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Trade and the Environment

Frameworks and Methods for Impact Assessment

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Trade and the Environment: Frameworks and Methods for Impact Assessment

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List of Abbreviations

AfT	Aid for Trade
ASEAN	Association of East-Asian Nations
CBA	Cost-Benefit Analysis
CGE	Computable Equilibrium Models
CVM	Carbon Valuation Methods
DECC	British Department of Energy and Climate Change
DEFRA	British Department for Environment, Food and Rural Affairs
DFID	British Department for International Development
EC	European Commission
EC Trade SIA	European Union Trade Sustainability Impact Assessment
EF	Ecological Footprint
EIA	Environmental Impact Assessment
EU	European Union
FTA	Free Trade Agreement
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GHG	Greenhouse Gas
GTAP	The Global Trade Analysis Project
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IA	Impact Assessment
IATRP	Impact Assessment on Trade Related Policies
IISD	International Institute for Sustainable Development
KfW	Kreditanstalt für Wiederaufbau
LCA	Life Cycle Analysis
MCA	Multi Criteria Analysis
MFA	Material Flow Accounting
ODI	Overseas Development Institute
OECD	Organization for Economic Cooperation and Development
OECD DAC	Organization for Economic Cooperation and Development – Development Assistance Committee
PE model	Partial Equilibrium model
PIOT	Physical Input-Output Tables
RTA	Regional Trade Agreement
RTEA	Rapid Trade Environmental Assessment
SEA	Strategic Environmental Assessment
SEAT	Sustaining Ethical Aquaculture Trade
UK	United Kingdom
UKP	Umwelt- und Klimaprüfung (Environment and Climate Assessment)
UN	United Nations
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America

WTO	World Trade Organization
WTO CTE	World Trade Organization Committee on Trade and Environment
WWF	World Wildlife Fund

Executive Summary

This study provides an overview of existing approaches and methods for assessing the environmental impacts of trade and trade-related activities. It considers both approaches that are tailored to the assessment of trade-environment linkages and more generic approaches for environmental assessment and analyzes their respective usability in the context of trade-related development cooperation. The study thereby aims to contribute to a more extensive use of such tools, while improving the practice and application of environmental assessments of trade-related policies and programs. In doing so, the study will complement the existing study on the assessment of the socio-economic impacts from trade carried out by the Overseas Development Institute (ODI)[1].

The study is divided into two parts. Part I begins with a brief discussion on trade-related development cooperation followed by a short overview of the debate on trade, development and the environment. Next it provides an overview of existing approaches to conceptualizing environmental impacts from trade-related activities. After this, it provides a general introduction to impact assessment (IA) and the assessment of environmental impacts in this context. It closes with a brief overview of the assessment of environmental aspects in German development cooperation. Part II provides a more detailed review of existing frameworks and methods for assessing the environmental impacts from trade-related policies and programs.

Part I: Assessing the Linkage between Trade, Development and the Environment

German Aid for Trade and the Role of the Environment

A central aim of trade-related development cooperation is to enable developing countries to capture the gains from trade liberalization. For this purpose, the Aid for Trade (AfT) Initiative was launched at the World Trade Organization's (WTO) Hong Kong Ministerial Conference in December 2005. In its final declaration, the Ministerial called on donors to increase their AfT resources to support developing countries in building the necessary capacities for enabling countries to "implement and benefit from WTO Agreements and more broadly to expand their trade"[2].

As pointed out in the German AfT strategy[3], trade-related development cooperation may not only influence economic development, but may also have important impacts on the environment. Therefore, Germany's approach to trade-related development cooperation stresses the importance of considering environmental impacts and strengthening compliance with social and environmental standards to foster sustainable development. Particu-

[1] ODI 2008.
[2] WTO 2006.
[3] BMZ 2011.

larly, the consideration of impacts of trade-related activities on climate should be strengthened in trade-related programs.

Trade, Development and the Environment

Especially in developing countries effects on the environment caused by an increase in trade may have far-reaching effects. Many developing countries are highly dependent on the export of natural resources and agricultural products. In the absence of a corresponding environmental policy framework, increased export activities in these sectors are likely to have significant implications for the environment. Simultaneously, the dependence on natural resources for human livelihoods in developing countries implies that the human costs of environmental degradation are particularly severe[4].

Moreover, environmental impacts of trade-related measures may vary significantly based on the accompanying measures that are put in place[5]. Assessing the specific impacts of increased trade or the introduction of a trade-related measure on the environment, therefore, requires a careful analysis of the given context. For this reason, the systematic assessment of environmental impacts is an important tool to support trade policy development.

Conceptualizing Environmental Effects in the Trade Context

To conduct an assessment of the environmental effects of trade-related activities, it is essential to have a basic understanding of the main linkages between the related intervention and the environment. For this purpose, this report presents the OECD's approach for conceptualizing the linkages between trade-related activities and the environment. The OECD distinguishes between five categories of effects resulting from trade-related measures and policies[6]: scale effects, structural effects, product effects, technology effects, and regulatory effects. These are defined as follows:

Scale effects relate to macro-economic effects resulting from a trade agreement or measure. Related growth in trade may facilitate increased volumes of production in certain economic sectors, enabling economies of scale, i.e. the production of goods at a lower cost per unit.

Structural effects are related to changes in the patterns of economic activities. Structural effects describe the changes in the composition of a country's economy. This means it refers to the effects resulting from the growth or shrinkage of economic sectors[7].

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[4] UNDP 2011; Giljum and Eisenmenger 2004.
[5] EC 2012a.
[6] OECD 1994, 1999, 2008b.
[7] UNEP/IISD 2005.

Product effects refer to trade flows in specific products that may harm or enhance the environment, depending on whether these products lead to an increase or decrease in environmental degradation.

Technology effects occur when, as a result from a trade measure, there are changes in the way products are made, referring to the technologies that are used to produce them.

Regulatory effects correspond to the legal and policy effects of a trade measure or agreement.

These trade-related effects can have both negative and positive impacts on the environment. They are not mutually exclusive thus a trade-related measure may induce effects in several of these categories at the same time. Moreover, it is possible that there are spillover effects across the different categories. Finally, it is also important to consider the scope of environmental impacts. This can take a geographic or a sectoral perspective. While the former emphasizes the environmental impacts resulting from activities or policy changes within a defined geographic area, the latter might consider an entire value chain, spanning multiple countries.

Impact Assessment and the Environment

A comprehensive IA has the ambition to take the potential environmental impacts of a policy measure into account before a policy is adopted, and thereby enable decision makers to minimize unwanted effects and enhance desired impacts. However, in practice environmental impacts are often not adequately considered[8]. This is due to the fact that the assessment of environmental impacts is often challenging in terms of understanding causal chains and cumulative effects and making accurate predictions. Additionally, environmental concerns are often assigned a relatively low priority in the decision-making process.

Despite these manifold challenges, IA is often conceived as a tool to generate clearly defined quantitative results for assessing policy proposals. However, given the various uncertainties in assessing likely impacts, this is rarely a sufficient basis for decision-making. Therefore, IAs have increasingly evolved into broad approaches for assessing how policies induce final impacts via behavioral changes in society. In this context, IA is conceptualized as a process to collect and process evidence in cooperation with relevant stakeholders. Although many different approaches towards IA exist and different concepts and frameworks have been developed with regard to the respective national context, IA generally follows a set of procedural steps, including:

- Problem identification and objective definition
- Development of policy, program or project options

[8] Adelle and Weiland 2012.

- Scoping of the assessment and selection of methods and tools
- Impact analysis
- Mitigating measures to optimize positive outcomes
- Presenting results

Throughout all the steps of an IA, it is desirable to consult relevant stakeholders including the relevant departments within government to increase the evidence-base of the IA and to increase acceptance of the initiative.

Part II: Frameworks and Methods for Assessing the Impact of Trade Policy and Promotion on the Environment

The OECD concepts and the basic IA process outlined above offer a general framework for conducting an IA that considers trade-related impacts on the environment. To provide a more detailed assessment of possible environmental effects, various methods and procedural frameworks have been developed. Some have been designed especially for a trade-related context, while others represent generic frameworks with potential applications to the trade sector.

Frameworks for Assessing Environmental Impacts

Frameworks for assessing environmental impacts define the priorities and the scope of an IA, and they typically break down the assessment into a set of procedural steps. In some cases, they may provide guidance for identifying relevant impact areas and for selecting appropriate indicators and analytical methods.

This report presents three such frameworks and assesses their applicability in the context of trade-related development cooperation: the European Commission's (EC) Trade Sustainability Assessment (Trade SIA), the United Nations Environment Programme's (UNEP) Integrated Assessment of Trade-Related Policies (IATRP) and Strategic Environmental Assessment (SEA). Additionally, it provides a brief introduction to the EC's generic IA framework. UNEP's IATRP and the EC's Trade SIA are both aimed specifically at the trade sector and cover impacts across all three dimensions of sustainable development. The EU's IA framework and SEA are generic frameworks that are not aimed at any specific policy field. Only SEA is focused primarily on environmental impacts. All the considered frameworks have in common that they outline a number of steps to help structure the process of conducting an IA. They do not determine the methods that should be used for generating and evaluating data and information. They may, however, provide examples and general guidance to support the selection of appropriate methods for conducting a detailed assessment of relevant impacts. This is the case for UNEP's approach on integrated assessment of trade-related policies as well as the EU's Trade SIA framework.

Methods to Support Impact Assessment

In addition to a review of these frameworks for IA, the study also reviews methods that facilitate the generation of evidence during the various activities set out by the IA frameworks. It provides an overview of five method families, which may be applied at different stages and for different purposes in an IA: scoping methods, environmental accounting methods, scenario development methods, economic valuation methods, and methods for aggregation and comparison.

None of these method families is specifically designed for the analysis of trade-related policies or measures. Rather they represent methods that have the potential to be used in a trade-related context. Moreover, a number of categories might be partially overlapping, and certain techniques may be used in conjunction with approaches in the other method families or sub-categories. In other words, the categories represent a structure for presenting the different methods and their uses rather than clearly defined analytical categories. Following the presentation of these method families, the report also briefly presents the LIAISE shared toolbox, a web-based compilation of IA instruments and knowledge for conducting sustainability-oriented IA.

Scoping Methods

Scoping methods are used for a preliminary assessment to identify the most important impacts of a planned measure and, if necessary, to determine the focus and methods for a more detailed assessment. The report presents three specific scoping methods: checklists, results chain analysis and matrices. While results chain analyses and matrices represent methods for visualizing the impacts of a planned intervention, checklists offer guidance for directing the scoping exercise towards issue areas that are considered important in the field of application. They may include simple devices for assessing the relative significance of different aspects being considered. The main advantages of scoping methods are the limited resources and time that are required for applying them. Consequently, the results are also not very robust.

Environmental Accounting Methods

Environmental accounting methods track material flows in the economy. The main methods considered in this method family are Physical Input-Output Tables (PIOT), Material Flow Accounting (MFA), Life-Cycle Assessment (LCA) and Ecological Footprint (EF). They allow for the analysis of physical aspects (in contrast to accounting of monetary issues) of economic activities, products, processes or consumption patterns. While PIOTs and MFAs describe the physical input-output flows with a *regional* focus, LCA and EF analyze physical impacts at *product* level[9]. The application of these methods is rather resource-intensive.

[9] Faße et al. 2009.

Scenario Development Methods

Scenario development is an important feature of IA since it allows for the formulation of assumptions on future developments in one connected storyline. "Scenarios are consistent and coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present, and future developments, which can serve as a basis for action"[10]. Scenarios can be described qualitatively or quantitatively. Often both approaches are combined. Models are used to provide quantitative simulations of the likely impacts of selected variables under various circumstances. Participatory scenario development allows for the integration of stakeholders' views on the key influencing factors of future courses and the embedding of scenario assumptions in a specific regional context.

Economic Valuation and Valuation-based Approaches

Economic Valuation Methods (EVM) seek to put a monetary value on environmental impacts, which may be positive (e.g. improved water quality) or negative (e.g. increased air pollution). Applying monetary values to environmental goods and services can help in weighing the potential economic gains of increased trade against the potential costs of related economic changes and their environmental implications. EVM is a fairly new approach and involves the risk of over- or undervaluing environmental goods and services. Moreover, it is relatively resource-intensive and requires sophisticated economic expertise.

Additionally, there are so-called Carbon Valuation Methods (CVM). These are focused and standardized approaches to quantify and monetize the climate change impacts from planned policies in form of increased or decreased greenhouse gas (GHG) emissions. They have been developed in selected OECD countries and require a fairly sophisticated preliminary analysis if applied to interventions with more complex causal chains, as is common in a trade-related context.

Methods for Aggregation and Comparison

Methods for aggregation and comparison are methods for the decision-making stage in an IA. These methods summarize the different aspects of assessed options into one result. This helps to compare, rank and finally recommend one option to decision-makers. This can be done by valuing all costs and benefits from a proposed intervention and aggregating them into one single monetary value in a Cost-Benefit Analysis (CBA). In CBAs, all impacts have to be presented in monetary terms. CBA's may therefore draw on the results of an exercise using EVM. Multi-Criteria Analysis (MCA) aims at integrating qualitative, quantitative and monetized information and weighing the different options against a set of selected criteria. MCA may be useful if environmental or social impacts cannot be displayed in monetary values. Both approaches are relatively data and resource-intensive.

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[10] Van Notten 2006.

Compilations of IA Instruments and Knowledge

Finally, compilations or toolboxes for IA assemble existing knowledge and instruments available for assessing the effects of policies, plans and programs. Their aim is to help IA practitioners identify suitable instruments and expertise for supporting a given IA process. They seek to provide IA practitioners with access to up to date knowledge for conducting an IA. The LIAISE shared toolbox serves as a good example for a compilation of IA instruments and knowledge for conducting sustainability-oriented IA.

Conclusion

All of the methods and method families considered in this study focus on different aspects of the IA process and consider different dimensions of the trade-environment linkage. Therefore, a combination of methods may be most suitable to gain a more complete overview on possible environmental impacts resulting from trade policies and programs. An overview of the main strengths and weaknesses of the presented frameworks and methods can be found in Table 4 and 5 at the end of this report.

Even if robust data are available for conducting the impact analysis, a high level of uncertainty of these assessments will remain. Therefore, the involvement of stakeholders in the assessment process is essential for including all relevant aspects in the assessment and for validating the results. Moreover, one-off IA exercises are less effective in the trade sector, due to the complexity of assessing trade-related impacts. Rather, an ongoing process of monitoring and evaluation is more likely to help integrate environmental concerns in trade-related measures and enhance the quality of policies and programs over time.

PART I: ASSESSING THE LINKAGES BETWEEN TRADE, DEVELOPMENT AND THE ENVIRONMENT

1 Introduction

1.1 Background

There has been a long-standing debate on the link between trade and development. In principle, the benefit of increased trade for promoting economic development is now widely accepted. Simultaneously, however, there is agreement that to capture the economic gains from trade, especially in developing countries, the careful sequencing of trade reforms and the implementation of complementary measures are essential (such as infrastructure development, trade facilitation measures and other trade promotion activities). Moreover, these gains may be distributed unevenly across different sectors of society, requiring measures to mitigate negative social impacts. These socio-economic challenges represent the core rationale for Aid for Trade (AfT), an initiative launched in the context of the Doha Round of trade negotiations.

A similar debate on trade and the environment has been ongoing in the context of multilateral trade negotiations since at least the early 90s. In 1994, shortly before the official founding of the World Trade Organization (WTO), its Committee on Trade and Environment (CTE) was created to provide an official forum for dialogue on these questions. Negotiations on the subject were launched in 2001 in the context of the Doha Round of trade negotiations. However, with the conclusion of the Doha Round still pending, no official mechanism to match the AfT initiative has been created.

Mirroring these developments, the assessment of socio-economic implications of trade reforms is relatively well established in development cooperation. In 2008, the GTZ (Deutsche Gesellschaft für Technische Zusammenarbeit) commissioned a study, carried out by the Overseas Development Institute (ODI), which provides an overview of existing tools and methods for the assessment of socio-economic impacts in the trade sector[11]. While the environmental dimension of trade and trade-related policies has gained increasing importance in recent years, approaches to analyzing the environmental dimensions of trade policy and trade-related activities are more dispersed. Nonetheless, a number of approaches exist. They range from integrated approaches tailored to the trade sector, in which environmental impacts are considered among other factors, to generic environmental assessments, such as Strategic Environmental Assessment (SEA), designed for the as-

[11] ODI 2008.

sessment of a broad range of programs. Other approaches, like Life Cycle Assessment (LCA), aim at assessing product-related impacts throughout the value chain.

1.2 Purpose and Structure of the Study

This study provides an overview of the existing approaches and methods for assessing the environmental impacts of trade and trade-related activities. It considers both approaches that are tailored to the assessment of trade-environment linkages and more generic approaches for environmental assessment and analyzes their respective usability in the context of trade-related development cooperation. The study thereby aims to contribute to a more extensive use of such tools, while improving the practice and application of environmental assessments of trade-related policies and programs. In doing so, the study will complement the existing study on the assessment of the socio-economic impacts from trade carried out by ODI[12].

The following study is divided into two parts: Part I begins with a brief discussion on trade-related development cooperation followed by a short overview of the debate on trade, development and the environment. Next it provides an overview of existing approaches to conceptualizing environmental impacts from trade-related activities. After this it provides a general introduction to impact assessment (IA) and the assessment of environmental impacts in this context. Finally, Part I closes with a brief overview of the assessment of environmental aspects in German development cooperation. Part II provides a more detailed review of existing frameworks and methods for assessing the environmental impacts from trade-related policies and programs.

1.3 The Aid for Trade Initiative

As indicated above, a central aim of trade-related development cooperation is to enable developing countries to capture the gains from trade liberalization. For this purpose, the AfT Initiative was launched at the WTO's Hong Kong Ministerial Conference in December 2005. In its final declaration, the Ministerial called on donors to increase their AfT resources to support developing countries in building the necessary capacities for enabling countries to "implement and benefit from WTO Agreements and more broadly to expand their trade"[13]. A task force was set up to work on recommendations on how to operationalize AfT.

The WTO defined five categories for AfT activities, which distinguish between AfT in the narrow sense (also referred to as Trade Related Assistance) and a broader set of AfT measures:

In the narrow sense AfT encompasses assistance in the following two categories:

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[12] ODI 2008

[13] WTO 2006.

- Trade policy and regulation, which can include training or support in the development and implementation of trade regulations and rules.
- Trade development, which includes market analyses and development, institutional support for trade or investment promotion.

In the broader sense, AfT also includes:

- The development of economic infrastructure, which includes physical infrastructure for transport or storage, communication as well as energy supply.
- Building productive capacity, which includes productive sectors such as industry, agriculture, fishing, mineral resources and etc., which are not marked as trade development
- Trade-related adjustment measures, which include, for example, contributions to budgets for the implementation of trade reforms or adjustments to trade policy measures by other countries.

As a sixth category other trade-related support can be part of AfT programs, if they are not captured under the categories above[14].

1.4 German Aid for Trade and the Role of the Environment

As mentioned previously, trade can be a way to foster economic growth, reduce poverty and enhance sustainable development[15]. However, as it may be particularly difficult for developing countries to utilize the full potential of trading opportunities, the European Union (EU) and its Member States have adopted a joint strategy on AfT in 2007 to strengthen the target countries' capacities to negotiate and implement trade agreements and to target the "supply-side" constraints, like a lack of productive capacity, poor infrastructure or the inability to meet standards in high value export markets. In this way the EU aims at increasing the benefits from increasing trading opportunities. This strategy embraces all six categories of AfT mentioned above[16].

The EU is one of the leading providers of AfT and has consistently increased AfT commitments since 2004[17]. Within the EU, Germany contributed about €2.3 billion to AfT measures in 2010 and, therefore, is one of the three largest European providers of AfT[18]. To define priority areas for German AfT, the German Federal Ministry for Economic Cooperation and Development (BMZ) developed a cross-sectoral strategy for trade-related development cooperation in 2011. According to this, it is the goal of German AfT to strengthen the capacities of partner countries to engage in trade negotiations as well as in trade policy formula-

[14] EC 2009a.
[15] See Chapter 2.
[16] EC 2011.
[17] EC 2009a.
[18] BMZ/GIZ 2012; EC 2011.

tion and implementation. Moreover, German AfT aims at capacity building for the implementation of trade agreements and related economic policies, the improvement of export and supply capacities as well as improving the integration into regional and international value chains also including the extension of economic infrastructure[19].

In practice, AfT is implemented through projects in cooperation with bilateral or multilateral donors and can have a national, regional or global focus. Moreover, the projects may apply to the micro-, meso- or macro level. Therefore, diverse projects in German development cooperation can be assigned to AfT. AfT provided by the GIZ (Deutsche Gesellschaft für Internationale Zusammenarbeit) is typically targeted at ministries of economy and trade, chambers of industry and commerce, trade associations and enterprises as well as organizations for regional integration. Among other things, these projects may encompass the facilitation of dialogue between the private sector and civil society regarding their interests in the context of economic development and the formulation of trade and investment policies, legal and strategic consultancy regarding the negotiation of trade and investment agreements as well as support for the implementation of monitoring systems, the advancement of qualifications of public and private institutions or the support of partners in complying with international quality standards and the facilitation of technology transfer and innovation[20].

As pointed out in the German strategy for trade-related development cooperation, AfT may not only influence economic development, but may also have important impacts on the environment. Therefore, Germany's approach to AfT stresses the importance of considering environmental impacts and strengthening compliance with social and environmental standards to foster sustainable development. Particularly, the consideration of impacts of trade-related activities on climate should be strengthened in AfT programs. In this context, the introduction of environmental standards and labeling is considered an important dimension of AfT. Furthermore, knowledge and technology transfer and adjustments to changing export structures, due to climate change mitigation and adaptation, are regarded as crucial in AfT[21]. To be able to better understand the inter-linkages between trade and the environment, their relationship is briefly described in the following section.

[19] BMZ 2011; BMZ/GIZ 2012.
[20] BMZ/GIZ 2012.
[21] BMZ 2011.

2 Trade, Development and the Environment

It is widely acknowledged that there are strong inter-relations between trade and the environment, as economic development induced by trade-related measures may cause changes in the environment. On the one hand, current trends suggest that this relationship is negative. Increasing volumes of trade and growing global economic inter-dependence are developing hand in hand with mounting pressures on the environment and natural resources. These trends are strongly interrelated, as much environmental damage is clearly a result of the increasing scale of global economic activity[22].

Especially in developing countries effects on the environment caused by an increase in trade may have far-reaching effects. Many developing countries are highly dependent on the export of natural resources and agricultural exports. In the absence of a corresponding environmental policy framework, increased export activities in these sectors are likely to have significant implications for the environment. Simultaneously, the dependence on natural resources for human livelihoods in developing countries implies that the human costs of environmental degradation are particularly severe[23].

Additionally, critics argue that a reduction of trade barriers leads to a shift of pollution intensive industries from high income countries with more stringent environmental regulations to lower income countries with lower environmental standards, known as the "pollution haven hypothesis"[24]. Along similar lines, it is argued that trade liberalization might trigger a 'race to the bottom', where environmental standards are lowered to prevent capital outflow and to maintain national competitiveness. Both hypotheses claim that an increase in trade and further trade liberalization will increase environmental damage unless international trade agreements incorporate provisions for environmental protection[25].

On the other hand, however, there is considerable evidence that in many areas an opposite trend – a 'race to the top' in environmental standards – is in fact visible. In particular for product related standards, global supply chains are forcing producers to adopt the increasingly ambitious standards of the respective import markets.[26] Moreover, economic analysis has also shown that ambitious environmental standards do not necessarily harm the competitiveness of an economy. Under certain conditions, stringent environmental regulation can boost innovation and drive international export success[27]. In fact, international trade is often a key driver for the international diffusion of environmental innovations. Once an

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[22] UNEP/IISD 2005.
[23] UNDP 2011; Giljum and Eisenmenger 2004.
[24] Copeland and Taylor 2004.
[25] Dinda 2004.
[26] E.g. Jaenicke and Jacob 2004.
[27] Porter 1991.

environmental innovation is available in a so-called lead market, other countries are more likely to tighten environmental standards to tackle the related environmental challenge[28].

Moreover, numerous studies have shown that the relationship between economic development and environmental performance is positive for certain pollutants after a certain threshold of economic prosperity (i.e. income per capita) has been reached (the so-called environmental Kuznets curve). In other words, an initial phase of economic development, where environmental impacts increase, is followed by a process of continued improvements. It can, therefore, be argued that economic gains from trade are ultimately translated into improved environmental performance. This relationship only holds for certain pollutants, however. Most importantly, it does not apply to the emission of GHG or trends in resource consumption[29].

In conclusion, the relationship between trade, economic development and environmental performance is complex and non-linear, especially regarding developing countries. Among other things, the impacts of trade on the environment depend crucially on the environmental policy regime that is in place. If it is ensured that trade policies are accompanied with effective environmental legislation, increased trade openness can provide incentives for the transfer of environmentally friendly technologies. Moreover, if designed appropriately, environmental standards can increase economic efficiency and improve productivity and thus enhance trade performance. At the same time, however, policy makers may opt for economic development strategies based on lax environmental regulations that allow firms to boost their economic competitiveness by externalizing environmental costs. Environmental impacts of trade-related measures thus vary significantly based on the particular strategy and the accompanying measures that are put in place[30].

Assessing the specific impacts of increased trade or the introduction of a trade-related measure on the environment, therefore, requires a careful analysis of the given context. For this reason, the systematic assessment of environmental impacts is an important tool to support trade policy development.

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[28] Beise and Rennings 2005.
[29] Yandle et al. 2002.
[30] EC 2012a.

3 Conceptualizing the Environmental Impacts from Trade-Related Activities

Before presenting specific methods for the assessment of environmental impacts in the trade sector, the following section presents existing approaches to conceptualizing environmental impacts from trade-related activities. These provide the basis for conducting a more detailed assessment drawing on the methods presented in Part II of the report.

3.1 Direct and Indirect Impacts

As discussed in Chapter 2, there are strong inter-linkages between trade and the environment. Depending on the trade-related activity, these environmental impacts can be direct or indirect. Direct impacts refer to environmental degradation, which results directly from a given intervention to facilitate trade. For example, trade-related measures might include the construction of infrastructure, such as a new port. The direct effects from this intervention would include both environmental impacts resulting from the construction project itself, such as the destruction of local eco-systems, as well as the resulting increase in traffic once the project has been completed[31]. Indirect effects, on the other hand, refer to environmental impacts resulting from broader changes in economic activity due to trade liberalization or other regulatory or behavioral changes accompanying trade-related interventions. In order to conceptualize these indirect effects, the OECD has developed a framework for categorizing the different types of intermediate effects, which help to explain the causal links between trade or trade-related interventions and the environment.

3.2 Types of Environmental Impacts

Whether direct or indirect, the environmental impacts from trade-related activities can be further sub-divided into the different *types* of environmental impacts that are caused. The OECD[32] distinguishes between three broad impact categories: resource effects, pollution effects, as well as health and safety effects. They are defined as follows:

Resource effects include changes in the use of energy and natural resources, changes related to the destruction of ecosystems, effects on biodiversity and changes in land use patterns.

Pollution effects refer to a change in emissions of harmful substances into the air, water or land, which also includes the disposal of waste. This can have effects on soil quality, air quality or water quality and supply.

[31] UNEP/IISD 2005.
[32] OECD 1994, 1999, 2008b.

Health and safety effects are defined by the OECD as the changes in the protection of human, animal or plant health and life and can relate to effects on sanitation, potable water services, chemicals in food supply, the spread of pests, or environment-related diseases.

3.3 The OECD's Categories of Trade-Related Effects on the Environment

As pointed out in Section 3.1, trade does not necessarily have direct effects on the environment. However, it is usually assumed that lowering trade barriers will enhance economic growth. Economic development and changes in production patterns, in turn, can have different types of effects on the environment. In this context, the OECD distinguishes between five categories of trade-related effects on the environment[33]: scale effects, structural effects, product effects, technology effects, and regulatory effects. Among these effects, product effects, technology effects and regulatory effects may be either direct or indirect. Scale effects and structural effects are rather indirect effects and therefore often more difficult to assess[34]. These different trade-related effects are not mutually exclusive, but a trade agreement or measure may induce effects in several of these categories at the same time. Moreover, it is possible that there are spillover effects across the different categories.

The OECD defines these five categories as follows:

Scale effects relate to macro-economic effects resulting from a trade agreement or measure. Increased trade opportunities may facilitate increased volumes of production in certain economic sectors, enabling economies of scale, i.e. the production of goods at a lower cost per unit. These scale effects have both positive and negative environmental effects. Negative scale effects might include the accelerated depletion of natural resources and increases in pollution, due to higher volumes of production and the related techniques employed to boost production (e.g. the use of mono-cultures or the increased use of fertilizers in agricultural production). On the other hand, positive scale effects may occur, if the related increase in economic returns is invested in measures to protect the environment such as investment in environmentally friendly technologies. In some cases, scale effects might also entail an increase in resource efficiency, although total resource use might still increase. Indirectly, scale effects may also lead to greater affluence and thus help in creating a higher demand for environmental protection or environmentally friendly goods in society. Conversely, if no appropriate policies to protect the environment are in place, negative impacts on the environment may outweigh the gains.

Structural effects are related to changes in the patterns of economic activities. Structural effects describe the changes in the composition of a country's economy. This means it re-

[33] OECD 1994, 1999, 2008b.
[34] OECD 1994.

fers to the effects resulting from the growth or shrinkage of economic sectors[35]. Again, environmental impacts may be positive or negative. Positive effects may occur, if the composition of the economy changes so that less polluting sectors increase their share of the economy, or vice versa.

Product effects refer to trade flows in specific products that may harm or enhance the environment, depending on whether these products lead to an increase or decrease in environmental degradation. For instance, an increase in trade of more environmentally friendly consumer goods, like more fuel efficient cars, would lead to environmental improvements, if they replace less efficient products in the respective country. Similarly, positive product effects are associated with an increased trade of inputs that reduce environmental effects, like low sulfur coal. Negative effects might result from an increase in the trade in goods that are environmentally sensitive, when they replace locally produced alternatives that are less environmentally sensitive. Moreover, trade in environmentally sensitive products, such as hazardous waste or other products with special requirements regarding their disposal, may have negative environmental consequences, if sold to countries without the related environmental legislation in place.

Technology effects occur when, as a result from increased trade openness, there are changes in the way products are made, referring to the technologies that are used to produce them. For instance, a reduction of trade barriers may facilitate the import of machinery or environmental technologies that reduce pollution per unit produced or decrease the amount of resources needed in the production of a particular product[36]. In other cases, the technology effects may also be negative, however, if imported technologies enable more resource intensive or more polluting production processes.

Regulatory effects correspond to the legal and policy effects of a trade measure or agreement. Negative effects may occur, if legal changes resulting from trade agreements or trade policy measures constrain the involved government’s ability to pursue appropriate environmental policy measures. On the other hand, trade agreements may include clauses strengthening the environmental policy regime or promoting measures to protect the environment, including issues related to worker’s health. For instance, during the phase out of the Multi-Fibre Agreement, the US negotiated a trade agreement with Cambodia, which contained mechanisms that linked improvements in labor conditions, including health and safety standards, to an increase in import quotas[37].

[35] UNEP/IISD 2005.
[36] UNEP/IISD 2005.
[37] ODI 2009.

3.4 Scope of Effects

Next to the type of environmental impacts it is also important to consider the scope of environmental impacts. This can take a geographic or a sectoral perspective. While the former emphasizes the environmental impacts resulting from activities or policy changes within a defined geographic area, the latter takes a sectoral focus and might consider an entire value chain, spanning multiple countries.

Geographic Perspective

In the past, the majority of approaches for the assessment of environmental impacts from trade-related measures and policies have focused on assessing impacts from a geographic point of view. Taking a geographic perspective, environmental impacts may be further subdivided into local, national, transnational and global impacts. These sub-divisions refer only to the scope of the *effect*, while the economic and regulatory changes responsible for the effect remain confined to the relevant geographic entity, typically the national level. In this case, local effects refer to effects resulting only in one specific site as a direct result from an intervention. National effects, on the other hand, are largely limited to the territorial borders of a country (e.g. urban smog, polluted soil), but may not be site-specific. Transnational effects affect two or more countries (e.g. polluted rivers, management of migratory species). Finally, global environmental effects cannot be confined to a specific region but affect all countries (e.g. climate change).

Sectoral or Value Chain Perspective

More recently, increasing attention is being placed on the assessment of environmental impacts from a sectoral or value chain perspective. Especially corporate actors have started to develop approaches for assessing and quantifying the environmental implications along their international supply chains. These approaches are utilized in the context of global supply chain management and serve the purpose of improving environmental performance. Additionally, they may be applied in the context of sustainability-oriented labeling and certification schemes.

Within the context of development cooperation, an increasing focus on value chains and value chain analysis make these approaches highly relevant. They might be applied in the context of generic value chain-based development strategies as well as the increasing number of trade-related initiatives directly supporting environmentally friendly value chains and the implementation of environmental standards and labels.

When applied in the context of international trade, a supply chain or value chain perspective implies that, in sum, the impacts being analyzed are often international in their scope. Simultaneously, the analysis will typically focus on the more immediate effects resulting from activities along the supply chain. The broader implications captured by the OECD categories are, therefore, less relevant from this perspective. Nevertheless, the individual impacts occurring at different segments of a value chain may still be sub-divided into local, national, transnational and global effects.

3.5 Results Chains for Environmental Impacts in Trade-Related Activities

The concepts and categories outlined above provide the basis for conceptualizing the environmental impacts from trade and trade-related activities. They represent a basic analytical framework for the assessment of trade-related impacts on the environment. Drawing on these concepts, a basic results chain analysis of trade-related projects can be conducted. To operationalize the concepts in the context of trade-related interventions, the following section outlines basic results chains for the different types of trade-related measures introduced in Section 1.3 .

A results chain illustrates the causal sequence from cause to effect. Whether explicitly or implicitly, any IA will need to draw on an analysis of causal chains, and it is common to initiate an IA with some form of results chain analysis. A results chain visualizes how a planned activity (e.g. trade agreement, infrastructure project) is likely to translate from the initial intervention into various impacts. A results chain can be used to trace both the intended and unintended effects of a planned intervention. Usually, a results chain analysis starts with describing the planned activity, considers the outputs or immediate outcomes, followed by intermediate and final outcomes. Finally, based on these findings, it points at the impacts that are likely to occur. Identifying the main indicators for analyzing and monitoring the impacts of a planned activity can also be part of a results chain analysis.

If applied to the analysis of environmental impacts of trade measures, a results chain analysis may take the following steps:

Step 1: Identification of relevant measures: To identify measures for which a causal sequence can be usefully developed, the policy or program may have to be disaggregated into a set of individual measures or activities, or, in other cases, the combined effect of a set of activities may have to be considered.

Step 2: Identification of outputs/immediate outcomes: Based on this, the outputs or immediate outcomes of the chosen measures should be determined.

Step 3: Identification of intermediate effects (where applicable): In a next step, intermediate effects should be identified based on the five OECD categories of trade-related effects. Depending on the particular case or level of detail, several intermediate effects might be identified, resulting in a longer results chain. Direct impacts will have no or only a very simple set of intermediate effects.

Step 4: Identification of final outcomes: To identify the direct and indirect environmental impacts, a final outcome, representing the ultimate cause of the environmental impact, should be identified. In some cases, the immediate and final outcome may be identical.

Step 5: Identification of direct and indirect impacts: Next, the likely consequences from these intermediate effects should be translated into the final environmental impact, distinguishing between resource, pollution and health and safety effects.

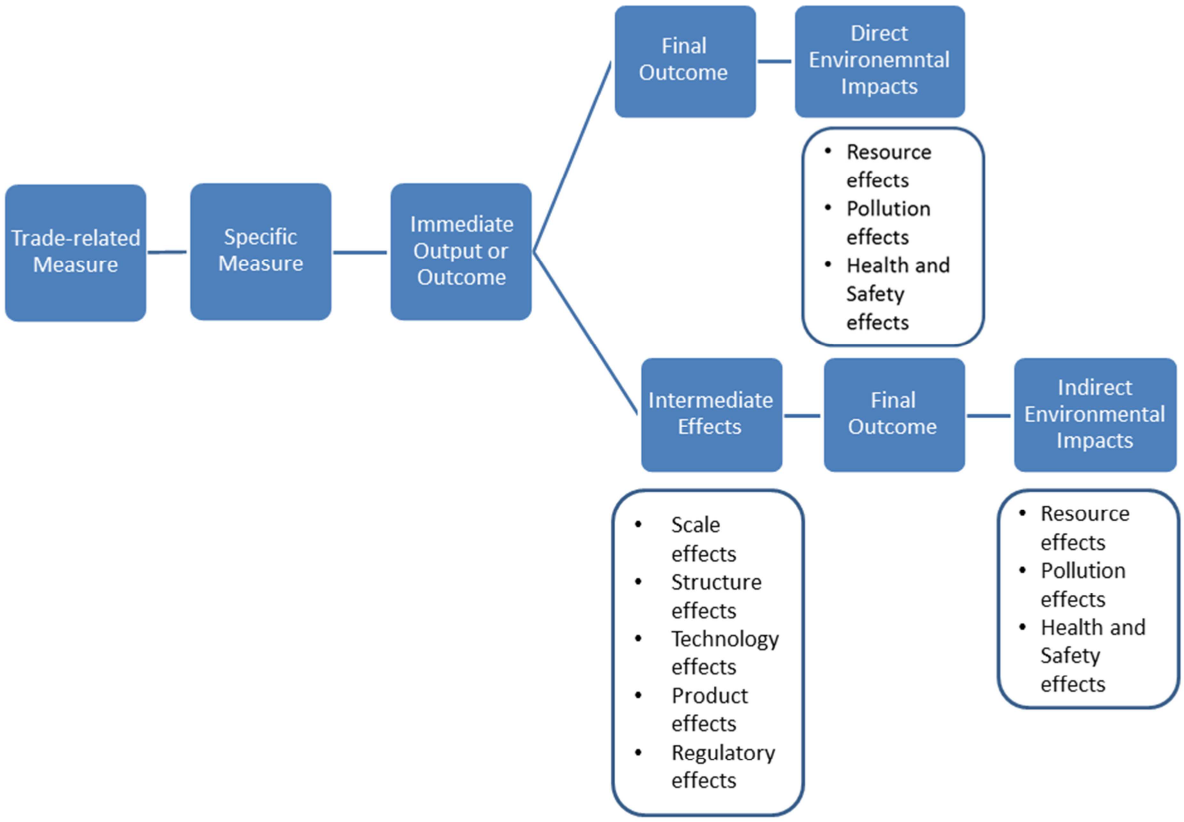
Step 6: Evaluation of the scope of environmental impacts: In a final step, the results chain analysis may consider the scope of the effects, distinguishing between local, national, transnational and global.

The construction of results chains for the most salient features of trade-related measures provides a starting point for further analysis and the development of possible flanking measures within the context of the program. Specifically it provides the basis for the identification of:

1. the most relevant environmental impacts that are likely to occur;
2. areas that might require mitigating measures to avoid serious environmental damage;
3. areas that require further analysis;
4. possible interaction effects between different impacts and/or intermediate outcomes.

The results chain in Figure 1 on the following page visualizes a generic causal sequence of how a trade-related intervention might be translated into direct and indirect environmental impacts.

Figure 1: Generic Results Chain for Analyzing the Environmental Impacts from trade-related measures



The following examples of different types of trade measures illustrate how a results chain analysis may be conducted to analyze a specific trade-related intervention. The examples reveal the broad spectrum of measures and corresponding causal sequences potentially covered by trade measures. Moreover, the different examples serve to illustrate both, the potentials and the limitations of a simple results chain analysis in a trade-related context.

The results chains for these examples do however not intend to give a comprehensive overview on all possible effects. Instead, some exemplary results chains are constructed to demonstrate the various possible environmental effects that a trade measure might cause.

3.5.1 Example 1: Trade Policy and Regulation: EU-India Free Trade Agreement

Although India is a growing global economic power and an important trade partner for the EU, there are still tariff and non-tariff barriers that hinder trade with the EU. Therefore, a High Level Trade Group was set up to explore opportunities to facilitate trade between the EU and India. This resulted in the recommendation of negotiating a broad trade and investment agreement. To assess the economic, environmental and social impacts of this agreement, an EC Trade SIA was carried out over the course of 2008. The final results were published in 2009 and present a detailed qualitative and quantitative analysis of the likely impacts of a Free Trade Agreement (FTA) between the EU and India, also considering possible third country effects[38]. Drawing on these results, two simplified results chains within the context of the FTA are outlined below:

Step 1: Identification of relevant measures: First, the FTA has to be disaggregated into a set of activities, for which a results chain can be usefully constructed. Here two activities are chosen to illustrate a likely positive and a likely negative impact resulting from the FTA: firstly, the lowering of EU tariffs on Indian textiles and, secondly, the lowering of Indian tariffs for European environmental technologies.

Step 2: Identification of outputs/ immediate outcomes: Second, the immediate output(s)/outcome(s) of each measure should be identified. From an Indian perspective, the immediate outcome would be increased export opportunities for Indian textiles and lower costs for European environmental technologies.

Step 3: Identification of intermediate effects: If relevant, intermediate effects resulting from the initial outcomes should be identified based on the OECD categories. In this case, this only applies to increased export opportunities in the textile sector, which causes increased investment in the Indian textile sector, leading to increased exports.

Step 4: Identification of final outcomes: The final outcome, resulting directly from the lower cost of European environmental technology, might be the increased adoption of European environmental technologies (technology effect), while increased investments and exports in the Indian textile sector would cause the medium-term growth of the Indian textile sector (structural effect).

Step 5: Identification of direct and indirect environmental impacts: Increased adoption of environmental technologies would lead to pollution reduction in related industries, possibly including CO_2 reductions (pollution effect). The growth in the textile sector would lead to increased consumption of resources used in textile production, most importantly water, as well as increased water pollution.

Step 6: Evaluation of the scope of the environmental impacts: The scope of increased water consumption and pollution might be national or transboundary, depending on the location of textile production. Given the size of India, however, the transboundary effects would be less significant. Pollution reduction from the increased adoption of environmental technologies would depend on the specific technologies adopted and might be both national and global (in the case of CO_2).

Figure 2 and Figure 3 demonstrate how the results chains for this brief analysis may look like.

[38] ECORYS et al 2009; ECORYS 2012; EC 2006b; EC 2012a.

Figure 2: Results Chain from the Analysis of the EU India FTA: Structural Effects

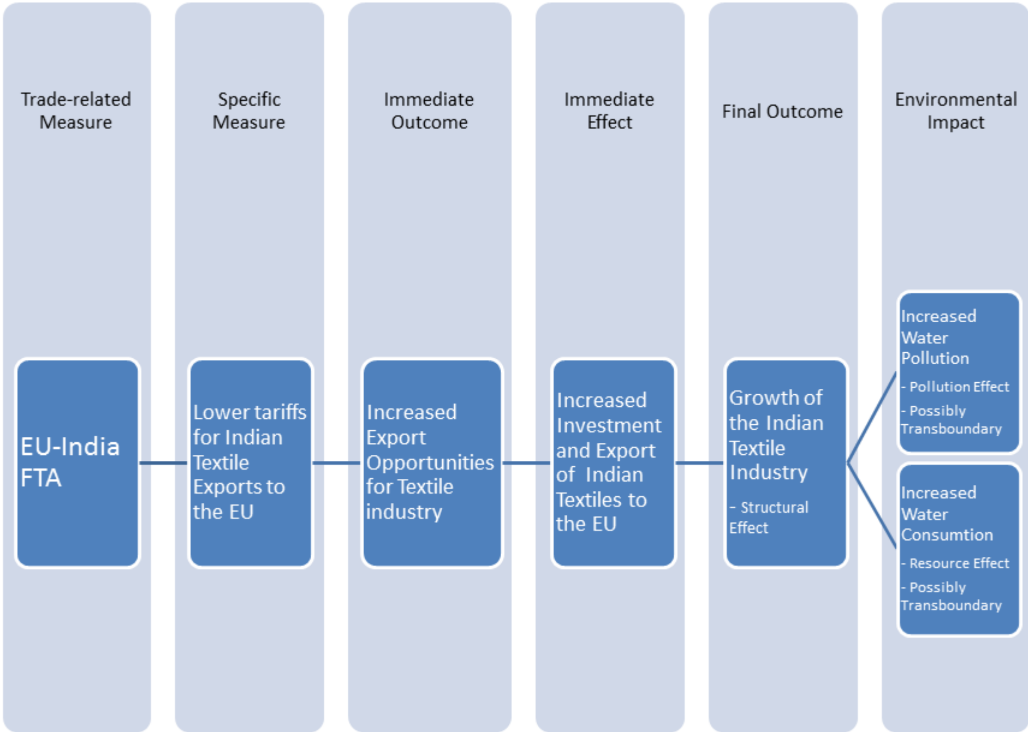
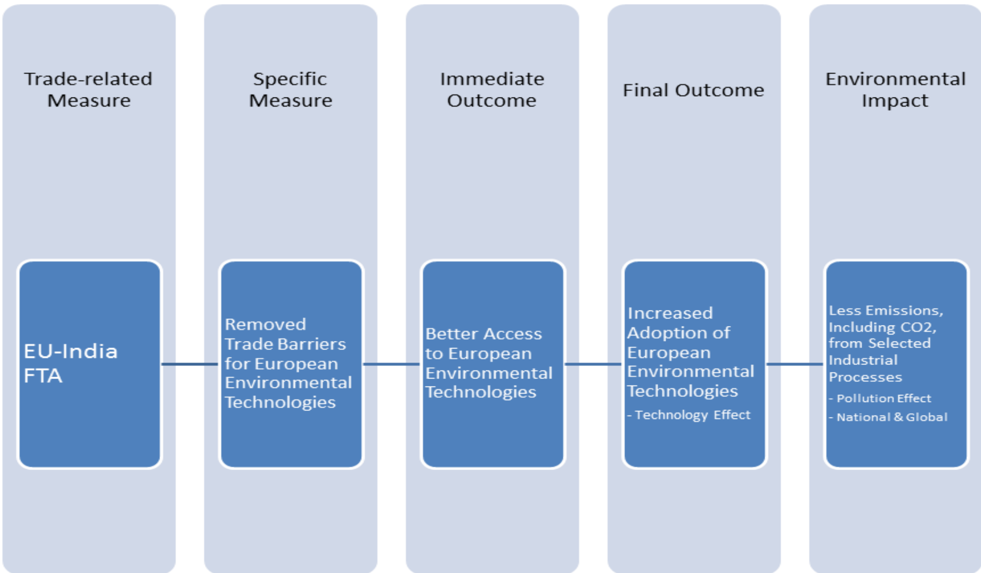


Figure 3: Results Chain from the Analysis of the EU-India FTA: Technology Effects



As these examples indicate, a results chain analysis can provide only a first approximation of the likely environmental impacts from a trade-related measure. Moreover, each results chain provides only an isolated perspective of the expected causal sequence. However, as these two examples also illustrate, the combined effect may be different, due to interaction effects between the different results chains. For instance, while growth of the textile sector may result in increased pollution on its own, this may be mitigated by the adoption of new environmental technologies within the sector. Also, additional flanking measures, such as measures to facilitate the increased adoption of environmental technologies, may be considered to mitigate possible environmental impacts or enhance the positive technology effect.

Key Lessons:

- Individually, results chains only offer an isolated perspective on environmental impacts.
- To assess environmental impacts, interaction effects between different measures of a trade reform should be considered.
- The assessment of environmental impacts may help in identifying entry-points for flanking measures for the mitigation of harmful environmental consequences and the enhancement of positive impacts, i.e. the increased adoption of environmental technologies.

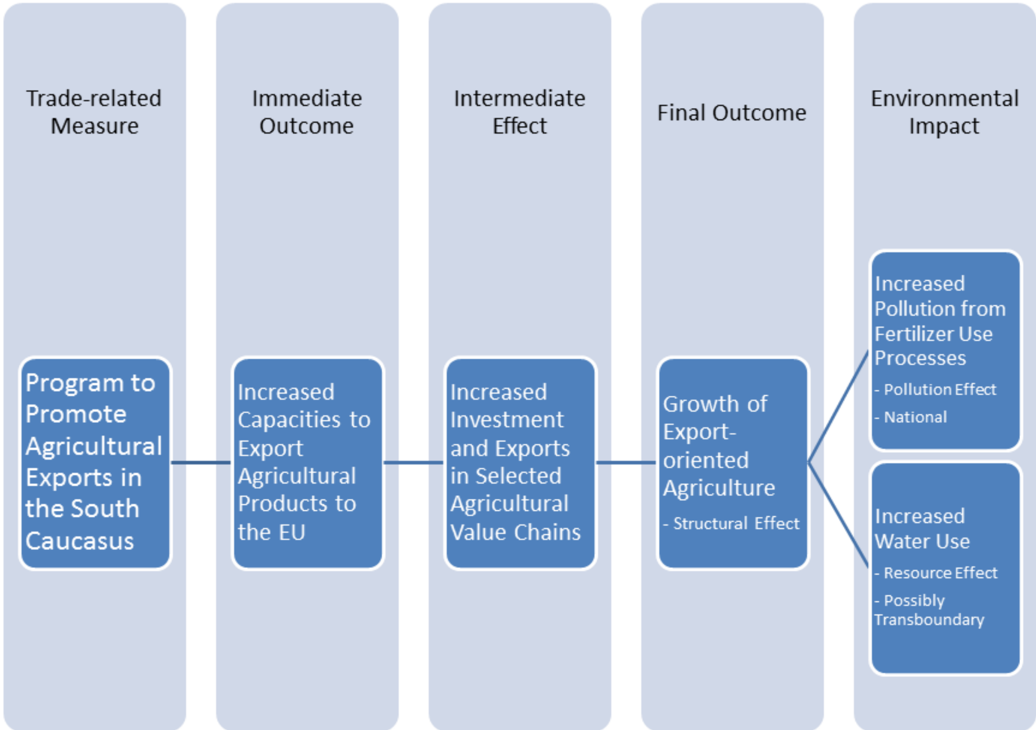
3.5.2 Example 2: Trade Development: Promotion of Agricultural Trade in the South Caucasus

In the South Caucasus, the GIZ runs a program to promote agricultural exports with a focus on small and medium enterprises in Armenia, Georgia and Azerbaijan. The program facilitates access to information on EU standards and regulations as well as the participation of the partner countries at the International Green Week in Berlin and the Food and Beverage Fair (ANUGA) in Cologne. Moreover, the project promotes closer cooperation and regular exchanges between public and private stakeholders and offers technical and organizational trainings via the Georgian Export Promotion Agency in cooperation with the respective institutions in Armenia and Azerbaijan[39].

These trade promotion activities in the South Caucasus represent a typical set of interventions to boost trade in a given sector. It is fairly clear that no significant direct environmental impacts will result from the individual activities. Rather, in this case, the intended combined effect – the growth of the export-oriented agricultural sector in the three countries – represents the most important cause of potential environmental impacts. The results chain in Figure 4 visualizes the related causal sequence.

[39] GIZ 2010a.

Figure 4: Results Chain from the Analysis of the Trade Promotion Program in the South Caucasus: Structural Effects



The results chain analysis illustrated here only represents a very general representation of the likely environmental impacts from increased agricultural exports to the EU. To construct a more nuanced set of results chains, it would be necessary to involve experts familiar with the agricultural sector in the region. In other words, it might represent the starting point for launching a more in-depth scoping, possibly followed by more data collection and analysis. Moreover, this example points to the importance of a value chain-perspective in the context of trade development measures. To conduct an in-depth analysis of the environmental impacts of the trade promotion activities outlined above, a detailed understanding of the respective value chains and the related activities is essential. While such a value chain-based analysis may focus on the impacts that occur within a given country (e.g. an agricultural value chain in Georgia), it may also extend beyond the producing country and analyze the complete value chain up to the point of final consumption, potentially including multiple countries.

Key Lessons:

- Economic and hence environmental effects from trade development activities may only result from the combined effect of mutually supportive measures, resulting in indirect environmental impacts.
- Assessing the impacts from trade development measures are likely to require a nuanced understanding of the related value chain(s).
- A value chain-based analysis may focus on a value chain within a specific country, or it may extend the analysis to the entire value chain up to the final point of consumption, potentially including multiple countries.

3.5.3 Example 3: Building Economic Infrastructure

Developing economic infrastructure to facilitate the transportation of export goods represents another important AfT category. It differs from the other examples, as it implies major local environmental impacts, in addition to the environmental impacts resulting from increased trade and related changes in the economy. The construction and upgrading of the Walvis Bay Port in Namibia represents typical example of such a trade-related measure. The aim of the project is to lower costs for transportation and to facilitate economic development along a transport corridor as well as to provide new jobs in the logistics sector[40].

Step 1: Identification of relevant measure: The relevant measure in this case is the construction and upgrading of Walvis Bay port.

Step 2: Identification of outputs/ immediate outcomes: The immediate outcome of the measure would be an enlarged port and the increased ability to handle exports, enhancing export opportunities for local industries.

Step 3: Identification of intermediate effects: In the absence of other trade development measures, a likely intermediate effect would be increased mineral exports, in particular zinc and uranium, as these represent Namibia's most important export products.

Step 4: Identification of final outcomes: Final outcomes resulting directly from the intervention are the expanded port facilities (identical to immediate outcome) and increased marine and road transport. Additionally, increased mineral exports would lead to the overall growth of mining activities in Namibia (scale effect).

Step *5a: Identification of direct environmental impacts*: Direct local impacts resulting from port expansion include biodiversity loss (resource effect), as natural habitats may be destroyed. Moreover, increased marine and ground transportation will lead to increased local water and air pollution (pollution effects) as well as an increase in local energy con-

[40] GIZ 2011b; GIZ 2010b.

sumption (resource effect). Moreover, water pollution may have impacts on fishery resources (resource effect).

Step 5b: Identification of indirect impacts: Finally, increased mining activities would imply significant environmental impacts, including resource, pollution and health and safety effects. In the case of uranium mining, some of these include the contamination of local water resources, air pollution due to the emission of toxins, radioactive contamination of soil and plants and the generation of toxic waste. On the other hand, increased export revenues might be invested in more environmentally-friendly mining techniques, leading to a reduction of certain environmental impacts (not considered in the visualization below, as it will most likely depend on additional flanking measures).

Step 6: Evaluation of the scope of the environmental impacts: The scope of the environmental impacts from the expansion of Walvis Bay Port would be primarily national. Some transboundary impacts might occur, depending on the location of mining activities. Moreover, impacts on fishery resources might be transboundary in nature, as they might affect catchment areas belonging to neighboring countries.

Following from this brief analysis, a results chain sketching the main direct and indirect environmental impacts of the port construction project is constructed in Figure 5 and Figure 6.

Figure 5: Results Chain from the Analysis of the Walvis Port Bay Project: Direct Effects

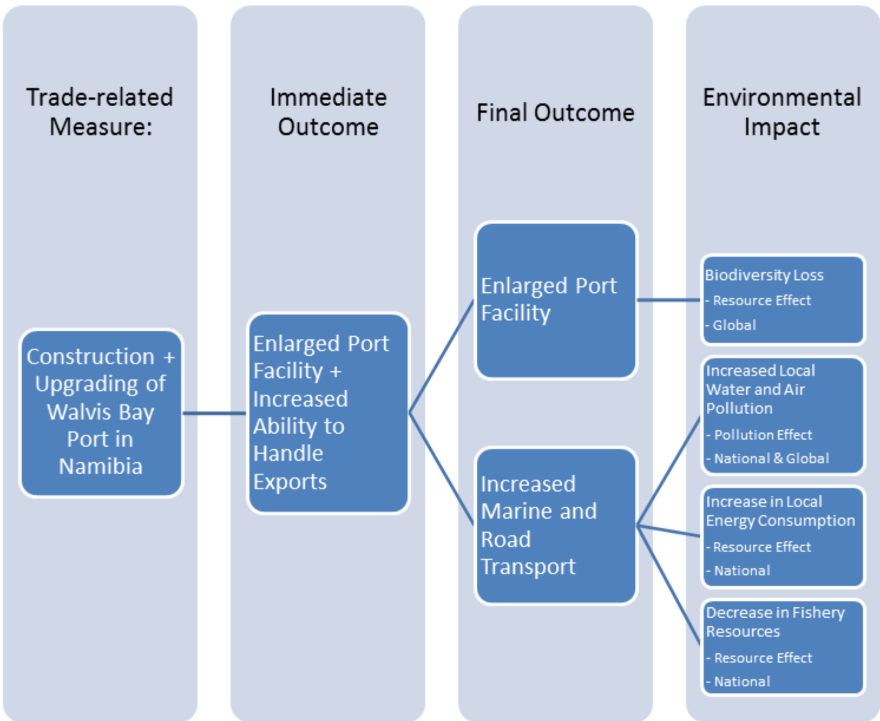
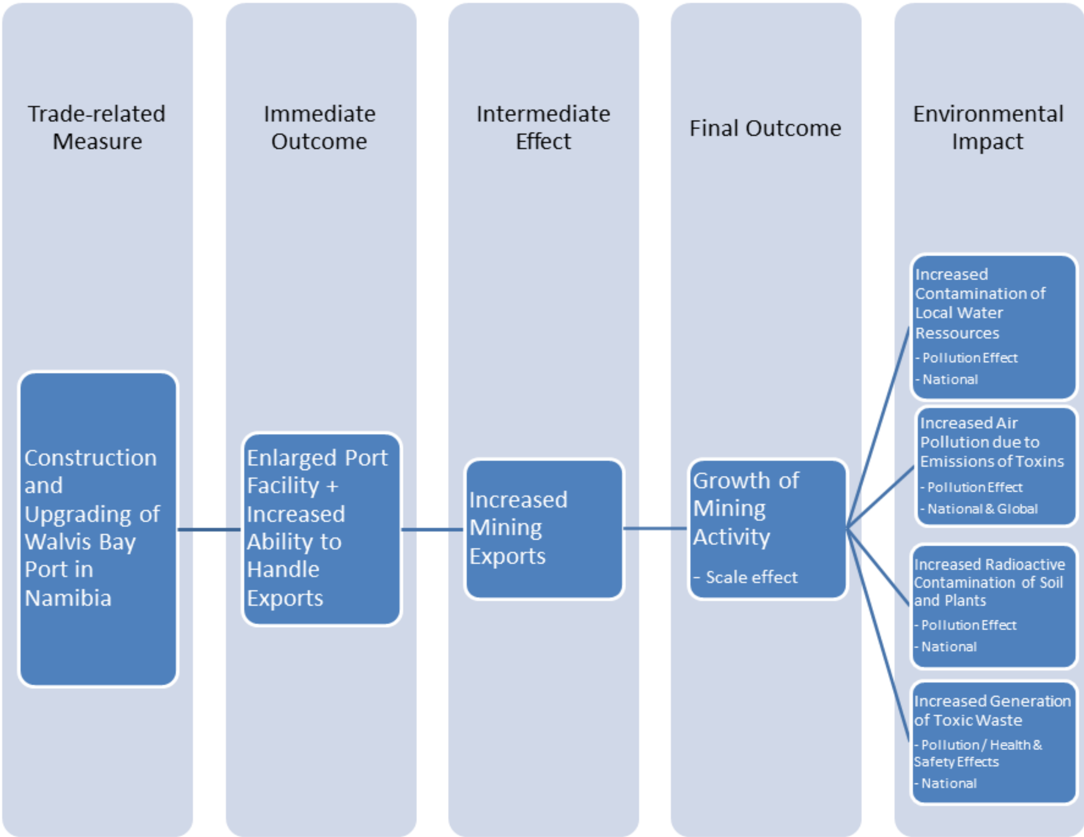


Figure 6: Results Chain from the Analysis of the Walvis Port Bay Project: Indirect Effects



The results chains depicted in Figure 5 and 6 show that the development of trade-related infrastructure may have multiple direct and indirect effects. The direct effects resulting from the construction of the port are easier to identify and may require a more technical Environmental Impact Assessment (EIA) (see the following section for more details) to consider different options for mitigating environmental impacts. Indirect effects may vary, depending on accompanying measures. For instance, in a broader trade facilitation program, the port construction may be accompanied by targeted measures to develop new export sectors. These may alter the expected scale effects, possibly replacing them with structural effects. To assess these combined effects, a more strategic assessment might be needed, allowing for a consideration of appropriate flanking measures at the policy level.

Key Lessons

- The development of trade-related infrastructure will typically result in direct impacts from construction activities and increased transport as well as indirect effects, resulting from changes in the economy.
- In the absence of parallel trade development measures, the growth of existing export sectors is likely.
- In combination with targeted measures to promote new export sectors, the development of trade-related infrastructure may further enhance related structural effects.

The above examples have shown that trade-related measures can have very different impacts on the environment depending on the type of activity and their scale. To adequately consider these different impacts, it is necessary to conduct a systematic IA process. The following section offers a brief introduction to the history and current practice of impact assessment and the role of the environment in this context.

4 Impact Assessment and Environmental Impacts

4.1 Overview

In general, **impact assessment (IA)** describes a family of instruments that are used in decision-making processes to assess ex-ante (before a decision is made) the effects of a proposal so that they can be taken into account in decision-making.

In order to cover environmental impacts in such an assessment process, several types of IAs have been developed. Starting in the 1970s, **Environmental Impact Assessment (EIA)** was introduced to assess the likely environmental effects at project level. These assessments are usually rather technical in nature and do not take into account strategic planning processes but focus on the actual implementation of a project. Though they may be relevant for considering certain direct impacts from trade-related measures, EIAs are not considered in this report.

The need for assessing environmental impacts at an earlier stage and at a more strategic level soon became evident. As a result, approaches to consider environmental aspects in the context of regional planning processes were developed, eventually giving rise to **SEA**. First adopted as a formal requirement by the EU in 2001, SEA has evolved from an approach focused on the formal assessment of environmental concerns within the context of territorial planning into an increasingly strategic tool aimed at mainstreaming environmental concerns into decision-making. Moreover, it is becoming a legal requirement in an increasing number of countries. As a result, a great variety of approaches to SEA exist, as the SEA process is usually designed with regard to the respective national context[41]. While in the EU, SEA remains explicitly restricted to the assessment of programs and plans, in the context of development cooperation, SEA is also frequently applied for policy-level assessment. (A more detailed discussion of SEA can be found in Section 6.3) Moreover, even though SEA has been designed to consider mainly environmental impacts, a trend of broadening its scope can be observed. Increasingly, also social, economic and health impacts are included in the assessment to be able to capture synergies and trade-offs between these different dimensions[42].

A third assessment process that considers environmental impacts is **Policy Impact Assessment (PIA)**[43]**,** which is applied at the level of policies and other strategic regulatory measures. PIA involves the ex-ante analysis of possible impacts of a planned policy on specified issue areas or indicators and aims to improve the quality of policies and regulations by maximizing the benefits and minimizing unwanted side effects[44]. PIA developed

[41] UNEP 2004a.
[42] GIZ 2011c; UNEP 2004a.
[43] Policy Impact Assessment is also frequently referred to simply as Impact Assessment (for instance in the EU). For the sake of clarity, this report utilizes the term IA only as a general term referring to all types of IAs.
[44] Radaelli 2004; Adelle and Weiland 2012.

out of two different strands in IA practice: Firstly, since the 1980s, so-called **Regulatory Impact Assessment (RIA)** procedures were implemented to address the recognized need to create better and simpler regulatory environments. First launched in the US and the UK, these RIAs mainly considered aspects of "better regulation" and focused on the administrative burden and the economic costs resulting from new regulatory measures. A second trend in PIA practice stems from experiences with SEAs. After a first wave of fairly technical, environmentally-focused SEAs, the need for more integrated, sustainability-oriented assessments was recognized. Simultaneously, efforts were made to move the assessment process from the planning to the policy level, giving rise to **sustainability-oriented IAs** (also referred to simply as IA). Together with a broadening of RIA approaches, these sustainability-oriented IAs have led to a broad range of PIAs, covering social (e.g. impacts on employment or poverty), economic (e.g. impacts on SMEs, on innovation, etc.) and environmental aspects (e.g. on climate, air pollution or biodiversity). Given the breadth of these approaches, in some cases governments have chosen to prioritize particular issue areas on the basis of existing strategies or policy documents (e.g. national sustainable development strategies), so that the PIA process reflects national political priorities[45].

4.2 Impact Assessment as a Process

IA at a strategic level (both in SEAs and PIAs) is frequently conceived as a tool to generate clearly defined quantitative results for assessing policy proposals. However, given the manifold uncertainties in assessing likely impacts, this is rarely a sufficient basis for decision-making. Therefore, IA has evolved into broad approaches for assessing how policies induce final impacts via behavioral changes in society. This involves the construction of causal chains that reflect how regulations translate into actual impacts. In order to estimate policy-induced changes, assessments develop scenarios based on a theoretical framework and a set of assumptions, which may be disputed and which are subject to contestation. To minimize such disputes, IA should therefore be perceived and **organized as a process** to collect and process evidence in cooperation with relevant stakeholders. The involvement of stakeholders is a key requirement for enhancing the legitimacy of results and enabling its uptake by policy makers.

If understood as a process and **adapted to the respective regional context,** IAs have the potential to improve the overall quality of trade-related policy by:

- informing decision-makers about possible effects on social, environmental and economic aspects so that policy debates are more **evidence-based** and focused on a broader spectrum of effects, reducing the scope for the pursuit of narrow sectoral interests;

[45] Jacob et al. 2011.

- improving the **transparency** of decision-making processes by offering an analysis of the likely effects of policy proposals;
- increasing **participation** in the decision-making processes, in order to reflect a wide range of stakeholder considerations; and
- provide for **capacity development** in departments by making regulatory quality a subject of discussion among involved policy-makers and by making clear how policy initiative can contribute to poverty reduction and sustainability goals.

So far, formal IA procedures have been established in OECD countries and the EU. However, even in these countries, a number of challenges for comprehensive IAs remain. Partner countries in development cooperation might face even stronger institutional, financial as well as capacity constraints for carrying out IAs. Hence, especially in developing countries, the introduction of IA requires simultaneous investments in related capacity development.

4.3 Steps in the Impact Assessment Process

While there are many different approaches to conducting an IA, in general IAs can be broken down into a set of typical procedural and analytical steps, summarized in Table 1 below:

Table 1: Main Steps of an Impact Assessment

Problem identification and objective definition	Consultation and Participation
Development of policy/ program/ project options	
Scoping of the assessment and selection of methods and tools	
Impact analysis	
Mitigating measures to optimize positive outcomes	
Presenting results	

An IA should commence with defining the problem and the objective that the planned policy is supposed to tackle. Questions that should be answered by the analyst include: What are the problems and the underlying causes which are to be addressed by the planned policy? What is the exact objective that is to be pursued? In particular: What is the expected behavior or change in the behavior of a target group of the policy? With this step, the boundaries of the system are to be defined, including the affected actors and their behavior. If the boundaries are too narrow, important impacts may be overlooked, if they are defined too broad, the assessment is too complex.

The following step includes identifying the policy options with which the policy objectives might be achieved. The analyst might ask: What options are available to achieve the objectives? What would happen if no action is taken? This step is meant to identify possible alternatives and to define a baseline scenario (no-intervention scenario). To provide leeway for the consideration of different policy options, an IA should start as early as possible in the policy-making process.

A central step is the analysis of potential impacts of the options identified. With this step, the expected impacts on the various issue areas or indicators are analyzed. This requires a scoping of what relevant impacts can be expected and what methods are suitable. The policy options should be compared regarding the expected impacts in order to identify a preferred option to recommend to policy-makers. Based on the comparison, flanking measures (e.g. accompanying environmental agreements for trade agreements) should be identified to mitigate impacts. The results and the conclusions or recommendations of the IA are to be summarized in a report or a summary to be presented to policy-makers.

Throughout all steps of an IA, it is desirable to consult relevant stakeholders including the relevant departments within government to increase the evidence-base of the IA and the acceptance of the policy initiative.

4.4 Assessment of Environmental Aspects in Impact Assessment

Environmental impacts often occur as a side effect of policies or legislation. A comprehensive IA has the ambition to take such possible impacts into account before a policy is adopted, and thereby enable decision-makers to minimize such unwanted effects. However, in practice environmental impacts are often not adequately considered[46]. This is due to the fact that the assessment of environmental impacts is often challenging in terms of understanding causal chains and cumulative effects and making accurate predictions. Additionally, environmental concerns are often assigned a relatively low priority in the decision-making process.

Especially where there are no robust institutions to ensure the consideration of environmental dimensions in the IA process, the incorporation of environmental issues remains a weak point in IA. To ensure the integration of environmental concerns in IA, it is not sufficient to provide guidelines for IA. Experience has shown that the consideration of environmental concerns in IAs also requires procedural requirements (e.g. coordination between lead department and environmental department), institutions to assess the quality of IAs (e.g. scrutinizing if significant environmental impacts have been assessed), transparency of IA results (i.e. disclosure of how environmental impacts have been taken into account), and last but not least sufficient funding and capacities to enable the consideration of environmental impacts.

[46] Adelle and Weiland 2012.

Nevertheless, a broad spectrum of approaches and methods for assessing environmental impacts from policies, programs and projects exist. Some of these have been developed specifically for the assessment of environmental impacts from trade and trade-related policies and measures. The frameworks and methods suitable for the assessment of environmental effects from trade-related activities are discussed in more detail in Part II of this report.

5 Assessment of Environmental Impacts in German Development Co-operation

5.1 Background

In German development cooperation, it has been mandatory to consider environmental aspects at the project-level since 1988. In 2010, the guidelines for the consideration of environmental aspects were revised and extended in two important ways. Firstly, aspects related to climate change mitigation and adaptation have been added to the issues to be considered. Secondly, it is now mandatory to consider environmental and climate issues both at the strategic level, directly by the German Ministry of Development Cooperation (BMZ), and at the operational level, by implementing agencies (such as GIZ and the Kreditanstalt für Wiederaufbau (KfW)). For this purpose, slightly different guidance for conducting an environmental and climate assessment (Umwelt- und Klimaprüfung, UKP) has been introduced in the ministry and the various implementing organizations. In both cases, they are used for a systematic scoping of environmental and climate risks and to identify entry-points for improving environmental quality, reduce GHG emissions as well as to strengthen capacities for climate change adaptation. The respective guidelines are binding for the BMZ as well as for the other German development organizations[47].

5.2 Environment and Climate Assessments at the Strategic Level (BMZ)

The BMZ guidelines consist of lists of aspects that are potentially relevant in each of the priority areas of German development cooperation and provide guidance as to the applicability, scope, time requirements and timing of the assessment as well as responsibilities for its implementation. The typical timeframe for the assessment is one day. In certain cases, additional information may have to be acquired, which may take up to four days. The aspects mentioned in the guidelines provide a first overview of issues to be considered in the scoping and classify sectors according to their general relevance from an environmental or climate perspective. However, the descriptions are not intended to be comprehensive and are to be complemented by more sector- and country specific expertise during the assessment[48].

5.3 Environment and Climate Assessments at the Operational Level (GIZ)

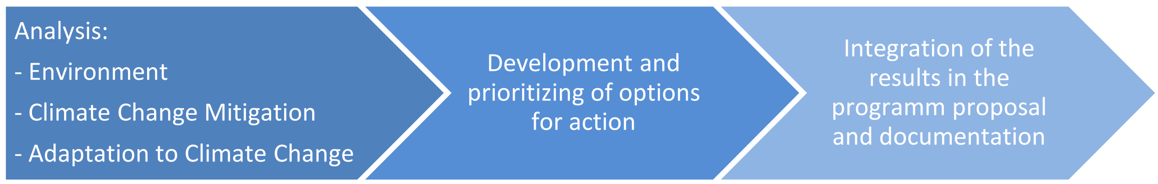
Based on the BMZ guideline, GIZ and other implementing organizations have developed separate assessment procedures for integrating environmental and climate issues in the development of projects and programs. In the following, only the assessment procedures developed by the GIZ is described in detail. The GIZ has developed both general assessment procedures, which represent a binding framework for all planned interventions fund-

[47] GIZ 2011a; BMZ 2010b.
[48] BMZ 2010a.

ed by BMZ, and sectoral guidance notes, which provide support for conducting an UKP in the respective sectors. Different than the BMZ approach at the strategic level, the UKP in the GIZ consists of two phases. In the first phase, a preliminary screening is conducted based on a questionnaire checklist (see Section 7.1.1). This screening aims at identifying whether a measure is likely to have significant impacts on the environment. If so, a more detailed analysis has to follow to elaborate in more detail, which environmental and climate impacts are likely to occur and which measures may be useful to mitigate possible negative effects.

This second phase encompasses three issue areas: the environment, climate change mitigation, and adaptation to climate change. Depending on the results of the preliminary screening, one or more of these issue areas will have to be considered in the second phase. The process of this more detailed analysis consists of three main steps (see Figure 7). For each issue area and step in the analysis, the GIZ assessment procedures offer information on how to proceed in the analysis and which aspects might be relevant. For this purpose, guiding questions are included as well as well as lists of potentially relevant indicators and issue areas for each of the three focus areas of the analysis. In addition, sectoral guidance notes exist that point out distinctive features of individual sectors in German development cooperation.

Figure 7: UKP Steps in Phase 2 (adapted from GIZ 2011a)



The UKP and the respective sectoral guidance notes provide a framework for considering potential impacts on the environment resulting from GIZ program activities as well as for identifying potential flanking measures. However, given the time and resources allocated to the UKP, it is hardly possible to analyze impacts in greater detail. The full process is allocated a maximum of 5 days with not additional funding available for its implementation. Especially, in a trade-related context, impacts are often indirect or have cross-sectoral or cross-border effects, so that it is difficult to capture the full range of potential impacts in the context of an UKP. Rather the UKP may point to the need for further analysis, which might be integrated in the implementation of the program or project.

5.4 How to Use this Report: A Guide for Development Practitioners

The frameworks and methods presented in the remainder of this report offer guidance that is relevant both for conducting an internal assessment process within individual donor agencies, such as the UKP at BMZ or GIZ, and for developing a more extensive environmental assessment within the process of program or project implementation. Section 7.1 on scoping methods is particularly relevant for the former, while the remaining methods imply more extensive resource requirements and are, therefore, more likely to be applied in the context of an extended assessment process in cooperation with the respective partner government. The frameworks highlighted in Section 6 provide guidelines on how to structure such an extended assessment process, while also offering useful guidance on how to structure a less time- and resource-intensive process.

PART II: FRAMEWORKS AND METHODS FOR ASSESSING THE IMPACT OF TRADE-RELATED ACTIVITIES ON THE ENVIRONMENT

Part I of the study provided an overview on the inter-linkages between trade and the environment and pointed out the opportunities that IAs offer for improving the consideration of environmental impacts in the development of trade-related policies or programs. It outlined the general steps in an IA as well as a broad conceptual framework for analyzing the environmental impacts of trade-related measures.

Part II provides an overview of existing frameworks and methods for considering environmental impacts of trade-related activities. It considers both approaches that are tailored to the assessment of trade-environment linkages and more generic approaches for environmental assessment and analyzes their respective usability in the context of trade-related development cooperation.

Section 6 introduces frameworks for conducting IAs addressing trade and environment issues. These frameworks represent broad approaches that help structure the IA process. After this, Section 7 will discuss specific methods that can be used within the context of such an IA process. It presents five method families and highlights their potential application for the assessment of environmental impacts from trade-related activities. Section 7 closes with a brief description of an IA toolbox which offers support for identifying suitable IA instruments and accessing existing knowledge and expertise for conducting an IA.

Sub-sections on the frameworks (Section 6) and methods (Section 7) include:

- A description of the framework or methods and their applicability for assessing environmental impacts in the context of trade-related development cooperation;
- A brief note on the resource requirements and expertise needed for applying the framework/ methods;
- An overview of the main strengths and weaknesses of the framework/ methods;
- Further sources of information on the framework/ methods.

In a number of cases, practice examples are provided to illustrate their use for the assessment of environmental impacts from trade-related measures (or a closely related field of application).

6 Frameworks for Assessing Environmental Impacts

6.1 Overview

Frameworks for assessing environmental impacts define the priorities and the scope of an IA, and they typically break down the assessment into a set of procedural steps. In some cases, they may provide guidance for identifying relevant impact areas and for selecting appropriate, indicators and analytical methods.

The IA frameworks described in the following section include both approaches with a specific focus on the environment and integrated approaches, which cover all dimensions of sustainable development. They have in common that they all outline a number of steps to help structure the process of conducting an IA. These frameworks do not determine the methods that should be used for generating and evaluating data and information. They may, however, provide examples and general guidance to help select appropriate methods for conducting a detailed assessment of relevant impacts. This is the case for UNEP's approach of the integrated assessment of trade-related policies as well as the EU's Trade SIA framework. The EU's IA framework and SEA are generic frameworks that are not aimed at any specific policy field. For this reason they also refrain from providing guidance on how to conduct the analysis itself. Finally, only SEA is primarily aimed at the program or project-level, while the remaining frameworks are aimed at assessing the impact of policies.

6.2 Data and Resource Requirements

The frameworks presented in this section define processes for conducting an environmental assessment and, in some cases, provide guidance to help structure the analysis and to choose appropriate methods for conducting a more detailed analysis of impacts. Since they do not prescribe any specific method or model, the data and resource requirements may vary significantly, depending on the particular intervention and on the ambition of those responsible for the assessment.

Nevertheless, these frameworks pursue the aim of providing a comprehensive overview of all significant impacts of a proposed policy measure or intervention. They suggest to begin the assessment as early as possible and to accompany the full policy or planning process. They aim to cover a wide range of economic, environmental and social impacts, which requires expertise and in depth-knowledge in each of these areas and for each country, region or sector that is subject to an IA. Moreover, they usually suggest extensive stakeholder consultation, which makes the process both time consuming and resource intensive.

6.3 Strategic Environmental Assessments

SEAs are used for the ex-ante analysis of possible environmental impacts of planned policies, programs and plans. In the EU and in an increasing number of other industrialized as well as developing countries, SEA has become mandatory for the ex-ante assessment of programs and plans and in some cases policies to ensure that the environmental dimension is adequately represented in these strategic measures[49]. SEAs typically focus on the assessment of environmental impacts, but may also take an integrated approach considering social and economic impacts. They are not only analytical approaches. Rather, they have been established as governance tools for engaging stakeholders in decision-making processes that involve important environmental impacts. The aim is to take into account the environmental dimensions of an intervention, while enabling relevant stakeholders to contribute their views and knowledge. Doing so enables decision-makers to take strategic decisions based not only on a sound analytical foundation, but also based on the preferences and needs of affected stakeholders. The design and implementation of SEAs varies significantly depending on political, institutional and legal circumstances, and many countries have developed their own SEA processes. In the context of development cooperation, an important focus has been on the development of the legal framework and required local capacities to conduct SEA[50].

Most importantly, SEAs aim at identifying and integrating environmental concerns in the development process of policies, plans or strategic projects that are expected to have significant implications for the environment. This approach is usually applied before decisions are taken and there are still options for choosing alternatives[51]. Therefore, SEAs differ from traditional EIAs, which are rather oriented towards a micro-perspective, considering mainly local impacts of an action or specific project that has already been decided[52]. SEAs do not pre-define or suggest any specific analytical or methodological approach. Rather frameworks for conducting an SEA typically consist of a series of steps or phases (see Figure 8 for the basic steps of an SEA based on the OECD Development Assistance Committee's definition).

SEAs may also be applied in a trade-related context, in particular to interventions that have an explicit territorial dimension, such as the development of transport infrastructure. A wealth of experience exists on the use of SEA at this level, showing positive results in terms of enabling the better integration of environmental concerns in planning decisions[53]. Additionally, an SEA might be used to assess a broader program for trade promotion. In this case, it would have the role of identifying the most important potential environmental impacts, choosing areas for more detailed analysis and engaging stakeholders and decision-makers in a dialogue about trade-offs between different policy options. In principle, this procedural approach could also be applied to assess the impacts of a trade policy or trade agreement, however, other frameworks, like UNEP's integrated assessment or the EU's Trade SIA, would provide more detailed and context-specific guidance for this purpose.

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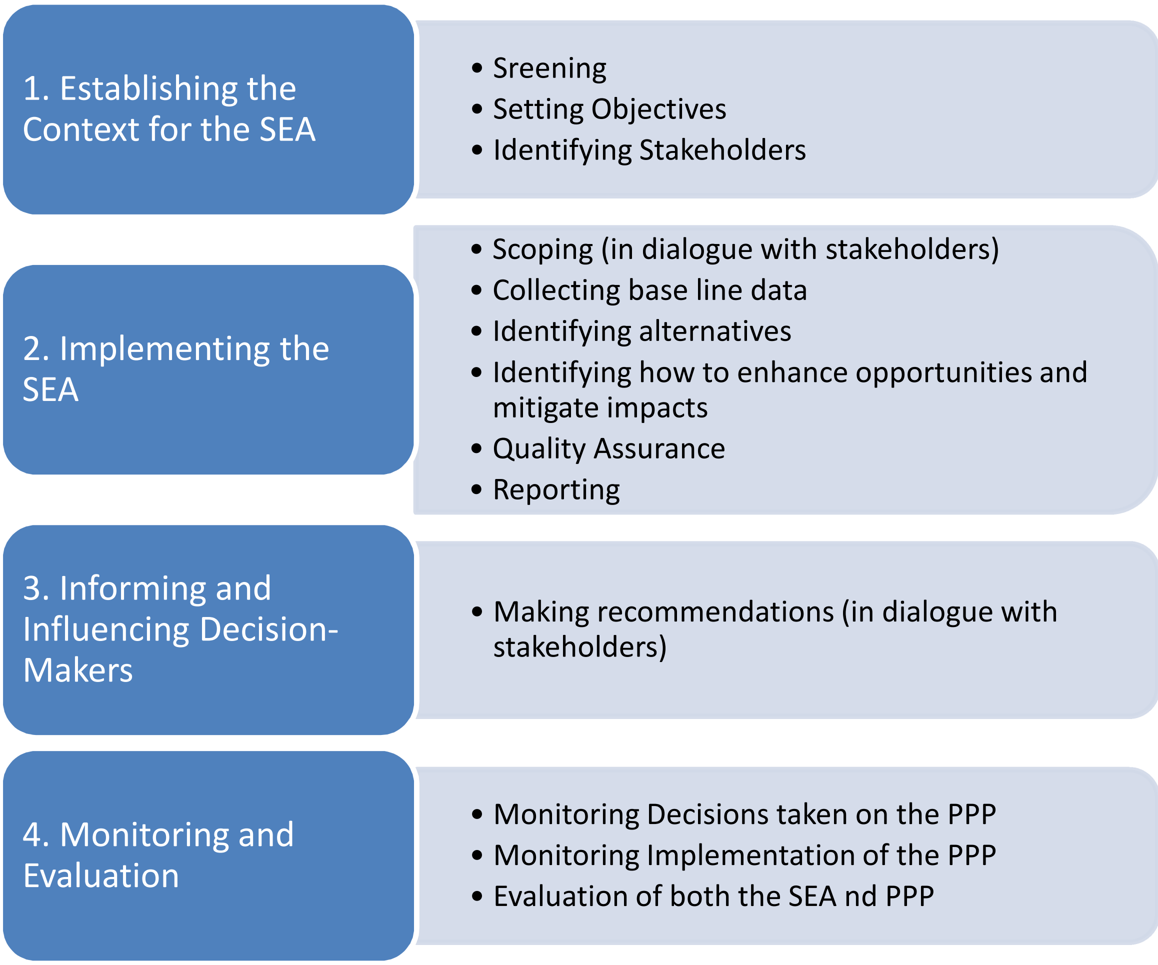
[49] GIZ 2011c.
[50] GIZ 2011c; OECD 2012.
[51] Dalal-Clayton and Sadler 2005.
[52] UNEP 2004a.
[53] Fischer and Seaton 2010.

Figure 8: Steps in a Strategic Environmental Assessment (according to OECD DAC 2006)



Strengths and Weaknesses

Well-established approach with many practical examples in the area of planning and infrastructure development

Institutional mechanisms for conducting SEA are in place in many countries

Potential for stakeholder engagement

No specific guidance for conceptualizing the impacts of a specific intervention

Broad scope of programs and interventions to which SEA is applied may lead to superficial analysis

Resource-intensive, if a comprehensive analysis is carried out

Further Reading

European Commission Webpage on Strategic Environmental Assessment – SEA: http://ec.europa.eu/environment/eia/sea-legalcontext.htm, checked on 10/01/2012.

GIZ (ed.) (2011c): Strategic Environmental Assessment – A Governance Tool for Sustainable Development: Lessons learnt from applying strategic environmental assessment within development cooperation focusing on aid effectiveness, Bonn. Available online at *http://www2.gtz.de/dokumente/bib-2011/giz2011-0509en-environmental-assessment.pdf*, checked on 10/01/2012.

OECD (2012): Strategic Environmental Assessment in Development Practice - A review of recent experience. OECD Publishing, Paris.

OECD (2006): Applying Strategic Environmental Assessment –Good Practice Guidance for Development Co-operation. Available online at http://www.oecd.org/environment/environmentanddevelopment/37353858.pdf, checked on 10/01/2012.

United Nations Economic Commission for Europe (UNECE) Homepage: The Kyiv (SEA) Protocol. Available online at http://www.unece.org/env/eia/sea_protocol.html, checked on 10/01/2012.

UNEP (2004a): Environmental Impact Assessment and Strategic Environmental Assessment: Towards an Integrated Approach. Available online at http://www.unep.ch/etu/publications/textONUbr.pdf, checked on 10/01/2012.

6.4 The ECs Impact Assessment and Trade Sustainability Impact Assessment

The EC has developed a comprehensive framework for conducting ex-ante IA of all its planned policy proposals, which aims to integrate the economic, environmental and social dimensions of a planned policy. In addition to this generic IA, the EC has developed a Trade Sustainability Impact Assessment (Trade SIA) which is applied to trade-related measures, which involve negotiations with other non-EU countries (i.e. FTAs). According to the EC, the generic IA process is applied to assess whether a trade agreement with a partner country should be pursued, and it is carried out before a negotiation process starts. EC Trade SIA is applied during the negotiation phase of an FTA and assesses how the FTA should be designed to be most beneficial to all contracting parties, including non-EU countries.

6.4.1 The European Commission's Impact Assessment Process

The EC's general IA process is a well-established procedure which is applied to European policy proposals on a regular basis. The EC has developed detailed guidelines that define a standardized process for conducting the IA and defines 21 so-called "impact areas" to be considered when assessing a policy proposal. These impact areas are grouped into economic, social and environmental impacts, 13 of which refer to environmental impacts (see Box 1 for a list of the environmental impact areas).

Box 1: Environmental Impact Areas in the EU's IA Framework

- The Climate;
- Transport and the use of energy;
- Air quality;
- Biodiversity, flora, fauna and landscapes;
- Water quality and resources;
- Soil quality or resources;
- Land-use;
- Renewable or non-renewable resources;
- The environmental consequences of firms and consumers;
- Waste production/ generation/ recycling;
- The likelihood or scale of environmental risks;
- Animal welfare;
- International environmental impacts.

For each impact area a set of guiding questions has been developed to point at possible effects in the respective impact area. Additionally, the EC has developed an overview on methods for the quantitative and qualitative assessment of social, environmental and economic impacts (see also Section 0 on the LIAISE shared Toolbox). The guidelines do not prescribe any specific methods, however[54].

In addition to these impact areas, the EU prescribes a set of steps to be followed when conducting the IA (see Annex 1). The process is characterized by a high degree of institutionalization, and it integrates all dimensions of sustainable development in a single assessment. Moreover, the inclusion of stakeholders in the process as well as the publication of the final results of the IA are mandatory, thus enhancing transparency in the policy development process.

6.4.2 European Commission’s Trade Sustainability Impact Assessment

The EC’s Trade SIA is an IA framework tailored to the assessment of trade agreements between the EU and non-EU countries which complements the generic IA process. Like the general IA, the Trade SIA represents an integrated framework that covers environmental, economic and social impacts. Its aim is to inform negotiators and decision makers about the likely consequences of a trade agreement and identify possible synergies and trade-offs between policy options. Moreover, it should provide the basis for developing potential flanking measures (mitigation and enhancement analysis). By doing so, it should help reduce negative effects and help utilize the full potential of the policy. Finally, it is intended to make the decision-making process more transparent. Extensive stakeholder consultations take place during the whole assessment process to validate the analysis and ensure its legitimacy. In principle, the Trade SIA process is designed to accompany the trade negotiation process, but it can also be applied after a trade agreement is in operation to conduct an ex-post analysis of the impacts of the FTA.

A typical Trade SIA includes detailed qualitative and quantitative analysis of the likely impacts under various scenarios. It considers effects on different sectors as well as cross-sectoral effects. The choice of specific methods, however, remains up to the specific team conducting the analysis. The guidelines also provide recommendations on how to include stakeholders in the process (see Box 2 for details) and how to choose appropriate indicators for monitoring and evaluation. Finally, it points out the importance of considering the respective background conditions in the analyzed countries (e.g. data availability). A Trade SIA handbook[55] exists that defines the steps to be followed during the assessment and provides guidance for the selection and application of appropriate methods of analysis.

[54] EC 2009a.
[55] EC 2006a.

Box 2: Stakeholder Consultation in the EC Trade SIA

Stakeholder participation plays an important role in the EC's Trade SIA. Its aim is to include the different points of view and expectations of the relevant groups that may be affected by the assessed trade measure. Additionally, the consultation process helps to ensure a greater awareness among stakeholders of the Trade SIA and to increase transparency and accountability in the trade negotiation process. An extensive stakeholder analysis is necessary to identify all relevant parties that should be included in the consultation process and to ensure that the consultations are carried out in a balanced way. The group of stakeholders should consist of those affected by the trade measure and its consequences, stakeholders that will be involved in the implementation of the measure, and representatives of organizations that have stated objectives and are directly interested in the negotiation process[1].

The Trade SIA Handbook suggests using the following checklist to organize a consultation process:

- Who should be consulted? Set up an international advisory committee; analyse the wider circle of stakeholders that should be reached;
- What is the desired result? This may include comments on reports, methodological suggestions and analytical inputs. Explain the purpose of the consultation to participants;
- What material needs to be made available and how?
- How should consultation be done? Describe the method chosen – meetings, call for contributions via email;
- Who responds? How? Record the responses in terms of sources and content;
- How is the input used? Provide feedback on the way in which the material is used.

Annex 5 of the Trade SIA Handbook includes a more detailed description of the organization of a consultation process and the required reporting of results.

In Trade SIAs that have been conducted so far, several methods have been used to involve stakeholders in the assessment process. Some of these measures have been:

- Dialogue between the consultant and stakeholders with interests in individual sectors or in the negotiations as a whole;
- Use of an international network of experts to comment on the project reports (international steering committees);
- Publication of project reports on a dedicated website with facilities for comment;
- Meetings with civil society organized by the EC and Member States to discuss project reports;

Contacts with other organizations involved in the policy and practice of IA of trade issues, through policy dialogue and conference participation.

Inception Phase

In the inception phase, a screening and scoping of likely impacts has to be included. During the screening phase, the trade policy measures (e.g. tariff reduction) are identified that are likely to have significant impacts, either inside or outside the EU. It serves to identify which components of the trade agreement should be subject to the Trade SIA. Following this, the scoping process helps to further narrow down the specific focus of the EC Trade SIA by beginning with an identification of the most important impacts that are expected. By using a simplified causal chain analysis, target country groups and trade liberalization scenarios are analyzed. This preliminary assessment helps select key priorities for the EC Trade SIA and the key issues to be considered in the more detailed impact analysis that follows.

Analysis and Case Study Phase

This phase consists of a detailed IA of the chosen focus areas, typically including both qualitative and quantitative analysis. The EU's guidelines do not specify which methods or models should be used for this analysis. Rather, the appropriate tools for assessing all significant impacts in detail can be chosen with regard to the respective policy that is being analyzed.

The assessment should however include:

- Determination of priority trade scenarios;
- An analysis of separate components of the trade measure and their cumulative impact;
- The use of detailed causal chain analysis;
- Adjustment of the indicators from the preliminary analysis;
- Strategies for coping with variations within country groupings (or single countries) by selecting contrasting countries (regions);
- Preliminary IA and identification of main sustainability impacts;

Based on the findings from this detailed analysis, suggestions should be developed on how potential amendments might improve the trade measure in terms of their impacts on sustainable development and which complementary measures might be introduced to address negative effects and to maximize the positive effects. The analysis of these mitigating and enhancing measures should include measures on the domestic, regional and international level. Moreover, trade-offs among the measures should be identified.

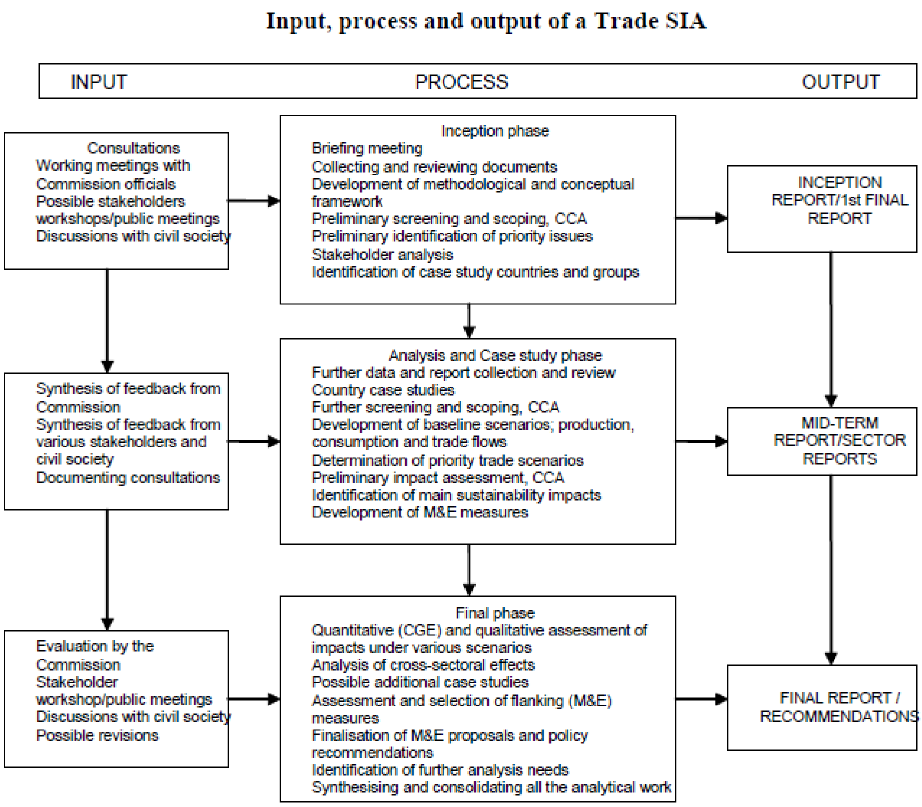
Final Phase

The analysis conducted in the Analysis and Case Study phase may suggest a need for a more detailed sector-based analysis. The guidelines suggest including the following aspects in this analysis:

- Quantitative and qualitative assessments of sector-based impacts: This analysis should be based on case studies, considering economic, social and environmental impacts and distinguishing between different EU regions. Also cross-sectoral effects should be considered;
- Assessment and final selection of flanking measures;
- Identification of future assessment needs.

Finally, this detailed IA should provide the basis for an ex-post monitoring and evaluation of the trade measure, but also suggest possible changes in the negotiation position like amendments or adaptions of the trade measure. Figure 9 presents an overview of the content of the different phases of the EC Trade SIA.

Figure 9: EC Trade SIA Process



Source: EC 2006a.

Strengths and Weaknesses

- Incorporates the economic, social and environmental dimension: trade-offs among the different dimensions can be identified
- Covers all relevant sectors, cross-sectoral impacts as well as economy-wide and global impacts
- Considers impacts in the EU and the partner countries at the same time
- Structured process, but methodology for the assessment can be chosen as appropriate
- Includes guidelines for engaging stakeholders in the IA process
- Only applicable for policy proposals
- No detailed guidelines on choosing the methods for analysis
- Extensive data requirements
- Very resource intensive

Further Reading

European Commission Homepage: Trade. Analysis. Sustainability Impact Assessment: http://ec.europa.eu/trade/analysis/sustainability-impact-assessments/, checked on 10/01/2012.

European Commission (2009): Impact Assessment Guidelines. Available online at http://ec.europa.eu/governance/impact/commission_guidelines/docs/iag_2009_en.pdf, checked on 10/01/2012.

- Key procedural steps. Available online at http://ec.europa.eu/governance/impact/ia_key/ia_key_en.htm, checked on 10/01/2012.
- List of Impact Assessments. Available online at http://ec.europa.eu/governance/impact/ia_carried_out/cia_2012_en.htm, checked on 10/01/2012.

European Commission (2006a): Handbook for Trade Sustainability Impact Assessment http://trade.ec.europa.eu/doclib/docs/2006/march/tradoc_127974.pdf

European Commission Website on Impact Assessment: http://ec.europa.eu/governance/impact/index_en.htm, checked on 10/01//2012.

European Commission Homepage: List of Trade SIAs. Available online at http://ec.europa.eu/trade/analysis/sustainability-impact-assessments/assessments/, checked on 10/01/2012

Box 3: Practice Example EC Trade SIA: European Union Korean FTA SIA

In 2007, negotiations of a FTA between the EU and the Republic of Korea were launched. In this context, the EU commissioned an EC Trade SIA. The aim of the Trade SIA was to identify the significant economic, environmental and social impacts of the planned FTA and to develop policy recommendations for optimizing the outcome of the negotiations by enhancing positive effects and minimizing negative effects. For this purpose, two scenarios were developed and analyzed: 1.) the implementation of a comprehensive FTA involving the removal of all non-food tariffs, the removal of most food tariffs, and comprehensive liberalization of trade in services; 2.) a "deep" FTA, which includes the comprehensive FTA and the analysis of case studies for certain economic sectors and the impacts of the measures on third countries. For example, the effects of clearer rule and disciplines for technical regulations and its implications were examined in detail. For both scenarios direct impacts as well as long-term effects of the FTA were assessed, comprising the following aspects:

- A global analysis of economic and trade relations between the EU and Korea;
- The analysis of the social and environmental context;
- Quantitative economy-wide impacts of an FTA
- The screening of sectors and horizontal issues; and
- An in-depth studies of particular sectors and horizontal issues

After a pre-screening of issues, a number of horizontal and sectoral issues were chosen for an in-depth analysis. The horizontal issues included rules of origin, technical regulations, standards and sanitary and phytosanitary measures, intellectual property rights, and investment-related measures. Sectoral analyses were conducted for the automotive, agricultural, financial service, and environmental goods and services sectors, considering input from stakeholders and civil society representatives.

The SIA utilized a range of methods to analyze the potential economic, social and environmental impacts of the FTA. Next to a review of existing quantitative and qualitative studies, the SIA applied a Computable General Equilibrium (CGE) model (using the Global Trade Analysis Project (GTAP) model and data base) to undertake an economy-wide quantitative analysis to examine some of the potential dynamic effects of increased investment flows and to evaluate the global impact of the FTA. Following from this in-depth assessment, the study provided several recommendations for improving the FTA and for implementing flanking measures. For example, it was suggested to include a chapter on sustainable in the FTA encompassing the following aspects (IBM Belgium et al 2008, 26):

- Agreement to cooperate on core labor standards and the decent work agenda including in areas where core ILO conventions are not yet ratified.
- Common commitments to multilateral environmental conventions and international labor

standards should be reaffirmed.

- The relaxation of environmental standards or labor standards should not be used as an investment incentive or as a trade distorting measure.
- Agreement to pursue complementary efforts to co-operate in the sphere of the development of positive responses to multilateral environmental challenges.
- Development of a Sustainable Development Council or Forum representing a range of stakeholders in the EU and Korea which can review any issues or concerns raised with respect to social or environmental matters.

Additionally, a number of flanking measures for minimizing negative environmental effects and maximizing the positive ones were suggested. Different than the issues mentioned above, these are not integrated in the FTA itself, but are intended as complementary measures:

- Ensure that energy pricing reflects economic costs and environmental impacts so that there are appropriate incentives for long term investment in energy efficiency and innovation.
- Promote cooperation between the EU and Korea on the development of standards and technical regulation and ensure that standards and energy efficiency norms comply with best international practice for energy efficiency in products including transport equipment and infrastructure.
- Consider increasing public support for public-private partnerships for R&D technology projects for renewable energy.
- Promoting renewable power generation using market mechanisms such as tradable certificates for emissions or pricing regimes that reflect environmental costs.
- Develop common approaches to international environmental conventions and international environmental responsibilities, including under the United Nations Framework Convention on Climate Change (UNFCCC) and the Bali Roadmap.

Sources:

European Commission (2007): European Union Korea FTA Sustainability Impact Assessment, Homepage. Available online at www.eu-korea-sia.org/pub/, checked on 10/01/2012.

IBM Belgium et al. (2008): Trade Sustainability Impact Assessment of the EU-Korea FTA: Final Report (Phase 3). Available online at http://trade.ec.europa.eu/doclib/docs/2008/december/tradoc_141660.pdf, checked on 10/01/2012.

6.5 UNEP's Integrated Assessment of Trade Related Policies

UNEP has developed an integrated assessment framework (Integrated Assessment of Trade-Related Policies, IATRP) to assess the likely environmental as well as economic and social consequences of a trade measure. The first set of guidelines was issued in 2001[56]. This was adapted for assessments in the agricultural sector in 2005[57], followed in 2010 by the publication of a step-by-step guide and accompanying reference manual for the assessment of trade-related impacts in the agricultural sector with a focus on impacts on biodiversity[58].

These guidelines provide assistance for conceptualizing and structuring the assessment process with a special focus on the inclusion of stakeholders. Conceptually, the original guidelines build on the OECD concepts outlined in Section 2. The guidelines on agriculture and biodiversity present a new conceptual framework developed on the basis of the Millennium Ecosystem Assessment[59] and aim at capturing the complex inter-linkages between trade, agriculture and biodiversity. Building on a generic conceptual framework of interactions among biodiversity, ecosystem services, human well-being, and drivers of change the framework is sufficiently general to be adapted to other sectors as well. Hence, it represents not only a specialized guide for the agricultural sector and biodiversity but also a further development of the previous guidelines.

The IATRP has been described as a case study approach, since the original UNEP guidelines do not provide a predefined process for the assessment but rather describe different elements an integrated assessment for trade policies should consist of[60]. Both the 2001 and 2005 guidelines provide recommendations on how to conduct an assessment in terms of timing, consultation and participation as well as in terms of how to identify relevant indicators for the assessment. Furthermore, a range of methods are presented that might be used for a detailed analysis of the environmental, economic and social impacts at the national level[61]. Finally, the guidelines provide guidance for the selection of flanking measures that might be considered to mitigate relevant social and environmental impacts.

The 2010 guidelines go significantly further in defining a specific IA process. They represent a step-by-step guide, offering specific guidance at each stage of the assessment process. These steps include a scenario development exercise, which has been widely used in studies based on the manual. The accompanying reference manual provides more in-depth guidance for certain aspects of the IA process. In particular, it provides a detailed description of the conceptual framework as well as methods for assigning value to biodiversity (see also Section 7.4 in this report). It does not offer a general overview of analytical

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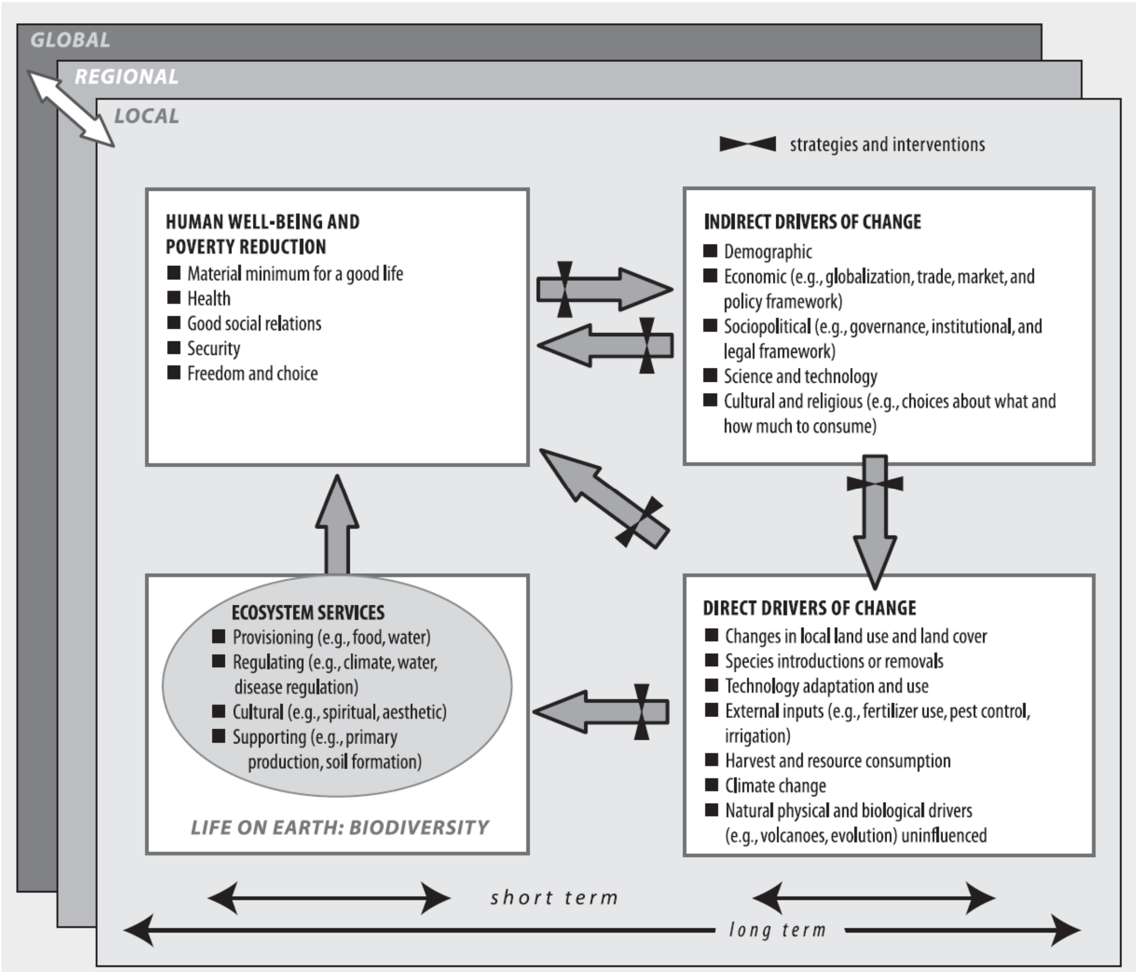
[56] UNEP 2001.
[57] UNEP 2005.
[58] UNEP 2010a, UNEP 2010b.
[59] Millennium Ecosystem Assessment Homepage.
[60] Blobel et al. 2005.
[61] UNEP 2001.

methods, but refers to the previous guidelines as well as more generalized guidelines on integrated IA (published in 2009)[62].

Figure 10: UNEP Conceptual Framework adapted from Millennium Ecosystem Services 2003



Source: UNEP 2010a

Different than the EC's Trade SIA, the IATRP is not defined explicitly for the ex-ante assessment of trade-related measures. Rather it has frequently been applied as an approach for establishing an ongoing assessment and monitoring of trade-related impacts. The IATRP process is generally led by the respective governments rather than by external experts, as is the case with the EC's Trade SIA. They are intended as capacity building exercises aimed at identifying and bringing together relevant ministries as well as affected stakeholder groups and to foster inter-ministerial cooperation. In other words, the process of promoting discussion of environmental impacts among the relevant actors is considered more important than the final IA report.

[62] UNEP 2009b.

Also, UNEP's approach does not necessarily seek to provide a comprehensive overview of all likely impacts. Rather, it suggests choosing a particular focus based on the respective national priorities. Possible focus areas suggested by the UNEP manual include a specific economic sector, a geographic region, a specific environmental or social issue or a specified time-frame[63]. To help choose an appropriate focus area, the original manual provides a number of criteria. As a result, the UNEP approach has largely been used for conducting sectoral case studies carried out at the national level. In a number of cases, these studies have been carried out as comparative case studies across several countries, although methodologies and focus areas were not necessarily identical. These studies typically offer a summary and comparison of the results as well as recommendations for future policy measures.

These types of sector-based studies are not considered effective at capturing cross-sector or economy-wide impacts, and they frequently fail to isolate trade-related effects from other factors[64] Moreover, due to the integrated approach of the assessment and due to stakeholder preferences, in some cases the environmental aspects figured less prominently in the IATRP than socio-economic issues. The studies based on the 2010 guidelines were also conducted as integrated assessments. However, given the explicit focus on biodiversity in the manual, environmental issues figured more prominently in these studies.

Strengths and Weaknesses

👍 Original manual provides a comprehensive overview of analytical methods suitable for the assessment of trade-related measures

👍 Manual on agriculture and biodiversity offers a step-by-step guide for conducting an IA process

👍 Offers criteria to help determine an appropriate focus for the analysis

👍 Provides guidance for the development of flanking measures

👍 Promotes an in-depth analysis of specific sectors in a specific country

👍 Serves as a capacity building exercise to foster stakeholder engagement and inter-ministerial cooperation

✋ In practice, sector-based approach has provided limited potential for a direct comparison of results across different countries

✋ Analysis is not suitable to identify and assess cross-sectoral impacts

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[63] UNEP 2001.
[64] Blobel et al 2005; EC 2006a.

Further Reading

Blobel, D., Knigge, M., Görlach, B. (2005): Report on Trade, Environment, and Sustainability Impact Assessment. Available online at http://ecologic.eu/download/projekte/1800-1849/1800/6_1800_cate_sia.pdf, checked on 10/01/2012.

UNEP (2010a): Agriculture, Trade and Biodiversity: A Policy Assessment Manual Volume I: A Practical Step-by-Step Guide. Available online at www.unep.ch/etb/publications/Trade%20and%20Biodiversity/UNEP_Trade%20&%20Biodiv_Vol1%202011.pdf, checked on 10/01/2012.

UNEP (2010b): Agriculture, Trade and Biodiversity: A Policy Assessment Manual Volume II: Reference Manual. Available online at www.unep.ch/etb/publications/Trade%20and%20Biodiversity/UNEP_Trade%20&%20Biodiv_Vol2%202011.pdf, checked on 10/01/2012.

UNEP (2009b): Integrated Policymaking for Sustainable Development: A reference manual. Available online at www.unep.ch/etb/publications/IPSD%20manual/UNEP%20IPSD%20final.pdf, checked on 10/01/2012.

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UNEP (2001): Reference Manual for the Integrated Assessment of Trade-Related Policies. Available online at www.unep.ch/etb/publications/intAssessment/refmaniaFinal.pdf, checked on 10/01/2012.

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UNEP Homepage: Integrated Assessment and Planning Initiative. Available online at www.unep.ch/etb/areas/inteAsse.php, checked on 10/01/2012.

Box 4: Practice Example UNEP-IATRP: Potential Impacts of the EU-ACP Economic Partnership Agreement in Uganda - A Case Study in the Horticulture Sector

Based on the Integrated Assessment of Trade-related Policies and Biological Diversity in the Agricultural Sector manual, six case studies of the potential impacts of the Economic Partnership Agreements (EPA) concluded between the EU and ACP countries were conducted. Their aim was to develop additional National Policy Action Plans, which seek to balance trade, development and biodiversity goals. The ACP countries, that participated in the initiative, included Cameroon, Jamaica, Madagascar, Mauritius, Papua New Guinea and Uganda.

In the case of Uganda, the horticulture sector was chosen for the analysis, including fresh fruits and vegetables (FFV) as well as cut flowers. It represents one of the most important export sectors of the country, having surpassed even traditional export crops, like coffee or cotton. The IA followed four main steps:

1. Identifying the criteria relevant to the main issues of concern for developing economic, social and environmental indicators;
2. determining the baseline for the IA;
3. identifying the most likely scenarios and policy options to be reviewed;
4. conducting the analysis.

The data needed for this assessment were collected through stakeholder consultations, interviews and literature reviews. The key issues to be addressed were identified in a stakeholder workshop. The main issues identified in this workshop were land requirements for the fresh fruits and vegetables and flower sub-sectors, pollution and loss of ecosystem services, market access, use of chemicals, the health and well-being of workers, livelihoods issues, as well as food security.

In the scenario analysis three scenarios were developed addressing changes in the areas mentioned above. A *business as usual scenario* describes the status quo and assumes that with or without the EPA, both the growth of the horticulture sector and the export rate of horticulture will not change significantly. Under a *leading edge scenario* it is estimated that Uganda will increase its trade with the EU under the EPA by becoming as competitive as other countries in the region, which will lead to a higher growth rate of the horticulture sector. *The matching the best scenario* uses even higher growth rates assuming that under the EPA Uganda will match its peak export performance from 2006-2007 for FFV and from 2003-2004 for cut flowers in the immediate future.

These scenarios provided the basis for the further assessment of environmental, social and economic impacts. They were analyzed using a simplified regression model as well as a root-cause-analysis to identify the main reasons for environmental, social and economic problems. However, data limitations prevented the use of a robust CBA. The assessment showed that the leading edge scenario and the matching the best scenario both offer a realistic opportunity for the expansion of the horticulture sector in Uganda. However, especially regarding related environmental impacts, findings varied between FFV and cut flowers. For this reason, a more aggressive growth was recommended for FFV, while a more cautious approach was recommended for cut-flowers.

Sources:

Ministry of Water and Environment, Republic of Uganda/ National Environment Management Authority (NEMA)/ UNEP (2009): Integrated Assessment of Trade-Related Policies and Biological Diversity in the Agricultural Sector in Uganda – The potential impacts of the EU-ACP Economic Partnership Agreement: A case study in the horticulture sector. Available online at www.unep.ch/etb/initiatives/pdf/Final%20Study%20Uganda%2012%202009.pdf, checked on 10/01/2012.

6.6 Other Relevant Frameworks

Other organizations have also developed approaches for conducting IAs in the trade context:

- The **World Wildlife Fund (WWF)** has developed an integrated case study approach with parallels to the approach employed by UNEP. It offers guiding questions to assess possible impacts of a trade measure. It also emphasizes the importance of considering all relevant actors in the process, including stakeholders as well as providing for transparency in the process[65].
- **International Institute for Sustainable Development (IISD)** has developed the Rapid Trade and Environment Assessment (RTEA) as an analytical process for flagging areas of concern or opportunity for environmental sustainability in trade policymaking. This approach does not envisage conducting detailed quantitative analysis, but is rather designed for quick assessments to identify the main impact areas of a trade measure and to provide timely policy advice. Currently, there is no general guidance on how to conduct the analysis is available. Rather a number of case study reports are available online, which may serve as examples[66].

Further Reading

IISD (2012): Rapid Trade and Environment Assessment. Available online at www.iisd.org/trade/policy/rapid_trade.asp, checked on 10/01/2012.

WWF (2000): Sustainability Assessment of Trade: A Summary of Key Issues.

WWF (1998): Developing a methodology for the environmental assessment of trade liberalization agreements. WWF International discussion paper.

[65] WWF 1998, 2000.
[66] IISD 2012.

7 Methods to Support Impact Assessment

The frameworks for conducting IAs that have been presented in Chapter 6, define processes and analytical steps in the assessment. Hence, they are designed to structure the process and to provide guidance on the conceptualization of the process. In most cases, however, these frameworks do not stipulate specific methods that should be used in each step of the process.

In the following chapter, **methods** that facilitate the generation of evidence during the various activities set out by the IA frameworks are presented. It provides an overview of five method families, which may be applied at different stages and for different purposes in an IA:

- *Scoping methods* are used for a preliminary assessment in the early stage of an assessment;
- *Environmental accounting methods* are used for the accounting of material flows in the economy and allow for the analysis of physical aspects of economic activities, products, processes or consumption patterns;
- *Scenario development methods* may be used to develop descriptions of alternative hypothetical futures, which take into account changes in different parameters in the future;
- *Economic valuation methods* are used to put a monetary value on environmental impacts of a planned measure to be able to weigh these against other social and economic costs and benefits;
- *Methods for aggregation and comparison* are usually applied at an advanced stage of the assessment process to support the final decision-making by summarizing and comparing the different aspects of the assessed options.

None of these method families is specifically designed for the analysis of trade-related policies or measures. Rather they represent methods that have the potential to be used in a trade-related context. Hence, practice examples of their application in the trade-related context (or a closely related field of application) are given to illustrate their potential in this context. Moreover, a number of categories might be partially overlapping, and certain technique may be used in conjunction with approaches in the other method families or sub-categories. In other words, the categories represent a structure for presenting the different methods and their uses rather than clearly defined analytical categories.

7.1 Scoping Methods

The term scoping is used to describe the process of deciding what should be included in an IA. It may be seen as a way to identify the main public concerns related to a policy proposal and for defining a focus for more in-depth analysis. It may also involve the identification of relevant actors (e.g. different ministries, societal stakeholders, industries) to be involved in the IA process.

The scoping can be supported by different methods, including:

- Checklists
- Results chain analysis
- Development of matrices to visualize impacts

7.1.1 Checklists

Checklists are the simplest method for systematizing a preliminary scoping of the likely effects of a proposed policy or program. If employed as a scoping method, they help point out areas that require a more detailed assessment (e.g. in form of an SEA). In some cases checklists also represent the impact analyses itself. They can also be used for a comparison of policy or program options. In general, checklists belong to those methods, which are not as time-consuming. Questions may often be answered with yes or no, or they may require only an ordinal assessment of impacts. Hence, checklists can be quick and easy to use, if all necessary data have already been collected, these data are readily available, and the person using the checklist is already familiar with the proposed measure. However, if data are missing, checklists can identify which evidence or analysis is still required and which expertise is still needed to complete the analysis.

Checklists can be divided into the following types:

Simple checklists merely list aspects to be considered in the analysis. They function as a guide for conducting the analysis by pointing out issues that are likely be affected, including those that may be less obvious but may still be relevant. They do not provide any other additional support for the analysis. The guides for environmental screening developed by the British Department for International Development (DFID)[67] and the German Ministry for Development Cooperation (BMZ)[68] represent such simple checklists (see Section 5.2 for more details on the BMZ guide). The DFID checklist contains a separate section on trade-related environmental impacts[69].

Descriptive checklists add to simple checklists as they do not only list the aspects to be considered but provide additional background information on each aspect. For example, they may identify the most important indicators to measure each component.

Questionnaire checklists are composed of a series of questions that highlight potentially relevant issues. Usually, the checklists first identifies a general issue area (e.g. climate change) and then asks more detailed questions about the concrete impacts of a measure in

[67] DFID 2003.
[68] BMZ 2010a.
[69] DFID 2003.

this issue area (e.g. expected raise of CO2 emissions) and their likely importance. The Umwelt- und Klimaprüfung (UKP, English: Environment and Climate Assessment) in the GIZ utilizes such a questionnaire checklist to structure the scoping of environmental issues during project and program development (see Section 5.3 for more details).

Finally, *weighting checklists* include simple devices for assessing importance or significance of suspected aspects. This might be through the use of letter or numeric scales, assigned based on criteria supplied in the checklist, to indicate the importance of an impact. Another approach is to use threshold values, based on statutory criteria (e.g. for water quality standards) or on derived measures (e.g. visitor carrying-capacity for a given locality). The suspected impact can be estimated in broad terms and given a value to represent its significance. This represents a starting point for comparing and ranking alternative policy options[70]. A weighting checklist is used in the Swiss approach to Sustainability Impact Assessment, for example. The checklist draws on the Swiss Federal Council's criteria for sustainable development to point out impacts along the three dimensions of sustainable development. Hence, this checklist can also be used to identify trade-offs among the different categories and compare impacts across the different dimensions[71].

To be most effective, checklists should be developed for a specific context or issue area – in this case trade-related interventions - so they can point to common impacts and risks. This way, checklists can help to organize the assessment and identify the most important issues. At the same time, there is the risk that specific issues, important in a particular country context, are left out as they are not included in the checklist and may therefore not be considered in the analysis. No checklists aimed specifically at assessing the environmental impacts of trade-related measures could be identified. Partial exceptions are the DFID Environmental Screening Guide (mentioned above)-, which includes a section on trade, as well as the OECD Checklist for Negotiators of Environmental Provisions in Regional Trade Agreements (RTAs) (see the following Practice Example). The latter does not provide guidance for the identification of environmental impacts but on how to incorporate environmental provisions (i.e. a type of flanking measure) in RTAs.

[70] Anderson 2000.
[71] ARE 2009.

Box 5: Practices Example: OECD Checklist for Negotiators of Environmental Provisions in RTAs

The OECD's Checklist for Negotiators of Environmental Provisions in Regional Trade Agreements (RTAs) has been developed by its Joint Working Party on Trade and Environment to provide negotiators of RTAs with guidance on how to incorporate environmental provisions in an RTA. The focus is not on the assessment of environmental impacts of RTAs, but on the assessment of ways to ensure that environmental concerns are safeguarded during the development and implementation of the RTA. The questions have been compiled based on existing experiences with the incorporation of environmental provisions in RTAs. Moreover, the list has been drawn up as a 'living document' that can be complemented and updated with new experiences. Some countries have developed their own approaches based on the OECD's checklist.

The checklist consists of the following five sections addressing different ways that environmental aspects can be considered and integrated in the context of an RTA. Each set of questions points at possible options for integrating environmental aspects within an RTA and offers related practice examples:

1. Alternative approaches for the incorporation of environmental provisions in an RTA: What mandate and which alternative approaches for incorporating environmental provision in the RTA exist?
2. EIA of RTAs: What options for conducting EIAs in the context of an RTA exist and what aspects should be considered in relation to the provisions for EIA in an RTA?
3. The contents of environmental provisions: What are the options for formulating the specific content of environmental provisions in an RTA?
4. Institutional issues: Who will be responsible for negotiating the RTA and how will environmental issues be represented within the negotiating process?
5. Overarching issues: What are the overall modalities and scope of the RTA negotiations and what are the implications for incorporating environmental concerns in the RTA?

Sources:

OECD (2008a): Checklist for Negotiators of environmental provisions in regional trade agreements. OECD Trade and Environment Working Paper 2008-02, Paris. Available online at www.oecd.org/dataoecd/32/1/45455319.pdf, checked on 06/14/2012.

7.1.2 Results Chain Analysis

Underlying any scoping exercise is always the aim to facilitate a preliminary reflection on the causal sequences that lead from an intervention to an environmental impact. A common scoping method is, therefore, the development of results chains. A results chain analysis helps visualize and make explicit the causal sequence leading to expected environmental impact. Results chains may be developed as desk exercises or as more participatory exercises with the involvement of stakeholders or external experts to enable a more in-depth reflection. Results chain analyses can be applied to any type of intervention. However, to conduct an appropriate analysis it is useful to draw on a conceptual framework tailored to the respective sector. For more information on the use of results chains in the trade-related context, see Section 3.5.

7.1.3 Matrices

UNEP suggests the use of a matrix to help to identify and visualize the most likely impacts of a proposed trade policy. The matrix provides a framework for systematizing the most important environmental effects, which are expected to result from the economic impacts that a trade measure might have. The matrix developed by UNEP takes the five categories developed by the OECD[72] for analyzing trade-related effects as a starting point. Each type of effect is then sub-divided into more specific outcomes and final environmental impacts (see example in Figure 11).

Figure 11: Impact Matrix for a Case Study on Chile's Mining Sector

Summary of principal environmental effects								
		Environmental Indicators						
Economic effect	*Related economic/ environmental factor*	*Air quality*	*Water quality*	*Quality of the soil*	*Water use*	*Security of abandoning of sites*	*Biodiversity*	*Use of non-renewable resources*
Scale effect	Increase in production					-	-	---
	Increase in concentrates	-	-	-	---			
	Increase in cathodes	-	-	-	--			
	Increase in blister	--	-	-	-			
Product effects	Relative increase in concentrates	-	-	-	---			
Technological effects	Changes in pyrometalurgy	+++	+	++	++	0		
	Increase in hydrometalurgy	++	+++	++	++	--		
	Desalinization	0	0	0	+	0		
Regulatory effects	Environmental regulation	+++	+	0	0	+	0	0
Industry management	Environmental management	+	+	+	+	+	+	+
NOTE: - light negative impact; -- moderate negative impact; --- significant negative impact; 0 no noticeable impact								

Source: UNEP 2001

The matrix can be filled with entries ranging from positive impacts, negative impacts to no entry, meaning that there are no significant impacts to be expected from the measure. Thereby, the matrix provides an overview of significant impacts and provides a basis for choosing areas that require a more detailed analysis. As indicated above, filling out such a

[72] See Chapter 3.3.

matrix requires an analysis of the underlying causal sequences, while the matrix itself merely offers a simplified approach for visualizing and comparing the results of this analysis.

Strengths and Weaknesses

👍 Scoping methods help to identify key impacts and aspects that need further assessment

👍 Preliminary analysis can be completed quickly

👍 Helps to structure and organize a more detailed analysis

👍 Do not require significant resources or expertise

✋ Do not allow for a detailed assessment

✋ Results are not very robust

✋ Are not necessarily designed for a trade related context

Further Reading

ARE (2009): Assessing sustainability within the federal government. (See Excel Tool SA). Available online at www.are.admin.ch/themen/nachhaltig/00270/03005/index.html?lang=en, checked on 10/01/2012.

BMZ (2010a): Arbeitshilfe für die Berücksichtigung von Umwelt- und Klimafragen bei der Erstellung von Schwerpunktstrategiepapieren.

BMZ (2010b): Leitlinie für die Prüfung und Berücksichtigung von Umwelt- und Klimaaspekten in der bilateralen staatlichen Entwicklungszusammenarbeit.

DFID (2003): A Guide to Environmental Screening. London.

GIZ (2011a): Arbeitshilfe zur Umwelt- und Klimaprüfung für Vorhaben der Technischen Zusammenarbeit.

GIZ (2010): Merkblatt: Umwelt- und Klimaprüfung. Available online at http://www2.gtz.de/dokumente/bib-2010/gtz2010-0422de-umwelt-klimapruefung.pdf, checked on 10/01/2012.

ODI (2008): An Overview of Ex Ante Tools for Assessing the Impact of Trade Liberalization on the poor.

UNECE Homepage: Environmental Impacts Checklist. Available online at www.unece.org/env/eia/resources/checklists.html, checked on 10/01/2012.

UNEP (2001): Reference Manual for the Integrated Assessment of Trade-Related Policies.

7.2 Environmental Accounting Methods

Physical Input-Output Tables (PIOT), **Material Flow Accounting** (MFA), **Life-Cycle Assessment** (LCA) and **Ecological Footprint** (EF) represent methods for accounting of material flows in the economy. They allow for the analysis of physical aspects (in contrast to accounting of monetary issues) of economic activities, products, processes or consumption patterns. While PIOTs and MFAs describe the physical input-output flows with a *regional* focus (e.g. of a defined economy or economic sector in a specific country), LCA and EF analyze physical impacts at *product* level (measuring input-output flows of a defined functional unit without being site-specific)[73].

7.2.1 Physical Input-Output Tables and Material Flow Accounting

PIOTs and **MFAs** are primarily macro-level tools applied to inform decision-makers particularly at policy level about key trends of resource inputs and outputs involved in the production, processing, consumption, and recycling of materials. They are used to *monitor resource-intensity and efficiency* of economic activities (environmental hot-spots), by deriving volume indicators inter alia. Both methods are suitable for considering the implications of specific policy strategies in terms of material flows. In a trade context, they might be applied for regularly monitoring or for simulating changes in material flows resulting from trade-related measures that induce scale or structural effects in the economy (see definitions in Section 3.3)[74]. By identifying the material requirements related to activities designed to support export-oriented economic development, relevant flanking measures might be identified. Furthermore, they are relevant for pointing out economic activities that indicate a strong need or offer potential for pollution reduction. In a trade context, this may help identify measures to facilitate the transfer of related environmental technologies.

PIOTs (German: physische Input-Output-Tabellen) are extended versions of traditional monetary input-output tables[75] that provide a method to trace physical inputs (commodities, water, land, etc.) and outputs (emissions, waste, sewage) of an economy. Building on statistical data they capture material flows between different economic sectors or the materials required to produce other materials (e.g. showing the amount of iron ore and coke used to produce steel). The analyst can identify material dependencies in sectors that might require policy adjustments on the basis of PIOTs, monitor resource-efficiency of production processes, or identify 'environmental hot-spots' along the production consumption chains (e.g. iron and steel consumption and related emissions or recycling rates). Information in IO tables can be provided in monetary (€/a) or physical terms (t/a). PIOTs as

[73] Faße et al. 2009.
[74] Giljum and Hubacek 2001; Eurostat 2008.
[75] OECD 2009.

shown in Table 2 provide the basis for MFAs, LCAs as well as CGE models (discussed in Section 7.3.2.)

Table 2: Example of an Input-Output Table

	Receiving Sectors				
Providing Sectors	1	2	3	4	n
1		Z_{12}	Z_{13}	Z_{14}	Z_{1n}
2	Z_{21}		Z_{23}	Z_{24}	Z_{2n}
3	Z_{31}	Z_{32}		Z_{34}	Z_{3n}
4	Z_{41}	Z_{42}	Z_{43}		Z_{4n}
N	Z_{n1}	Z_{n2}	Z_{n3}	Z_{n4}	

Source: Reisinger et al. 2009: 15.

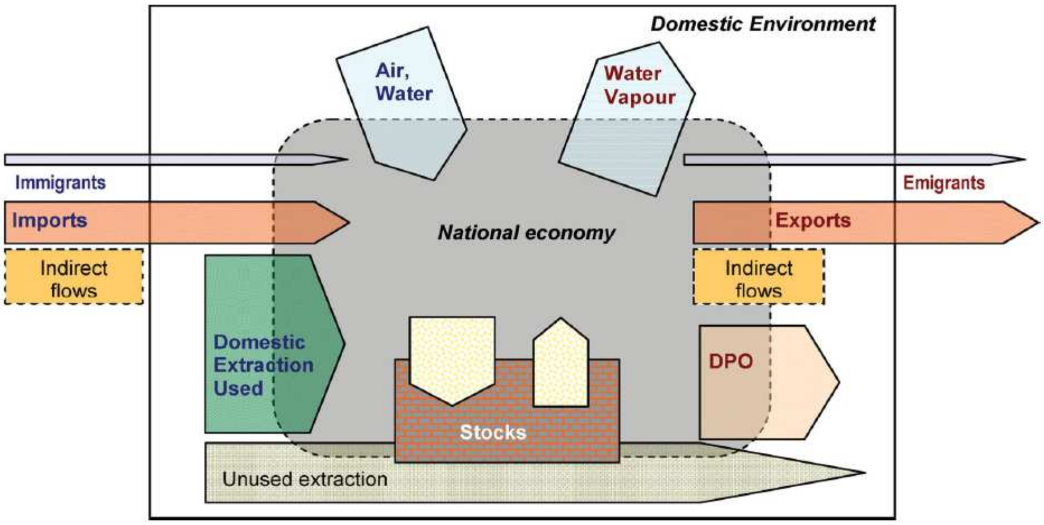
Z_{12} meaning flow from sector 1 to sector 2

MFAs (German: Materialflussanalyse) are based on PIOTs (providing the quantitative input-output matrix) and refer to a number of methodologies such as economy-wide MFA or Substance Flow Analysis, that account for physical flows of a societies' metabolism[76]. They are based on the mass balance principle (inputs into a system must equal material outputs plus net accumulation of materials in the system) as shown in Figure 12. While PIOTs characterize the *internal interactions* and processes of an *economy*, MFAs record material flows crossing the system boundaries *between the environment and the economy* (but not the material flows within an economic system[77]). MFAs are the only tools that can provide a holistic and integrated view of physical flows through an economy and can help to understand how material flows shift within and among countries and regions and how this affects the economy and the environment within countries and abroad. It thus provides the fact-base for tracking implications for natural resource consumption resulting from structural changes of the economy, including changes in trade, technology, investments and consumption[78].

The method's main purpose is to derive volume indicators (such as the input indicator Direct Material Input or output indicators such as Domestic Processed Output) assessing environmental resource extraction (input side) or the emission of waste (output side). Depending on the method applied (e.g. economy-wide MFA vs. Substance Flow Analysis) they can also be carried out at various scales ranging from international to company level[79].

[76] EIONET 2010; OECD 2008c.
[77] Statistik Austria 2009.
[78] Reisinger et al. 2009 cit. Giljum et al. 2008.
[79] EIONET 2010.

Figure 12: The Economy-wide Material Balance Model



Source: Fischer-Kowalski et al. 2011: 860

Resource Requirements and Expertise

Developing PIOTs and MFAs is resource and time intensive, demanding input from statisticians but also various other disciplines. Due to the amount of data required they are usually compiled by national statistical offices. However, once established, resource demands decrease. Building MFAs is still a fairly young discipline, and economy-wide MFAs have mostly been developed in industrialized countries. However, it is expected that MFAs will be of growing concern especially in industrializing countries which rely heavily on raw materials for production and export of manufactured goods[80].

Strengths and Weaknesses

👍 PIOTs provide a *complete* picture of economic-ecological interactions of an economy

👍 MFAs are methodologically robust and coherent which makes it easier to compare implications in an international context.

👍 MFAs can monitor the implications of (extensive) trade measures on environmental resource flows in a country.

✋ The data in a PIOT does not allow for a qualitative assessment of material flows (a ton of a given material does not allow a statement of its toxicity).

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[80] Aoki-Suzuki et al. 2012.

✋ Indicators derived from MFAS can, to a large extent, be dominated by only one material category which can lead to misinterpretations of results, as detailed information on other material groups or economic sectors might be diluted[81].

✋ PIOTs and MFAs are resource and data intensive and require a high level of specialized expertise.

Further Reading

Fischer-Kowalski, M., Krausmann, F., Giljum, S., Lutter, S., Mayer, A., Bringezu, S., Moriguchi, Y., Schütz, H., Schandl,, H., Weisz, H. (2011): Methodology and Indicators of Economy-wide Material Flow Accounting. State of the Art and Reliability Across Sources. In: Journal of Industrial Ecology 15 (6), pp. 855-876.

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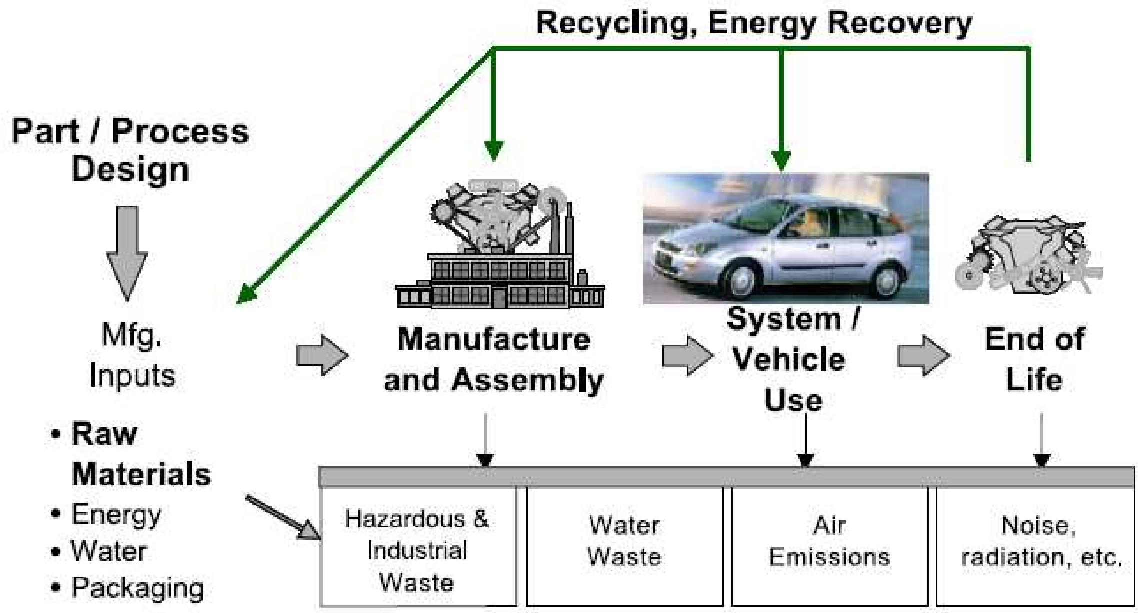
WRI (2005): Material Flow Accounts. A Tool for Making Environmental Policy. Washington, DC.

[81] Hinterberger et al. 2003.

7.2.2 Life-Cycle Analysis

While PIOTs and MFAs are geared towards questions relating to *quantities* and *paths* of material flows, **LCAs** (German: Ökobilanz) rather focus on the *environmental impacts* related to these material flows[82]. It "is a method for the analysis of products and for the 'compilation and evaluation of the inputs and outputs and the potential environmental impacts of a product system throughout its life cycle"[83]. With an LCA the environmental impacts of a new or changed product or production process can be quantified. These impacts can be used to compare them to impacts of other products/systems, analyzing them from 'cradle-to-grave' (see Figure 13). In contrast to MFA methodologies, it is an internationally standardized approach[84] that follows a defined sequence of steps[85]. Results of an LCA may be expressed in different forms, such as MJ for primary energy used or in CO_2-equivalents for the GHG potential of a product/system/process.

Figure 13: Life-cycle of an Automobile



Source: Adams and Schmidt 1998.

LCA is used to inform public policy, businesses and the public on the 'environmental friendliness' of a product or sector and helps identify environmental impacts along the

[82] UBA 2012.
[83] ISO 14040: 1997.
[84] Ibid.
[85] 1) Goal definition and Scoping of the LCA study; 2) Inventory Analysis of environmental resource usage in the product/process/system; 3) IA - assess the potential human and ecological effects of the resource usage; 4) Interpretation as evaluation of the previous steps to select the preferred product/process/system (EPA 2006).

complete value chain. LCAs are helpful in developing product or value chain oriented programs (e.g. for eco-labeling of export products or developing strategies to improve the environmental performance of a particular value chain), process-oriented policies (e.g. regulating the use of hazardous materials in a production process) or waste management strategies (e.g. determining whether specific materials should be recycled or disposed of and what targets should be). It can be applied to export promotion activities to evaluate the 'greening potential' of value chains, for instance of agricultural products. Another field of application is the assessment of the environmental effects of introducing new technology standards in partner countries (e.g. cleaner technologies) or to assess the environmental effects of production processes in context of trade promotion activities, for instance packaging options of export products. At the policy level LCA results can be used to support the design of measures on eco-design, or for product-oriented policies (e.g. deciding on subsidies for promoting desirable production practices). They also support decisions on which economic sectors to promote and how, showing the environmental implications of included value chains.

Standardized LCAs are carried out as relatively complex quantitative exercises. However, in recent years, less time and resource-intensive qualitative LCA methodologies have been developed. These 'LCAs light' are often conducted as Qualitative Matrix LCAs that can also be used as starting points for a complete LCA. In the matrix the rows may represent the different stages of a certain product's production process and the lines the different impact categories, indicating the production stages' scores. These matrices can be used as stand-alone tools and are combined with text-based assessment as well as scoring[86]. They represent qualitative assessments conducted by experts and/or stakeholders. The assessment of environmental impacts is less robust compared to the standardized LCA. They can be applied in the context of high-level decisions, and they are also useful for involving stakeholders, since they will be easier to understand for non-specialists. Another option to promote LCA in policy-making is Life-Cycle Thinking. This does not represent a formalized analytical framework, but an approach promoting cradle-to-grave thinking with policy-makers, e.g. when designing policies.

Finally, integrated LCA's combine the quantitative and qualitative elements of the standardized LCA approach and LCAs light. One such an example is the PROSA project[87] (Product Sustainability Assessment) carried out by the Öko-Institut. It represents a process- and stakeholder-driven framework for an integrated, strategic product portfolio planning. Next to environmental aspects it pays particular attention to the analysis of social and economic implications of products. It includes a number of development phases (from objective definition to strategy development) and provides a range of analytical tools. These include LCA, Life-Cycle-Costing (considering the costs of product development at all product-

[86] SolidWorks 2012.
[87] PROSA project homepage: www.prosa.org.

stages), Social LCA (considers the social impacts of products along their life-cycle) as well as benefit analysis, providing the analytical basis for assessing the sustainability implications of a product[88].

Resource Requirements and Expertise

A full LCA is a sophisticated accounting method, which is generally resource and time intensive[89] and which requires advanced expertise. Data can be acquired from industry data reports, databases, consultants, government documents, reports, databases, and clearinghouses or previous life cycle inventory studies. Furthermore, a broad range of LCA tools (software) and databases to support LCAs have been developed in recent years.

According to BCorporation[90] (2008), the price for conducting an LCA ranges from 8,000€ and 50,000€ (on average), depending on the scope of the assessment (i.e. consideration of the complete life-cycle of a product/process or only parts of it) and on the detail of the analysis (.i.e. consideration of all types of environmental impacts or only selected ones). Qualitative LCAs will be less expensive than full LCAs, as they do not require quantitative data. However, they still need professional expertise to be carried out.

Strengths and Weaknesses

👍 Provides a holistic picture of environmental impacts and of the locus and intensity with which they occur within a value chain.

👍 Provides a basis for developing targeted policies at individual segments of a value chain.

👍Allows comparison of the 'environmental friendliness' of two or more products/ processes.

✋ Performing an LCA is often resource and time intensive.

✋ Data might be difficult to compile, although an increasing number of free LCA data bases and LCA software are aimed at simplifying LCAs studies.

✋ Standard LCA does not determine which product/process is the most cost effective.

88 Öko-Institut e.V. 2007.
89 EPA 2006.
90 BCorporation 2008.

Further Reading

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UNEP (2004b): Why Take A Life Cycle Approach? Paris. Available online at www.unep.fr/scp/lifecycle/, checked on 10/01/2012.

USAid (2012): Trade Impact of Life Cycle Analysis in Multi-Attribute Certification Programs for Flooring Materials and Plumbing Fixtures in Five Focus APEC Member Economies. APEC Secretariat, Singapore.

Box 6: Practice Example Life Cycle Analysis: Environmental Life Cycle Assessment of South-East Asian Aquaculture Systems

In the context of the EU-FP7 project ‘Sustaining Ethical Aquaculture Trade’[91] (SEAT) four detailed LCAs were carried out, each requiring between 20 and 200 days of work”[92] (depending on the level of analysis). The overall aim of the project was to improve the sustainability of four major aquatic food commodities farmed in Asia and exported to Europe. The LCAs supported sustainable industry expansion and the promotion of safe and sustainable products for consumers, whilst ensuring a fair deal for producers who meet appropriate social and environmental standards. The LCAs enabled the comparison of the environmental performance of products and services associated with specified number of Asian fish and crustacean production systems and warm-water aquaculture systems with the same species in Europe. On this basis, the LCAs helped to identify options for minimizing environmental impacts in the respective value chains.

Specifically the LCAs made available environmental information on:

- the environmental impact and its causes of aquaculture systems for Tilapia, Catfish, Shrimp and Prawns in Bangladesh, China, Thailand and Vietnam;
- starting points (“hot spot identification”) for improving the environmental performance of the aquaculture systems in these countries

Results of the LCA were intended to generate information for discussions among stakeholders on improving existing aquaculture practices. Stakeholders included the EC, Asian farmers, producers, processors and traders (both SMEs and larger enterprises), NGOs, and policy-makers. Moreover, the LCAs supported the development of criteria for a next generation of the ethical aquatic food index.

Sources:

Guinée, J., Kleijn, R., Henriksson, P. (2010). Environmental Life Cycle Assessment of South-East Asian Aquaculture Systems for Tilapia, Pangasius Catfish, Peneid Shrimp and Macrobrachium Prawns - Goal & Scope Definition Report. SEAT Deliverable Ref: D 2.4.

[91] SEAT Global 2012.
[92] A simplified LCA not completely following ISO guidelines was declared requiring 1 to 20 days of work.

7.2.3 Ecological Footprint Analysis

EF (German: Ökologischer Fußabdruck) is a method to examine the area necessary to continuously provide for the standard of living of humans under current conditions of production. It may also be used in aggregate form to measure the impacts of current *consumption patterns* of communities, regions or countries. It is used primarily as a sustainability indicator for the purpose of monitoring activities and as a communication tool (enabling statements like: if everyone lived the lifestyle of a Peruvian person, we would 'only' need one planet)[93].

EFs are designed to quantify the demand for the biosphere's regenerative capacity imposed by human activities. It measures the amount of biologically productive land and water area required to produce a product or bundle of products an individual, a region, country or activity consumes, and to absorb the waste they generate[94]. The EF can be used to measure resource use and/or pollution generation embodied in trade flows. For instance, the imports and exports of domestic or international trade products of a country or region can be expressed in an EF. The footprint of imported goods is fully added to the consumers' EF[95].

If regularly updated, the EF of a defined unit can be considered as a sustainability indicator suitable for monitoring resource use (e.g. as consequence of economic growth). It is mainly applied at the national level where it can make available a robust and transparent account of the pressure put on ecological services and resources by human activity. As such, it represents a method allowing for international comparison of a nation's demands on the global regenerative capacity. Furthermore, EF is particularly helpful in communication of (non)-sustainable consumption trends and developments with its results being presented in just one single measurement unit, the global hectare (gha).

Next to the EF a number of other more specialized environmental footprint types exist, such as the water, energy, nitrogen or biodiversity footprint. The EF represents a composite approach of the carbon, land and fishing-grounds footprint. In addition to that, social as well as economic footprint approaches are available for sustainability evaluation.

Resource Requirements and Expertise

Similar to PIOTs and MFAs institutionalizing the EF as a national sustainability indicator requires comprehensive statistical data and expertise. The Global Footprint Network publishes the National Footprint Accounts of 150 jurisdictions on the basis of United Nations' (UN) source datasets on an annual basis. These national accounts build approximately on

[93] See Global Footpring Network Homepage: www.footprintnetwork.org/en/index.php/GFN/page/peru/

[94] Global Footprint Network 2009.

[95] Turner et al. 2007.

6000 data points per country per year, from 1961 onwards[96]. In recent years various calculators for quick footprint analysis as well as more sophisticated tools for integrated consideration of different footprints and other indicators have been developed to support footprint application[97].

Strengths and Weaknesses

👍 Footprints reflect changes in resource use over time.

👍 They compare human demand against "carrying capacity", an otherwise overlooked aspect.[98]

👍 Provides an indicator that enables the comparison of resource use in different jurisdictions.

✋Does not disaggregate impacts according to policy measures and does not immediately lead to policy recommendations.

✋ EF accounts do not contain spatially disaggregated data on actual land use and do not provide precise information on ecosystem impacts.

Further Reading

Čuček, L., Klemes, J. J., Kravanja, Z. (2012): Review of Footprint analysis tools for monitoring impacts on sustainability. In: Journal of Cleaner Production 34, pp. 9-20.

Global Footprint Network (2012): Start Page. Available online at www.footprintnetwork.org/en/index.php/GFN/, checked on 06/07/2012

Lenzen, M., A Murray, S. (2003): The Ecological Footprint – Issues and Trends. ISA Research Paper 01-03. The University of Sydney. Sydney, Australia.

[96] See Global Footprint Network Homepage: www.footprintnetwork.org.
[97] Čuček et al. 2012.

[98] Best et al. 2008.

7.3 Scenario Development

Scenario development is an important feature of IA since it allows for the formulation of assumptions on future developments in one connected storyline. According to Van Notten (2006), "Scenarios are consistent and coherent descriptions of alternative hypothetical futures that reflect different perspectives on past, present, and future developments, which can serve as a basis for action".[99] Scenarios can be described qualitatively or quantitatively, often both approaches will be combined. Scenarios are for instance used to integrate the qualitative storylines regarding future development of complex systems with the quantitative formulations applied in formal modeling. Participatory scenario development allows for the integration of stakeholders' views on the key influencing factors of future developments and the embedding of scenario assumptions in a specific regional context.

The two following sections will introduce different types of modeling techniques as well as approaches for qualitative or participatory scenario development.

7.3.1 Modeling

Modeling in the context of IA describes numerical and quantitative techniques for analyzing the impacts of policy proposals simulated with computer software. They represent a form of quantitative in-depth analysis of the most significant impacts of a policy initiative[100]. The main objective is to provide simplified versions of complex real-world phenomena in order to infer statements on the system under consideration. Models are used to simulate the likely impacts of selected exogenous variables (e.g. policy changes or tariff reductions) under various circumstances on different markets (commodity markets, financial markets, labor markets, resource use, emissions, etc.) or systems as endogenous variables explained by equations within the model.

In models that assess the implications of trade, the environment dimension is mostly considered by linking economic activities and their inputs (e.g. fossil fuel, ores, fertilizers, chemicals) to changes in environmental quality. So far, models have mostly considered the relationship between changes in economic activities and energy use and the resulting changes in GHG emissions or air pollution. To a growing extent models are being developed that trace (worldwide) material flows, either in more general terms or for specific materials such as copper or mineral resources. They allow for an evaluation of more detailed material streams (e.g. paths and where materials accumulate). The effects of implementing environmental regulations (e.g. the introduction of environmental taxes, the introduction of backstop technologies[101] or the upgrading of environmental standards) has also been a broad field of application in modeling exercises. In terms of data requirements regarding

[99] Van Notten 2006.
[100] EC 2009a.
[101] O'Ryan et al. 2002.

partner countries one problem may be the lack of industry-specific pollution data (pollution per unit of output) and the lack of environmental data for assessing environmental impacts of trade[102] (see also Section 7.2.1.).

Each model is designed for a specific purpose or area of analysis and is based on a set of assumptions that is suitable for this purpose. These assumptions need to be made transparent for users in every modeling exercise since they have relevant effects on modeling results and are also relevant for interpretation of these results. They are usually embodied in large-scale computer algorithms, requiring data sets tailored to the particular problem area.

Four major model groups for modeling the trade-environment relations will be outlined in the following:

- **Computable general equilibrium models** simulate long-term effects of trade activities on a complete economy and feedbacks between different sectors and are based on neoclassical (Walrasian) economic theory;
- **Partial equilibrium models** focus on a specific policy area, but do not consider interactions between the remaining sectors. These single-sector models deliver more disaggregated and detailed results than CGEs;
- **Econometric models** are predominantly used for forecasting, relying on statistical inference methods and observed behavior. They use historical data to make assumptions on future developments;
- **Micro-simulation models** are a specific type of single-sector model and are typically used to assess the impacts of policy changes on small units such as firms or vehicles.

Input-Output-Models represent another category that has already been presented above (see Section 7.2.1). Finally, **integrated assessment models** combine relevant models to assess impacts in several policy areas simultaneously (they will not be further discussed in this chapter). They are usually developed in the context of large research projects[103].

7.3.2 Computable General Equilibrium Models

Computable general equilibrium models (CGEs) (German: berechenbare allgemeine Gleichgewichtsmodelle) give an indication of the 'economy-wide' impacts of a policy on different sectors, producers, government and households. CGE models have been widely used in analyzing the consequences of trade (liberalization) on the environment, principally in developing countries. Many CGE models have used the GTAP database (see practice example in Box 1) to cover data requirements. CGE models have investigated the environmental

[102] WTO 1999: 34.
[103] Cambridge Econometrics 2009.

and economic costs of trade liberalization, particularly energy related GHG emissions with direct links to economic activities. Complex economic-environment interactions, such as water stress or biodiversity loss, are hardly considered[104].

CGE models are based on neoclassical economic theory, and derive behavioral equations from micro-economic principles (i.e. assuming utility-maximizing individuals, profit-maximizing enterprises). This also includes the assumption of an economy in which all sectors are in equilibrium, resources are allocated efficiently and supply equals demand. The internal consistency involved with this foundation belongs to the perceived strengths of CGE models. Another advantage lies in the inclusion of the entire economy and the ability to take into account feedback mechanisms between sectors. This comprehensive perspective however, limits CGEs suitability in terms of meaningful results for a particular sector. They are generally calibrated to a single base year of data, which means that data needs of CGE models are rather low compared to other models. Data bases can be (P)IOTs (see Section 7.2.1) or Social Accounting Matrices, from which subsequent development is calculated[105].

They can be static (comparing the situation at different dates) or dynamic (showing developments from one period to another). They are typically employed to analyze the *long-term effects* of general economic policies. Unlike econometric models (see paragraph below) they are not considered to be suitable for the analysis of short-term effects or forecasting, as they frequently lack consistency with real world behavior and real world data. For instance, the costs of reducing CO_2 emissions may seem higher, due to the assumption that all “best available technologies” are already in use[106]. Other caveats represent the models’ extensive time requirements and the difficulty of interpreting results. Due to their complexity they should be primarily focused on magnitudes, directions, and distributive patterns rather than specific numeric outcomes[107].

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[104] Böhringer and Löschel 2006.
[105] Ibid.
[106] Ibid.
[107] IDB 2012.

Box 7: Practice Example CGE models: The Global Trade Analysis Project

Background on the Global Trade Analysis Project

The GTAP is a global project that aims at building one globally consistent data base for quantitative analysis of trade issues. Since its launch in 1993 the GTAProject has developed into an extensive global network of researchers and policy makers conducting quantitative analysis of international policy issues. Centerpieces of the project are a **global database** and the **GTAP model**. The database describes bilateral trade patterns, production, consumption, and intermediate use of commodities and services. It contains data for the quantitative analysis of global trade issues (e.g. effects of FTAs). The current version provides complete bilateral trade information, transport and protection linkages for 129 countries and 57 sectors. It has recently been extended to cover climate change issues and biofuels as well as land use (covered by 18 agro-ecological zones). The **GTAP model** is a multiregional, multi-sector CGE model building on the GTAP data bases. It has been applied to evaluate the costs of pollution abatement and to assess the spill-over effects of GHG abatement policies via international trade and sectoral interaction.

Application of the GTAP model to assess the impacts of East-Asian Free Trade on Regional GHG Emissions

Using the GTAP model Thomassin and Mukhopadhyay (2008) estimated the economic as well as climate impacts from trade liberalization endeavors in six East-Asian countries: Japan, Republic of Korea, China, Indonesia, Thailand, and Vietnam. To analyze potential effects on GHG emissions, the model simulated a RTA that decreased import tariff restrictions between the six individual countries and other ASEAN (Association of East-Asian Nations) countries.

Three scenarios were analyzed: The base scenario representing current levels of import tariffs across countries and regions; the moderate scenario assuming a reduction of 40% of import tariffs on agricultural commodities and 50% on all other commodities; and the deep scenario building on an 80% reduction of import tariffs on agricultural commodities and 100% for all other commodities between the selected and other ASEAN countries. The GTAP model simulated the change in trade flows induced by these import tariff reductions and the resulting changes in countries' industrial outputs. Based on that the environmental effects as changes in GHG emissions (CO_2, CH_4, and N_2O) could be estimated.

Overall results show that in both liberalization scenarios emissions increase in all countries, due to growth in the total industrial output. While Vietnam is highly affected, Japan and Korea experience a moderate GHG increase. China would benefit least from tariff reductions, which translates into lower GHG increases. Results could also be clustered according to climate relevant emissions in specific sectors. The most relevant sectors in terms of increasing GHG emissions included electricity, transport, chemical industry, and plastics products.

Based on the results of the simulation Thomassin and Mukhopadhyay make a number of policy suggestions, while highlighting that CGE modeling should not be the sole measure on which to base conclusions for the design of trade agreements. They suggest the imposition of taxes on emissions resulting from the production of goods, particularly eco-duties; a uniform carbon tax on electricity and transport in all countries, and a fuel tax to provide incentives to adopt fuel efficient production techniques.

Sources:

Global Trade Analysis Project Homepage. Available online at www.gtap.agecon.purdue.edu/, checked 10/01/2012.

Thomassin, P. J., Mukhopadhyay, K. (2008). Impact of East-Asian Free Trade on Regional Greenhouse Gas Emissions. In: Journal of International and Global Economic Studies, 1(2), pp. 57-83.

7.3.3 Partial Equilibrium Models

In contrast to CGEs, **partial equilibrium (PE) models** (German: partielle Gleichgewichtsmodelle) only consider the effects of a given policy action in the market(s) that are directly affected. For this reason, they are also referred to as single-sector models. Partial equilibrium is a synonym for demand and supply analysis (equilibrium being the intersection of supply and demand curves). They imply a ceteris paribus condition, so they do not take account of the economic interactions between the various markets in a given economy[108].

PE models are frequently used to examine the effects of a trade policy on a specific market. Results can be delivered on a fairly disaggregated level (e.g. for a specific commodity or family of commodities) and can be used for evaluating distributional aspects for certain economic groups. In the trade context they mainly have been applied to assess the effects of changes in the considered markets (e.g. agriculture) on emission pollution[109] and land use. By virtue of their limitation to a single-sector they could not answer the question of what would happen to emissions in other sectors or economy-wide for instance if changes in the considered sector take place.

PE models rely on statistical data, though not as comprehensive as in models considering the entire economy. Compared to CGE models, they offer a more detailed analysis, and they tend to be more transparent and easier to implement, due lower data requirements. However, PE models can only be conducted on a limited number of pre-determined economic variables. Moreover, they might miss relevant interactions and feedbacks between markets.

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108 World Bank 2010c.
109 Jayavedappa and Sumedha 2000.

7.3.4 Econometric Models

Generally, **econometric models** (German: ökonometrische Modelle) are used for conducting structural analysis of a regional, national or international economic system[110], relying on a quantitative measurement of the underlying relationships of the system's variables, and to *forecast* short-to medium term developments (in contrast to prediction as a probabilistic exercise). They are also applied for policy evaluation (ex-post analysis of policy implementation). Generally, econometric models are algebraic models that are stochastic and include random variables (as opposed to deterministic models)[111]. In contrast to CGEs and PEs, econometric models use statistical methods for validating equations that define relationships between variables in a system.[112].

Based on a set of variables, such as household incomes, tax and interest rates, population growth, technological change, etc., they seek to forecast how changes in selected variables might affect future courses in others[113]. They are capable of integrating feedback and multiplier effects and well-defined links between economic sectors.

They come into play when decision-makers are interested in estimating the effects of specified interventions and can assume that the underlying system will not change fundamentally (large structural changes cannot be captured by econometric models). In the trade sector, they have primarily been used to model the effects of international trade and trade liberalization on the consumption of fossil fuels and related GHG emissions as well as impacts on air and water pollutants. Results allow for statements such as the following: "If oil prices rise by 10%, this will decrease car traffic by approximately 3%". This would in turn enable the estimation of increases in CO_2 emissions. The relationship between oil price and car traffic would be estimated from time-series data on oil prices and car traffic in the past. Relying on time-series data (multiple time-points) they also provide a technique to explore temporal relationships between trade and the environment[114] (how does environmental quality respond to different levels of trade activity over time).

Due to their reliance on statistical data, econometric models have the largest data requirements of all models[115]. Many econometric models are based on data from national accounts. The availability of multiple time-points allows the estimation of relationships between variables over time. An important weakness of econometric models relates to the fact that they draw on historical data to forecast future developments, which may lead to misleading conclusions. Moreover, especially macro-economic models are frequently criticized for lacking micro-economic foundations.

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110 EC 2009b.
111 Intriligator 1983.
112 Cambridge Econometrics 2009
113 Econlib 2008.
114 Huang 2002.
115 Cambridge Econometrics 2009.

7.3.5 Micro-Simulation Models

Micro-simulation models (German: Mikrosimulationsmodelle) are a specific type of single-sector model. They are usually based on micro-economic data (often drawn from surveys) and are typically used to assess the impacts of various policy changes on small units such as persons, households, firms, or vehicles. Within micro-simulation models, each unit of analysis is represented by a unique identifier and a set of associated attributes (e.g. lists of individuals with attributes such as age, sex, employment status etc.). A set of rules (transition probabilities, i.e. the probability of transitioning from one state to another in a single step) are then applied to these units leading to simulated changes in state and behavior. By using a representative sample, micro-level changes can be aggregated in order to estimate macro-level effects (such as on an entire country). So far, micro-simulation models have been largely used to investigate the impacts of fiscal changes and distributional effects (e.g. the impacts of new tax systems) or distribution of traffic flows. In a trade-context they were particularly used to investigate the socio-economic impacts of trade-liberalization at the household-level. Environmental modeling in micro-simulations has been limited so far.

Micro-simulations can be static or dynamic and can be combined with CGE models. Their strength lies in the level of detail of simulation results. Similar to single-sector models the missing link to other parts of the economy represents a weakness of micro-simulation models. Reliance on survey data can also be critical since possibilities of sampling errors are given[116].

Resource Requirements and Expertise

Modeling belongs to the highly data and resource-intensive methods, which require extensive expertise most importantly in the field of economics. Constructing a new model suitable for analyzing a particular set of impacts typically requires twelve person months or more[117].

[116] Ibid.
[117] Ibid.

Strengths and Weaknesses

👍 Used for complex, quantitative analysis of impacts, with multiple inputs or outputs.

👍 Results are very robust (within the parameters set for the analysis).

👍 Provide fixed structure for analyses (e.g. most economic models are based on national accounts)

✋ There is a risk that assumptions are not (made) clear, although they have crucial influence on the modeling results.

✋ Stakeholders and policy makers may not know how to interpret results or may not have confidence in the model, which may lead to incorrect conclusions as well low impact on policy development.

✋ Very high resource requirements.

✋ Modeling trade and environmental interactions requires an interdisciplinary approach (including knowledge economics, environmental science, international relations, and scientific law) usually related to transaction costs for those involved.

✋ All models require complete data sets and their results are dependent on their input data

✋ Lack of flexibility offered by the fixed model structure.

Further Reading

FAOSTAT database. Available online at http://faostat3.fao.org/home/index.html#HOME, checked on 07/09/2012.

Hammouda, H. B., Osakwe, P. N. (2006): Global Trade Models and Economic Policy Analyses: Relevance, Risks, and Repercussions for Africa. African Trade Policy Centre / UNEP Economic Commission for Africa, Work in Progress No. 47, Addis Ababa, Ethiopia.

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Zaki, C. (2010): Towards an explicit modeling of trade facilitation in CGE models: Evidence from Egypt. Economic Research Forum, Working Paper 515, Cairo, Egypt.

7.3.6 Participatory Foresight or Scenario Development Methods

Overview

As the future is unknown, participatory foresight or scenario development methods provide an option for thinking creatively about uncertain, complex futures and to prepare for a range of possible outcomes. They typically do so by developing different possible scenarios each based on a different set of fixed parameters to develop several plausible descriptions how the future might look like and to identify the required steps along a desirable trajectory. As it relies on qualitative assessments by experts or stakeholders (typically supplemented by other existing data), it can be applied to any type of policy proposal, including trade policy.

Usually drawing on existing quantitative and qualitative data, stakeholders and/or experts construct a number of potential development paths based on differing assumptions regarding key influencing factors. Such “explorative scenarios” are developed to identify key factors that may become important in the future, make explicit the uncertainties that prevail in relation to a given issue or policy and provide a systematic description of possible developments. Moreover, a participatory approach that includes not only experts but also affected stakeholders can help initiate an informed dialogue on policy options in the selected context. Typically, a set of different explorative scenarios is developed to capture different perspectives on the issue and to evaluate possible implications of choosing different policy options. The construction of explorative scenarios is, therefore, suitable, for comparing the possible implications of different policy options, depending on how a chosen factor or set of factors develops.

“Normative scenarios”, on the other hand, are used to identify desirable future developments and map out the steps needed to achieve a desired future outcome. Therefore, they are often used in processes to develop strategies and policy targets and are also described as pre-policy research[118]. In practice, these two approaches are often combined in a two-step process. In an initial phase, a set of business-as-usual scenarios may be constructed. This may be followed by the development of desirable scenarios, based on possible actions to be taken. In this way, different policy options can be compared and consensus for a given course of action can be established.

An important aim of participatory scenario development is to supplement and synthesize existing data and formalized knowledge with other relevant forms of stakeholder knowledge. By actively engaging stakeholders, it allows for taking into account localized or tacit knowledge as well as relevant priorities and concerns of stakeholders. In this way, participatory methods for scenario development aim to increase the consistency, robust-

[118] van Notten 2004.

ness and relevance of the scenarios that are constructed. Usually, stakeholders encompass political decision-makers, experts as well as representatives from civil society and the private sector[119]. If stakeholders are engaged during the initial scenario development phase, the data and knowledge derived from these consultations may have to be combined with data from other sources such as models, literature reviews or interviews to construct scenarios for the further analysis. To do so systematically, a number of different software solutions have been developed. The "Scenarios for Sustainability" website offers an open source toolkit for the generation of scenarios[120]. Figure 14 shows how a participatory scenario development process may be organized.

Figure 14: Participatory Scenario Development Process

When	Step	Who
Before first workshop	Decide on purpose of scenario and stakeholder involvement	Core team in consultation with main stakeholder groups
At first workshop	Icebreaker: Getting people to think about the long-term future	Stakeholder group with core team facilitation
	Introduce the concept of scenarios	Core team
	Back casting (revisiting history) exercise[a]	Stakeholder group with core team facilitation
	Identify main areas of uncertainty[a]	Stakeholder group with core team facilitation
	Develop focal questions to be addressed by scenarios[a]	Stakeholder group with core team facilitation
	Identify main drivers of change[a]	Stakeholder group with core team facilitation
	Develop first set of storylines	Stakeholder group with core team facilitation
	Decide on modeling capacity	Stakeholder group and core team
Between workshops	Prepare documentation material of first workshop	Core team
	Model runs	Modeling teams
At the second workshop	Critically assess storylines and incorporate model results[a]	Stakeholder group with core team facilitation
	Identify important surprises[a]	Stakeholder group with core team facilitation
	Identify implications of scenarios for the main stakeholder groups in the area	Stakeholder group with core team facilitation
	Decide on final storylines	Stakeholder group with core team facilitation
	Evaluate the implications of each scenario for addressing identified uncertainties	
Optional	Wider stakeholder feedback session and scenario iterations	Core team facilitation
After workshop	Final write up of scenario storylines and their implications	Core team
	Dissemination of scenarios write-up	Core team

[a]The sequencing of these steps can vary.

Source: Thongbai et al. 2006.

[119] Reed et al. 2012.
[120] Scenarios for Sustainability Website: http://scenariosforsustainability.org/tools_kit.php#scennarr.

Selected Methods

Several methods exist to include stakeholders in scenario development processes. In the following, some of the more prominent methods that may be used for participatory scenario development are described. In most cases, they can be used for both the generation of data for creating scenarios and the evaluation of previously developed scenarios to identify priorities.

Focus groups: Focus groups represent the most basic method for involving stakeholders in scenario development. A focus group is a planned discussion among a small group of stakeholders that is facilitated by a moderator. It is designed to obtain information about people's preferences, values and opinions on a planned measure or on expected future developments in a sector or issue area. This method is especially useful in the initial phase of an assessment process to explore a concept and to generate ideas. Moreover, it may be used to gather stakeholder input in the development or review of a program. In a focus group, the participants can either develop normative scenarios by discussing preferences and desirable future developments. At the same time, this method can also be used to gather input for explorative scenarios by collecting information from the involved stakeholders on the expected future developments, on their expectations, which key factors may become important in the future as well as to develop a rating of these factors.

Delphi method: The Delphi method describes a systematic process of consulting experts in the field about future developments. In an iterative process, experts are consulted via questionnaires about their opinions regarding likely developments in a specified issue area. After an initial round, experts are presented with a summary of the previous round's results and are invited to revise their forecasts on this basis. In this way, it is possible to determine the degree of agreement or disagreement about the estimated future and allows for conclusions on how uncertain the knowledge about possible future developments is. This expert opinion can be included in the further development process of a planned trade policy or program. Moreover, the findings from this process may be used to identify the areas where flanking measures may be necessary to deploy the full potential of the planned measure and to mitigate the negative effects that might be connected to it.

Road-Mapping: Road-Mapping is a normative scenario development exercise and represents the systematic gathering of challenges and options for achieving a goal. Often, the process starts with defining the targets of a measure and then identifies important steps that have to be taken to achieve this (known as a back-casting process). The identified targets and intermediary milestones are displayed on a timeline to visualize the process. In a trade related context, it may be used for developing a policy package to promote exports in a selected sector or region, while minimizing related environmental impacts.

Future workshops: Future workshops are also used to identify and discuss possible solutions to a problem. This process usually involves three phases. First, stakeholders have the opportunity to express critique and point at deficits, challenges or problems connected to a measure under discussion. Secondly, the participants enter the fantasy or utopia phase. At this point visions for a desirable future are developed. This second phase is then followed by a realization phase, which explores the options for implementing the scenarios developed in the utopia phase.

Similar to the road-mapping process, normative storylines are developed in a future workshop, which may later be revised based on results from quantitative modeling exercises to derive explorative scenarios to make explicit the uncertainties connected to future developments and to identify the key factors that may influence these developments.

Co-operative discourse model: The Co-operative Discourse Model, developed by Renn and Webler[121], is an approach aimed at the systematic engagement of a wide range of stakeholders in the assessment and development of policy options to reach a specified goal or set of goals. The approach entails three steps. First, concerns and evaluation criteria are identified and selected by asking all relevant stakeholder groups about their priorities and criteria for judging different policy options. For visualizing the results, a value-tree may serve as a helpful method which results in a hierarchically structured list of values representing the concerns of all involved parties. Secondly, impacts and consequences of different policy options are identified and measured by using the evaluation criteria derived from the valuation tree. A research team or external experts operationalize these criteria for the analysis, followed by validation by the participating stakeholder groups. These indicators then serve as the measurement rules for the assessment of each policy option, which is usually conducted by experts on the matter. The final phase includes a discussion of these results with a randomly selected group of citizens who serve as jurors and representatives of interest groups to evaluate the results and design policy options based on their knowledge about the likely consequences and their personal preferences.

Resource Requirements and Experts

The resources needed for participatory scenario development may vary significantly depending on the techniques used for the analysis, the number of stakeholder included in the process and the planned duration of the process. Rather simple scenarios can be developed in a short period of time (several days) and may require limited resources in terms of time and money. However, to analyze complex correlations, the process will have to be extended and the number of relevant stakeholders that should be included in the process will be larger. Particularly, if scenarios for cross-border or international trade measures are developed, participatory scenario developments might be rather resource intensive.

[121] Renn 2006.

Strengths and Weaknesses

👍 Option for including stakeholders in the assessment process

👍 By using participatory methods, local or tacit knowledge can be fed into the assessment process.

👍 Flexible structure for analyses with the possibility to easily adapt the method to various contexts

✋ Stakeholder knowledge is not always robust or detailed enough to provide sufficient information on the relationships between different systems.

✋ Depending on the selection of stakeholders, the results of the scenario building process might be biased.

✋ Resource requirements might be high for analyzing complex situations.

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Box 8: Practice Example Participatory Scenario Development: Use of scenarios in the Integrated Assessment of Trade Related Policies in Mauritius

The Integrated Assessments of Trade-related Policies and Biological Diversity in the Agricultural Sector have analyzed the potential impacts of the Economic Partnership Agreements (EPA) concluded between the EU and ACP countries. In Mauritius, the sugar sector has been subject to such an assessment, conducted between 2007 and 2008. The sugar sector is particularly important for Mauritius' economy as sugar production accounts for 62% of agricultural exports and roughly half of all agricultural activity. Moreover, sugar cane supplies around 20% of Mauritius' energy needs through the production of electricity from bagasse.

One important aspect of the project was the development of scenarios in order to explore the most likely impacts from the EPA. The scenario building processes involved intensive stakeholder consultation. This involved the implementation of focus groups with planters to collect data to be used in the scenario building process. Additionally, several multi-stakeholder working groups were organized to project likely impacts of possible changes in land use. This was then integrated with information from technical reports and historical data.

The benefits of these extensive stakeholder consultations have been the following. Firstly, it helped validate the assessment conducted based on desk research and field survey. Moreover, supplementary information could be collected during the scenario building process. Secondly, the scenario development served as a capacity building exercise for future policy assessments. It has promoted a better understanding of linkages between trade policy and environmental impacts, especially impacts on biodiversity, and it has helped to build institutional as well as human capacity related to assessment methodologies, project management and inter-institutional cooperation.

Source:

UNEP, Ministry of Agro Industry, Food Production and Security, Republic of Mauritius (2009): Integrated Assessment of Trade-Related Policies and Biological Diversity in the Agricultural Sector in Mauritius – A Case Study on the Sugar Industry. Integrated Assessment Study. Country Report. Available online at www.unep.ch/etb/initiatives/pdf/Final%20Study%20Mauritius%2012%202009.pdf, checked on 07/30/2012.

7.4 Economic Valuation and Valuation-Based Approaches

Economic valuation methods (EVM) are used to put a monetary value on the negative (e.g. environmental degradation) as well as positive (e.g. improved air/water quality) environmental impacts of a policy, program or project. **Carbon valuation methods** (CVM) are mostly based on economic valuation methods using a fixed value for GHG emissions (price for a ton of CO_2) and are applied for the routine assessment of the climate relevance of proposed policies. In a trade context, EVM can be used in IAs to assess the costs associated with direct or indirect environmental impacts of trade or trade-related activities. CVM can be used to evaluate the climate effects resulting from a planned (trade) policy. In principle, putting prices on environmental/climate effects allows to incorporate them into cost-benefit considerations of an intervention going beyond qualitative or quantitative assessments and to enable the analyst to weigh them against the economic and social costs and benefits.

7.4.1 Economic Valuation Methods

EVM (German: monetäre Bewertung) represents a range of economic techniques to compare the costs and benefits associated with ecosystems functions and services, by attempting to measure them and expressing them typically in a monetary unit[122]. This is of particular relevance since environmental impacts are often not considered in monetary assessments of policies, programs or projects. The reasons for the neglect of environmental impacts are, firstly, that environmental goods and services are often not traded in markets and, secondly, the complexity of ecosystems is difficult to capture in analytical and, thus, monetary terms[123]. Economic valuation of ecosystems' services has experienced growing attention through the recent TEEB initiative[124].

Applying monetary values to environmental goods and services can help in weighing the potential economic gains of increased trade against the potential costs of related economic changes and their environmental implications. It might also help compare the costs and benefits of different trade strategies by considering the net impact or value of different product categories or infrastructure development options. Moreover, valuation methods may help support decisions on the adoption of relevant flanking measures aimed at environmental protection by providing a basis for comparing the value of the relevant environmental goods to the cost of the proposed measure.

Prices attached to ecosystem functions are inferred from the preferences that individuals have for those functions. The **revealed preference method** builds on observed economic behavior of individuals to infer values for an environmental good or service. **The stated**

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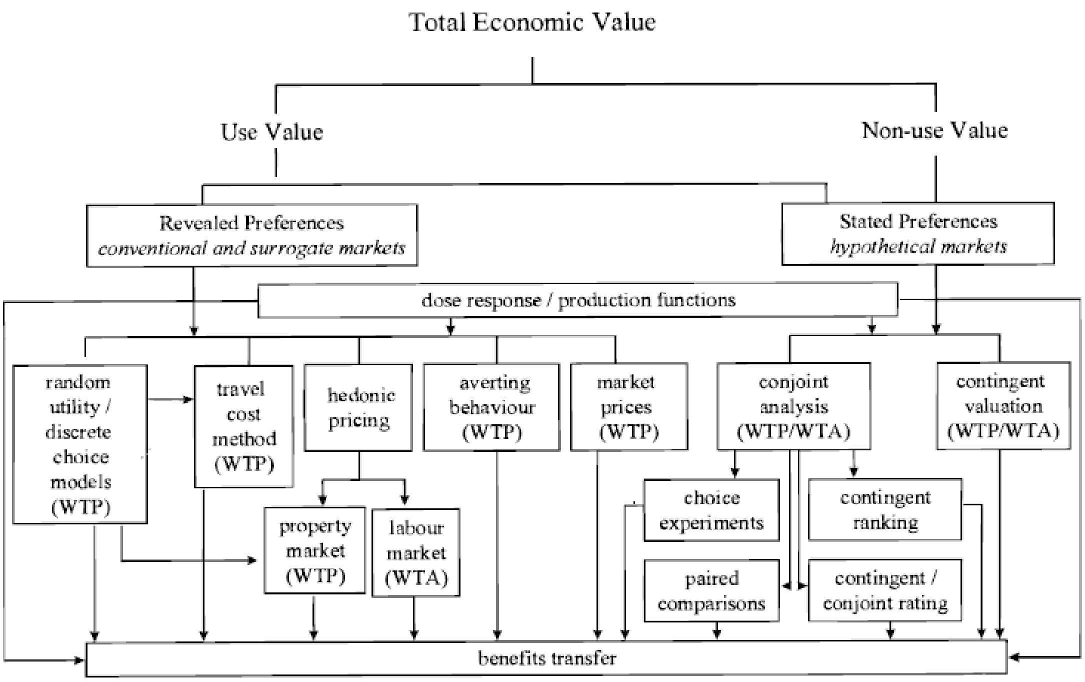
122 Pagiola et al. 2004, 9.
123 Hanley and Spash 1993.
124 See Van der Ploeg et al. 2008.

preference method (also known as contingent valuation) uses questionnaires to elicit individuals' preferences for a change in an environmental good or service. Stated preferences are measured by determining individuals' willingness to pay (WTP) for securing or retaining ecosystem services or by determining the willingness to accept (WTA) payment for forgoing environmental gain or allowing a loss. Use values refer to an actual or planned (indirect) use of an ecosystem service, whereas non-use values are derived from the knowledge that the natural environment is maintained[125]. Figure 15 shows the major techniques for valuation (for a more complete overview of the approaches and their purposes see Annex 3).

Figure 15: Techniques for Economic Valuation



Source: Pearce and Seccombe-Hett 2000, 1420.

Since determining the price of environmental functions and services is fairly resource-intensive, analysts may transfer the economic values that have been generated in one context to other contexts (benefit transfer of values)[126]. Data bases for providing values of ecosystems are being developed, but have not yet been completed. The transfer of values may be a significant source of imprecision, as the value of environmental goods may vary depending on the particular eco-system.

[125] DEFRA 2007.
[126] See DEFRA 2010.

Resource Requirements and Experts

Primary valuation studies are fairly resource demanding, regarding time and financial resources. Benefit transfer requires considerably less time and resources. Although they might be less accurate, decision-makers might accept this in exchange for achieving quicker results[127]. Economic Valuation is an advanced technique in the field of environmental economics and requires corresponding expertise in the field of economics.

Strengths and Weaknesses

Each of the valuation techniques has its own advantages and disadvantages (see annex 3). Here, the pros and cons of economic valuation in general are presented:

👍 Enables benefits of ecosystem functions to be expressed in the same units (monetary) and to be compared directly to other benefits of a proposed measure.

👍 Enables costs and benefits of different usage types of environmental resources to be compared and weighed against each other.

👍 Valuation results can easily be integrated into standard assessment methods such as CBA (see Chapter 7.5.1)

✋ Economic valuation is a challenging task, and there is a risk of over- or undervaluing environmental goods and services.

✋ There is a risk of applying benefit transfer values inappropriately.

✋ The prevailing socio-economic situation (status quo) can influence the value placed on an environmental function or service.

✋ Economic valuation is resource intensive and requires advanced economic expertise.

Further Reading

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[127] UNEP 2010b.

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Box 9: Practice Example Valuation methods: Establishing a multi-stakeholder value index in medicinal plants in Keral and Tamil Nadu

In a study on medicinal plants in Kerala and Tamil Nadu in India, Suneetha and Chandrakanth attempt to prioritize 18 medicinal plants on the basis of their economic importance and endemicity. They use market and non-market valuation techniques to rank the plants according to their cultural values, provisioning of non-monetary services, to their industrial demand as well as their function in regard to national biodiversity. Ranking the medicinal plants according to these diverse values (aggregated in a single score for each plant) supports the formulation of national policies to regulate the access and use of medicinal plants in line with international regulations like the Convention on Biodiversity and Intellectual Property Rights (IPR) and to adopt strategies for promoting their economic exploitation.

The different value dimensions of the plants (cultural/spiritual, market value, etc.) were explored by integrating various stakeholder perspectives through a survey. To collect data the authors interviewed local healers, representatives of Ayurvedic pharmacies and research institutes involved in processing medicinal plants, as well as representatives of organizations involved in the conservation of medicinal plants. The overall values of medicinal plants were determined on the basis of the following variables (the more variables applied to a plant, the higher it could score regarding its total value):

- market value of medicinal, plants (e.g. inferred from the domestic market price or International trade in medicinal plant (volume)and existence of specific IPR on a plant)
- existing investments (e.g. government programs to add value to the medicinal plant)
- non-market use values (e.g. consumptive use values of plant for providing food for local communities)
- benefit sharing measures, and cultural/spiritual values attached to medicinal

The 18 medicinal plant species considered were then ranked according to the total scores they obtained in all variables. The analysis found that plants would inter alia rank higher when they could score in the sphere of benefit sharing arrangements. It also showed that including benefit-sharing mechanisms into the plant valuation framework enabled highlighting of the utility of benefit sharing in sustaining indigenous traditions through economic options.

This valuation approach showed that the inclusion of the preferences of various stakeholders when valuing medicinal plants helps to prioritize species based on a broader set of values. The monetary values determined for each plant species enabled policy makers to prioritize investment decisions.

Source:

Suneetha, M. S., Chandrakanth, M. G. (2006): Establishing a multi-stakeholder value index in medicinal plants — an economic study on selected plants in Kerala and Tamilnadu States of India. Ecological Economics 60, pp. 36-48.

7.4.2 Climate IA and Carbon Valuation Methods – the UK Approach

CVM (German: Methoden zur Kohlenstoffbewertung, Klimaverträglichkeitsprüfungen in a broader sense) are focused and standardized approaches to quantify and monetize the climate change impacts from planned policies in form of increased or decreased GHG emissions. In principle, they are used to determine the most climate friendly policy option and show the net benefits of each option assessed. Since all changes in a country's economy will result in changes in GHG emissions, CVMs are relevant for all types of trade-related measures.

CVMs represent a recent development in IA and reflect the global efforts to reduce GHG emissions. They offer an opportunity to strategically consider climate issues, when the framework conditions for following climate relevant activities are laid down in policy proposals. So far, selected countries have applied such CVMs. Among them are the UK, the US, Austria and Belgium, France and Switzerland. In a study commissioned by the OECD, the Environmental Policy Research Centre (FFU) has compared the different approaches to climate IA in the above mentioned jurisdictions[128]. Another country experimenting with a special type of CVM for its IA system is Poland[129].

Given the novelty of the approach, CVMs are described based on the UK GHG test, one of the first systematic applications of the approach. The UK GHG test is obligatory for all IAs conducted by the UK government, and its results should be incorporated in CBAs of planned policies. Comprehensive guidelines on how to apply the carbon valuation in CBA are provided by DECC (Department of Energy and Climate Change) and DEFRA (Department for Environment, Food and Rural Affairs)[130]. The GHG test consists of a toolkit in the form of an Excel workbook enabling the calculation of impacts on changes in GHG emissions re-

[128] Jacob et al. 2010
[129] Ferretti et al. 2011
[130] Cf. www.decc.gov.uk/en/content/cms/emissions/valuation/valuation.aspx

sulting from changes in energy use or energy generation up to the year 2050[131]. The toolkit supports the policy analyst in quantifying impacts on GHGs by automatically calculating changes in energy use and air quality resulting from an intervention. It remains up to the policy analyst, however, to enter data that can be converted into GHG emissions by the tool, which involves estimating the impact of an intervention on a number of climate-relevant variables. Moreover, depending on the time horizon of the GHG test, the analyst is required to apply a discount rate (see Section 7.5.1 on CBAs on this issue).

For example, for a policy aimed at increased road construction to facilitate trade, the analyst would need to estimate the amount of kilometers of new roads that are to be built and then estimate the increase in traffic of different vehicle types (e.g. heavy good vehicles, passenger cars) related to the road network improvements. The tool could then convert these quantifications of vehicle increases into changes in overall GHG emissions, based on the chosen discount rate. As this example demonstrates, the CVM does not represent a stand-alone tool, but it depends on a preliminary analysis of intermediate outcomes in the results chain (see Section 3.5). Depending on the complexity of the intervention, this preliminary analysis may be complemented by sophisticated modeling techniques to arrive at a more robust estimation.

The toolkit comprises a range of Excel-based calculation sheets that have been provided by DECC[132]. Within these Excel-sheets three carbon values are applied for a ton of CO_2-equivalents. The first is set for policies that reduce or increase carbon emissions in sectors that are included in the European Emission Trading System (EU ETS). The second is defined for policies targeted at sectors, which are non-traded. Thirdly, in the long term view (2030 onwards), both prices (traded and non-traded) are joined in a single traded price of carbon[133]. Carbon prices for policies in sectors under the EU ETS are determined using the traded price of carbon. The carbon prices for policies in non-traded sectors were calculated by means of integrated assessment models and will be subject to constant review. In other words, the price for GHG emissions has already been inferred and has to be used regularly for assessment of planned policy proposals. The GHG tool is based on statistical data, as well as modeling exercises (e.g. for calculating the non-traded CO_2-price until the year 2050).

[131] See DECC 2010.

[132] See www.decc.gov.uk/en/content/cms/emissions/valuation/valuation.aspx

[133] DECC 2009, 6.

Resource Requirements and Experts

Carbon valuation tools require complex background information 'to make them work'. Ideally, departments whose competences are involved (e.g. environment, energy, economy) cooperate for implementation of such a tool. Once established CVMs can be applicable to *all types* of policies. In many CVM procedures the environment department provides a helpdesk for policy officials in other departments carrying out the test.

Strengths and Weaknesses

- 👍 Represents a standardized tool; which can be applied to any type of intervention, once established.
- 👍 Enables a focused assessment of climate impacts
- ✋ Excludes other environmental impacts.
- ✋ Establishing the tool is resource and time-consuming.
- ✋ Requires complete statistical data as input data.
- ✋ Might require complex preliminary analysis to be applied.
- ✋ Choice of discount rate has a major impact on results.

Further Reading

For Austria:

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For the UK:

HM Treasury and DECC (2011): Valuation of Energy Use and Greenhouse Gas Emissions for Appraisal and Evaluation. Available online at www.decc.gov.uk/assets/decc/statistics/analysis_group/122-valuationenergyuseggemissions.pdf, checked on 08/31/2012.

7.5 Methods for Aggregation and Comparison

The following section presents the two most common aggregation methods for summarizing different aspects of an IA into one final result. They are known as **Cost-Benefit Analysis (CBA)** and **Multi-Criteria-Analysis (MCA).** They are both methods for the decision-making stage in an IA, and their purpose is to compare, rank and finally recommend one policy or program option to decision-makers.

In contrast to MCA, CBA requires *all* data to be presented in monetary terms. This is done by valuing all the costs and benefits from a proposed intervention and aggregating them into one single value, thus indicating the costs of the intervention. MCA on the other hand can integrate qualitative, quantitative, and monetized information regarding negative and positive impacts of a policy or program. It weighs the different options against a set of selected criteria. MCA is particularly useful when significant environmental and social impacts cannot be provided in monetary values and hence cannot be integrated into a CBA.

7.5.1 Cost-Benefit Analysis

CBA (German: Kosten-Nutzen Analyse) is the method most often required in IA guidelines worldwide. Environmental CBA is also increasingly applied in developing countries, primarily driven by the appraisal procedures at the World Bank[134]. CBA is meant to monetize the positive and negative (social, environmental and economic) impacts of a proposed intervention and aggregate them in one single monetary value so that they can be used for comparing policy options. The rationale is that a policy is to be preferred if more benefits than costs can be expected from it. The option with the largest net benefits (benefits minus costs) is usually the recommended one.

A CBA can roughly be structured according to the following steps[135]:

1. Definition of the project
2. Identification of project impacts
3. Identification of economically relevant impacts
4. Physical quantification of relevant impacts
5. Monetary valuation of relevant effects
6. Discounting of cost and benefit flows
7. Applying the net present value test
8. Sensitivity analysis.

[134] Atkinson and Mourato 2008, 333.
[135] Hanley and Spash 1993.

In order to monetize environmental impacts economic valuation techniques (Step 5) or benefit transfer are used (see Section 7.4). However, it is still a challenging task to apply them. Reasons for this include the difficulties to place values on environmental goods such as biodiversity and the complexity of ecosystems that do not allow for an easy estimation of likely effects or the handling and valuation of irreversible effects. These issues contribute to the high risk that environmental impacts are not incorporated into CBA at all[136].

Another crucial aspect in a CBA that incorporates environmental impacts is the choice of a discount rate. A discount rate has to be applied to all projects that involve costs and benefits spread out over time. The discount rate is used to convert costs and benefits that occur in the future to a net present value so that they can be compared. A high discount rate will favor benefits occurring in the present over those occurring in the future. The choice of the discount rate is therefore, critical when it comes to valuing long-term (environmental) effects.

Another major caveat in CBA relates to its ‘blindness’ regarding distributional effects. It seeks to indicate whether social welfare is improved at an aggregate level, but it does not make explicit how the benefits are distributed across social groups. Finally, CBAs are known to be notoriously inaccurate in the monetary estimates that they draw on. Therefore results need to be handled with great care.

Resource Requirements and Experts

A critical point in CBA is its complexity, in terms of time-consuming analysis and efforts necessary to collect information for the analysis. The Australian Handbook on CBA comments that this may sometimes be avoided by replicating CBAs[137], similarly to benefit transfer in economic valuation (see Section 7.4).

Strengths and Weaknesses

👍 Aggregation of different types of impacts into one single value.

👍 Monetized results can easily be communicated to decision-makers.

✋ Non-market goods, particularly environmental impacts, are oftentimes not integrated into CBA, due to difficulties in generating a monetary value.

✋ The choice of discount rates has an important influence on results..

✋ High requirements in terms of time, resources and data.

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136 Hanley and Spash 2003, 19f; Heinzerling and Ackerman 2002.
137 Commonwealth of Australia 2006, 95.

Further Reading

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Pearce, P., Atkinson, G., Mourato, S. (2006): Cost-Benefit Analysis and the Environment. Recent Development. OECD, Paris.

USAID Website on Economic Governance and Fiscal Reform: Cost-Benefit Analysis/Project Appraisal. Available online at www.fiscalreform.net/index.php?option=com_content&task=category&sectionid=8&id=37&Itemid=160, checked on 10/02/2012.

Box 10: Practice Example Cost-Benefit Analysis: Jamaica Highway 2000 Project

Affecting Users

- Travel time savings;
- Vehicle operation cost savings;
- Security related savings (life and injuries, damage to property).

Affecting Owners and Operators of the Road Network

- Highway construction costs;
- Land acquisition;
- Maintenance costs;
- Network operating costs;
- Savings related to postponement of maintenance costs on other roads (*ex.* existing road).

Affecting Non-users

- Travel time savings or costs from changes in traffic on other roads or modes;
- Costs and benefits related to air quality;
- Costs and benefits related to energy consumption of different transportation modes;
- Other externalities.

The CBA was carried out to determine the economic profitability of a new highway in Jamaica. The highway was planned as a 4-lane high speed limited access motorway that would connect the four major Jamaican cities from Kingston to Montego Bay and Ocho Rios. The general assumption of the Jamaican government was that it would trigger economic development and investment activities.

Two project alternatives were assessed: the first one assumed that the highway was built starting in 2002 (with a horizon of 50 years); the second assumed that no highway was built.

The main benefit and cost items taken into account in the CBA are shown in the figure above. The environmental costs taken into account included air and water pollution, noise and land use. They were calculated on a per vehicle-km basis, based on an increasing relationship. This means that when total vehicle-km increase, the externalities in terms of volumes and costs also increase. Assumptions are mainly based on travelling prices in transport and the vehicle fleet.

In order to calculate the present value of the highway a 10% discount rate was applied. The overall benefits for the highway construction are calculated to be in the range of 608,791,006 US$ or 855,911,690 US$. The ranges in the costs of the project are the result of assuming lower/higher values for the value of time per hour for work related travel. The consultants' conclusion is that the direct and indirect benefits of the Highway 2000 project exceed the costs and that the Jamaican economy would benefit from the project in economic terms.

Sources:

Dessau-Soprin Consultants (2000): Highway 2000 Project – Preliminary Design Phase. Economic Cost-Benefit Analysis, Laval/Canada.

7.5.2 Multi-Criteria Analysis

MCA (German: Mehrkriterienanalyse) is aimed at comparing different policy or program options with one another by following an agreed set of criteria[138]. MCA is not a stand-alone method but draws on the results of other tools. Oftentimes it is recommended to combine CBA with MCA. Results from the analysis of all kinds of positive and negative trade impacts (social, environmental, economic) can be fed into a MCA[139]. It is also possible to link MCA to participation (e.g. with stakeholders), either during particular steps or during the whole MCA process. One distinct strength of MCA is that it helps to structure complex information in a consistent manner. Furthermore, it is a useful tool for identifying the most preferred policy or program alternative and for ranking the options analyzed.

MCA's are typically based on a performance matrix, in which different policy or program options are entered in the rows and the criteria against which they are measured in the different columns (e.g. effectiveness, greening potential). Criteria should be selected by the analyst and stakeholders involved in the policy or program. Measuring can be conducted by a simple marking system (such as plus, minus and 0). More advanced MCAs use numerical values following scoring and weighting. Scoring means assigning a value to each criterion for each option according to the expected consequences, usually with scores between 0 and 100. The lower the value, the least preferred the option. Finally, the options appraised are ranked according to their scoring[140]. Table 3 shows an example of a performance matrix.

Table 3: Example of MCA Matrix

Options	Performance criteria			
	criterion 1	criterion 2	criterion 3	criterion n
Option 1	score	score	score	score
Option 2	score	score	score	score
Option 3	score	score	score	score
Option m	score	score	score	score

One advantage of the tool is that the multiple dimensions of sustainability can be taken into account in MCA and allowing for different data types to be compared within the performance matrix. Moreover, especially in contrast to CBA, distributional effects and trade-offs can be shown within MCA[141]. Moreover, an MCA can be carried out regardless of whether assessed criteria can be weighted or not[142]. This is of special importance regarding environmental issues, which are not yet routinely transferred into monetary values. MCA is as-

138 Typically an amount of six to 20 criteria is applied.
139 De Ridder 2006.
140 EC 2009a.
141 Ibid.
142 Phillips and Stock 2003.

sessed as a transparent method by making the analysis criteria and weighting elements open and explicit. However, MCA does not measure whether the preferred option will improve social welfare (i.e. whether benefits will outweigh the costs)[143].

Resource Requirements and Experts

Resource requirements may vary, depending on the degree of stakeholder involvement. It is also possible to leave performance measuring up to experts, though this also requires a considerable amount of resources. Analysts performing an MCA should have skills in mathematical concepts and data aggregation methodologies. Kasperczyk and Knickel[144] state that a standard application of a MCA takes about 4-10 person months of work if data has already been collected or is easily to obtain. In this case, performing an MCA is relatively easy but structuring the data and information available can be time-consuming.

Strengths and Weaknesses

👍 Capacity to simplify complex inter-relationships.

👍 Helps perform an integrated assessment of all social, environmental, and economic impacts of a trade-related measure.

👍 The selected criteria for assessing a trade-related measure are straightforward, understandable, and drafted by the group in charge of the analysis.

👍 Useful negotiation tool for debates among stakeholders.

✋ MCAs are often based on slow and iterative processes.

✋ Can be considered as a subjective method.

✋ MCAs are usually time- and resource demanding.

Further Reading

Chandio, I. A., Bin Matori, A. N. (2011): GIS-based Multi-criteria Decision Analysis of Land Suitability for Hillside Development. In: International Journal of Environmental Science and Development, Vol. 2(6), pp. 469 - 473.

Henson, S., Masakure, O. (2011): Establishing Priorities for SPS Capacity – building: A Guide to Multi – Criteria Decision – Making. Working Document Standards and Trade Development Facility, University of Guelph, Ontario/Canada.

143 DTLR 2001.
144 Kasperczyk and Knickel 2006, 29.

UNEP Website on Multi-Criteria Analysis for climate change: MCA4Climate - developing guidance for pro-development climate policy planning. Available online at www.mca4climate.info/, checked on 10/02/2012.

Box 11: Practice Example Multi-Criteria Analysis: The Colombian Rice Sector - Scenarios and Strategic Options for Increasing Competitiveness Considering International FTAs

In this study MCA was used to assess three scenarios on the future of the Colombian rice sector in relationship to the potential implementation of FTAs in the Colombian agricultural sector. Rice production in Colombia is considered an important agricultural activity with high relevance for national food security. In order to protect national rice production, the sector benefits from a high degree of tariff protection. Rice is mainly produced in three Columbian regions: Eastern plains, North Coast and Central Region. So far, the Colombian rice sector is rather characterized by imports than exports of rice.

The following three scenarios of FTA implications for the rice sector were developed in the context of a focus group interview with an expert group for the period 2011-2020 (shortened):

Entrepreneurial progress	Technological forefront	Falling behind
•High level of technology adoption •Development of business management skills under an entrepreneurial environment by farmers and industry •Associativity and forward vertical integration of farmers •Incorporation of technologies that support competitiveness •Articulation among the stages in the value chain •Development of efficient varieties through genetic technologies	•Strenghtening of the productive activity due to research and development •High level of technology adoption •Low level of farmers' associativity and entrepreneurship •Intermittent cohesion and cooperation among the stages in the value chain •Increase in productivity and reduction in costs of production due to agronomic development and biotechnology research •Milling industry continues adoption of technology	•Reduction in production areas •Lack of articulation among the stages in the value chain due to sharp difference of interests •Lack of adoption of new farming practices and technologies •Increase in rate of crop reconversion due to high competition from imported rice •Weak organizational and managerial structure of farmers •Machinery inventories fall behind new technologies

For conducting the MCA, seven major organizational stakeholders (e.g. Columbian Rice Federation) were asked to rank the three scenarios on a scale from 0 to 100 to identify the extent to which each of the scenarios would influence the set of objectives considered by them (see table below). The Rice Federation, for instance, was seeking to improve the quality of seeds, to promote the use of certified seeds, and to lead in the use of biotechnology for developing new materials.

Environmental aspects were not directly incorporated in the MCA matrix but were part of the identifi cation of macro-level driving forces. Driving forces were defined as having determinant influence on the success or failure of the strategies developed by stakeholders. Environmental key forces included water, resource and agrochemicals management, as well as GHG emissions.

MCDA Matrix of Scenario Options

OBJECTIVE 1:			OBJECTIVE 2:			OBJECTIVE 3:		
SCENARIOS 2020			SCENARIOS 2020			SCENARIOS 2020		
Entrepreneurial Progress (EP)	Technological Forefront (TF)	Falling Behind (FB)	Entrepreneurial Progress (EP)	Technological Forefront (TF)	Falling Behind (FB)	Entrepreneurial Progress (EP)	Technological Forefront (TF)	Falling Behind (FB)
A.	D.	G.	A.	D.	G.	A.	D.	G.
B.	E.	H.	B.	E.	H.	B.	E.	H.
C.	F.	I.	C.	F.	I.	C.	F.	I.

The assessment of the stakeholders' own strategies in light of the scenarios allowed for the identification of the most important strategic options to be realized by them in the future. Based on the MCA results overall conclusions for the Columbian rice sector could be drawn in order to prepare for FTA implementation. The general recommendations highlighted the potential of exploring genetic technologies for developing new rice varieties that could provide higher yields which could increase the competitiveness of the Columbian rice sector. Another conclusion was to the opportunity to create initiatives for developing innovative rice by-products which could achieve export levels.

Sources:

Montoya, J. D. A. (2011): The Colombian Rice Sector: Scenarios and Strategic Options for Increasing the Competitiveness Considering International FTAs. Thesis Management Studies, Wageningen University, Wageningen.

7.6 Compilation of IA Instruments and Knowledge – The LIAISE Toolbox

Compilations or toolboxes for IA assemble existing knowledge and techniques available for assessing the effects of policies and programs. Their aim is to help IA practitioners identify suitable instruments and expertise for supporting a given IA process. They seek to provide IA practitioners with access to up to date knowledge for conducting an IA. Within the EU-funded LIAISE project[145] (Linking Impact Assessment Instruments to Sustainability Expertise) a toolbox for sustainability-oriented IA is currently being developed for the EC's IA system as well as other EU member states' IA procedures. The publically available, web-based **LIAISE shared toolbox** builds on two previous EU-projects to develop toolboxes in support of the EC's IA: IA Tools[146] which was developed in order to support integrated IA of the EC, and the SustainabilityA-Test[147] project whose toolbox contained a catalogue of IA methods and frameworks.

A central goal of the LIAISE shared toolbox is to improve the availability and use of models and other relevant IA techniques and knowledge. It does so by providing meta-descriptions of IA instruments and other IA relevant knowledge, pointing out what an analytical technique can offer and how it works. Such meta-information facilitates the selection of models and other IA techniques for the purposes of a specific IA process. Furthermore, this information should allow the user to judge whether and how different IA models or other techniques can be combined. To help identify a suitable IA instrument, the LIAISE shared toolbox offers both a free text search and a standardized search, based on a number of categories, including impact areas, policy area, policy instrument, modeling technique, etc. By applying multiple search filters, these standardized categories help narrow down the set of available instruments.

In addition to supporting the selection of suitable IA instruments, the LIAISE shared toolbox has the ambition to provide knowledge and services to support the entire IA process. For this purpose it also includes:

- A database with experts;
- A database with examples of good practices of IA;
- Background information on the impact areas;
- Background information about generic methods which can be used in IA; and
- Background information about the requirements for IA in a wide range of countries.

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[145] The FP7 project LIAISE runs from 2009-2014, one of the main outputs is the LIAISE toolbox which will go online in a ß-version expected in December 2012. For further information, please see www.liaise-noe.eu or contact Klaus Jacob at Freie Universität Berlin (klaus.jacob@fu-berlin.de).

[146] JRC 2006.

[147] De Ridder 2006.

All databases can be searched by a standardized as well as full-text search, while the background information is included as html text.

Finally, the LIAISE shared toolbox will include interactive features. It will enable users to provide comments and other feedback to support search and selection, and the beta version will include forum software offering an interface for communication between experts and policy makers. The background information will be open for editing and additions under the supervision of special editors.

8 Conclusions

As this report has pointed out, the identification of environmental impacts from trade and trade-related measures is particularly challenging, as the relationships between both are often indirect and may take effect through changes in the economic structure. Moreover, the specific environmental changes may differ, depending on the design and implementation of accompanying flanking measures as well as the existing environmental policy regime that is in place. Assessing cross-sectoral and cross-border impacts of trade-related interventions is especially difficult, and in the past, most assessments have chosen to focus on individual sectors within a single country. More recently, identifying the environmental implications along international value chains has gained in importance.

Due to the high level of uncertainty involved in these assessments, the involvement of stakeholders in the assessment of environmental impacts from trade-related interventions is particularly relevant. The engagement of stakeholders is essential both for validating results and for enhancing uptake by policy makers. Both the EC's Trade SIA and UNEP's integrated assessment approach place an important emphasis on this aspect. Moreover, one-off IA exercises are less effective in the trade sector, due to the complexity of assessing trade-related impacts. Rather, an ongoing process of monitoring and evaluation is more likely to help integrate environmental concerns in trade-related measures and enhance the quality of policies and programs over time. For this reason, the assessments sponsored by UNEP have been conceived as capacity building exercises, similar to the support of SEA system development by donor agencies. Building on existing SEA systems may, in fact, offer an entry-point for the development of a more systematic consideration of environmental impacts from trade-related interventions. It is likely to require similar governance mechanisms, such as institutions to promote inter-ministerial cooperation and stakeholder engagement in policy making processes.

8.1 Assessment Frameworks

Given the diversity of trade-related interventions as well as related impacts, there is no blueprint for conducting an environmental assessment in the area of trade. For this reason, the frameworks presented in this report do not propose the use of any specific methods. Rather the assessment *process* is emphasized. The various assessment guidelines suggest a number of steps and offer guidance in designing the analytical process, including choosing an appropriate focus, determining the scope of the exercise as well as deciding on the choice of corresponding methods. In this way they provide guidance for structuring the IA, but remain flexible and can be adapted to the given national context. The specific choice of methods is ultimately also a function of the resources available for the assessment. Especially in the context of developing countries, data availability and the availability of relevant expertise may also influence the selection of assessment tools.

8.2 Integrated versus Environmental Assessments

While this report focuses on the environmental dimensions of impacts of trade measures, there is a trend towards conducting integrated assessments, which combine the assessment of environmental, social and economic impacts of a planned measure. Both the EC's Trade SIA and the UNEP framework take such an integrated, sustainability-oriented approach. Given the close inter-linkages between these three dimensions, especially in a developing country context, this approach seems to be appropriate. Simultaneously, it implies the risk of neglecting environmental dimensions. Especially in a trade-related context, socio-economic issues have been at the forefront of international and national debates. In the early studies conducted by UNEP, a tendency to prioritize the socio-economic dimension of trade could, therefore, be noticed. In later studies, based on the framework on trade, agriculture and biodiversity, environmental issues were also integrated with an analysis of socio-economic issues, however, environmental issues figured more prominently.

A possible conclusion from this might be to pursue studies with a focus on environmental sustainability, while integrating socio-economic issues within such an environment-focused framework. This approach would reflect a similar practice in SEA. Given the high priority that socio-economic issues have in most political discussions, this might enable more balanced assessments. On the other hand, such an approach may in turn imply the risk that poverty-related issues, as opposed to more general socio-economic considerations, may figure less prominently in the analysis. Whether this poses a problem within the context of development cooperation is not the subject of this study. Given the extensive experience with Poverty and Social Impact Analysis within the donor community, it might be considered to launch integrated assessments that seek to combine a focus on poverty and environment.

8.3 Climate IA and Carbon Valuation Methods

Parallel to the use of integrated assessments within development cooperation, a number of OECD countries (among them the UK, the US, Austria and Belgium) have moved towards focused assessments of climate impacts using carbon valuation methods[148]. Once established, climate IAs offer a standardized method for providing a rough estimate of changes in GHG emissions resulting from policy proposals. Given their focused nature, they provide a useful input to the broader assessment process and serve to flag key issues, in this case the implications of given policy options on climate change. Given the complexity of estimating trade-related impacts, however, the use of these tools may require relatively sophisticated preliminary analyses to generate appropriate input data.

[148] See Jacob et al. 2010.

8.4 Methods for Conducting the Analysis

This report provides an overview of a broad spectrum of methods for considering the environmental impacts of trade interventions. They vary in terms of their concrete application to the assessment of environmental impacts in the trade sector in developing countries. All frameworks and methods have in common, however, that they need to be adapted to the specific context to which they are applied. Only if tailored to the specific assessment they can be expected to yield realistic, policy relevant and accepted results.

Several methods stand out in terms of their suitability to assess the implications of a worldwide and increasingly interconnected trade sector and the related material streams. LCA as well as different model groups have (increasing) potential to examine cross-border environmental impacts and to depict the manifold effects of trade-related activities. Given the increasing awareness of the importance of functioning ecosystems for economic development and human well-being, economic valuation methods and the growing number of benefit transfer studies and databases represent another domain of particular importance. This is especially true for developing countries where the environment-economy linkage is particularly relevant.

All of the methods considered, can shed light on different aspects of the trade-environment dimension in the IA process. Oftentimes a combination of methods will be indicated to gain a more complete picture of the situation and to get more precise answers on possible future developments from trade interventions. Apart from resource constraints the availability of (complete) data sets and information will be of major importance for the applicability of the methods introduced, notably those requiring large amounts of quantitative data. Another challenge remaining is the communication of the evidence gained through assessment methods to policy-makers. This step in assessment exercises is crucial for enabling the consideration of environmental aspects in decision-making and the weighting together with other impacts.

The following tables provide a final overview of the different frameworks and methods and offer a comparison along selected aspects. Table 4 provides a comparison of the three main frameworks discussed above, while Table 5 compares the various methods described above.

Table 4: Overview and comparison of frameworks for the assessment of environmental impacts in the trade sector

Strategic Environmental Assessment (SEA)	EC's Trade Sustainability Impact Assessment (Trade SIA)	UNEP's Integrated Assessment of Trade Related Policies (IATRP)
Description / Purpose		
In an increasing number of industrialized as well as developing countries, SEA has become mandatory for the ex-ante assessment of policies, programs and plans to ensure that the environmental dimension is adequately represented. SEAs typically focus on the assessment of environmental impacts, but may also take an integrated approach considering also social and economic impacts. They are not only analytical approaches. Rather, they have been established as governance tools for integrating environmental concerns and engaging stakeholders in decision-making processes.	The EC's Trade SIA is an IA framework tailored to the assessment of trade agreements between the EU and non-EU countries. The Trade SIA represents an integrated framework that covers environmental, economic and social impacts. Its aim is to inform negotiators and decision makers about the likely consequences of a trade agreement and identify possible synergies and trade-offs between policy options.	UNEP has developed an integrated assessment framework to assess the likely environmental as well as economic and social consequences of a trade measure. This approach is not defined explicitly for the ex-ante assessment of trade-related measures. Rather it has frequently been applied as an approach for establishing an ongoing assessment and monitoring of trade-related impacts and to build related capacities.
Level of application		
Policies, plans, programs	Policies	Policies
Application in the trade sector		
SEAs have been introduced and are mandatory in many developed and developing countries. They are usually applied to interventions with a spatial dimension and are particularly relevant for infrastructure development and other programmatic interventions in the trade sector.	Trade SIAs are obligatory for all FTAs of the EU with partner countries and have been applied only in this context.	UNEP's framework has primarily been applied to assess the environmental, social and economic impacts of trade policy reforms in specified sectors. It has served as a capacity building exercise in the countries where it has been applied.

Strategic Environmental Assessment (SEA)	EC's Trade Sustainability Impact Assessment (Trade SIA)	UNEP's Integrated Assessment of Trade Related Policies (IATRP)
Strengths		
↑ Well-established approach with many practical examples in the area of planning and infrastructure development ↑ Institutional mechanisms for conducting SEA are in place in many countries ↑ Potential for stakeholder engagement ↑ Structured process, but methods can be chosen as appropriate	↑ Incorporates the economic, social and environmental dimension and identifies trade-offs between different dimensions and policy options. ↑ Covers all relevant sectors, cross-sectoral impacts as well as economy-wide and global impacts. ↑ Considers impacts in the EU and the partner countries at the same time ↑ Structured process, but methods can be chosen as appropriate ↑ Includes guidelines for engaging stakeholders	↑ Provides a stet-by-step guide, conceptual framework and comprehensive overview of analytical methods suitable for the assessment of trade-related measures ↑ Offers guidance for selecting appropriate focus of the analysis and for selecting flanking measures ↑ Serves as a capacity building exercise to foster stakeholder engagement and inter-ministerial cooperation ↑ Promotes an in-depth analysis of specific sectors in a specific country
Weaknesses		
↓No specific guidance for conceptualizing the impacts of a trade-related intervention ↓ Broad scope of programs and interventions to which SEA is applied may lead to superficial analysis ↓ Resource-intensive if a comprehensive analysis is carried out	↓ Only applicable for policy proposals ↓ No detailed guidelines on choosing the methods for analysis ↓ Extensive data requirements ↓ Very resource-intensive	↓ In practice, the sector-based approach has provided limited potential for capturing economy-wide and cross-sectoral effects.
Consideration of environmental impacts		
Broad consideration of all relevant environmental impacts, frequently also considering social and economic dimensions.	Broad consideration of all relevant environmental impacts in combination with social and economic dimensions.	Broad consideration of all relevant environmental impacts in combination with social and economic dimensions; includes a manual focused on the impacts on biodiversity.

Timeframe		
Typically, relatively time consuming, although this depends on the scope of the assessment.	Very time consuming.	Typically less time consuming than the Trade SIA, but aimed at establishing ongoing monitoring and assessment.
Data requirements		
Detailed qualitative and quantitative data are required for a full assessment.	Detailed qualitative and quantitative data required for a full assessment.	Detailed qualitative and quantitative data are required for a full assessment.
Expertise and cost		
Level of expertise required depends on the complexity of the intervention and the scope of the exercise. Studies are usually carried out under the responsibility of the respective country.	High level of expertise is required for a a full Trade SIA. Trade SIA studies are commissioned to external experts. Costs for conducting a full Trade SIA are very high.	Typically involves a high level of expertise, but not essential, depending on choice of methods. Studies are usually carried by partner governments. Budgets have ranged from $50,000 to $80,000.

Table 5: Overview and Comparison of Methods for the Assessment of Environmental Impacts in the Trade Sector

Scoping methods	PIOTs / MFA	LCA	Ecological Footprints	Modeling	Participatory Scenario Dvlpmt.	Economic Valuation	Carbon Valuation	CBA	MCA
Description / Purpose									
Scoping methods are used at an early stage in the IA process to conduct a preliminary assessment of the main impacts of a planned measure. They are often applied to determine the focus of a more in depth analysis. They may also involve the identification of relevant stakeholders.	Methods applied to analyze the physical input-output flows of a defined economy or economic sector.	LCA is used to assess product-related environmental impacts. It aims to inform decision-makers about the 'environmental friendliness' of a product and helps identify environmental impacts along an entire value chain. It can be used to identify options for enhancing the environmental efficiency of a specified value chain.	Quantitative measurement primarily used for monitoring and raising awareness about environmental impacts related to products or bundles of products based on one a composite indicator. Footprints can be used to measure resource use and/or pollution generation embodied in trade flows	Models can be used for quantitative in-depth analysis of the effects of trade agreements and policies. Environmental impacts are mostly considered by linking economic inputs to changes in environmental quality, particularly GHG emissions.	Methods for PSB provide an option for thinking creatively about, complex futures. They allow for developing different possible scenarios each based on a different set of fixed parameters. Based on these scenarios, the most desirable options can be identified.	A range of methods aimed at generating monetary values for potentially significant environmental costs and benefits of an intervention, so that they can be weighed against and considered together with economic and social impacts (e.g. in a CBA).	Focused and standardized approaches to quantify and monetize the climate change impacts from planned policies in form of increased or decreased GHG emissions.	CBA can be applied to examine environmental, social and economic costs and benefits of an intervention by aggregating these into one single monetary value.	MCA can help compare and rank different policy or program options with one another following an agreed set of criteria for scoring and weighting of impacts. Different types of data can be fed into a MCA, to take into account environmental, social, economic impacts.
Level of analysis									
All levels of analysis.	Primarily policies or trade agreements.	Policies, programs, projects.	Monitoring tool, primarily for policies or programs.	Primarily policies, trade agreements or programs.	All levels of analysis.	All levels of analysis (with other methods).	Primarily policies or trade agreements (with prel. analysis)	Applicable to all levels of analysis.	Applicable to all levels of analysis.
Application in the trade sector									
Scoping methods should be part of any IA exercise, including in the trade sector.	Where available, applicable for monitoring or simulating changes in material flows resulting from trade-related measures that induce scale or structural effects.	LCA is specifically aimed at capturing environmental impacts along the value chain. Hence, its application is always related to a trade-related context.	Can be used for measuring of environmental impacts of trade flows, i.e. imports and exports. National footprints available in increasing number of countries.	Environmental impacts are increasingly considered in trade-related modeling exercises.	Participatory scenario development has been applied in a number of integrated assessment studies of trade-related impacts using the UNEP framework.	EVM can be utilized for integrating environmental aspects in CBA of trade-related measures. They are increasingly being applied in developing countries.	Assessment developed recently in selected OECD countries; can be applied to trade-related measures in conjunction with preliminary analysis.	Frequently required in IA guidelines, increasingly applied in developing countries. Challenging to apply to complex interventions, such as trade policies impacts.	Can be applied to integrate different impact types of any intervention. Resource / data requirements increase with the complexity of interventions.

Scoping methods	PIOTs / MFA	LCA	Ecological Footprints	Modeling	Participatory Scenario Dvlpmt.	Economic Valuation	Carbon Valuation	CBA	MCA
Strengths									
↑ Helps to structure and organize a more detailed analysis ↑Do not require significant resources or expertise	↑ PIOTs provide a complete picture of economic-environmental interactions of an economy ↑ MFAs are methodologically robust allow comparison across countries.	↑ Provides a holistic picture of environmental impacts along a value chain ↑ Enables identification of policies aimed at a particular segment of a value chain. ↑ Enables comparison of the 'environmental friendliness' of two or more products / processes.	↑ Reflects changes in resource use over time. ↑ Compares human demand against "carrying capacity", an otherwise overlooked aspect. ↑ Provides an indicator that enables the comparison of resource use in different jurisdictions	↑ For complex, quantitative analysis of impacts, with multiple inputs or outputs. ↑ Robust results within parameters of the model. ↑ Provide fixed structure for analyses (e.g. most economic models are based on national accounts)	↑ Option for including stakeholders. ↑ Option for including local or tacit knowledge. ↑ Flexible structure for analyses with the possibility to easily adapt the method to various contexts	↑ Enables benefits of ecosystem functions to be compared directly to other benefits of a proposed measure. ↑ Enables costs and benefits of different usage types of environmental resources to be compared. ↑ Valuation results can easily be integrated into standard assessment methods such as CBA.	Represents a standardized tool; which can be applied to any type of intervention, once established. ↑ Enables a focused assessment of climate impacts.	↑ Aggregation of different types of impacts into one single value. ↑ Monetized results can easily be communicated to decision-makers.	↑ Capacity to simplify complex interrelationships. ↑ Integrates social, economic and environmental impacts. ↑ The selected criteria for assessing a measure are straightforward, understandable, and drafted by the group in charge of the analysis. ↑ Useful negotiation tool for debates among stakeholders.-
Weaknesses									
↓ Do not allow for a detailed assessment ↓ Results are not very robust ↓ Are not necessarily designed for a trade-related context.	↓ PIOT do not assess the qualitative impacts of material flows ↓ Resulting indicators may be dominated by a single material flow. ↓ Resource/data intensive	↓Full LCA is resource and time intensive. ↓ Data might be difficult to compile. ↓ Standard LCA does not determine which product / process is the most cost effective.	↓ Does not disaggregate impacts according to policy measures ↓Does not contain spatially disaggregated data on actual land use and do not provide precise information on ecosystem impacts.	↓ Risk that assumptions are not (made) clear, despite crucial influence on results. ↓ Risk of misinterpretation of results and low policy uptake ↓ Resource / data intensive. ↓ Requires interdisciplinary expertise to incorporate environmental aspects. ↓ Lack of flexibility due to the fixed model structure.	↓ Stakeholder knowledge is not always robust or detailed. ↓ Depending on the selection of stakeholders, the results of the scenario building process might be biased. ↓ Resource requirements might be high for analyzing complex situations.	↓Economic valuation is a challenging task and there is a risk of over- or undervaluing environmental goods and services. ↓Risk of applying benefit transfer inappropriately. ↓ Status quo can influence the value placed on an environmental function or service. ↓ Resource / time intensive. ↓ High level of expertise required.	↓ Excludes other environmental impacts. ↓ Establishing the tool is resource and time-consuming. ↓ Requires complete statistical data as input data. ↓ Might require complex preliminary analysis to be applied. ↓ Choice of discount rate has a major impact on results.	↓ Non-market goods, particularly environmental impacts, are oftentimes not integrated into CBA, due to difficulties in generating a monetary value. ↓ The choice of discount rates has a major impact on results. ↓ Resource, time and data intensive.	↓ Can be considered a subjective tool (particularly scoring and weighting) ↓ MCAs are often based on slow and iterative processes. ↓ Resource, time and data intensive..

Scoping methods	PIOTs / MFA	LCA	Ecological Footprints	Modeling	Participatory Scenario Dvlpmt.	Economic Valuation	Carbon Valuation	CBA	MCA
Use in the IA process									
Preliminary assessment	Detailed impact analysis, monitoring.	Detailed impact analysis.	Monitoring.	Detailed impact analysis.	Detailed impact analysis and development of policy options.	Generation of data for assessment.	Impact analysis.	Aggregation of results from impact analysis	Aggregation of results from impact analysis.
Qualitative or quantitative method									
Qualitative.	Quantitative.	Quantitative or qualitative or mixed methods.	Quantitative.	Quantitative.	Qualitative, but may draw on quantitative data.	Quantification / monetization of environmental aspects.	Quantitative.	Quantitative.	Integrates quantitative and qualitative data.
Suitability for integrated or focused environmental assessments									
Either	Focused	Typically, focused on environmental impacts.	Focused.	Either.	Either.	Focused on enabling the integration of environmental impacts with other impacts.	Focused.	Focused on integrating different types of impacts.	Focused on integrating environmental impacts with other impacts.
Types of environmental impacts considered									
Broad consideration of direct and indirect impacts possible.	Broad consideration of material flows. However, resulting indicators may be dominated by a small number of materials.	Broad consideration of direct environmental impacts along a value chain.	Broad consideration of environmental impacts. Specialized footprints (i.e. water footprint) may focus on specific impacts.	Consideration of direct and indirect impacts with a focus on a limited number of EI, most frequently GHG emissions.	Broad consideration of environmental impacts is possible, but limited by available data and expertise.	Broad consideration of environmental impacts.	Focused on GHG emissions.	Broad consideration of environmental impacts is possible, but difficult to achieve.	Aims at broad consideration of environmental impacts.
Robustness of results									
Not robust.	Very robust and coherent results. However, indicators derived from MFAs can be dominated by only one material category.	Robust to very robust, depending on the LCA method applied.	Robust to very robust, depending on level of standardization of the analysis.	Not robust to very robust, depending on specific model and quality of data.	Not robust to robust or very robust, depending on how extensive the exercise was and which experts and stakeholders were included.	Not very robust (benefit transfer) to relatively robust, depending on how extensive the valuation exercise was.	Not robust o robust, depending on the preliminary analysis.	Not robust to robust. Robustness decreases with the complexity of the intervention and dimensions that are included in the CBA.	Somewhat robust to very robust, depends on accuracy of precedent IA results and specific MCA method applied. Sensitivity analysis applied to increase robustness.

Scoping methods	PIOTs / MFA	LCA	Ecological Footprints	Modeling	Participatory Scenario Dvlpmt.	Economic Valuation	Carbon Valuation	CBA	MCA
Timeframe									
Very quick.	Very time consuming	Ranges from very time consuming to somewhat time consuming.	Very time consuming.	Very time consuming.	Very time consuming to somewhat time consuming, depending on the scope and degree of stakeholder involvement.	Ranges from very time consuming for primary valuation studies to somewhat time consuming for benefit transfer studies.	Very time consuming to establish. Very quick to apply once established.	Very time consuming to somewhat time consuming, depending on the complexity of the intervention and the ambition of the CBA, in terms of integrating different impacts.	Very time consuming to somewhat time consuming, depending on the complexity of the intervention and the ambition of the MCA, in terms of involving stakeholders.
Data requirements									
Very low.	Very high, comprehensive statistical data are required.	Medium to very high, depending on type of LCA method applied and depending on scope of assessment.	High to very high, depending on scope of footprint analysis. Statistical data are required.	Low. Existing data and analysis may be used as an input to the process.	Very high, comprehensive statistical data are required.	Medium to very high, depending on method applied (revealed/stated preferences, use of benefit transfer) and focus of study.	Very high, comprehensive statistical data are required.	High to very high, requires quantitative and monetarized data as input.	High to very high, requires some form of data as input.
Expertise and cost									
Low costs and low level of expertise required. However, quality improves with additional resources and expertise.	High costs and high level of expertise required.	Medium to high costs and medium to high level of expertise required, depending on LCA method applied.	High cost and high level of expertise required. Increasingly, calculators are being made available that enable a more simple and standardized assessment.	Very high resource requirements.	Medium to very high costs, depending on how extensive the exercise is. Medium to high level of expertise required to generate useful results.	Medium to high costs, depending on how extensive the valuation exercise is. High level of expertise required.	Low costs and low level of expertise required, once the tool has been established. Very high costs and high level of expertise required for tool establishment. May require complex preliminary analysis.	High costs and high-level of expertise required.	High costs and high level of expertise required.

1 EC Impact Assessment Process

	Summary of key analytical steps
1	**Identifying the problem**
	• Describe the nature and extent of the problem.
	• Identify the key players/affected populations.
	• Establish the drivers and underlying causes.
	• Is the problem in the Union's remit to act? Does it pass the necessity and value added test?
	• Develop a clear baseline scenario, including, where necessary, sensitivity analysis and risk assessment.
2	**Define the objectives**
	• Set objectives that correspond to the problem and its root causes.
	• Establish objectives at a number of levels, going from general to specific/operational.
	• Ensure that the objectives are coherent with existing EU policies and strategies, such as the Lisbon and Sustainable Development Strategies, respect for Fundamental Rights as well as the Commission's main priorities and proposals.
3	**Develop main policy options**
	• Identify policy options, where appropriate distinguishing between options for content and options for delivery mechanisms (regulatory/non-regulatory approaches).
	• Check the proportionality principle.
	• Begin to narrow the range through screening for technical and other constraints, and measuring against criteria of effectiveness, efficiency and coherence.
	• Draw-up a shortlist of potentially valid options for further analysis.
4	**Analyse the impacts of the options**
	• Identify (direct and indirect) economic, social and environmental impacts and how they occur (causality).
	• Identify who is affected (including those outside the EU) and in what way.
	• Assess the impacts against the baseline in qualitative, quantitative and monetary terms. If quantification is not possible explain why.
	• Identify and assess administrative burden/simplification benefits (or provide a justification if this is not done).
	• Consider the risks and uncertainties in the policy choices, including obstacles to transposition/compliance.
5	**Compare the options**
	• Weigh-up the positive and negative impacts for each option on the basis of criteria clearly linked to the objectives.
	• Where feasible, display aggregated and disaggregated results.
	• Present comparisons between options by categories of impacts or affected stakeholder.
	• Identify, where possible and appropriate, a preferred option.
6	**Outline policy monitoring and evaluation**
	• Identify core progress indicators for the key objectives of the possible intervention.
	• Provide a broad outline of possible monitoring and evaluation arrangements.

Source: EC Impact Assessment Guidelines 2009

2 The UNEP Integrated Assessment Process

Box 1.1 The Integrated Assessment Process

Stage		Purpose	Actions
A	Understand the policy context and initiate the assessment	To clarify the purpose of the assessment, understand its policy context and ensure effective stakeholder engagement	**A1.** Confirm the overall purpose of the assessment **A2.** Understand the policy context and the specific policy **A3.** Ensure stakeholders engagement **A4.** Identify and review relevant information
B	Determining the focus of the assessment (Scoping)	To identify the specific issues to be considered in the Integrated Assessment and to confirm the approach that will be taken	**B1.** Define general scope of the assessment **B2.** Develop a conceptual framework **B3.** Identify priorities, objectives and indicators **B4.** Decide approaches and methods to be used
C	Assess the impacts	To analyse economic, social and environmental impacts of various policy options	**C1.** Establish baselines and trends for selected indicators **C2.** Identify which policy options to assess **C3.** Analyse impacts using appropriate tools and techniques
D	Develop policy recommendations	To interpret outcomes of Integrated Assessment and influence policy decisions	**D1.** Finalise assessment of trade-offs and draw conclusions **D2.** Develop policy recommendations **D3.** Communicate policy recommendations
E	Implement policy recommendations	To translate policy recommendations into action	**E1.** Identify actions for implementation **E2.** Establish a monitoring and feed-back mechanism
F	Monitor and evaluate	To refine policies implemented following outcomes of the Integrated Assessment	**F1.** Monitor impacts **F2.** Review and revise policy recommendations

Source: UNEP 2010a.

3 Overview of Valuation Methods

	Method	Description	Applications	Data requirements	Potential challenges/ limitations
	Revealed-preference methods				
	Change in productivity	Trace impact of change in ecosystem services on produced goods.	Any impact that affects produced goods.	Change in service; impact on production; net value of produced goods.	Lacking data on change in service and consequent impact on production.
	Cost of illness, human capital	Trace impact of change in ecosystem services on morbidity and mortality.	Any impact that affects health (e.g., air or water pollution).	Change in service; impact on health (dose-response functions); cost of illness or value of life.	Lacking dose-response functions linking environmental conditions to health; value of life cannot be estimated.
	Cost-based approaches (replacement/ restoration costs)	Use cost of replacing or restoring the service.	Any loss of goods or services; Identification of least cost option to meet given objective.	Extent of loss of goods or services and cost of replacing or restoring them.	Risk of overestimating actual value if unknown benefits are higher than identified costs.
	Travel cost (TCM)	Derive demand curve from data on actual travel costs.	Site-specific recreation; sightseeing (e.g., protected areas).	Survey to collect monetary and time costs of travel to destination, distance travelled.	Limited to described applications; difficult to use when trips are to multiple destinations.
	Hedonic prices	Extract effect of ecosystem service on price of goods that include those factors.	Air quality, scenic beauty, cultural benefits	Prices and characteristics of goods.	Requires transparent and well-working markets, and vast quantities of data; very sensitive to specification.
	Stated-preference methods				
6.2.8	Contingent valuation (CV)	Ask respondents directly their WTP for a specified service.	In particular in cases where non-use values are deemed to be important.	Survey that presents scenarios and elicits WTP for specified service.	Ensuring that the sample is representative is important but a large survey is time-consuming and costly; knowledge of respondents may be insufficient; potential sources of bias in responses; guidelines exist for reliable application.
6.2.9	Choice modelling	Respondents choose preferred option from alternatives with particular attributes.	In particular in cases where non-use values are deemed to be important.	Survey of respondents.	Similar to CV, but minimizes some biases; analysis of the data generated is complex.
	Other methods				
6.2.10	Benefits transfer	Use results obtained in one case in a different, but very similar case.	Any where suitable comparison studies are available; applicable in cases where savings in time and costs outweigh certain loss of accuracy (e.g., rapid assessments).	High-quality valuation data from similar sites.	Can be very inaccurate when not used cautiously, as many factors may still vary even when cases seem 'similar'.

Source: UNEP 2010b.

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