroeconomic effects. For a combination of a micro and macro modelling approach, see section 3.5.9.

Survey data should be up-to-date to reflect current structural household information. The quality of simulation results is determined by the quality of the underlying micro data. In developing countries household *panel data* exists but often is not updated regularly (Baulch 2011). Furthermore, survey data is usually not available for a long time period. Therefore, MSMs are usually static models used for impact analysis but not for forecasting.

References

- Bourguignon & Spadaro (2006) discuss microsimulation techniques for redistribution and poverty analysis.
- Figari et al. (2014) provide an overview of microsimulation models that are applied for analysing impacts of tax-benefit policies on household income distribution.
- Orcutt (1957) introduces microsimulation models and their use for impact analysis on micro level units of social and economic policies.
- Li (2013) gives an overview about microsimulation models that have been developed over the last decade; model structure, methodologies and applications are described.

[12] *http://ec.europa.eu/eurostat/web/microdata/european-community-household-panel*

Box 42: Impacts of Education Policies in Ivory Coast

Grimm (2005) used a dynamic microsimulation model to study the distributional effects of education policies in Ivory Coast. The existing education policy had three objectives: achieve high numbers of primary school enrolment, reduce gender inequality and literate the adult population.
The simulation consists of four *scenarios* (including one baseline scenario and one scenario with four variants). The scenarios differ in assumptions about, among others, number of children starting school, income and household composition.

The results in all cases show a decrease of the illiteracy rate if a higher school entry rate is achieved. An illiteracy rate of less than 20 % can only be reached when additional illiteracy programmes with special focus on women are introduced.

The model is based on household surveys including socio-demographic characteristics such as education, employment, number of household members, income etc.

The time and human capacity for model development seems to be medium to high. The author did not use a preconfigured model, but he applied construction principles that are used in OECD countries to analyse pension reforms.

Box 43: *Ex-Ante* Analysis of Distributional Impacts of the Global Crisis in Bangladesh

Habib et al. (2010) used a microsimulation approach to estimate the impacts of the global financial crisis on households. Their micro model is not combined with a CGE model but uses macroeconomic forecasts to extrapolate micro model variables. Therefore it is not as simple as the PovStat model and not as complex as a combination of CGE and micro simulation models. The macroeconomic shock (global crisis) is transmitted to different household types in form of loss in employment and income. Results of the 'crisis' scenario are compared to a 'no-crisis' *scenario* for the same year or between pre-crisis and post-crisis years.

A comparison of the crisis and no-crisis scenario shows GDP growth rates at a lower level for the crisis scenario. Output and employment growth in the industry sectors suffer more than in the service sector. The macroeconomic effects are important for distributional impacts. Household incomes decrease due to lower labour and non-labour income (remittances), and hence poverty rate increases. Simulation results depend on assumed macroeconomic development in the no-crisis and crisis scenario. The higher economic growth in the no-crisis scenario, the stronger are the effects compared to the crisis scenario. This work was done in close cooperation with the Bangladesh Poverty Reduction and Economic Management (PREM) World Bank Team. The support from experts facilitated the *model* building process.

Time and data requirements are medium to high. At macro level, forecasted data on output, employment, population, income and prices are prerequisites. At micro level, information is needed on income (labour and non-labour), consumption, job characteristics and earnings. Human resource needs are higher than for PovStat models.

3.5.9 MICRO-MACRO MODELS

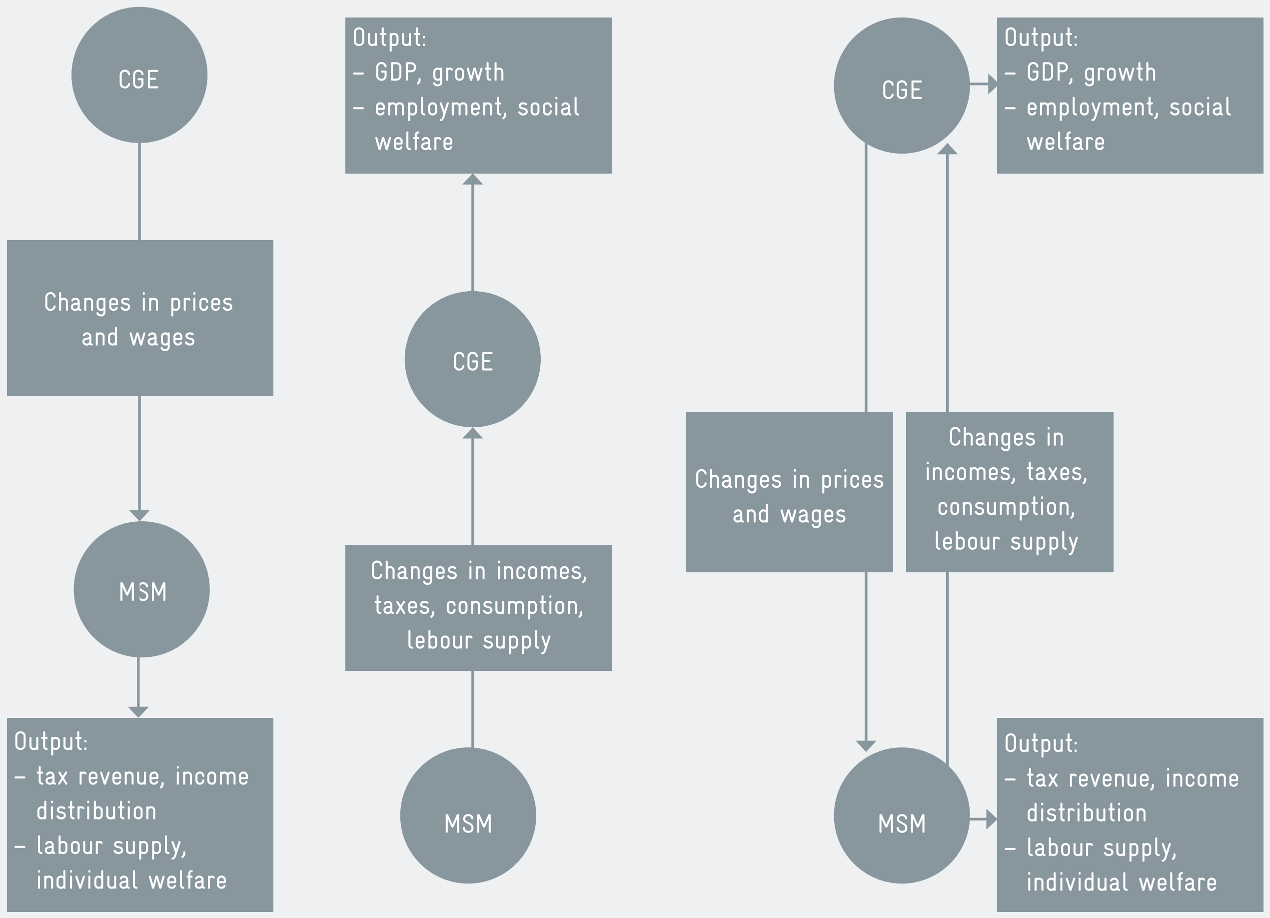
Micro-Macro (MM) models are a combination of *micro models* and macro models (e. g. *CGE-models*). The purpose in combining them is to overcome the shortcomings of each approach: Pure macro models entail the inherent assumption of representative agents that do not allow for analysing distributional effects. Micro models are partial models and do not usually consider the feedback effects of micro-oriented policies to macro variables and vice versa.

MM models can be combined in different ways (Cockburn et al. 2015, see Figure 17). The simplest way is to use a *top-down* approach. In this approach results of policies e. g. on prices, wages or employment are simulated with a macro model ('top level') and then fed into the micro model ('down level'). Impacts on different household types can be derived according to their employment status. There is no feedback linkage from the micro to the macro model and only *direct effects* can be calculated. This approach can be used for short-term distributional impact analysis.

In an integrated MM model household behaviour is modelled with micro data. Consumer preferences and labour supply are estimated for different household types. The macro model calculates wages, prices and labour demand. The output of the macro model becomes the input to the micro model and vice versa. This approach can be applied to estimate long-term distributional impacts.

In a *bottom-up* approach, results from a micro model (e. g. labour supply) are aggregated and fed into the macro model, subsequently macroeconomic impacts are analysed. Feedback effects from the macro to the micro model do not exist.

Figure 17: Top-down (left), Bottom up (middle) and Integrated (right) Approaches



Source: Peichl 2009 (MSM – Micro Simulation Model)

Fields of application

MM models are used to analyse the welfare consequences and distributional effects of macroeconomic phenomena (e. g. growth, inflation) as well as macroeconomic policy measures. Additionally, they can be applied to test effects of micro-oriented policies on macro variables.

Requirements (obligatory and optional)

The main requirement for MM models is a combination of resources (data, time and personnel) necessary for micro and macro resp. meso models (see for example sections 3.5.5 and 3.5.6). Micro datasets, data for macroeconomic indicators and appropriate software are prerequisites to build such models as well. Additional requirements stated for stand-alone *micro* and *macro* models are valid for MM models, too.

Building MM models is very time-consuming (up to one year) due to their complexity. Involvement of different *stakeholders* such as statisticians, experienced *model* builders and of course stakeholders supposed to use results later on is important.

Advantages and limitations

MM models are more comprehensive than partial (micro) models. Therefore, constructing them is more difficult and costly. Integrated approaches are the most sophisticated ones. Hence, only a few of them exist. More common and less time and cost-intensive is the *top-down* or *bottom-up* approach.

Results of MM models are more robust compared to using a single micro resp. macro model. Advantages of both approaches are combined and limitations are reduced. Nevertheless, top-down and bottom-up Micro-Macro modelling approaches have some limitations. Either feedback linkages from macro to micro model (bottom-up approach) or those from micro to macro model (top-down approach, see Figure 17 and Zhang 2015, Peichl 2009) are neglected.

The combination of MM models makes model building more challenging due to increased complexity. Empirical inconsistency between macro variables and survey data is a well-known problem especially for top-down and bottom-up approaches. Either survey data is adjusted to macro data or survey data is taken as it is and macro data is adjusted to micro data (Zhang 2015). Integrated approaches can overcome this limitation.

Box 44: Poverty Assessment for Latin America

Bourguignon et al. (2008) used a *top-down* macro-micro modelling framework to assess impacts of trade reforms on poverty in Latin America. They combined a global CGE model with a static micro simulation model. The micro data are connected to the CGE model by only a few important variables such as wages and consumer prices in order to reduce complexity. In a first step, the CGE model was used to derive price changes caused by trade reforms and other macro variables. In a second step, the price changes were transferred to the real incomes of households and prices for consumer goods.

Two trade *scenarios* were simulated with the MM model: The first scenario assumes a free trade area of the Americas. The second scenario analyses an elimination of all tariffs and export subsidies all over the world. The simulation results were compared in a *comparative-static* framework.

The simulation results show that trade reforms can help to reduce poverty. Lower tariffs result in higher exports for Latin American Countries and lower import prices e. g. for agricultural goods. Wages and individual household income will increase especially if workers are employed in industries which are positively affected by the trade reform. Comparing both reform *scenarios,* the effects are higher in the second scenario (full liberalisation).

The advantage of this approach lies in its structure which is less complex due to a *top-down* approach, a standard CGE model and static MSM. The latter is a limitation, too, as it does not allow a change in the behaviour of households. Welfare impacts on households are only indicative.
This kind of modelling approach requires household survey data and GTAP data. The top-down modelling approach without any feedback linkages has the advantage of not being too complex and requiring less time and personnel capacity.

References

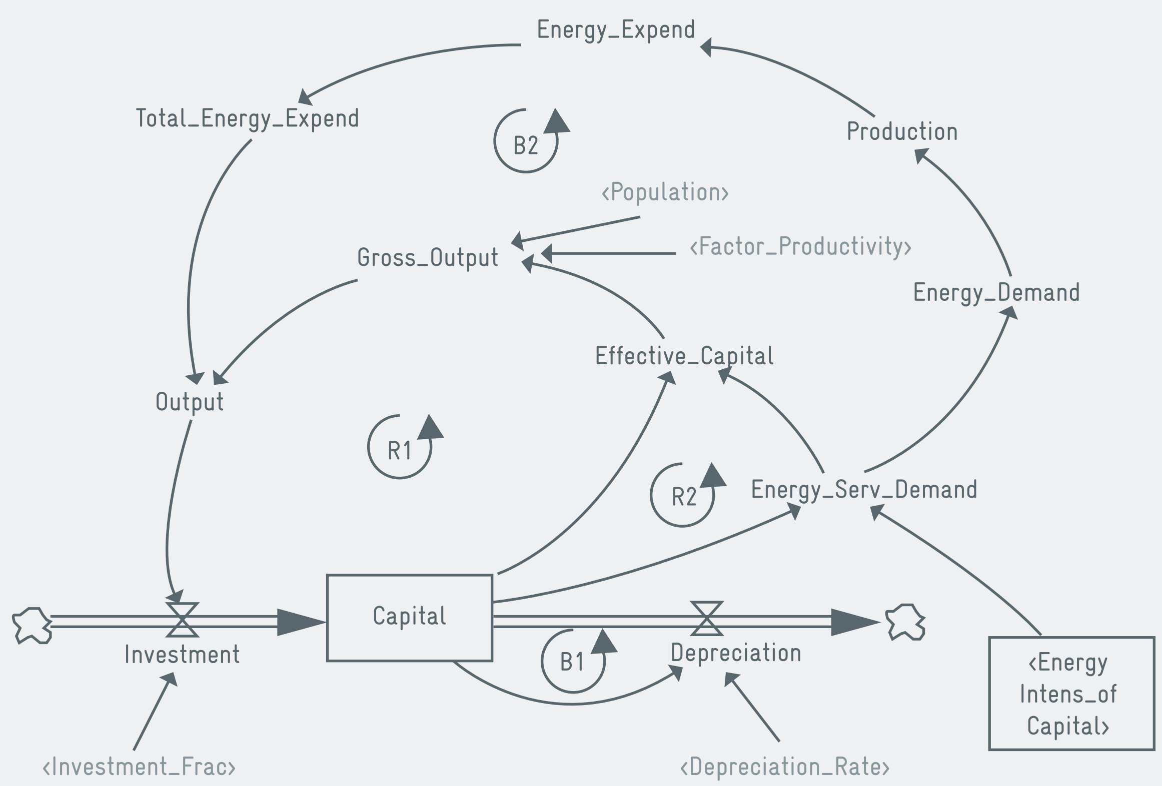
- Bourguignon et al. (2008) give a comprehensive overview on how to link macro and micro models.
- Cogneau et al. (2003) describe different microsimulation techniques and the combination with macro models as well as their use for poverty analysis.
- Davies (2009) explains how CGE and microsimulation models can be combined to study distributional issues.

3.5.10 SYSTEM DYNAMIC MODELS

System Dynamic (SD) models were developed by Forrester at the Massachusetts Institute of Technology in the 1950s (Forrester 1968, 2009). They are descriptive models that focus on the identification and replication of causal relations. Such models are helpful in analysing complex and dynamic systems, which especially emphasise on the system's feedback loops and properties of the "real" system such as *non-linearity* and *delays*. *Model* results will reveal the existence of correlations over time which is comparable with the outcomes of econometrics (UNEP 2014).

The system comprises of stocks and flows which define the relations between the stocks. A simple SD diagram with stocks, flows and feedback loops for an Integrated Climate Economy (NICE) model is given below:

Figure 18: SD Diagram Example



Source: Fiddaman 1997: 43

Flows are marked by arrows, stocks by rectangles. Arrows are used to describe flow dependencies. An arrow pointing at a stock (e. g. "investment" in Figure 18) means an inflow for the stock ("capital" in Figure 18). An outflow is indicated by an arrow pointing away from the stock (e. g. "depreciation"). *Exogenous* variables such as population are indicated in grey and marked with relational operators standing for 'less than' and 'greater than'. Clouds represent sources or links outside of the *model* system. Positive (reinforcing) or negative (balancing) feedback loops are labelled with 'R' (sometimes '+') resp. 'B' or '-'. For example, R1 indicates the reinforcing loop through re-investment.

SD models base their main assumptions on causal relations and the dynamic interplay of key variables. They do not follow a certain economic theory or assumptions, as for example CGE models do, which rely on Neo-Classic Theory. The system is highly customised to deal with issues that are under consideration (UNEP 2014: 14). For example, UNEP supports countries to analyse the impacts of green economy policies using customised SD models.

SD models were developed to support decision makers and other *stakeholders* in understanding the structure, main drivers for behaviour and dynamics of a complex system. In contrast to static models, they provide time-specific solutions. Another methodological difference to DSGE and most CGE models is that SD usually incorporates the environmental and social spheres besides the economy, as well as their feedback effects. Compared to CGE models, the economic degree of detail is lower and the economy is not necessarily modelled completely endogenously (Nicholson 2007: 109, UNEP 2011: 506).

Fields of application

SD models may be applied to dynamic systems with high degrees of interdependence, circular causality, interaction, *non-linear* relationships (the rate of change of one variable slows down or accelerates the rate of change of other related variables) and information feedback, e. g. economic and environmental systems. SD models are suitable for both forecasting (*http://www.millennium-institute.org/projects/region/ap/china-istic.html*, January 2016) and impact analysis of policy measures in the medium- and long-term, especially if development processes and feedback effects of a policy are focussed, not equilibrium effects or optimisation problems[13]. Econometric models, on the other hand, provide a better solution for problem identification by forecasting trends based on historical data (UNEP 2014: 15). For example, comparing greenhouse gas (GHG) emission trends with GHG targets may show the need for action. Resource allocation issues can be better analysed with CGE models (Bergman 2005).

SD models support decision-makers in testing the outcome of different "what-if"- *scenarios* by comparing such scenarios and detecting possible trade-offs between them. Simulation results are the impacts of a policy introduced at a specific point in time and in a specific context. The results of a simulation show the existence of correlations in a dynamic manner (UNEP 2014).

SD models comprising the economic, social and environmental dimensions are usually macro models. They can include extended industry detail as well as micro data (see for example Pedamallu et al. 2010).

Requirements (obligatory and optional)

Computer hardware and software are prerequisites for complex SD models. The "System Dynamics Society" (see *http://www.systemdynamics.org*) maintains an internet site which provides a list of tools for various tasks, e. g. core model building, and documentation. The Millennium institute offers a dynamic simulation tool named Threshold 21 (T21). It is preconfigured and has to be adapted to country-specific characteristics. Customising and refining a T21 needs approx. one year including training for model users (*http://www.millennium-institute.org/projects/index.html#training*).

When validating SD models, it is highly recommended to involve experts in order to check causalities and the strength of relations. Expert knowledge can easily be integrated due to an "open" model structure. New assumptions, additional cross-sectoral factors, feedback loops or even other methodologies, such as optimisation and econometrics, can be introduced into SD models (UNEP 2011: 535, UNEP 2014: 15). Of course, structural and behavioural tests are necessary to check model *sensitivity* and responsiveness.

Model validation helps to discover possible misspecifications. The model should be able to reproduce historical data quite well and has to have a valid structure.

[13] *http://www.millennium-institute.org/projects/region/africa/mali.html, http://www.millennium-institute.org/projects/issue/climate/index.html, January 2016*

Advantages and limitations

SD models support the user in understanding how systems can change over time and the reasons for doing so, especially when data availability is poor. Cause and effect relations as well as feedback effects are covered by such a model. All SD models share the same set of symbols to describe stocks and flows (arrows, rectangles etc., see Figure 18), which allows for various ways to explore the system behaviour.

There is a high degree of flexibility in building SD models. They can be altered and expanded in many ways e. g. with environmental and/or social variables. Furthermore, they can be linked to other modelling approaches such as econometrics or IO tables (UNEP 2014).

SD models can become very complex due to their numerous feedback loops and *non-linearity*. Although the values of the model variables may change, each SD model describes only one version of a specific situation. Different users introduce different assumptions and thus see a different picture of a given situation.

Due to their complexity, extensive capacity building is required and can take up to one year.

A common issue with SD models is the identification of relevant key variables and the causality between them. Input from econometric models can be used for modelling non-linearity.

In contrast to CGE models, SD models as well as micro models do not assume homogenous agents.

Box 45: Threshold 21 (T21) – The Example of Uruguay

The T21 model was created to support comprehensive, integrated, long-term national development planning by comparing different policy options across a wide range of sectors and including social and environmental factors (Millennium Institute s.a.a, s.a.b). It identifies the options which are leading towards a desired goal. T21 has been developed by the Millennium Institute (*http://www.millennium-institute.org/*).

Main applications of T21 models are the preparation of strategies for poverty reduction, Green Economy transformation and MDGs as well as the preparation of strategies aiming at sectoral or industrial interests. Currently more than 15 T21 models exist with applications for both industrialised (e. g. USA, Italy) and less industrialised countries (e. g. Malawi, Bangladesh, Uruguay).

T21 is preconfigured. Thus, users do not have to build their model from scratch, but country-specific adjustments are still necessary. Depending on experiences with SD models and the complexity of the model itself, model adjustments can take up to one year. The Millennium Institute recommends capacity building to be able to maintain the model independently.

For example, the Instituto de Economía de la Universidad de la República (IECON) employs the Uruguayan T21 model for assessing the transition towards a green economy. This *model* comprises economic, social and environmental aspects. Four sectors (transport, tourism, agriculture and livestock) are modelled in more detail due to the scope of the study (PNUMA 2015).

A "green scenario" considering proposed "green" initiatives in e. g. tourism and the transport sector was calculated with the T21 simulation model up to 2035. Compared to a business-as-usual scenario, the results of this "green scenario", including improvements in energy and resource efficiency, show positive effects on the economy, environment and social performance.

The study was carried out with the help of T21 experts from the Millennium Institute and supported by GIZ. Time and data requirements can be judged as medium.

Box 46: Modelling the Dynamics of Poverty Trap and Debt Accumulation (Ghana)

This SD model is based on the System Dynamics adaptation of the poverty trap and debt overhang theory (Ansah 2010). It has been developed by the System Dynamics Group, School of Social Sciences at the University of Bergen (Norway) to explain the poverty trap in Ghana as well as its linkage to public debt accumulation. The starting point was the observation of a population growth rate that exceeded GDP growth. The author establishes the reasons for the weak GDP growth in low investments. These in turn were caused by lower saving rates due to higher consumption, resulting in lower investment rates under the assumption that investments equal savings.

The model results show that a lower income per worker leads to a decline in savings and hence in lower domestic investments. At that time, foreign investments decreased as well and GDP growth declined. Simulation results show that measures to increase investments or savings may be appropriate policies to reduce poverty as well as public debt.

The complexity of that model is considered to be medium. Data requirements are related to macroeconomic variables and population.

References

- Introduction to SD (*http://www.systemdynamics.org/DL-IntroSysDyn/start.htm*).
- Kirkwood (1998) introduces System Dynamic methods.
- Boateng et al. (2013) show an example of an SD model application.
- UNEP (2014) describes different models used for green economy policy-making.

3.5.11 COST-BENEFIT-ANALYSIS

Cost-Benefit-Analysis (CBA) is a systematic approach to estimate costs and benefits of a project. To be able to compare costs and benefits which accrue over different time periods, a discounted value over the whole lifetime of the project is calculated. Decisions are made by comparing the net present value (NPV) of the project's costs with the NPV – discounted over the course of a defined planning horizon – of its benefits.

$$NPV = \sum_{t=0}^{T} \frac{B_t - (K_t + C_t)}{(1+d)^t}$$

B~benefit;K~capital costs;C~operating costs;d~discount rate;t~year

A project is recommended if the benefits outweigh the costs (NPV > 0). If more than one alternative is evaluated, the alternative with the highest NPV should be selected (see Figure 19).

Steps to complete a CBA are as follows (*http://ec.europa.eu/smart-regulation/guidelines/tool_55_en.htm*):

(1) Identify the full range of costs and benefits
(2) Monetise direct costs and benefits
(3) Assess *indirect impacts* and their costs and benefits
(4) Determine NPV
(5) Check robustness of results
(6) Select best alternative

Fields of application

A common application of a CBA is the *ex-ante* evaluation of investment projects (e. g. installation of renewable energy technologies, schools) with expected high expenditures (capital and/or labour).

Requirements (obligatory and optional)

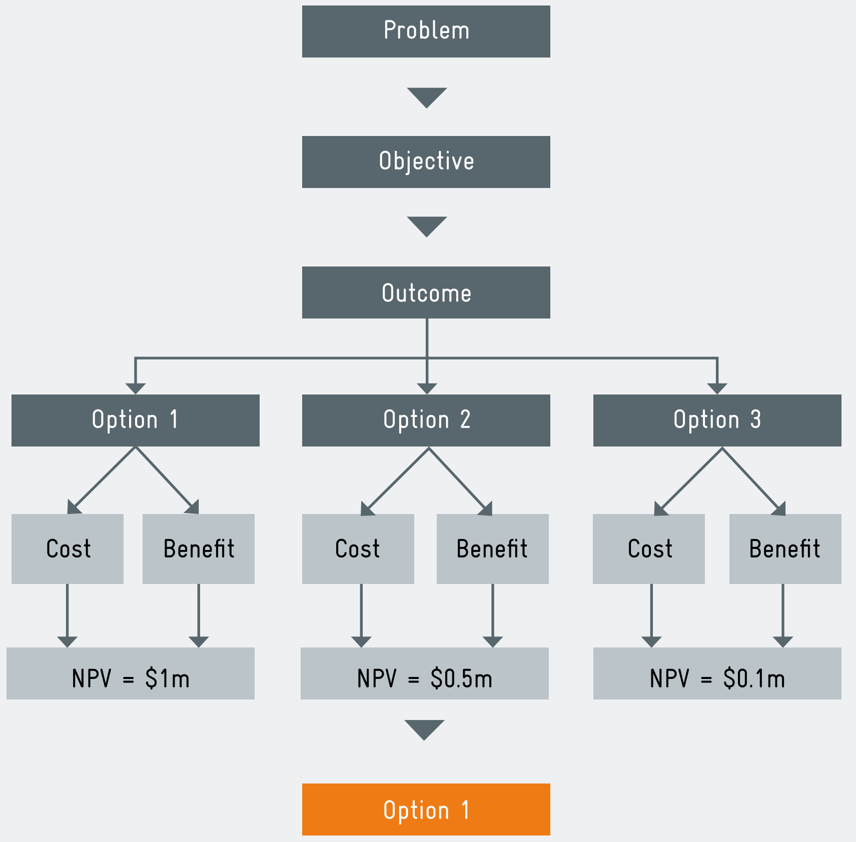
For a CBA, spreadsheet software such as Microsoft Excel or OpenOffice Calc is sufficient. For example see the following websites:

http://archive.treasury.gov.au/documents/794/XLS/Cost_Benefit_Analysis_Appendices.xls and *http://www.upenn.edu/computing/isc/pmap/Definition/Cost-benfit%20template%20condensed%20version.pdf.*

Time and data requirements are low to medium. A CBA can range from three to six months, depending on the complexity of the project.

Consulting field experts may help to get a better estimation of costs and benefits.

Figure 19: Basic Cost-Benefit-Analysis Diagram



Source: Department of Treasury and Finance (2013)

Advantages and limitations

Provided that the variables of an alternative are entered correctly, a CBA provides enough data to make a decision with confidence. The technique is useful to determine whether a project is affordable or not. It is important to be aware of the fact that, if some costs and/or benefits are overlooked, the results of the analysis might become inaccurate.

Costs can usually be quantified more easily than benefits (e. g. clean environment, life expectancy). Plenty of time and effort is necessary to quantify benefits, particularly of intangible goods. What are the benefits of an additional year of life in good health? Of a child not dying? Of an environmental disaster not happening? Another crux is the discount rate, because benefits of poverty mitigation, climate change adaptation, the transition to a green economy will occur much later in the future than the respective costs. If we assume a high preference for the presence, we have high discount rates and all values occurring in the future will be heavily discounted. Benefits of, for example, climate protection measures can be calculated by monetising the avoided environmental costs (such as costs caused by flooding or storms).

Setting the right discount rate is challenging and can have a strong impact on the results. An orientation is given by the ADB (2013) study. *Sensitivity analysis* is a good way to see what impacts different discount rates have on the respective results. The decision on a discount rate should be discussed with experts.

References

- ADB (2013) gives guidance in CBA including practical examples.
- The World Bank (2010) gives an overview in CBA in World Bank projects.
- For a step-by-step introduction to CBA, see *http://www.upenn.edu/computing/isc/pmap/Definition/Cost-benefit%20template%20condensed%20version.pdf.*

Box 47: CBA of Proposed New Health Warnings on Tobacco Products

The CBA has been carried out in Australia to evaluate the effects of larger and graphic health warnings to be displayed on tobacco products (Commonwealth Department of Health and Ageing 2003). The introduction of the new health warnings mainly concerns four groups: tobacco industry, tobacco consumers, government and third parties such as other industries. Costs and benefits have to be analysed for these groups. The tobacco industry has to pay for the printing costs and reduced tobacco consumption. The fall in consumption of cigarettes will affect tobacco taxes and company tax revenues due to decreased production. Additionally, other industries may have lower costs due to improved health.

The net present value was calculated with a discount rate of five to seven per cent to see the different results. The results show a net present value of $2.3 million ($1.30 million) from the new health warnings by using a discount rate of five (seven) per cent.

Requirements for time and data do not seem to be that high. An important fact is the involvement of experts to obtain an educated guess about e. g. future health improvements or future development of tobacco product consumption.

3.6 MODEL VARIATIONS
3.6.1 MODIFICATION OF QUANTITATIVE MODELS

So far, a range of quantitative economic models have been introduced including comments on their specific requirements, advantages and limitations. In some sections, it was noted that variations of the *models* are possible. That was related to e. g.

- Integrating regression functions in CGE or IO models
- Using IO tables instead of SAM in a CGE model
- Introducing non-market clearing prices in a CGE framework
- Introducing prices to IO models
- Modelling either top-down or *bottom-up*

These options are of particular importance for practitioners working in a field with a generally low data endowment and restricted resources in terms of skills and techniques provided.

Start working on the model step by step. Modifications can be performed constantly with increasing confidence in economic modelling.

It is often advisable to start working on quantitative economic models with a step-by-step approach – with only a few equations and no regression functions at the beginning. Reflecting the models described before, the simplest version should be used for the start. More data and more information can be added gradually – thus slowly transforming, for instance, a static model into a dynamic model by including one or two regression functions. At a later stage, structural information can be implemented. Some more regression functions can be included even later, e.g. the model may be transformed into an IO model by including input-output tables.

It is important to keep in mind that economic modelling is a “learning system” that can be improved, updated, enlarged etc. at all stages of development. If better data becomes available, previous data can be replaced or the model can be improved substantially as new aspects of the economy become observable in terms of data availability.

3.6.2 MODULARISATION OF QUANTITATIVE MODELS

Modularisation used in the context of economic modelling refers to the extension of the pure economic models with *modules* that elaborate parts of the economic model in greater detail. The MM model (see section 3.5.9) is one example which has been separately discussed. Furthermore, environmentally enhanced models have been presented in short in section 3.5.5 (IO models) and 3.5.6 (CGE models).

Modules have to be clearly positioned within the economic model. They can be *top-down* or *bottom-up*.

Most models explained in the previous subsections describe pure economic models, as they always form the basis for further research in environmental or social aspects. At this point, it is essential to recall that economic models always include some forms of environmental or social aspects already. For example, the energy sector is part of an analysis based on environmental aspects or labour demand or private consumption as part of an analysis based on social aspects.

There are two important aspects to consider when modularising an economic model:

- Clearly localise the spot where to connect the *module* with the economic core model.
- Clearly decide whether the module should only have “reporting” characteristics (*top-down* approach) or if it should have feedback impacts (*bottom-up* approach) on the economic core model.

To illustrate the difficulty of modularisation, this example shows how to incorporate labour qualification into a model: Qualification demand refers to the *specification* of labour demand (qualifications required by industries). In standard economic models, labour demand is generally described by the number of people employed. Depending on the detail of the *model*, labour demand can be described sector-specifically. Qualification information are add-ons to labour demand specification (=localisation in the economic model).

Information about the qualification distribution among labour demand in an economy is required. Such information is usually provided by the micro census. Qualifications are related to occupations, which is why information on occupations has to be extracted as well. Therefore, two distribution matrices have to be part of the qualification module: one that leads from employment by industries to employment by occupation and one that leads from employment by occupation to employment by qualification. Such matrices are often referred to as bridge matrices. Figure 20 in Annex I gives an illustrative example of that modularisation case. The two sub-modules of Figure 20 are constructed as top-down modules. There are no feedback-loops to the economic core model.

3.7 MIXED METHODS

This section highlights the possibility of combining both qualitative and quantitative methods. All methods introduced in the previous subchapters 3.4 and 3.5 do not necessarily have to be employed exclusively as single, stand-alone methodologies within an IA. As it has been indicated throughout the description of the methodologies and in the overview table of qualitative methods (Table 7), methods can be used in combination with others or can be used for generating input for other methodologies.

An optimal IA may be one where qualitative information is embedded in a quantitative impact assessment.

Fields of application:

Mixed methods can be applied for very sophisticated analyses. They are especially appropriate in areas with no or hardly any pre-research. Also, they are very useful for describing potential future developments and for formulating *scenarios*.

Future technological leaps can be formulated by applying qualitative methods such as Multi-Criteria Analysis, Delphi Method, Result Chain Analysis, case studies, interviews or surveys.

Mixed methods can be applied for both impact analysis and forecasting.

Results/Outcome

Mixed methods result in an in-depth analysis of policy interventions. They combine the advantages of qualitative and quantitative methods whilst reducing the disadvantages of both methodological approaches.

Position in the IA process

They can be located in the planning, execution and evaluation phase.

Requirements (obligatory and optional)

Requirements depend on the types of methods combined. They usually demand more time, manpower, technical and financial resources.

Time Requirements: medium to high (ranging from six months to one year).

Stakeholder involvement: medium to high; depending on which form of qualitative *method* is applied.

Advantages and limitations

The combination of qualitative and quantitative methodologies has the advantage of generating "both a statistically reliable measure of the magnitude of the impact as well as a greater depth of understanding of how and why a programme was or was not effective and how it might be adapted in future to make it more effective" (Garbarino & Hooland 2009: 5).

Mixed methods are limited by their time demand and human, technical and financial resources. Mixed methods in impact evaluation address the challenge that "rarely a single evaluation methodology (...) can fully capture all of the complexities of how programs operate in the real world" (Bamberger 2012: 3). Although in most cases a combination of qualitative and quantitative methods is used unintentionally[14], the mixed method approach is clearly characterized by an intended and planned usage of both types of methodologies.

References

- Bamberger (2012) gives an introduction to mixed methods in impact evaluation.
- Garbarino & Hooland (2009) discuss a range of quantitative and qualitative methods used for impact evaluation and measuring of results providing practical examples.

Box 48: Mixed Methods – Example of Abolition of User Fees in Health Units in Uganda

A mixed method approach was used for the *ex-post* evaluation of the abolition of user fees in health units in Uganda (Garbarino & Hooland 2009). The assessment was based on a sequencing of methods and data analysis. As a result, user fees were identified as one important obstacle for poor people to access health services. The user fees were abolished.

The assessment was based on the following approaches:
- Participatory Poverty Assessment Process: revealed significance of major health disturbances on the poor
- *Time series analysis*: showed that fee abolition and increasing supply of health services increased outpatient attendance
- Participatory research: confirmed the increase in outpatient attendance among poor households
- Wealth ranking: revealed that the poorest quartile benefited the most from fee abolition
- Household survey: confirmed that poorer income groups profited more than richer groups

[14] *Unintentionally means that the evaluation or construction of a model is connected to qualitative information: This refers to the assumptions that have to be defined, to the a priori formulation of a hypothesis or to the evaluation of the results.*

4 SUMMARY AND KEY RECOMMENDATIONS

The international community has recently adopted its new development agenda with the 2030 Agenda for Sustainable Development, a set of 169 single targets. The principles were agreed upon in the United Nations' General Assembly on September 2015. In order to reach the defined goals, evidence-based policy has become an increasingly used approach for improving the quality and the *efficiency* of policy action. An *ex-ante* IA is one approach that contributes to evidence-based policies. Whereas an IA is increasingly and regularly used in industrialised economies, it has not yet penetrated the decision-making process in developing countries.

This manual describes the key steps for conducting an ex-ante IA. It is especially designed for practitioners of development cooperation in developing or emerging economies. Based on desktop research and interviews, the manual provides a best-practice overview for assessing policy intervention measures. It presents a set of quantitative and qualitative methods well-suited for evaluating the economic, social and environmental impacts of policy measures. Textbook and practical examples from development work illustrate the application of the introduced methodologies. Practical examples also indicate some lessons learned from experiences of GIZ projects in partner countries. Warning signs highlight important issues along the way.

The overarching aim of conducting an IA is to improve policy quality. This requires a successful feedback of IA results into the policy decision-making process. Challenges exist that may hamper this feedback process. An accurate timing of the IA and the formulation of short and precise policy recommendations, however, may ease this process. If policy-makers can be convinced to claim the ownership of IA results, this will significantly enhance their commitment to use them.

Basically, any IA consists of three steps: planning – executing – evaluating. All three steps of an IA build on one another and show interlinkages. The key issues of any IA are the involvement of *stakeholders* as well as the collection, preparation and processing of data and other information relevant for the impact assessment.

Capacity development plays an important role in development cooperation and thus also in an IA. Its aim is to increase the sustainability of the IA process and to build capacities in partner institutions for implementing IA on their own. This particularly refers to building up skills, know-how and capabilities to perform an IA and to design, maintain and develop economic models.

In an *ex-ante* IA a range of different quantitative or qualitative methods can be applied to perform the actual impact assessment. The manual presents a non-exclusive selection of methods based on best-practice methodologies representing the current state of the art.

The choice of *methodology* is fundamental for the impact assessment. It depends on data availability, time capacity, local know-how for developing and/or using economic models, and on the analysis' degree of complexity. All these influencing factors have to be considered simultaneously. The manual provides assistance in the decision process with three tools: (i) a decision diagram that arranges the *models* according to data, time, know-how capability and complexity, (ii) two decision trees specifying the decision according to data availability and field of research (complexity), and (iii) a tabular overview on all methodologies which summarises the key features of each method.

In summary, the following key recommendations should be kept in mind for the various steps of the IA:

> In general, each practitioner has to balance what he/she wants to do and what he/she can do. A thorough stock-taking of financial, human, technical and institutional resources as well as data endowment at the beginning of the IA facilitates the work.
>
> Forward planning is important whilst conducting an IA. Using a roadmap and a timeline keeps the IA process on track.
>
> Stakeholders should be identified at an early stage of the IA. A stakeholder analysis helps to identify stakeholder's participation share and to reduce potential resistance to the IA.
>
> Financial, human, technical and institutional resources limit scope and scale of the IA. Especially capacity development is of crucial importance for ensuring the sustainability of the IA. Institutional resources are important to consider when it comes to feeding the results back into the policy decision process.
>
> The choice of instruments for the actual impact assessment should be balanced carefully against the specific problem, objectives and options. Some methods may be too sophisticated for the task at hand.
>
> The choice of *method* also depends on the availability of resources, data and time.
>
> Qualitative methods are used if little or no empirical evidence or hypotheses are available. They can also serve as a means of data collection. Quantitative methods are suitable for testing a *hypothesis*. Due to their quantitative nature, impacts are easier to determine.
>
> Evaluation is crucial for formulating policy recommendations.
>
> The IA report should clearly state the cause and reason why an IA has been conducted. Its *methodology* and results should be described in detail. It is essential to know the *transmission mechanism* of the impact assessment. The magnitude and location of the impacts should be elaborated.
>
> The results should be checked against an a priori *hypothesis*. This can be a result of "thoughtful thinking" or of a double check with other publications or projects performed on the same issue.
>
> An *ex-post* IA can be used for assessing whether a policy measure was actually successful. Such counterfactual analyses are often performed as a follow-up study of *ex-ante* IA.

Overall, a well-structured ex-ante IA can provide valuable input for decision-makers and it can contribute to reaching development or other policy goals. However, it can only function as a means of advice. The decision whether the findings from an IA result into active policy intervention depends on other factors such as policy coalition, terms of election etc. Nevertheless, the constant use and application of policy impact assessments contributes to an increasing awareness of the merits of evidence-based policy making and might lead to a wider acceptance of such a tool for policy advice.

REFERENCES

ACI (African Cashew Initiative) (2010): Poverty Impact Assessment – PIA Case Study Ghana. Ghana, April 2010.

Ahlert, G., Distelkamp, M., Lutz, C., Meyer, B., Mönnig, A., Wolter, M. (2009): Das IAB/INFORGE-Modell. In: Schnur, P., Zika, G. (Hrsg.): Das IAB/INFORGE-Modell. Ein sektorales makroökonometrisches Projektions- und Simulationsmodell zur Vorausschätzung des längerfristigen Arbeitskräftebedarfs. Nürnberg. IAB-Bibliothek 318, pp. 15–175.

Almon, C. (1991): The INFORUM Approach to Interindustry Modeling. Economic Systems Research 3, pp. 1–7.

Almon, C. (2011): The Craft of Economic Modeling. Part III. Multisectoral Models. Department of Economics University of Maryland. Almon, C.. (2012): The Craft of Economic Modeling. Part I. Department of Economics University of Maryland.

Annicchiarico, B. & Dio Dio, F. (2015): Environmental Policy and Macroeconomic Dynamics in a New Keynesian Model. In: Journal of Environmental Economics and Management. Volume 69, January 2015, pp. 1–21.

Ansah, J. (2010): Modeling the Dynamics of Poverty Trap and Debt Accumulation. Bergen.

Araar, A. & Duclos, J-Y. (2009): DAD: A software for poverty and distributive analysis. (*http://digital.csic.es/bitstream/10261/46628/1/10.3233-JEM-2009-0315.pdf*, January 2016).

Asian Development Bank [ADB] (2013): Cost-Benefit Analysis for Development. A Practical Guide.

AUSAID (ed.) (2005): AusGuidelines 3.3 The Logical Framework Approach. Sydney Commonwealth of Australia.

Baker, J. L. (2000) Evaluating the Impact of Development Projects on Poverty. A Handbook for Practitioners. World Bank. Washington.

Bamberger, M. (2012): Introduction to mixed methods in impact evaluation. Impact Evaluation Notes. No. 3, August 2012.

Baßler, U., Heinrich, J. & Utecht, B. (2002): Grundlagen und Probleme der Volkswirtschaft. 17. Auflage, Schäffer-Poeschel Verlag, Stuttgart.

Baulch, B. (2011): Household Panel Data Sets in Developing and Transition Countries.

Baxter, P., Jack, S. (2008): Qualitative Case Study Methodology: Study Design and Implementation for Novice Researchers. The Qualitative Report, Vol. 13, pp. 544–559.

Bergmann, L. (2005): CGE Modeling of Environmental Policy and Resource Management. In: Handbook of Environmental Economics, Vol. 3. Edited by Mäler, K.-G., Vincent, J. R, pp. 1273–1306.

Bergs, C. & Peichl, A. (2006): Numerische Gleichgewichtsmodelle. Grundlagen und Anwendungsgebiete. Finanzwissenschaftliche Diskussionsbeiträge Nr. 06-2, Universität Köln.

Bess, R. & Ambargis, Z. O. (2011): Input-Output Models for Impact Analysis: Suggestions for Practitioners Using RIMS II Multipliers. (*https://www.bea.gov/papers/pdf/WP_IOMIA_RIMSII_020612.pdf*, January 2016).

Bessau, D. & Lenk, Th. (1999): Makroökonomische Paradigmen und deren wirtschaftspolitische Implikationen. Eine Übersicht. Arbeitspapier Nr. 13. Institut für Finanzen. Universität Leipzig.

Boateng, P., Chen, Z., Ogunlana, S. & Ikediashi, D. (2013): A system dynamics approach to risks description in megaprojects development.

Bourguignon, F. & Pereira da Silva, L.A. (eds.) (2003): The Impact of Economic Policies on Poverty and Income Distribution – Evaluation Techniques and Tools. World Bank, Oxford University Press.

Bourguignon, F. & Spadaro, A. (2006): Microsimulation as a tool for evaluating redistribution policies. Journal of Economic Inequality (2006) 4, pp. 77–106. DOI: 10.1007/s10888-005-9012-6.

Bourguignon, F., Bussolo, M. & Pereira da Silva, L. (2008): The Impact of Macroeconomic Policies on Poverty and Income Distribution: Macro-Micro Evaluation Techniques and Tools, Palgrave.

Breitschopf, B., Nathani, C. & Resch, G. (2012): Methodological guidelines for estimating the employment impacts of using renewable energies for electricity generation. Study commissioned by IEA's Implementing Agreement on Renewable Energy Technology Deployment (IEA-RETD). Karlsruhe.

Burniaux, J. M. & Truong, T. P. (2002): GTAP-E: An Energy-Environmental Version of the GTAP Model, GTAP Technical Paper No. 16, GTAP, Purdue. (*https://www.gtap.agecon.purdue.edu/resources/download/1203.pdf*, January 2016).

Canter, L. W. (1999): Environmental Impact Assessment. Chapter 2. In: Environmental Engineers' Handbook. CRC Press LLC.

Capros, P., Regemorter, D. Van, Paroussos, L. & Karkatsoulis, P. (2013): GEM-E3 Model Documentation. JRC Technical Reports. (*http://publications.jrc.ec.europa.eu/repository/bitstream/JRC83177/jrc83177%20%283%29.pdf*, January 2016).

Carry, C. B. (2008): CGE Approaches to Policy Analysis in Developing Countries: Issues and Perspectives. SPERA Working Paper 2/2008. Centre for Economic Development, Health and the Environment.

Cockburn, J., Savard, L. & Tiberti, L. (2015): Macro-Micro Models. Working paper 2015-12.

Cogneau, D., Grimm, M. & Robilliard, A.-S. (2003): Evaluating poverty reduction policies. The contribution of micro-simulation techniques. Published in: Cling, J.-P., Razafindrakato, M. & Roubaud. F. (Eds.), New International Poverty Reduction Strategies. London, Routledge Books, 2003, pp. 340–370.

Commonwealth Department of Health and Ageing (2003): Cost-Benefit Analysis of Proposed New Health Warnings on Tobacco Products. Applied Economics.

Datt, G. & Walker, T. (2002): PovStat 2.12. A Poverty Projection Toolkit. User's Manual. World Bank.

Davies, J. B. (2009): Combining Microsimulation with CGE and Macro Modelling for Distributional Analysis in Developing and Transition Countries. International Journal of Microsimulation (2009), pp. 49–65. (*http://microsimulation.org/IJM/V2_1/IJM_2_1_4.pdf*, January 2016).

DBIS (Department for Business Innovation & Skills) (2015) Better Regulation Framework Manual – Practical Guidance for UK Government Officials. March 2015.

Deaton, A. (1997): The Analysis of Household Surveys. A Microeconometric Approach to Development Policy. Published for the World Bank. The Johns Hopkins University Press. Baltimore and London.

DEFRA (2003): Use of Multi-Criteria Analysis in Air Quality Policy. A Report Prepared for the Department for Environment, Food and Rural Affairs (DEFRA). United Kingdom.

De Grauwe, P. (2008): DSGE-modelling. When agents are imperfectly informed. European Central Bank Working paper Series No. 897. Department of Treasury and Finance (2013): Economic Evaluation for Business Cases Technical guidelines.

Department for Communities and Local Government (DCLG) (2009): Multi-criteria analysis: a manual.

Department for International Development (DFID) (2007): Results action plan 2008. (*http://webarchive.nationalarchives.gov.uk/, http:/www.dfid.gov.uk/Documents/publications/results-action-plan08.pdf*, January 2016).

Doran, G. T. (1981): There's a S.M.A.R.T. way to write management's goals and objectives. Management Review, Volume 70, Issue 11 (AMA FORUM), pp. 35–36.

Dougherty, C. (2011): Introduction to Econometrics. 4th Edition, Oxford, (*http://www.bazneshaste.com/upload/modules/articles/pdfs/6.pdf*, January 2016).

EC (European Commission (2004): Project Cycle Management Guidelines. Aid Delivery Methods. Volume 1. March 2004.

EC (European Commission) (2009): Part III: Annexes to Impact Assessment Guidelines. January 15th 2009.

EC (European Commission) (2015): Better Regulation Guidelines. Commission Working Document. May 2015.

EC (European Commission) (2015b): Better Regulation Toolbox. Commission Working Document

EC (European Commission), (2013). EVALSED – The resource for the evaluation of Socio-Economic Development: Sourcebook – Method and techniques. (*http://ec.europa.eu/regional_policy/sources/docgener/evaluation/guide/evaluation_sourcebook.pdf*, January 2016).

Europeaid (2006): Evaluation Methods for the European Union's External Assistance. Evaluation Tools. Volume 4. (*http://ec.europa.eu/europeaid/sites/devco/files/evaluation-methods-guidance-vol4_en.pdf*, January 2016).

Europeaid (2013): Evalsed Sourcebook: Method and Techniques. (*http://ec.europa.eu/regional_policy/sources/docgener/evaluation/guide/evaluation_sourcebook.pdf*, January 2016).

European Integration Office (2011): Guide to the Logical Framework Approach – A Key Tool for Project Cycle Management. Second Edition. Government of the Republic of Serbia. Belgrade.

Eurostat (2008): Eurostat Manual of Supply, Use and Input-Output Tables.

Ferretti, J., Guske, A.-L., Jacob, K. & Quitzow, R. (2012): Trade and the Environment – Frameworks and Methods for Impact Assessment. FFU-Report 05_2012, Forschungszentrum für Umweltpolitik, Freie Universität Berlin.

Ferroukhi, R., Lucas, H., Renner, M., Lehr, U., Breitschopf,, B., Lallement, D. & Petrick, C. (2013): Renewable Energy and Jobs. IRENA – International Renewable Energy Agency.

Fiddaman, T. S. (1997): Feedback Complexity in Integrated Climate-Economy Models. Submitted to the Alfred P. Sloan School of Management in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Management at the Massachusetts Institute of Technology.

Figari, F., Paulus, A., Sutherland, H. (2014): Microsimulation and Policy Analysis. ISER Working Paper Series, No. 2014–23, Institute for Social and Economic Research, Essex.

Forrester 1968: Industrial Dynamics – After the First Decade. Management Science, Vol. 14, No. 7, pp. 398–415.

Forrester 2009: Some Basic Concepts in System Dynamics. Sloan School of Management Massachusetts Institute of Technology.

Fraunhofer ISI, Rütter+Partner, EEG (2012): Economic and Industrial Development EID-EMPLOY. Methodological guidelines for estimating the employment impacts of using renewable energies for electricity generation. Study commissioned by IEA's Implementing Agreement on Renewable Energy Technology Deployment.

Garbarino, S. & Hooland, J. (2009): Quantitative and qualitative methods in impact evaluation and measuring results. Issue paper. Governance and Social Development resource Centre.

Gebert, R.; Namala, A. & Kumar, J. (2011): Poverty Impact Assessment Report – Chhattisgarh. PIA Report for EU. June 2011.

GIZ (2015) The GIZ results model. A working aid. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. Eschborn.

Gordon, T. J. (1994) The Delphi Method. The Millennium Project: Futures Research Methodology – V3.0.

Grave, K., Breitschopf, B., Lutz, C., Hazrat, M., Boeve, S., von Blücher, F., Bourgault, C., Bader, N., Friedrichsen, N., Arens, M., Aydemir, A., Pudlik, M., Duscha, M., Ordonez, J., Großmann, A. & Flaute, M. (2015): Electricity Costs of Energy Intensive Industries – An International Comparison. [zitiert als Ecofys, Fraunhofer ISI & GWS (2015)] Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie, Berlin, Karlsruhe, Osnabrück.

Greene, W. H. (2003): Econometric Analysis. Fifth Edition.

Grimm, M: (2005): Educational policies and poverty reduction in Cote d'Ivoire. Journal of Policy Modeling 17 (2005), pp. 231–247.

Großmann, A., Hohmann, F., Khorsohun, O. & Lehr, U. (2011): The Russian Economic-Environmental-Emission model "e3.ru". Developed under the Project "Support to the Development of New Generation Models to estimate and forecast GHG Emissions and Efficiency of Russian Climate Change Mitigation Measures and Policy" (EuropeAid/129527/C/SER/RU).

Habib, B., Narayan, A., Olivieri, S. & Sanches-Paramo (2010): Assessing Ex Ante the Poverty and Distributional Impact of the Global Crisis in a Developing Country. A Micro-simulation Approach with Application to Bangladesh. World Bank Policy Research Working Paper 5238. (*https://openknowledge.worldbank.org/bitstream/handle/10986/3725/WPS5238.pdf?sequence=1*, January 2016).

Hertel, T. (2013): Global Applied General Equilibrium Analysis using the Global Trade Analysis Project Framework. In: Handbook of CGE Modeling. Vol. 1. (http://dx.doi.org/10.1016/B978-0-444-59568-3.00012-2, January 2016).

Holub, H.-W. & Schnabl, H. (1985): Input-Output-Rechnung: Input-Output-Tabellen. 2nd edition, R. Oldenbourg Verlag, München, Wien.

Holub, H.-W. & Schnabl, H. (1994): Input-Output-Rechnung: Input-Output-Analyse. R. Oldenbourg Verlag, München, Wien.

IDB (Inter-American Development Bank) (s.a.a.): Understanding a Computable General Equilibrium Model. (*http://www.iadb.org/en/topics/trade/understanding-a-computable-general-equilibrium-model,1283.html*, January 2016).

IDB (Inter-American Development Bank) (s.a.b.): Frequently Asked Questions (FAQs). (*http://www.iadb.org/en/topics/trade/frequently-asked-questions-faqs,1284.html*, January 2016).

ILO (2011): Assessing green jobs potential in developing countries: A practitioner's guide. Geneva.

IRENA (2014): The Socio-economic Benefits of Solar and Wind Energy.

Jacob, K., Hertin, J., Bartolomeo, M., Vokery, A., Cirillo, M. & Wilkinson, D. (2004): Ex-ante sustainability appraisal of national-level policies: A comparative study of assessment practice in seven countries. Paper presented at the 2004 Berlin Conference "Greening of Policies? Interlinkages and Policy Integration".

Jacob, K., Weiland, S., Ferretti, J., Wascher, D. & Chodorowska, D. (2011): Integrating the environment in regulatory impact assessment. OECD April 2011. GOV/RPC(2011)8/FINAL.

Kim, K., Kratena, K. & Hewings, G. J. D. (2014): The extended econometric input-output model with heterogeneous household demand system. Economic System Research Vol. 27, Issue 2.

Kirkpatrick, C., Parker, D. & Zhang, Y.-F. (2004): Regulatory Impact Assessment in Developing and Transition Economies: a Survey of Current Practice. Centre on Regulation and Competition. Institute for Development Policy and Management, University of Manchester. Working Paper Series No. 83, June 2004.

Kirkwood, C. W. (1998): System Dynamics Methods. A quick introduction. Arizona State University.

Kumhof, M., Lebarz, C., Rancière, R., Richter, A. W. & Throckmorton, N. A. (2012): Income Inequality and Current Account Imbalances. IMF Working Paper WP/12/18. International Monetary Fund, January 2012.

Lamnek, S. (2005): Qualitative Sozialforschung. Lehrbuch. Weinheim, Beltz.

Lawrence, M., Goodwin, P., O'Connor, M. & Önkal, D. (2006): Judgmental Forecasting: A review of progress over the last 25 years. International Journal of Forecasting Vol. 22 Issue 3, pp. 493–518.

Le Anh, M. (2006): Macroeconomic Policy Analysis of Vietnam – A Macro-Econometric Model Approach. Nagoya University Graduate School of International Development. (*http://www.grips.ac.jp/vietnam/VDFTokyo/Doc/2ndConf15Jul06/1EcoSession1LAMinh2.pdf*, January 2016)

Lehr, U., Lutz, C., Edler, D., O'Sullivan, M., Nienhaus, K., Nitsch, J., Breitschopf, B., Bickel, P. & Ottmüller, M. (2011): Kurz- und langfristige Auswirkungen des Ausbaus der erneuerbaren Energien auf den deutschen Arbeitsmarkt. Study commissioned by the German Federal Ministry for the Environment, Nature Protection and Nuclear Safety, Osnabrück, Stuttgart, Berlin, Februar 2011.

Lehr, U., Lutz, C. & Ulrich, P. (2014): Economic Evaluation of Climate Protection Measures in Germany. International Journal of Energy Economics and Policy, 4(4), pp. 693–705.

Lehr, U., Mönnig, A., Missaoui, R & Marrouki, S. (2012): Renewable energy and energy efficiency in Tunisia – employment, qualification and economic effects. Published by GIZ, Eschborn, December 2012. (*https://www.giz.de/fachexpertise/downloads/giz2012-en-employment-renewable-energy-tunisia.pdf*, January 2016).

Lutz, C., Lindenberger, D., Schlesinger, M., Großmann, A., Lehr, U., Knaut, A., Malischek, R., Paulus, S., Tode, C., Wagner, J., Kemmler, A., Ley, A., Piégsa, A., Straßburg, S. & Koziel, S. (2014): Gesamtwirtschaftliche Effekte der Energiewende. [zitiert als GWS, EWI & Prognos (2014)] Studie im Auftrag des Bundesministeriums für Wirtschaft und Energie, Osnabrück, Köln, Basel.

Li, J. (2013): A survey of dynamic microsimulation models: uses, model structure and methodology. International Journal of Microsimulation 6 (2), pp. 3–55.

LIAISE (2014): Regulatory Impact Assessment: A survey of selected developing and emerging economies. Linking Impact Assessment Instruments to Sustainability Expertis (LIAISE). Report for the European Commission.

Lofgren, H., Cicowiez, M. & Diaz-Bonilla, C. (2013): MAMS – A Computable General Equilibrium Model for Developing Country Strategy Analysis. In: Handbook of Computable General Equilibrium Modeling. Edited by Dixon, P. B. & Jorgenson, D. W.

Lutz, C., Flaute, M., Lehr, U. & Wiebe, K. S. (2015): Economic Impacts of Renewable Power Generation Technologies and the Role of Endogenous Technological Change. Open Journal of Applied Sciences, 5, pp. 696–704. DOI: 10.4236/ojapps.2015.511069.

Maier, T., Mönnig, A. & Zika, G. (2015): Labour demand in Germany by Industrial Sector, Occupational Field and Qualification Until 2025. In: Economic Systems Research. Volume 27, Number 1, March 2015.

Mayring, P. (2003): Qualitative Inhaltsanalyse. Grundlagen und Techniken. Weinheim, Beltz.

Meyer, I. & Sommer, M. W. (2014): Employment effects of Renewable Energy Supply. A Meta Analysis. Policy Paper No. 12. (*http://www.foreurope.eu/fileadmin/documents/pdf/PolicyPapers/WWWforEurope_Policy_Paper_012.pdf*, January 2016).

Millennium Institute (s.a.a.) Threshold 21 Model. (*http://www.millennium-institute.org/integrated_planning/tools/T21/*, January 2016).

Millennium Institute (s.a.b.) A General Introduction to Threshold 21. Integrated Development Model. (*http://www.millennium-institute.org/resources/elibrary/papers/T21brief_general.pdf*, January 2016).

Miller, R. & Blair, P. (1985): Input-Output Analysis: Foundations and Extentions, Prentice-Hall, Inc, New Jersey.

Nicholson 2007: Review of methods for modelling systems evolution. International Livestock Research Institute, Discussion Paper No. 3.

OECD (2008): Building an Institutional Framework for Regulatory Impact Analysis (RIA) guidance for Policy Makers. Version 1.1, OECD Regulatory Policy Division Directorate for Public Governance and Territorial Development, Paris.

OECD (2008b): Introductory Handbook for Undertaking Regulatory Impact Analysis (RIA). Version 1.0, October 2008.

OECD (2007): Promoting Pro-Poor Growth – A Practical Guide to Ex-Ante Poverty Impact Assessment.

Okoli, C. & Pawlowski, S. (2004): The Delphi Method as a Research Tool: An Example, Design Considerations and Applications. Information and Management, Vol. 42, Issue 1, pp. 15–29.

Orcutt, G. H. (1957): A new type of socio-economic system. Review of Economics and Statistics 39 (2), pp. 116–123.

Pedamallu, C. H., Ozdamar, L., Ganesh, L. S., Weber, G.-W. & Kropat, E. (2010): A System Dynamics Model for Improving Primary Education Enrollment in a Developing Country. Ipswich, Istanbul, Chennai, Ankara, Neubiberg.

Peichl, A. (2009): The benefits and problems of linking micro and macro models – evidence from a flat tax analysis. SOEPpapers on Multidisciplinary Panel Data Research 183, Berlin.

Philip, R., Anton, B., Bonjean, M., Bromley, J., Cox, D., Smits, S., Sullivan, C.A., Van Niekerk, K., Chonguica, E., Monggae, F., Nygwambo, L., Pule, R. & Berraondo Lopez, M. (2008): Local Government and Integrated Water Resources Management (IWRM) Part III: Engaging in IWRM – Practical Steps and Tools for Local Governments. ICLEI – Local Governments for Sustainability, Africa Secretariat. Durban, South Africa.

Pindyck. R. S. & Rubinfeld, D. L. (1997): Econometric Models and Economic Forecasts. 4th Edition.

PNUMA (2015). Hacia una economía verde en Uruguay: Condiciones favorables y oportunidades.

Prognos (2008): Der monetäre Teil der Gesetzesfolgenabschätzung: internationale Ansätze im Vergleich. ID4-020815-12/08, Studie im Auftrag des Bundesministerium für Wirtschaft und Technologie, Basel.

Robb, C. M. (2003): Poverty and Social Impact Analysis – Linking Macroeconomic Policies to Poverty Outcomes: Summary of Early Experiences. International Monetary Fund (IMF), WP/03/43.

Robinson, S., Yúnez-Naude, A. Hinojosa-Ojeda, R., Lewis, F. D. & Devarajan, S. (1999): From stylized to applied models: Building multisector CGE models for policy analysis. North American journal of Economics and Finance 10 (1999), pp. 5–38.

Roson, R. (2006): Introduction Imperfect Competition in CGE Models: Technical Aspects and Implications. Fondazione Eni Enrico Mattei. Climate Change Modelling and Policy, Milano.

Schleich, J., Nathani, C., Meyer, B. & Lutz, C. (2006): Endogenous technological change and CO_2-Emissions: The case of energy-intensive industries in Germany. ISI-Schriftenreihe Innovationspotenziale.

Sen, H. (1996): Social Accounting Matrix (SAM) and its Implications for Macroeconomic planning. Unpublished Assessed Article, Bradford University.

Soy, S. (1997): The Case Study as a Research Method. Unpublished paper, University of Texas at Austin. (*https://www.ischool.utexas.edu/~ssoy/usesusers/l391d1b.htm*, January 2016).

Sutcliffe, S. & Court, J. (2005): Evidence-based policy making: What is it? How does it work? What relevance for developing countries? Overseas Development Institute (ODI), November 2005.

Sutcliffe, S. & Court, J. (2006): Toolkit for Progressive Policymakers in Developing Countries. Overseas Development Institute, London.

Uganda's Ministry of Finance, Planning and Economic Development (2014): Poverty Status Report 2014. Structural Change and Poverty Reduction in Uganda.

UNDP (2009): Capacity Development: A UNDP Primer. United Nations Development programme, New York.

UNEP 2011: Modelling global green investment scenarios supporting the transition to a global green economy.

UNEP 2014: Using Models for Green Economy Policymaking.

UNFCCC (2005): Compendium on methods and tools to evaluate impacts of, and vulnerability and adaptation to, climate change. Final Draft Report.

UNICEF (2008): Bridging the gap. The role of monitoring and evaluation in evidence-based policy making. Evaluation Working Papers Issue #12.

UNIDO (s.a.): Delphi method.

UNU-WIDER (2012): The Small and Medium Enterprise Survey in Vietnam. United Nations University-World Institute for Development Economics Research.

West, G. R. (1995): Comparison Input-Output, Input-Output + Econometric and Computable General Equilibrium Impact Models at the Regional Level. Economic System Research, Vol. 7, No. 2, pp. 209–227.

Wolters, M. (2013): Möglichkeiten und Grenzen von makroökonomischen Modellen zur (exante) Evaluierung wirtschaftspolitischer Maßnahmen. Report für den Sachverständigenrat zur Begutachtung der gesamtwirtschaftlichen Entwicklung. (*http://www.sachverstaendigenrat-wirtschaft.de/fileadmin/dateiablage/download/publikationen/arbeitspapier_05_2013.pdf*, January 2016).

World Bank (2003): A User's Guide to Poverty and Social Impact Analysis. The World Bank, Washington.

World Bank (2004): Monitoring and Evaluation: Some tools, methods and approaches.

World Bank (2010): Cost-Benefit Analysis in World Bank Projects. Washington D. C.

World Bank (2012): Poverty and Social Impact Analysis (PSIA) – Enhancing in-country Partnerships in Poverty and Social Impact Analysis (PSIA). Social Development Department, December 2012.

Yin, R. K. (2003): Case study research: Design and methods (3rd ed.). Thousand Oaks, CA: Sage.

Yousuf, M. I. (2007): The Delphi Technique. Essays in Education, Vol. 20, pp. 80–89.

Zainal, Z. (2007): Case study as a research method. Journal Kemanusiaan (The Asian Journal of Humanities), pp. 1–6.

Zhang, X. (2015): Incorporating household survey data into a CGE model. Paper presented at the 18th Annual Conference on Global Economic Analysis, Melbourne, June 17th –19th, 2015.

Zhang, Y.-F. (2009): Towards better regulatory governance? Regulatory reform in selected developing countries over the period 2003–2007. Institute for Development Policy and Management, University of Manchester, January 2009.

ANNEX I

Table 4: Overview Software and Modelling System

Name	Application	Costs
Matlab	Software environment and programming language. Allows matrix calculation, plotting of functions and data, implementation of algorithms, creation of user interfaces and connecting with programs written in other languages (e.g. C, C++, Java, Fortran and Python).	Approx. 2,000€ for one individual licence
Eviews	A statistical package for Windows. Can be used for general statistical analysis and econometric analyses such as cross-section and panel data analysis and time series estimation and forecasting.	Approx. 1,365€ for one individual licence
Excel	Microsoft-Office-Suite used for spreadsheet analysis. Pivot tables, diagrams and functions can be applied. Its usage can be extended by applying the integrated programming language Visual Basic for Applicaton (VBA).	Approx. 100€ for one individual licence
RATS	Software package for analysing econometrics, time series and cross sectional data, developing and estimating econometric models, forecasting, etc.	Approx. 500€ for standard version
R	Free software environment for statistical computing (linear and nonlinear modelling, classical statistical tests, time-series analysis,...) and graphics.	Freeware
g7	Econometric regression and model-building programme for Windows. It is designed for estimation of regression equations with annual, quarterly or monthly data.	Freeware
Stata	Complete, integrated statistical software package that provides tools for data analysis, data management and graphics.	Approx. 1,000€ but varies with conditions
GAMS	GAMS (General Algebraic Modeling System) is a modeling system for mathematical programming. GAMS is tailored for complex, large scale models.	Approx. 3,200$ for single user license (GAMS Base Module)
GEMPACK	RunGTAP is the software interface used by GTAP (Global Trade Analysis Project) and is run with GEMPACK. GTAP is a global network that uses a uniform database and software surrounding mainly for performing quantitative impact assessment. GTAP is based on CGE type of models.	GEMPACK licence required
STATISTICA	STATISTICA is a software package offered by StatSoft company. The software can be applied for statistical and graphical data analysis in all areas (data, statistics, predictive analytics, big data).	1,035.30€ for basic version
DYNARE	It is a software platform for handling a range of economic models, in particular DSGE models. The software runs either on Matlab or Octave.	Freeware
Octave	Software for solving mathematical problems (matrix calculation, differential functions, integration etc.). Octave is an open-source clone of Matlab.	Freeware
PovStat	Excel-based software program that uses country-specific household survey data and a set of user-supplied projection parameters of countries. PovStat was prerpared by the World Bank to analyse poverty and distributional effects.	Freeware
DAD	DAD is a software designed to facilitate the analysis of social welfare, inequality and poverty.	Freeware
IMPLAN	IMPLAN (IMpact analysis for PLANning) uses input-output analysis in combination with SAM and model multipliers. Its database consists of federal economic statistics.	Approx. 2,000-4,000$ for IMPLAN-Online

There are some rationales for using licensed software: a critical success factor for open source software is the number of developers involved in the project. Projects with only a few active developers quite often disappear without notice and/or freeware is not updated on a regular basis. Licensed software, by contrast, guarantees tested, established and often well-known techniques. But there may also be arguments against using licensed software: First of all, it is a question of money. Some software or programmes are rather expensive. In case of tight financial resources, these are serious obstacles. But even if financial resources allow the purchase of licenced software, the conditions for using the software have to be considered. In some cases, updates have to be purchased regularly or the software allows only restricted usage of functions.

Table 5: Types of Case Studies

Explanatory	Seeks to answer a question or explain the presumed causal links in real life interventions that are too complex for the survey or experimental strategies.
Exploratory	Explores situations in which the intervention being evaluated has no clear, single set of outcomes.
Descriptive	Describes an intervention or phenomenon and the real life context in which it occurred.
Multiple-case Study	Explores differences within and between cases. The goal is to replicate findings across cases. Cases are chosen carefully so that the researcher can predict similar results across cases.
Intrinsic	The intent is to better understand the case. It is not undertaken primarily because the case represents other cases or because it illustrates a particular trait or problem, but because in all its particularity and ordinariness, the case itself is of interest.
Instrumental	Provides insight into an issue or helps to refine a theory. The case is of secondary interest; it plays a supportive role.

Source: Baxter & Jack 2008: 547 ff.

Table 6: Key Steps for conducting MCA

Applying MCA: Detailed Steps
1. Establish the decision context. 1.1 Establish aims of the MCA, and identify decision makers and other key players. 1.2 Design the socio-technical system for conducting the MCA. 1.3 Consider the context of the appraisal
2. Identify the options to be appraised.
3. Identify objectives and criteria. 3.1 Identify criteria for assessing the consequences of each option. 3.2 Organise the criteria by clustering them under high-level and lower-level objectives in a hierarchy.
4. 'Scoring'. Assess the expected performance of each option against the criteria. Then assess the value associated with the consequences of each option for each criteria. 4.1 Describe the consequences of the options. 4.2 Score the options on the criteria. 4.3 Check the consistency of the scores on each criterion.
5. 'Weighting'. Assign weights for each of the criteria to reflect their relative importance to the decision.
6. Combine the weights and scores for each option to derive an overall value. 6.1 Calculate overall weighted scores at each level in the hierarchy. 6.2 Calculate overall weighted scores.
7. Examine the results.
8. Sensitivity analysis. 8.1 Conduct a sensitivity analysis: do other preferences or weights affect the overall ordering of the options? 8.2 Look at the advantage and disadvantages of selected options, and compare pairs of options. 8.3 Create possible new options that might be better than those originally considered. 8.4 Repeat the above steps until a 'requisite' model is obtained.

Source: DCLG 2009: 50

Table 7: Summary of Qualitative Methods

	Description	Application	Outcome	Localisation	Requirements	Advantages	Disadvantages	Link to other Methods	Time required
Checklist (CL)	Systematic method for organising processes or rating impacts	Structured processes – pre-thinking through projects	Textual list to work through	Planning phase; (execution phase)	Low; logical, process-oriented thinking	Standardised form; quick and easy use	Cannot control complex processes	Complimantory to all	Up to three months
Logical Framework Approach (LFA)	Goal-oriented project planning; identification of result chains	"Aid to thinking"; support for creating operational plans	Logical framework matrix	Planning phase	Low; logical, process-oriented thinking	Structured planning process that includes inter-dependencies	Behavioural changes, real-life complexity not considered	Input for qualitative methods used in execution/evaluation phase (CS, MCA, RCA, IW, DM, S)	Up to three months
Case Studies (CS)	In-depth analysis of a single situation (=case)	Provide background information; formulate first hypothesis	Report	Planning; execution and evaluation phase	Time-consuming; research-intensive	Combines quantitative data with qualitative information; real-life complexity	Generalisation not possible	Input for quantitative methods and qualitative methods used in execution phase (MCA, RCA, DM, S)	Up to one year
Result Chain Analysis (RCA)	Preliminary impact analysis	Linkages between policy measures and impacts; formulate first hypothesis	Cause-effect relationship	Execution phase	Low; desk-research; workshops with stakeholder involvement	Creates explicit assumptions and hypothesis	Behavioural changes, real-life complexity not considered	Input for quantitative methods and qualitative methods used in execution phase (CS, MCA, DM, S)	Up to three months
Multi-Criteria Analysis (MCA)	Decision tool for disclosing preferences between policies	Useful if time and budget are limited or monetary values are missing	Performance matrix	Execution and evaluation phase	Low; time-consuming when stakeholders are involved	Explicit, open and simple approach to comprise complex situations	Subjective; behavioural changes, real-life complexity not considered	Replace single-criterion, quantitative methods (e.g. CBA) if monitary values do not exist	Up to six months
Interviews (IW)	Information collection tool using face-to-face interview techniques	For evaluation or data collection purposes; formulate first hypothesis	Cause-effect relationship; opinions, percpetions, perspectives are collected	Planning and evaluation phase	Low; requirements on interviewer increase with complexity	Quick and easy; helps to understand stakeholders perceptions	Number of interviews limited; costs rise with number of interviews; subjective	Input for quantitative methods and qualitative methods used in execution phase (CS, MCA, RCA, DM, S)	Ranging from one to six months
Delphi Method (DM)	Structured and anonymous survey	Quantitative guess of probable impacts; formulate first hypothesis	Quantitative and/or qualitative opinions of experts	Planning; execution and evaluation phase	Low; time-consuming; research-intensive	Structured and anonymous; objective	Time-consuming; results depend on experts' input	Input for quantitative methods and qualitative methods used in execution phase (CS, MCA, RCA, S)	Up to six months
Surveys (S)	Information collection tool using questionnaires	Questioning large number of people; collecting quantitative data; collecting opinion	Quantitative and/or qualitative opinions of large number of persons	Planning; execution and evaluation phase	High; time-consuming; research-intensive; requirements on interviewer	Data collection; identification of changes, opinions of large number of people	Time-consuming; large number of staff; reporting errors; not compatible with other data sources	Input for quantitative methods	Up to one year

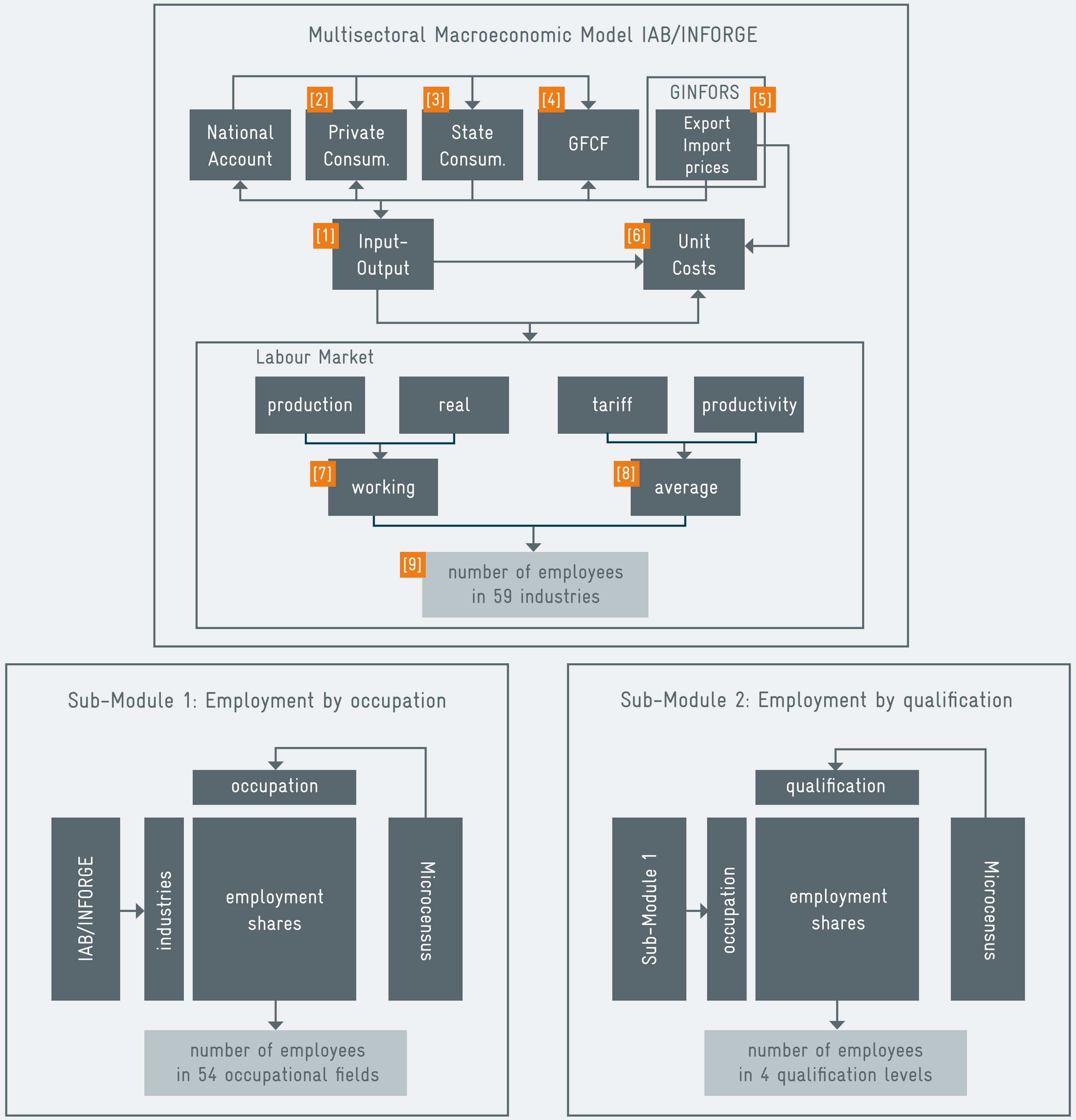
Table 8: Summary of Quantitative Methods

	Description	Application	Outcome	Localisation	Requirements	Advantages	Disadvantages	Link to other Methods	Time required
Econometric Models	Describe observed past behaviour by analysing time series	Forecasting Results of single estimations can be used in econometric models that relate variables according to an economic theory	Possible future developments	Execution phase, Evaluation process	Data: time series Software: regression programmes e. g. Eviews, RATS Skills: econometrics Manpower: medium to high	Historical data gives better understanding of impacts of past developments Explains causes and effects of certain developments	Relies on data Based on the assumptions that future developments are the same as observed in the past	CGE, DSGE, IO, micro and macro models, SD	Ranging from six months to one year
CGE Models	Quantify relations between economic agents and their behaviour Description of economic agents and their optimising behaviour Structural information on industrial level	Long-term forecasting, Impact analysis	Simulation results show potential impacts on total economy and on industries	Execution phase, Evaluation process	Data: e. g. GTAP, meso data Software: e. g. GAMS, MATLAB Skills: economic theory, (econometrics) Manpower: medium to high	Comprehensive economic model Theoretically consistent approach	Time consuming Complex modelling Expensive Expert knowledge required Results rely on many assumptions and parameters Representative households, firms	Micro-macro models, SAM, IO, (econometric analysis)	Up to one year
DSGE Models	Description of economic agents and their optimising behaviour	Impact analysis Short- to medium-term analysis Business cycle analysis	Impact of policy measures on behaviour of agents Short-term projections	Execution phase, Evaluation process	Data: macro data Software: econometrics Skills: econometrics Manpower: high	Focus on preferences of economic agents Show path dependencies	Rely on many assumptions (representative households, firms; rational expectations of agents)	CGE, econometric analysis	Ranging from six months to one year
IO Models	Show links between industries and economic agents (government, households etc.) Economic structure	Estimation of economy-wide direct, indirect and induced effects Impact analysis	Cause and effect relations Production, employment effects of policy measures/ activities on industry level	Execution phase, Evaluation process	Data: IO table Software: e. g. Excel, IMPLAN, Interdyme/G7, MATLAB Skills: IO analysis Manpower: medium to high	Industry structure and relations clearly described	Constant ratio of output to inputs, no substitution process Risk of double counting (gross effects)	SAM, surveys, CGE, econometric models, CBA	Ranging from six months to one year
Micro Models	Show different characteristics of households	Forecasting Impact analysis Study impacts of tax or labour market reforms on distribution Poverty analysis	Distributional impacts of policy measures	Execution phase, Evaluation process	Data: micro data, surveys Software: e. g. STATA, PovStat, DAD Skills: technical expertise to work with large survey datasets Manpower: medium to high	High degree of detail No representative household	Large amount of data Partial model Neglecting possible indirect and induced impacts	Macro models, surveys, econometric analysis, PSIA	Ranging from a few months to one year
Micro-Macro Models	Combination of micro, meso and macro models	Forecasting, Impact analysis Policies with impact at micro, meso and macro level	Direct, indirect and induced effects	Execution phase, Evaluation process	Data: micro, meso, macro data Software: see micro and macro models Skills: high Manpower: high	Instead of e. g. representative households heterogenous household sector Comprehensive economic model	Time consuming Complex modelling Expensive Expert knowledge required Large amount of data	Micro models, macro models, surveys, econometric analysis, PSIA	Up to one year
SD Models	Dynamic model Focus on system's feedback loops	Forecasting Impact analysis Poverty analysis, environmental reforms, education Analysing complex and dynamic systems	Support decision makers in understanding the structure and dynamics of a system	Execution phase, Evaluation process	Data: micro, meso, macro data Software: e. g. T21 and others http://tools.systemdynamics.org Skills: medium to high Manpower: medium to high	Cause and effect relations	High degree of complexity due to many feedback linkages	econometric analysis	Up to one year
Cost-Benefit-Analysis	Systematic approach to estimate costs and benefits	Decision tool Ex-ante evaluation	Evaluation of alternative projects	Execution phase, Evaluation process	Data: related to projects to be evaluated Software: spreadsheet software e. g. Excel Skills: low to medium Manpower: low to medium	Structured approach Comparison of costs and benefits	Results might be inaccurate if some costs and/or benefits are overlooked Monetarisation of costs and/or benefits sometimes difficult	CGE, IO, micro and macro models	Ranging from three to six months

Table 9: Model Overview

Model types	Statistical properties		Customisation								Areas												Time span of forecast	Rating	
			Resources		Data			Time			Economic						Environment				Social				
	Assumption	Economic foundation	Technical	Human	Type of data	Source of data	Availability and quality of data	Development	Maintenance	Training	Economic policy	Private sector development	Trade	Fiscal reform	Monetary policy	Labour market	Environmental finance	Environmental-economic accounting	Green economy	Low-emission development	Poverty	Ageing		Strength	Weakness
QUANTITATIVE MODELS																									
IO	"- limitational production function (fixed input structure)	- static or dynamic - demand side driven - macroeconomy - shows industry structure and monetary flows between industries and economic agents	e. g. Excel, IM-PLAN	medium to high	IO tables	Official	usually not published every year	medium to high	medium to high	medium to high	x	x	x	x	x	x	x	x	x	x			- medium to long - yearly Sequence	- easy to use - cause and effect relations - expandable by e. g. environmental and social aspects - impact analysis	- highly dependent on reliable primary data
Econometric Models	- past reactions are also effective in future	- empirical foundation (described observed past behaviour by analysis time series) - micro, meso and macro analysis	e. g. Eviews, RATS, g7	medium to high	time series data	Official	yearly, quarterly or monthly	medium to high	medium to high	medium to high	x	x	x	x	x	x	x	x	x	x	x	x	- short- to long-term - quarterly, monthly, yearly sequence	- Using past development for future approximation - especially good for short term forecasts"	- highly dependent on reliable data - labour and time intensive
CGE	- Rational expectation, full information - representative households, firms	- Classical-neoclassical theory; microfounded - Cobb Douglas production function (substitution between input factors possible) - macro economy and industries	e. g. GAMS, MAT-LAB	medium to high	meso data	Official	usually yearly	medium to high	medium to high	medium to high	x	x	x	x		x	x	x	x	x			- medium to long term - yearly sequence	- theoretically consistent approach - impact analysis - forecasting	- complex modelling - results rely on many assumptions
DSGE	- Rational expectation, full information - representative households, firms	- Optimising behaviour of agents - neoclassic or New Keynesian theory; microfounded - empirical foundation; stochastic	e. g. Eviews	high	macro data	Official	yearly, quarterly, monthly	high	high	high	x	x	x	x	x	x	x	x	x	x			- short- to medium-term - yearly, quarterly, monthly sequence	- Show path dependencies - impact analysis, forecasting	- complex modelling - results rely on many assumptions
Micro Models	- Partial models - heterogenity of economic agents	- empirical foundation - microfoundation	e. g. STATA, PovStat, DAD	medium to high	surveys	Official	not regularly published	medium to high	medium to high	medium to high		x		x		x					x	x		- impact analysis - distributional effects - very detailed	- partial analysis - indirect or induced effects not modelled - no forecasting model
System Dynamic	- dynamic model	- focus on system's feedback loops	e. g. T21	medium to high	macro, meso, micro data	Official	usually yearly	medium to high	medium to high	medium to high	x		x	x	x	x	x		x	x	x		medium- to long-term	- forecasting - impact analysis - cause and effects	- high degree of complexity due to many feedback linkages
Micro-Macro Model	- combination of micro, meso and macro models: no representative economic agents; no partial model	- empirical foundation - combining micro and macroeconomics	e. g. GAMS, MAT-LAB, STATA	high	micro, meso, macro	official	usually yearly	high	high	high	x	x	x	x	x	x	x	x	x	x	x	x	short- to long-term	- combining stength of micro models with macro models - forecasting and IA	- complex modelling - time and labour intensive
CBA	- discounting rate		e. g. Excel	low to medium	project data	project data	usually yearly	low to medium	low	low	x		x	x			x		x	x			short- to medium-term	- systematic approach - comparison of costs and benefits	- monetarisation of intangible goods

Figure 20: Modularisation Example: Employment by Qualification



Source: Maier et al. 2015: 23

ANNEX II: OTHER QUALITATIVE METHODS

CHECKLIST

Checklists (CL) are a simple but systematic method for organising a process and/or for skimming through likely effects of a proposed measure or policy (Ferretti 2012: 51).

Creating such a checklist can be of help to point out tasks which need a more detailed assessment. Four types of checklists can be distinguished:

Figure 21: Types of Checklists

Simple Checklist	Descriptive Checklist	Questionnaire Checklist	Weighting Checklist
• Specify aspects to be considered in the course of the analysis • Guide for carrying out analysis	• Extension of simple checklist • Provides additional information for each aspect	• Consists of questions to bring out potentially important issues • Starts with general questions and becomes more detailed later on	• E.g. usage of numeric scales, criteria, threshold values etc. • Additionally includes simple devices for assessing significance os aspects

Source: Ferretti et al. 2012: 51 ff.

Fields of application

A checklist can help to identify what kind of analysis/evidence is still needed and which expertise is required to complete the task. A checklist is most useful if it is applied within a specific context or area.

Results/outcome

The result of a checklist approach is a pre-structured IA process.

Position in the IA

The checklist is located in the planning process of an IA and also in the execution process when sophisticated checklist types (weighting checklists) are used for impact analysis.

Requirements (obligatory and optional)

Requirements in general are low. The challenging part is to think through the single procedural steps beforehand. This requires logical and process-oriented thinking. Experience in project and process management is helpful. In case of more sophisticated checklist approaches, e. g. the questionnaire checklist, detailed knowledge about the content of the IA is needed.

Time requirements: low (up to three months)

Stakeholder involvement: low; tool mainly for project management

Advantages and limitations

The advantage lies in its standardised procedure. Once developed, it requires only limited effort and time, and can be used quickly and easily.
For more complex or ad-hoc IA, the checklist method may be of limited use (Ferretti 2012).

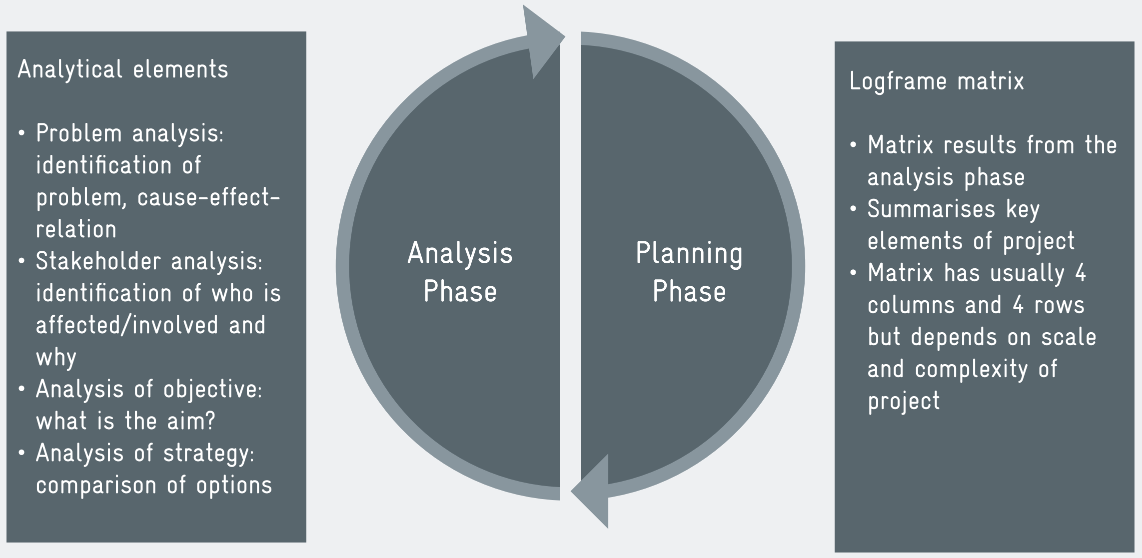
References

- Ferretti et al. (2012) provide an overview of existing approaches and methods used for ex-ante IA. Canter (1999) describes the simple checklist approach and provides a simple questionnaire checklist as example.

LOGICAL FRAMEWORK APPROACH

The Logical Framework Approach (LFA) is a systematic, analytical planning process for goal-oriented project planning and it should be thought of as an "aid to thinking". It helps to create a systematic and structured approach, so that no important aspects are forgotten and weaknesses are identified (European Integration Office 2011). It aims at identifying interdependences in the subsequent result chain: input, process, output, outcome and impact (World Bank 2004: 8).[15] An LFA consists of two phases used in project identification and formulation:

Figure 22: Two Phases of LFA



Source: European Integration Office 2011 – own illustration

Fields of application

An LFA can be applied for increasing the ***efficiency*** and ***effectiveness*** of a project's design. All planned activities are condensed within one overview (logical framework matrix) which provides support for creating operational plans.

Results/outcome

The outcome of an LFA is the logical framework matrix (logframe matrix). The matrix summarises the examined project and breaks it down to single activity levels (European Integration Office 2011: 28). An example of a logframe matrix is given in Table 10.

The logical framework matrix should be read bottom up (as indicated by the orange arrows in Table 10). Each row contains assumptions which need to be met in order to reach the next level. The lowest row represents activities/actions which need to be taken, and, assuming that the assumptions apply, the outputs will be accomplished.

Position in the IA process

The LFA is located in the planning process of an IA.

[15] *The GIZ results model (GIZ 2015) closely relates to the LFA. The logframe matrix and the results matrix are interchangeable. The difference is that the GIZ results model also tries to disclose impacts outside the specific sphere of responsibility.*

Table 10:Logical Framework Matrix – Logframe Matrix

Project Description		Objectively verifiable indicators of achievement	Sources and means of verification	Assumptions
Goal	What is the overall broader impact to which the action will contribute?	What are the key indicators related to the overall goal?	What are the sources of information for these indicators?	What are the external factors necessary to sustain objectives in the long term?
Purpose	What is the immediate development outcome at the end of the project?	Which indicators clearly show that the objective of the action has been achieved?	What are the sources of information that exist or can be collected? What are the methods required to get this information?	Which factors and conditions are necessary to achieve that objective? (external conditions)
Outputs	What are the specifically deliverable results envisaged to achieve the specific objectives?	What are the indicators to measure whether and to what extent the action achieves the expected results?	What are the sources of information for these indicators?	What external conditions must be met to obtain the expected results on schedule?
Activities	What are the key activities to be carried out and in what sequence in order to produce the expected results?	What are the means required to implement these activities, e.g. personnel, equipment, supplies, etc.	What are the sources of information about action progress? What are the action costs?	What preconditions are required before the action starts?

...this could be acchieved

and this holds true...

If this occurs...

Source: Adapted from AUSAID 2005: 3 and 18

Requirements (obligatory and optional)

The requirements are in general low. The challenge is to think through single procedural steps. That requires logical and process-oriented thinking. Experiences in project and process management are helpful.

Time requirements: low (up to three months)

Stakeholder involvement: low; tool mainly for project management

Advantages and limitations

The advantage is an improved planning by asking fundamental questions and extracting the most relevant information. An LFA guides through inter-related key elements of an IA (European Integration Office 2011: 11). The standardised procedure allows for gathering and assessing information in a structured and logical framework.

However, there is a constant need for updating key elements of the IA during the implementation phase. It does not show any changing conditions or factors outside the framework (World Bank 2004).

Examples

Engaging in Integrated Water Resources Management (IWRM)
In Philip et al. (2008) a LFA is described using the example of water resources. For the rows of the logframe matrix that is: • Goal: to reduce the risk of flood • Purpose: local flooding is reduced through the development of sustainable urban drainage systems • Output: an upgraded flood warning system • Activities: the construction of wetlands For the rows of the logframe matrix that is • Indicators of achievement: frequency, duration and extent of flooding • Means of verification: evaluation surveys with relevant stakeholders • Assumptions: estimates of future agricultural water flooding are accurate *Source: Philip et al. 2008*

References

- European Integration Office (2011) provides a guide on how and when to apply the logical framework approach and how it is connected to project cycle management.
- The World Bank (2004) introduces some monitoring and evaluation tools.
- AUSAID (2005) presents a guide on how to apply the logical framework approach.
- The EC (2004) describes the logical framework approach.
- Philip et al. (2008) introduce practical steps and tools for local governments for engaging in integrated water resource management.
- Working aid to the GIZ Results Model by GIZ (2015).

INTERVIEWS

The interview is an information collection tool, usually applied face-to-face between an interviewer and a *stakeholder* (see section 2.2.4 for types of stakeholders). Three types of interviews can be distinguished (Table 11).

Fields of application

An interview is applied either for evaluation purposes or for collecting any kind of information in order to verify statements, collect opinions or perspectives, collect and learn about reactions to developed hypotheses and conclusions or to identify criteria, options, problems etc.

Table 11:Types of Interviews

Unstructured	Semi-structured	Structured
• No prearranged questions • Unplanned topics can be discussed • Helpful at the beginning of evaluation • Gives overview • Identifies major topics	• Using interview guideline • Most frequently used • Requires sufficient knowledge of the interviewee	• Strict interview guidelines • Answers tend to be short • Useful if a large number of interviews must be carried out

Source: Europeaid 2006: 48

Results/outcome

The result of an interview is the provision of (background) information to be used for the ongoing project. Cause-and-effect relationships may be disclosed. Opinions, perceptions and perspectives are collected.

Position in the IA process
Interviews can be positioned throughout the whole IA process. They may be most relevant in the planning and evaluation phase.

Requirements (obligatory and optional)

Requirements are in general low. The requirements on the interviewer increase with the complexity of the questionnaire (knowledge about addressed topic, interview skills, responsiveness and interaction). The duration of the interview phase depends on the number and availability of persons to be interviewed.

Time requirements: short to medium (ranging from one to six months)

Stakeholder involvement: medium to high depending on number of interviews held.

Advantages and limitations

Interviews can be performed quickly and easily. It is a tool to meet a number of selected respondents and to understand *stakeholder*'s perception of the project.

Only a limited number of people can be interviewed at reasonable costs. For further usage, the information given by the interviewee should be double-checked and methods have to be applied to generate unbiased results. In most cases, the interview tool is combined with other qualitative or quantitative methods.

References

- Europeaid (2006) summarises and gives a basic introduction to selected evaluation methods.
- Europeaid (2013) describes the technique and when and how it is applied as well as the steps to take.

SURVEYS

A survey collects data from a sample of persons targeted by the evaluation (Europeaid 2006: 62). It allows quantifying and comparing the information. A survey is conducted by drafting a questionnaire that asks for information. There are two types of questionnaires: structured and open-ended (Table 12). A survey often combines both types. The sample size, i.e. the number of persons interviewed in a survey, is usually large.

Table 12: Types of Questionnaire in a Survey

Structured Questionnaire	Open-ended Questionnaire
• Structured items • Answers are often limited and predetermined • The aim is to collect facts ➔ quantitative survey	• Similar to structured interviews • Precise questions are answered and interviewer takes notes ➔ qualitative survey

Source: Europeaid 2006: 62 – own illustration

Fields of application

Surveys are applied to learn about opinions. A survey is a suitable tool for analysing the final beneficiaries' degree of satisfaction concerning a policy. It can also be used for collecting new/additional data. A structured questionnaire provides the opportunity to generate statistics out of data.

Results/outcome

Results of a survey can be e. g. household and business surveys.

Position in the IA process

A survey can be positioned in the planning, executing (if used as data collection instrument) or evaluation phase.

Requirements (obligatory and optional)

Requirements are in general high. Working with open-ended questionnaires is more time-consuming than using structured questionnaires. The requirements on the interviewer increase with the complexity of the questionnaire (knowledge about addressed topic, interview skills, ability to quick responsiveness and interaction). A general guideline for preparing a questionnaire is given in Table 13.

Time requirements: long (up to one year)

Stakeholder involvement: medium to high, depending on the number of questionnaires.

Table 13: General Guidelines for Preparing Questionnaires

1	Clear definition of the topic
2	Design of the questionnaire should be precise
3	Ask overlapping questions to check relevance and coherence of answers
4	Formulate clear and short questions

Source: Europeaid 2006: 65

Box 49: The Small and Medium-Size Enterprise Survey in Vietnam

SMEs are very important in Vietnam's economy to support pro-poor and pro-growth policy measures. Therefore, the objective of this survey is to explore and better understand the constraints these SMEs are confronted with in their daily operations. Researchers are especially interested in finding out the circumstances under which the SMEs are founded and the conditions which force them to withdraw from the market.
For this purpose, the researchers conduct surveys in more than 2,500 enterprises across the country every two years. Information gathered from these surveys is combined with information under the enterprise law to obtain a better understanding of these companies' situations.

Advantages and limitations

A survey is a useful instrument to identify changes and compare opinions of a large number of people. A structured survey allows collecting data that is specifically needed for an IA but not available through other (official) sources.

Usually, a survey is time-consuming and requires a large number of staff members to conduct the interviews and interpret the results. Surveys have to deal with reporting errors and response problems. A survey is always an incomplete database and not compatible with other datasets (e. g. *national accounts*).

References

- Europeaid (2006) summarises why and how to conduct a survey, how to develop a questionnaire and how the survey is carried out.
- UNU-WIDER (2012) provides an example of a survey conducted on small and medium-size enterprises in Vietnam.

Macroeconomic Modelling in Uzbekistan

Training in modern macroeconomic forecasting techniques

General Information	
Programme	Sustainable Economic Development in selected regions of Uzbekistan
Commissioned by	German Federal Ministry for Economic Cooperation and Development (BMZ)
Duration	09/2009 – 10/2017 (component "macroeconomic advice")

Context

Uzbekistan is one of the fastest growing economies in Central Asia. The country's economic growth is largely driven by the extractive industry sector. However, growth rates have not translated into an inclusive, regionally and cross-sectoral balanced development. Key public and private economic actors lack capacities and do not cooperate sufficiently for successful implementation of public policies and programmes. In order to provide state institutions with reliable research and data for effective and evidence-based macroeconomic policymaking, the Government of Uzbekistan has established the Institute for Forecasting and Macroeconomic Research (IFMR) in 2008. Against this background, the GIZ project "Sustainable Economic Development in selected regions of Uzbekistan" builds capacities of the IFMR.

Objective

The project aims at supporting the development of evidence-based, sound forecasting mechanisms in order to enable efficient strategic development and sound policy advice. By building the capacities of key institutions in macroeconomic forecasting, especially IFMR, macroeconomic research and strategy development, the project seeks to enhance the quality of macroeconomic policy design, thus ultimately contributing to increased employment and income opportunities in Uzbekistan.

Activities

The project focuses on comprehensive capacity development activities for IFMR and the Academy of Public Administration. These activities include a permanent GIZ expert working in IFMR, who supports with economic analyses and gradually improving the macroeconomic knowledge and capacities of IFMR's staff, especially young researchers. Additionally, Public Private Dialogues, joint research between IFMR, the Ministry of Economy and local universities. Further activities include round tables, seminars, study tours to international macroeconomic research institutes and trainings were created. The types of macroeconomic models and methods used by IFMR, as well as the Ministry of Economy, are diverse and include time series variation models, economic forecasting regression, labour market analyses and company surveys. To implement the trainings, the project partners with the Kiel Institute of World Economy (IfW), the Leibnitz Institute for Economic Research (Ifo Institute) and the Institute of economic research in Halle. The project ensures ongoing capacity building particularly of young researchers.

Snapshot: Macro-economic Modelling	
Type of model(s)	Econometric models (Time Series Variation) Business Climate Index
Activities	Capacity building Model development
Partners	The Institute for Forecasting and Macroeconomic Research (IFMR), the Ministry of Economy, the Academy of the Public Administration, The Kiel Institute of World Economy (IfW), Leibniz Institute for Economic Research (Ifo), GIZ

Moreover, together with the Ifo Institute, a Business Climate Index was elaborated for Uzbekistan to forecast key macroeconomic parameters. For the Uzbek monetary policy the Time Series Variation models were developed together with IfW. In detail, IfW supported regression and hypothesis testing, examination of model building, macroeconomic monitoring, short-term forecasting, growth convergence modelling, as well as export, population growth and price forecasting. Within 7 to 8 months, IfW developed entirely new models.

The Academy of Public Administration has been supported by the project since 2013. Here, a training programme was created aiming at training future employees and decision makers in good governance and regional economic development. Strategic partnerships to foster student exchange programmes were established between the Academy of the Public Administration and universities in Berlin, Nagoya, Japan and Westminster University, United Kingdom as well as the Management Development Institute of Singapore.

Results

Partner institutions now effectively make use of modern macroeconomic models and concepts in the process of formulating strategy papers and giving macroeconomic policy advice. Key macroeconomic models for forecasting have been developed for the country. These methods, for example the Business Climate Index, are already being used in IFMR and the Ministry of Economy – at least internally – as the basis for macroeconomic policy decisions. Further, national ministries now use macroeconomic models for designing and preparing policy measures, which was not the case before the project started, as macro-economic modelling was not used. As a result, the number of publications issued by the IFMR has significantly increased, from three in 2010 to 28 in 2014.

In addition to capacity development the project has supported several studies and policy papers which were presented to relevant government entities. For example, in collaboration with the United Nations Development Programme (UNDP), the project has initiated and supported the elaboration of a regional development strategy, which was designed by IFMR and the Ministry of Economy, for the regions Andijan, Surkhandarya and Karakalpakstan. Moreover, in cooperation with GIZ, Asian Development Bank and UNDP, IFMR has hosted several international and national fora among economic researchers and practitioners to facilitate exchange between researchers from different regions of Uzbekistan with colleagues from neighbouring countries (yearly Forum of economists and Forum of Young Economists).

Lessons learned
Language barriers hindered the efficiency and effectiveness of the trainings. As a response, later on a Russian trainer was engaged.
In order to support employees on a day-to-day basis a web-forum was implemented, where IFMR employees could address challenges and questions to IfW staff that helped out.
Staff fluctuation in IFMR is high, so that the transition from personal to institutional knowledge was hindered. As a response, IFMR established a special training department within its organizational structure, which also serves as an institutional memory keeper. Additionally, IFMR created stimuli for employees to participate in trainings, such as the participation in international conferences
Economic understanding of local staff was rather limited in the beginning, which made it important to start with teaching basic economics and only in a later step with macro-economic modelling.
Collaboration with other donor agencies, such as the World Bank and UNDP, can prevent duplicating work and create time- and cost-reducing benefits for all parties.
IFMR employees' workload was sometimes too high for allowing the participation in trainings. As a response, the Head of Department released a rule that impeded distracting the employee with day-to-day work during the trainings.

Macroeconomic Modelling in Burkina Faso

Introducing a medium-term economic forecasting system

General Information	
Programme	Advising the Ministry of Economy and Finance
Commissioned by	German Federal Ministry for Economic Cooperation and Development (BMZ)
Duration	08/2012 – 07/2015

Context

As one of the first countries in Sub-Saharan Africa, Burkina Faso passed a national strategy for poverty reduction, which was first introduced in 2002[1] and has since been updated several times. In order to implement this strategy and contribute effectively to poverty reduction, evidence-based policymaking is crucial. For example, alternative poverty reduction policies need to be tested ex-ante regarding their potential effects on low-income households and national household planning needs to reflect priorities set in the poverty reduction strategy. Furthermore, a stable macroeconomic situation that is able to withstand shocks contributes greatly to poverty reduction. Against this background, the programme "Advisor to the Ministry of Economy and Finance" supports the Ministry of Economy and Finance (MEF) of Burkina Faso through macroeconomic advice and by supporting the implementation of the national poverty reduction strategy through results-oriented budgeting.

Objective

The objective both of macroeconomic advice and of supporting the implementation of the national poverty reduction strategy through results-oriented budgeting is to strengthen evidence-based policymaking and budgeting and thus, ultimately, to contribute to a stable macroeconomic situation and effective poverty reduction. By introducing and building capacity of MEF's staff to use macroeconomic models for medium-term macroeconomic forecasts, and supporting medium-term financial planning, the project builds MEF's capacities to design policies based on sound evidence and to translate policy priorities into results-oriented public budgets.

Activities

The project advises MEF in an integrated approach. In the area of policy impact assessment and macroeconomic modelling, the project works in five pillars, which are: (1) Analysing the socioeconomic situation of the country (poverty mapping), (2) ex-ante policy impact assessment (microeconomic analysis of impacts of alternative poverty reduction policies on households in order to enable the selection of most effective policies), (3) medium-term financial planning (supporting the poverty reduction strategy), (4) improving data bases (support to the creation of financial databases and statistical financial yearbooks), and (5) ex-post impact analysis/impact monitoring of implemented policy measures within the poverty reduction strategy.

Snapshot: Policy Impact Assessment and Macroeconomic Modelling	
Type of model(s)	Input-Output
Activities	Introduction of a new forecasting model Capacity building Provision of data
Involved institutions	Ministry of Economy and Finance, the National Institute for Statistics and Demography, GIZ

In order to enable medium-term macroeconomic forecasts that feed into economic budgeting, the project supported the development of a new macroeconomic model, the "Instrument automatisé de Prévision" (Automatic Forecasting Instrument – IAP). First, IAP enables medium-term macroeconomic forecasts, which serve as a basis for negotiations with the International Monetary Fund (IMF). Secondly, IAP can calculate state revenues to inform evidence-based medium-term financial budgeting. Lastly, IAP enables the ex-ante analyses of impacts of macro-economic shocks and policy measures on growth and on the poverty situation of different socio-economic groups.

In order to reflect the MEF's necessities as well as to display Burkina Faso's economy as accurately as possible, from the very beginning IAP was constantly updated and expanded with new modules, improved data bases, and new methods for analysis (for example microeconomic methods for analysing poverty). The development of IAP started in 1990 being based on input-output tables that initially functioned with the software Lotus123 and, in 1992, were converted into Excel. As the government oriented its structural adjustment programme towards poverty reduction in 2002, IAP was connected with results from a survey about living conditions in Burkina Faso in order to enable ex-ante impact assessment of economic and social policy on different socio-economic groups (module IAP-micro). Until 2002 IAP was physically located in the GIZ office and then transferred to a special administrative department within MEF, the "Direction de la Prévision et des Analyses Macro-économiques" (DPAM).

Additionally, capacity development in macro-economic modelling and particularly in using IAP was conducted for MEF's staff. This included "on-the-job"-trainings with a frequency of two to three times per year, the implementation of training workshops as well as the establishment of smaller working groups for using IAP. An important activity was also the collection and provision of necessary household data for microeconomic modelling, which was conducted jointly (staff) and other relevant ministries, in order to assess policy impacts on poor households.

Nowadays IAP continues to be updated and further developed. For example, in 2009, the National Institute for Statistics and Demography has developed a module for cash flow based national accounting, called ERETES, which was embedded in IAP. Additionally, a special module for the mining industry, which is of high importance for Burkina Faso's economy, was developed and integrated into IAP.

Results

Staff of DPAM now conducts macroeconomic analysis and forecasting autonomously by making use of IAP. Also, DPAM adjusts IAP autonomously so that the project no longer supports the development of IAP. Instead, the GIZ-project is now focusing on financial good governance, supporting MEF in piloting the implementation of a budgetary reform, enhancing internal and external financial control mechanisms and promoting of civil society in the budgetary reform. The forecasts generated by IAP are used for evidence based policy making and serve also as a basis for negotiations with the IMF. Furthermore, DPAM is profiting from improved data quality, as the project enabled the collection of household data. Today, DPAM is gathering data autonomously.

Lessons learned
As data provision was sub-optimal, the implementation of household surveys aiming at collecting microeconomic data was an important complement to the introduction and training of staff on IAP for enabling evidence-based policy making because this data provided the basis for certain analyses using IAP.
The fluctuation of staff within MEF is very high. This complicates the development of a core group of IAP-experts. Therefore, trainings have to be conducted on a frequent and regular basis.
An important success factor is the long-term presence of the GIZ advisor as the process of implementing the poverty reduction strategy is complex and led by heterogeneous political interests.
DPAM has contributed to the strengthening of macroeconomic steering instruments and tools, including the development of macroeconomic frameworks and economic budgeting for analysing trends in national and international growth rates and forecasting economic growth rates for Burkina Faso.

[1] *The poverty reduction strategy was based on the structural adjustment programme that was established in 1989, receiving international financial support since 1991.*

Policy Impact Assessment in Benin

Strengthening national policy impact assessment capacities

General Information	
Programme	Macro-economic advisory for poverty reduction
Commissioned by	German Federal Ministry for Economic Cooperation and Development (BMZ)
Duration	01/2007 – 06/2017

Context

Benin faces diverse challenges on its trajectory towards sustainable development, most notably poverty reduction. According to the most recent household survey in Benin (2015), 40,1% of the population live below the national poverty line

Aiming at reducing poverty, Benin first introduced a Poverty Reduction Strategy in 2003, which is updated at regular four-year intervals, and which is oriented towards pro-poor growth. The Poverty Reduction Strategy serves as a strategic frame of reference for technical and financial development cooperation partners. The implementation of the strategy represents a major challenge for the government – in part because of the complexity of the overall development process, but also because it involves the coordination of many different actors. Moreover, the capacities of the responsible Minis-tries with regard to poverty reduction and inclusive growth are not yet sufficient. In particular, there is a lack thereof as far as carrying out (ex-ante) policy impact assessment is concerned. In particular, not enough Poverty and Social impact Assessments (PSIA) are carried out.

According to the country's most recent Growth and Poverty Reduction Strategy (GPRS 2011 – 2015), the periodic evaluation of policy reforms was unsatisfactory in the past and a system for assessing impacts of policies and programmes should be set up. Against this background, the GIZ project "Macro-economic advisory for poverty reduction" has supported several ex-post policy impact assessments and now focuses on the foundation and support of a PIA-network.

Objective

Benin's GPRS prescribes that the policy impact assessment (PIA) system shall measure the impact of policies and activities on the target groups and on the pursuit of development objectives (growth, poverty reduction and social development). Especially, the use of impact assessment instruments such as the Poverty and Social Impact Analysis (PSIA) is to be reinforced on the central and decentralised levels of government. This work is coordinated by the Social Change Observatory (SCO) which performs the task of identifying and selecting key challenges.

GIZ supports the SCO in efforts to build national capacities for policy impact assessment for the purposes of enhancing anti-poverty impetus in public policies and stimulating inclusive growth. Since Benin's government chose to embrace the PSIA method, the project's advisory work focuses particularly on this instrument.

Snapshot: Policy Impact Assessment and Macroeconomic Modelling	
Type of model(s)	Static micro-simulation and Computable General Equilibrium
Activities	Conducting Poverty and Social Impact Analysis (PSIA) Support to PSIA network Interactive conferences and workshops
Involved institutions	Ministry of Finance, Ministry of Development, GIZ, Social Change Observatory

Activities

The GIZ project's activities concerning PIA embrace diverse activities. Initially, GIZ supported three policy impact assessments, resulting in studies in the areas of taxation, health and education – all of them using PSIA as a method for the assessment. In 2009, a PIA for the government's decision to introduce the local development tax was conducted. In the health sector, the project supported a PIA for the government's plan to render the Caesarean section and health care for children under 5 years free of charge in 2012. The same year, another PIA was conducted for the government's decision to provide free nursery and primary education.

During the PIA process, stakeholder opinion surveys were conducted throughout the country and a scenario analysis was performed. In the area of taxation, PSIA showed that the local development tax reduces real income of all households, especially smallholders, and that the tax would only have significant economic and social impacts if combined with measures to increase taxation effectiveness and if the generated financial resources were primarily dedicated to investment. In the area of health, the PSIA showed that the rising number of patients would overburden the capacity for quality medical care, which led to the recommendation to hire more medical personnel and to purchase more equipment. For education, it was shown that free education would improve enrolment rates for both girls and boys and that drop-out rates would diminish.

However, because of low levels of political attention and commitment concerning PSIA study outcomes in general, GIZ now focuses on supporting the PSIA-network (RéNat-AIPS – Réseau National en Analyse d'impacts sur la pauvreté et le social) as a tool to promote PIA in Benin. RéNat-AIPS holds meetings on a regular basis (4 to 6 meetings per year) and, for example, evaluates PSIA studies that have already been undertaken.

Results

Supporting three PIAs using the PSIA method led to several technical recommendations concerning details of the policies that were communicated to partners and partially implemented. For example, in the area of taxation it led to the revision of the legal framework and to a reduction in the number of local taxes. However, the impact of the three studies supported by GIZ was rather limited due to low engagement from the political side. Therefore, the project changed its approach and is now promoting PIA by bringing together different stakeholders in RéNat-AIPS. The latter's meetings and activities put PIA on the agenda of a wide range of interested parties and thus contribute to raising awareness as well as building national capacities.

However, knowledge gaps with respect to evaluation of policies are still large. GIZ's support enables relevant stakeholders to acquire basic knowledge about concepts and methods of result-oriented PIA. Nevertheless, national capacities are still inadequate to bring PIA planning and implementation to scale.

Lessons learned
The RéNat-AIPS network faces difficulties in communicating PIA's and its own importance to relevant stakeholders. Promotional support should therefore play an explicit part of a project founding a new network.
PIAs are conducted to support decision making when introducing or reforming a policy measure. Timing of the PIA is crucial for the successful uptake of PIA results in the policymaking process. If the PIA is conducted too early in the decision making process policymakers might not be ready to integrate the results. Conversely, if PIA is conducted too late the political decision might already have been taken. Relevant timing might be hindered by delays in the process of conducting the PIA and data constraints.
The composition of the PIA steering groups has a significant impact on their influence on the political level. PIAs should be conducted in close cooperation with the ministries concerned in order to ensure their impact on the policy level. This is particularly crucial if the intrinsic interest for PIA of policymakers is generally low.
Consultants who conduct PSIAs often lack specific knowledge about the instrument. Therefore, it is crucial to support capacity development considering the design and conduction of the report and PSIA.
Partners should bear the application and use of PSIA results in order to ensure ownership. However, as PSIA values public discourse highly which expands the range of stakeholders, it is a challenging task to ensure the actual application of results. Thus, the government's interest in using PSIA is a necessary success factor.

Modelling the Green Economy Transformation in Uruguay

Designing Effective Green Economy Policies

General Information	
Programme	Enhancing low-carbon development by greening the economy in cooperation with the Partnership for Action on Green Economy
Commissioned by	German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)
Duration	08/2014 – 07/2017

Context

Uruguay's remarkable economic performance in the last decade is highly dependent on its environment as it is driven in large parts by exports of agricultural products such as beef, wool, rice and milk and dairy. Up to 80%[1] of Uruguayan exports thus rely on natural resource intensive sectors. Due to this dependency, Uruguay attributes great importance to natural resource preservation to ensure its competitiveness in the long run. Having initiated various efforts, for example in the renewable energy sector and expressed its interest in exploring Green Economy approaches, Uruguay is considered forward-looking with the potential to become a model to follow for the region.

In the framework of a Green Economy Assessment, GIZ and the United Nations Environment Programme (UNEP) jointly supported Uruguay to assess different policy scenarios and complement on-going efforts for greening key sectors. This initiative aims to drive forward the Green Economy transformation taking into account potential economic, social and environmental impacts in a number of defined sectors. Complementary to this, the project's support to the Uruguayan Government includes capacity building with regards to Green Economy concepts and instruments.

Objective

In order to picture Uruguay's Green Economy transformation and to assess the different policy scenarios, a macroeconomic modelling approach using the "Threshold 21" (T21) model was chosen. T21 is a dynamic simulation tool, developed by the Millennium Institute, designed to support an integrated and comprehensive medium- to long-term development planning process taking into account the economic, environmental and social spheres. Using a system dynamics approach, the model allows comparing, for a set of relevant indicators, a base scenario or "business as usual" scenario and a "green scenario".

The objectives of the T21 modelling exercise were (1) to discuss the greening potential of the selected sectors, (2) to provide information on the impacts of green economy policies in the long run (2014-2035), and (3) to discuss the need for reallocation of existing resources as well as additional resources to be invested.

Snapshot: Macroeconomic Modelling	
Type of model(s)	System Dynamics (T21)
Activities	Ex-ante impact assessment of Green Economy policies; Establishment of an inter-ministerial working group
Involved institutions	Ministry of Housing, Territorial Planning and Environment, United Nations Environment Programme (UNEP), Millennium Institute, Instituto de Economia of the Universidad de la República (IECON), GIZ

[1] *UNEP (2014): Hacia una economía verde en Uruguay: condiciones favorables y oportunidades.*

Activities

The Green Economy Assessment was taken forward in cooperation with the Uruguayan Ministry of Housing, Territorial Planning and Environment and 6 other Ministries[2]. The assessment focused on tourism, transport, agriculture and livestock farming, which had been defined as priority sectors for a Green Economy transformation in Uruguay due to their environmental impact and economic importance. Current economic, social and environmental challenges were identified in the above-mentioned key sectors, e.g. land use, water management, public transport development and energy efficiency. After this, "green" interventions, including both, policy measures already in place and potential policy options, were proposed to tackle the challenges. T21 was used to simulate the expected impacts of these interventions and the results were compared against a business-as-usual scenario. Based on this, recommendations were made with respect to monitoring and evaluation of the transition to a green economy as well as for future analyses. Building, applying and analysing T21 and the results took one year.

Local institutes and academics played a key role in the modelling exercise. They had been trained in the application of T21. The Instituto de Economia of the Universidad de la República was responsible for all economic and technical information that was fed into the model. In addition, workshops were held in order to train technical staff of different ministries in the interpretation and use of the results of the model.

Results

The results of the modelling exercise show that the implementation of the green economy policies assessed by the model would enable the country to maintain its economic growth and social development performance while using its natural resources more efficiently and making the country more resilient to the effects of climate change. It showed that green economy pathways are feasible and contribute to a transition towards sustainable development. The results provide evidence that the trade-off between growth and environmental conservation is not irreconcilable and that green growth is a viable alternative to business-as-usual.

The discussions along the whole process and about the modelling results helped to bring different ministries together to discuss Green Economy issues of joint interest. This laid the basis for an organisational development process which allowed creating a more formalized inter-ministerial working group as a place for communication and co-operation with respect to Green Economy topics.

[2] *Ministry of Livestock, Agriculture and Fishery ; Ministry of Transport and Public works; Ministry of Tourism; Ministry of Industry, Energy and Mining; Ministry of Labour and Social Affairs, Ministry of Economy and Finance*

Lessons learned
T21 is particularly useful for illustrating the causal relations between ecological, social and economic aspects of sustainability. Therefore it is highly suitable to model impacts of Green Economy policies. T21 can also be used to build scenarios for the entire economy as well as single sectors and is particularly useful for modelling medium- and long-term impacts.
As the policy options that were modelled by T21 were selected in close cooperation with the Ministries, the results were oriented towards practitioners' needs and are highly relevant for the government, especially because the majority of policies that were analysed had already started during the implementation of T21 modelling.
Given that the modelling process was closely linked to an indicator framework[3] that can be used for policy monitoring and evaluation, this exercise promises to be a good basis for ongoing and future efforts for policy design.
As Green Economy transformation is a process that addresses all sectors of the economy, many different ministries were involved in a complicated consensus finding. Defining responsibility and collaboration structures claimed much time.
The existence of an inter-institutional group that accompanies Green Economy approaches and particularly economic modelling is a crucial success factor for the process in general, an appropriate interpretation and the use of results.
The participatory process, specific workshops as well as one international conference fostered the exchange amongst national and international experts and contributed to further dialogue and capacity development in the country.

[3] *In particular, indicators for (1) issue identification, (2) policy formulation, (3) policy assessment and (4) policy monitoring and evaluation.*

Macroeconomic Modelling in Tajikistan

Supporting short- and medium-term macroeconomic forecasting

General Information	
Programme	Framework and Finance for Private Sector Development in Tajikistan
Commissioned by	German Federal Ministry for Economic Cooperation and Development (BMZ) with co-financing from UKaid, Department for International Development (DfID)
Duration	04/2011 – 03/2016

Context

Tajikistan remains the poorest country in the Central Asian region, although it enjoyed strong economic growth rates over the last decade. Measured by the ratio of labour remittances to GDP, it is the highest remittances-dependent country in the world, while domestic markets remain underdeveloped. Thus, reforms to create an enabling environment for the development of the private sector, especially through improving macroeconomic stability, economic dynamism and international integration, are faltering.

In this context, improving the government's capacities to carry out macroeconomic forecasts and to analyse the impacts of economic shocks on the country's economy and development is fundamental to enable proactive evidence-based economic policymaking. The project "Framework and Finance for Private Sector Development in Tajikistan" supports the Ministry of Economic Development and Trade (MoEDT), the National Bank of Tajikistan, the Ministry of Finance, the Statistical Office and other governmental and public bodies to conduct sound macroeconomic analyses to serve as the basis for evidence-based decision-making in economic policy.

Objective

MoEDT is a key governmental body that designs and implements economic policy. The project aims at improving MoEDT's capacities for economic analysis. In particular, the Analytical Centre and the Department of Macroeconomic Analysis are supported to apply medium-term and short-term macroeconomic forecasting methods. Moreover, in cooperation with the Statistical Office, the project aims at improving the framework for the System of National Accounts. The National Bank's and Ministry of Finance's forecasting capacities are also supported through technical aid and purchase of software. All of these activities aim to enhance the formulation of forward-looking economic and fiscal policymaking and budget development, which form the basis for macroeconomic stability.

Snapshot: Macro-economic Modelling	
Type of model(s)	Econometric models, structural macroeconomic models, Input-Output, Computable General Equilibrium models
Activities	Model development, capacity development (hands-on practical support in routine work, trainings, study tours, workshops), exchange fora
Partners institutions	Ministry of Economic Development and Trade, Ministry of Finance, National Bank of Tajikistan, Statistical Office, Centre for Strategic Studies, Institute for Economic Research and Policy Consulting, Halle Institute for Economic Research

Activities

The project has been advising its partners in macroeconomic modelling since 2011. Activities include capacity building (daily hands-on support in routine work and in-house trainings for government officials, external trainings, study tours, participation in conferences), development of new analytical tools and improvement of existing ones, as well as providing economic analysis and policy consulting.

GIZ works on the improvement and wider usage of the existing structural macroeconomic forecasting model (medium-term) in MoEDT, which is based on the production side of GDP and runs in Excel. As a support service, GIZ organises regular bi-weekly workshops focusing on the existing model in particular and on forecasting methods in general. Employees from different divisions within the MoEDT participate in these workshops and learn how to specify necessary data for macro-economic modelling, how to find the adequate data base, how to model different economic shocks and how to interpret the results.

In cooperation with the Halle Institute for Economic Research, the project developed a new macroeconomic model based on indicators. This tool was already applied successfully in Kyrgyzstan. The model was built as an in-house tool for MoEDT to carry out short-term (one to two quarters) economic forecasts. This new model, whose development took approximately one year, complements the existing ones, which are used for medium- to long-term forecasting and impact analysis. In addition to developing the new model, MoEDT staff is being trained in general forecasting methods, macroeconomics and econometric skills.

In addition, the project supports the Statistical Office to improve the System of National Accounts. An Input-Output table and Social Accounting Matrix for Tajikistan were drafted with the project's support. The data is for 2011 and provides information on 57 sectors of the economy. This data serves as the basis for applying Computable General Equilibrium models for the structural analysis of Tajikistan's economy. Also, the data for Tajikistan contributed to a model called Global Trade Analysis Project (GTAP).

Within the National Bank, the project closely supports the Bank's analytical division in carrying out prognoses by providing specific software that allows building econometric models, such as Eviews and Mathlab, by supporting the participation of National Bank staff in various events organised by Deutsche Bundesbank, and by involving the Bank's employees in trainings organised by GIZ. Also, the Analytical Unit of the Ministry of Finance is supported with trainings on macroeconomics and econometrics with E-views.

Results

The project successfully trained MoEDT's, the National Bank's and other governmental institutions' staff in macroeconomics and econometrics. Macroeconomic models are now used with higher frequency and serve to provide information to the government and the private sector with respect to economic prospects for designing the National Development Strategy and for budgetary planning. For the future, it is planned to complement macroeconomic modelling by deeper sectoral analysis.

Lessons learned
Models that have been introduced in Tajikistan by international organisations are often too complex and do not allow for easy adjustment to local necessities and capacities. Hence, the application of these models might end once donor support ceases. Therefore, it is fundamental to closely cooperate with the Ministries from the very beginning of the development process in order to ensure continuous model application.
Models are often used by employees without fully understanding the underlying model assumptions. Thus, models are not adjusted to country or sector-specific characteristics, which lead to inaccurate projections and the lack of "ownership". Therefore, the project has decided to develop an in-house model for MoEDT, which staff can fully understand and operate.
Basic trainings in statistics, macroeconomics and tools such as Excel and E-views need to be provided to partners before offering help to build macroeconomic models in order to ensure basic knowledge and skills.
As staff turnover is high, personal knowledge is not translated into institutional knowledge. Institutional structures for macroeconomic modelling processes therefore need to be established to increase institutional knowledge. Additionally, incentives to learn should be supported to ensure employees' participation.

Supporting Inclusive Growth in Rwanda

Enhancing sound macroeconomic analysis and investment planning

General Information	
Programme	Macroeconomic Advice for Poverty Reduction in Rwanda
Commissioned by	German Federal Ministry for Economic Cooperation and Development (BMZ)
Duration	02/2012 – 03/2018

Context

In Rwanda, 39,1% of the population live below the national poverty line of 0,7 USD per day, making poverty reduction – through inclusive growth – a vital development planning objective. Against this background, Rwanda passed the "Economic Development and Poverty Reduction Strategy II" (EDPRS-II) in 2013. For the coherent implementation of this strategy, which aims at halving poverty by 2020, macroeconomic stability, sustainable fiscal and investment planning are necessary. Achieving the goals requires sound fiscal and financial policies as well as evidence-based structural policies, linking the priorities of EDPRS-II to resource allocation. Therefore, the Ministry of Finance and Economic Planning of Rwanda (MINECOFIN) has been supported by the GIZ-project "Macroeconomic Advice for Poverty Reduction in Rwanda" since 2012.

Objectives

The project aims to enhance the quality of economic analyses, management and evidence-based economic policymaking by MINECOFIN, on two levels. Firstly, by strengthening the capacities of MINECOFIN's Chief Economist department to carry out sound analyses of macroeconomic policies concerning economic trends pertaining to domestic and external factors including economic shocks, aid and other budgetary resources, the balance of payments, employment, household income and poverty. Secondly, the project aims to increase the efficiency and effectiveness of public investment management by strengthening the capacity of MINECOFIN's National Development Planning and Research Department (NDPR) in the fields of investment appraisal and planning as well as project management.

Activities

The project enables the joint implementation of capacity development measures in economic analyses, forecasting and investment planning in MINECOFIN with the National Bank and the National Institute of Statistics. Project interventions are executed on three levels: (1) the individual level (staff) for strengthening (macro)economic and investment planning analytical skills, (2) the institutional level (government agencies) to improve coordination and learning mechanisms among the most important macroeconomic actors in Rwanda and (3) the systemic level (EPRN, Economic Policy Research Network, Rwanda) for promoting evidence-based policy making.

Snapshot: Macro-economic Modelling	
Type of model(s)	Financial programming, general equilibrium and econometric models
Activities	Building on the existing macroeconomic framework, developing a range of complementary forecasting and analytical models/tools, strengthening investment appraisal and management, including the socio-economic/environmental impact analysis of projects
Implementing institution(s)	Ministry of Finance and Economic Planning, National Bank of Rwanda, National Institute of Statistics, GIZ

In the macroeconomic area, employees of the Chief Economist department are trained in the development and use of projection and policy analysis tools. Such training builds on the existing macroeconomic framework, which is based on the IMF financial programming approach. This is part of a roadmap implemented by GIZ project staff to develop a range of macroeconomic and sectoral tools for the short, medium and long term. The main macroeconomic medium-term projection tool will be linked to more structural modules, such as tracing sectoral capacity, labour market, income distribution, poverty and employment. It will also link to the short-term forecasting tool of the National Bank and to the debt sustainability analysis undertaken as part of Rwanda's medium-term debt strategy. Aiming at strengthening coordination and communication mechanisms for government strategic budgeting, the macroeconomic research and modelling group, within the Chief Economist department, provides a forum for discussion of research papers and analytical work. The group has also been involved in developing the integrated macroeconomic framework. In the public investment management area, NDPR's staff is supported with trainings in investment analysis, project management and the development of appraisal and monitoring tools to improve the quality of planning procedures. Such improvements shall deliver a sound National Investment Programme, which will present funded and pipeline projects in such a way that the data can be extrapolated for macroeconomic projections.

Results

The first phase of converting the existing macro framework into an integrated macroeconomic framework - that works as a fully specified model allowing for scenario and certain macroeconomic impact assessments - was completed in 2015. This phase also streamlined data management and exchange of information across sectors. Furthermore, training in the use of the new macro framework and other projection tools has been initiated. The roadmap for macroeconomic and policy analysis tools foresees the development of other tools that will allow ex-ante and ex-post impact assessments on economic, social and environmental aspects. These tools are expected to be adopted in 2016 and will, in part, be implemented with the support of a German research consortium. In the meantime, impact studies will be carried out by external consultants. In this regard, the Institute for Policy Analysis and Research in Kigali is coordinating a network of Rwandan economists as a consultant pool for the commission of impact analyses by MINECOFIN. A first milestone in the public investment management area was achieved with the delivery of a draft "National Investment Policy".

Particular successes/lessons learned
Rwanda is a high performing economy, with understaffed institutions and high pressure placed on individuals. In this setting, an enabling framework - to promote analysis and research - and even a change of culture is necessary. This requires long-term capacity development plus permanent inputs in order to keep momentum.
Coordination between different units of MINECOFIN working on macroeconomic issues is currently rather limited. This results in variable assumptions concerning data and policy targets in macroeconomic analyses. A common consensus and data harmonisation are crucial for a coherent, target-oriented development planning and economic forecasting. Therefore, the introduction of processes such as regular meetings and working groups is an important complement for the project.
MINECOFIN has different macroeconomic models in place, but they are only used intermittently. Therefore, instead of introducing new models and analytical tools, advisory work would be better built upon existing models and knowledge bases.
Within MINECOFIN, employees tend to work on an ad-hoc basis, responding to urgent demands rather than according to longer-term work plans. This complicates the implementation of training programmes as participants frequently drop out because of deadlines.
Knowledge and improved capacities will only be translated into daily operations and working plans, when the training is hands-on, practical and leads to immediate results. Such short-term improvements can also support long-term capacity building needs. Therefore, trainings should always begin with a specific 'product' in mind that is to be utilised by the specific department.
The key challenge is to transform personal skills into institutional knowledge as fluctuation is high. Therefore, the programme follows a multi-fold approach: (1) Trainers come from institutions with similar work assignments as our partners, ensuring practical hands-on exchanges; (2) Trainings always begin with a concrete 'product' in mind, aiming at creating immediate results, which can be directly fed into daily work; (3) Long-term capacity development is ensured by supporting organisational development, including data and process management; (4) An enabling framework for analysis and debate is being created around the partner institutions, mainly through a network of local economists and institutions; (5) This network is supported by an international consortium of universities, research institutions and twinning partners.

GLOSSARY

A priori	Not based on evidence, purely empirical knowledge.
Behavioural function	Mathematical equation. The left hand side (dependent) variable of an equation is explained econometrically by the right hand side (independent) variable(s).
Bottom-up	Model construction principle. Bottom-up means that model components (modules) are designed in great detail and top level results are derived by aggregating information. Modules have feedback-loops to the top level.
Calibration	Process of determining parameters in the production and utility function in quantitative models.
Causal regression analysis	Statistical method to specify the relationship of variables. Independent variables (right hand side of an equation) are assumed to directly influence and thus cause changes in dependent variables (left hand side of an equation). Direction and magnitude of the relations are studied.
Closure rule	Closure rules are part of CGE models. In a CGE model, there are endogenous and exogenous variables, and relations between them are explained in equations. Balancing the system needs a choice of "closure". The choice of closure defines the direction of model causality and determines how equilibrium is reached after a shock (e. g. flexible wage rates).
Coefficient	A coefficient (or parameter) shows the direction and magnitude of the relation of dependent and independent variables.
Comparative-static	Comparison of two different situations before and after a "shock". Adjustment processes in the interim cannot be explained.
Definition	Mathematical equation. Variables are defined through other variables in a fixed and logic proportion.
Delays	Used in System Dynamic models to determine lags. Transmission of effects from one variable to another does not occur immediately.
Deterministic	Outcomes are precisely determined through known relationships. A given input always leads to identical results if the initial condition/situation is the same.
Direct effect / direct impact	Immediate cause and effect relation initiated by final demand changes.
Effectiveness	Capability to produce a desired outcome.
Efficiency	Capability to produce a desired outcome with minimal input.
Employment factor analysis	Method for assessing direct jobs per e. g. installed megawatt (MW) of renewable energy technologies. Data (employment factor) refer mainly to OECD countries (Ferroukhi et al. 2013).
Endogenous	Endogenous variables are calculated within a model and are influenced by other model variables.
Ex-ante	Forward looking
Exogenous variable	Variable (e. g. tax rates or weather) which is not calculated within a model, but influences other model variables.
Ex-post	Backward looking
Goodness of fit measures	Statistical test dimensions which give information on various aspects of the fitness of the regression function. Such measures are e. g. the Durbin Watson test (test on auto-correlation), t-test (coefficient of differentiation) or R^2 (coefficient of determination).
Gross effect	Only direct and indirect effects of a measure are accounted for.
Hypothesis	Proposed explanation for a phenomenon which can be tested.
Indirect effect / indirect impact	Cause-mediator-effect relation initiated by final demand changes. Indirect impacts follow direct impacts, because changes in industry output affect supplier industries along the supply chain.
Induced effect / induced impact	Direct and indirect effects of a policy intervention lead to further effects e. g. on employment and national income. According to consumer propensity, consumer demand changes.
Judgemental Forecast	Forecasting method which incorporates judgement from field experts. This method can complement other forecasting methods if data is lacking.
Least-square-estimation	Approach in regression analysis. Overall solution minimises the sum of the squares of the errors made in the results.
Leontief inverse / Leontief multiplier	Shows the input requirements, both direct and indirect, on all other producers generated by one unit of output.
Limitational production function	A production function shows the relation of inputs to output. Limitational means that inputs have a constant relation to outputs and that no substitution processes are possible.
Maximum-likelihood estimation	Approach in regression analysis. Selects the set of values of the model parameters that maximise the likelihood function.
Method	Tools, techniques or processes used for conducting a quantitative and/or qualitative research.
Methodology	Systematic, theoretical analysis of applied methods.
Mixed method	Combination of qualitative and quantitative methods.
Model	A model shows reality in a simplified way. It consists of variables which are needed to explain a certain phenomenon. Equations show the relationship between (endogenous) variables. Exogenous variables (e. g. tax rates or weather) are not calculated by the model, but influence other model variables. An empirical model includes estimated parameters/coefficients which determine the changes of the dependent (output) variable when the input variable changes. Depending on the economic theory, the relation of model equations can differ. Results of a model can be forecasts of model variables or effects on model variables through shocks when conducting an impact analysis.

Model specification	An economic model consists of many mathematical equations. The connection of all equations forms the structure of the model (model specification) and usually follows an economic theory.
Model variation	Refers to the (i) modification of the model as reaction to specific data availability and skills in economic modelling and to (ii) specific needs. Variations due to specific needs relate to the option of adding modules to basic economic models.
Modules	Special features of mostly quantitative models that spotlight specific aspects of an economy in greater detail. They can be constructed top-down or bottom-up.
National account	Complete and consistent measurement of the economic activity of a nation. It relies on double-entry accounting that guarantees consistency on both sides (debit and credit) of an account.
Net effect	The term net effects indicates that all – positive and negative – direct, indirect and induced effects are taken into account.
Non-linearity	In contrast to linear, non-linear means that the output of non-linear system is not directly proportional to the input.
Non-market clearing price	A market clearing price refers to a condition where a market price is established through competition such that the amount of goods or services sought by buyers is equal to the amount of goods or services produced by sellers. If the price is too high, thus attractive for producers to sell the goods or services, consumers will not buy the product. As a result, the supply is higher than the demand and the market is not cleared.
No-policy scenario	Also described as baseline scenario. That is a simplified description of the functioning of the economy under "normal" conditions without policy intervention. No-policy scenarios only exist in scenario analysis.
Panel data	Contains observations of multiple characteristics obtained over at least two periods for the same individuals.
Parameter	See coefficient
Production function	Describes how much labour and capital is used to produce goods and services in the economy using a certain technology.
Proportionality principle	Action should not go beyond what is necessary to satisfactorily achieve the objectives. The proportionality principle is usually applied in jurisdiction. However, its criteria legitimacy, suitability, necessity and adequacy can also be applied in other areas.
Randomness	Randomness means that events such as natural disasters are hard to predict as their occurrence does not follow any patterns. They do not follow rules, but have a certain probability to occur.
Roadmap	Action plan or strategy used as an overview for conducting a project.
Scenario	Alternative economic developments under different economic settings. Always in relation to the no-policy scenario.
Sensitivity analysis	Scenario in which only one single element is changed. Single cause-effect relations can be detected.

Single-factor analysis	Single factor analysis is used to isolate the effects of single factors on the development of the total economy. This method implies status-quo condition for all other factors.
Stakeholder	A person or group of persons who are affected by or – directly or indirectly – involved in a policy intervention.
Status quo	Describes the current situation without an introduced policy measure.
Substitution elasticity	Convertibility of goods or input factors in the production process.
Time series analysis	Analysis of a sequence of time-dependent variables.
Top-down	Model construction principle. Top-down indicates an aggregated modelling approach. At the top level results are derived and then fed into modules. Modules usually have no feedback-loops to the top level.
Transmission mechanism	Process of cause-effect-relation.
Window dressing	A terminology used when a good or favourable picture shall be transported into the public.

Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Friedrich-Ebert-Allee 36 + 40
53113 Bonn, Germany
T +49 228 44 60-0
F +49 228 44 60-17 66

Dag-Hammarskjöld-Weg 1 - 5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de

On behalf of

Federal Ministry
for Economic Cooperation
and Development