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Effectiveness and Perspectives of Access and Benefit-sharing Regimes in the Convention on Biological Diversity
-
A Comparative Analysis of Costa Rica, the Philippines, Ethiopia and the European Union

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Korreferent:	Prof. Dr. Thomas Heckelei
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Gefunden

Ich ging im Walde
So für mich hin,
Und nichts zu suchen,
Das war mein Sinn.

Im Schatten sah ich
Ein Blümchen stehn,
Wie Sterne leuchtend,
Wie Äuglein schön.

Ich wollt es brechen,
Da sagt es fein:
Soll ich zum Welken
Gebrochen sein?

Ich grub's mit allen
Den Würzlein aus.
Zum Garten trug ich's
Am hübschen Haus.

Und pflanzt es wieder
Am stillen Ort;
Nun zweigt es immer
Und blüht so fort.

Johann Wolfgang von Goethe

Found

Once through the forest
Alone I went;
To seek for nothing
My thoughts were bent.

I saw i' the shadow
A flower stand there
As stars it glisten'd,
As eyes 'twas fair.

I sought to pluck it,
It gently said:
“Shall I be gather'd
Only to fade?”

With all its roots
I dug it with care,
And took it home
To my garden fair.

In silent corner
Soon it was set;
There grows it ever,
There blooms it yet.

Johann Wolfgang von Goethe
(translated by Edgar Alfred Bowring, 1815)

Abstract

Effectiveness and Perspectives of Access and Benefit-sharing Regimes in the Convention on Biological Diversity - A Comparative Analysis of Costa Rica, the Philippines, Ethiopia and the European Union

The decline of biodiversity has reached an alarming rate and all the approaches that have been undertaken in the past were not sufficient to stop the on-going process. One of these approaches is Access and Benefit-Sharing (ABS), a market-based approach, which has been established with the adoption of the Convention on Biological Diversity (CBD) in 1992. The underlying idea of ABS is that it turns biodiversity and genetic resources from an open access good to a private or club good and creates a market for genetic resources. It internalizes the resources' positive externalities by pricing the commercial values for research and development and makes users pay for it. Users' benefits are shared with the resource holders and set incentives for the sustainable use and the conservation of biodiversity. So far the theory. However, in practice the question arises how the concept has to be designed to be an effective approach to contribute to the protection of biodiversity and to the fair and equitable sharing of benefits arising from the commercialization.

In this study, the effectiveness of the ABS concept with regard to biodiversity conservation is defined as "the capability of the ABS regime i) to set incentives for the sustainable use and the conservation of biodiversity, ii) to facilitate access to plant genetic material and iii) to enhance a fair and equitable benefit-sharing". To measure the realization of these objectives, their determinants, the so-called critical factors, they have to be identified. In this study they are derived from the application of economic theory to the loss of biodiversity and the ABS concept, and from the empirical findings of three case studies of biodiversity-providing countries Costa Rica, the Philippines and Ethiopia and one case study of a community of user countries, the European Union (EU). The identified critical factors are property rights, information asymmetries, time lags, good governance, administrative complexity, and market structure. Depending on how they are addressed through the implementation of ABS on the national level the effectiveness can be assessed. This study discusses user and provider measures that have the potential to address the critical factors. Finally, the study formulates policy recommendations for an international ABS regime based on the results of the study.

Kurzfassung

Effektivität und Perspektiven von Zugangs- und Vorteilsausgleichsregimen im Rahmen des Übereinkommens über die Biologische Vielfalt – Eine vergleichende Analyse von Costa Rica, den Philippinen, Äthiopien und der Europäischen Union

Der fortschreitende Verlust von Biodiversität ist alarmierend. Alle Versuche und Initiativen diesen Prozess aufzuhalten, sind bisher gescheitert. Der marktbasierte Ansatz *Access and Benefit-sharing* (ABS) (dt.: Zugang und Vorteilsausgleich) ist ein solcher Versuch. Er wurde 1992 im Rahmen des Übereinkommens über die Biologische Vielfalt (engl.: CBD) entwickelt und beschlossen. Dem Konzept liegt folgende, aus der Theorie abgeleitete Idee, zugrunde. Die Anwendung des ABS Konzeptes wandelt Biodiversität und genetische Ressourcen von *open access* Ressourcen in private Güter. Positive Externalitäten der Ressourcen werden durch die Monetarisierung der privaten Nutzen für Forschung und Entwicklung internalisiert. Die Nutzer genetischer Ressourcen teilen die Vorteile und Gewinne, die sie durch eine vorwiegend kommerzielle Nutzung erzielen, mit den Bereitstellern der Ressourcen. Die Erzielung von Einkommen durch die Bereitstellung von Biodiversität setzt Anreize zur Erhaltung und nachhaltigen Nutzung, sofern das alternative Einkommen der Bereitsteller die Opportunitätskosten deckt. Die Praxis hinkt der Theorie aber immer noch hinterher. Der Biodiversitätsverlust konnte bisher nicht aufgehalten werden und nur wenige ABS-Verträge haben zu einem sichtbaren Erfolg geführt. Die Frage, wie das ABS Konzept ausgestaltet werden muss, um tatsächlich ein effektiver Ansatz zur Erhaltung und nachhaltigen Nutzung genetischer Ressourcen, zur Schaffung eines leichteren Zugangs zu genetischen Ressourcen und zur Unterstützung des fairen und gerechten Vorteilsausgleichs zu sein, so wie die Konvention es verspricht, ist somit berechtigt.

Um die Effektivität messen zu können, müssen so genannte kritische Faktoren definiert werden. Sie werden in dieser Studie durch die Anwendung der ökonomischen Theorie auf den Verlust biologischer Vielfalt und das ABS Konzept, sowie auf Grundlage vier verschiedener Fallstudien hergeleitet. Die Daten der Fallstudien wurden in drei biodiversitätsreichen Bereitstellerländern: Costa Rica, Philippinen und Äthiopien, sowie in der EU als einer Nutzergemeinschaft, mit besonderem Fokus auf Deutschland, erhoben. Die abgeleiteten kritischen Faktoren sind Eigentumsrechte, Informationsasymmetrien, zeitliche Verzögerungen, gute Regierungsführung, administrative Komplexität und Marktstruktur. Der Effektivitätsgrad des Konzeptes kann in Abhängigkeit davon bestimmt werden, inwieweit die einzelnen kritischen Faktoren ausgeprägt sind und beachtet werden. Hierzu analysiert die Studie potentielle Bereitsteller- und Nutzermaßnahmen. Zuletzt formuliert die Studie, basierend auf der vergleichenden Analyse und den abgeleiteten Ergebnissen, Handlungsempfehlungen für ein zukünftiges internationales ABS Regime.

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Table of contents

List of Tables

List of Figures

List of Acronyms

ABS	Access and benefit-sharing
ACP	African, Caribbean and Pacific
ARA	Academic Research Agreement
ARCBC	ASEAN Regional Centre for Biodiversity Conservation
ARS	Agricultural Research Service
ASEAN	Association of Southeast Asian Nations
ASOEN	ASEAN Meeting Senior Officials on the Environment
AU	African Union
AWGNC	ASEAN Working Group on Nature Conservation
BCCM	Belgian Co-ordinated Collections of Micro-organisms
BMBF	Federal German Ministry for Education and Research
BMS	Bristol-Myers Squibb
BRCs	Biological resource centers
BTG	British Technology Group
BV	Bequest value
CBD	Convention on Biological Diversity
CBD-CHM	CBD’s Clearing House Mechanism
CGIAR	Consultative Group on International Agricultural Research
CGRFA	Commission on Genetic Resources for Food and Agriculture
CIFLORPAN	Centro de Investigaciones Farmacognosticas de la Flora Panameña
CIRAD	Agricultural Research for Developing Countries
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on the Conservation of Migratory Species of Wild Animals
CONAGEBIO	National Commission for the Management of Biodiversity
COP	Conference of the Parties
CRA	Commercial Research Agreements
DA	Department of Agriculture (Philippines)
DAO	Department Administrative Order
Defra	Department for the Environment (United Kingdom)
DENR	Department of Environment and Natural Resources (Philippines)
DFA	Department of Foreign Affairs (Philippines)
DNA	Deoxyribonucleic acid
DOST	Department of Science and Technology (Philippines)
DUV	Direct use values
EARO	Ethiopian Agricultural Research Organization

EC	European Community
EIAR	Ethiopian Institute for Agricultural Research
EMAS	EC Eco-Management and Audit Scheme
EO	Executive Order
EPA	Environmental Protection Authority (Ethiopia)
EPC	European Patent Convention
EU	European Union
EWCO	Ethiopian Wildlife Conservation Organization
FAO	Food and Agriculture Organization of the United Nations
FONAKIN	Federación de Organizaciones de la Nacionalidad Kichwa del Napo
GATS	General Agreement on Trade in Services
GATT	General Agreement of Tariffs and Trade
GDP	Gross Domestic Product
GEF	Global Environment Facility
GNI	Gross National Income
GNP	Gross National Product
GPGs	Global public goods
GTZ	Gesellschaft für technische Zusammenarbeit
HDI	Human Development Index
IACBGR	Inter Agency Committee for Biological and Genetic Resources (Philippines)
IAMME	Informal ASEAN Ministerial Meeting on the Environment
IBC	Institute of Biodiversity Conservation (Ethiopia)
IBCR	Institute of Biodiversity Conservation and Research
ICBG	International Cooperative Biodiversity Groups
IFO	Institute for Fermentation
IMF	International Monetary Fund
INBio	National Biodiversity Institute (Costa Rica)
IPAF	Integrated Protected Areas Fund
IPC	Intellectual Property Code of the Philippines
IPEN	International Plant Exchange Network
IPPC	Intergovernmental Panel on Climate Change
IPRs	Intellectual property rights
ISD	Ethiopian Institute for Sustainable Development
ISO	International Organization for Standardization
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IU	International Undertaking
IUCN	World Conservation Union

IUV	Indirect use values
LDCs	Least Developed Countries
LMMC	Like Minded Megadiverse Countries
LPGs	Local public goods
MAT	Mutually agreed terms
MEA	Millennium Ecosystem Assessment
MINAE	Ministry of Natural Resources and Energy and Mines (Costa Rica)
MOSAICC	Micro-organisms Sustainable Use and Access Regulation International Code of Conduct
MTA	Material Transfer Agreements
NCIP	National Commission on Indigenous Peoples
NGOs	Non-governmental organizations
NIH	National Institutes of Health
NIPAS	National Integrated Protected Areas System
NPGs	National public goods
NRC	National Research Council
NUV	Non-use value
OAU	Organization of African Unity
OECD	Organisation of Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
OV	Option values
PCSD	Palawan Council for Sustainable Development
PCT	Patent Cooperation Treaty
PGRFA	Plant genetic resources for food and agriculture
PhP	Philippine Peso
PIC	Prior Informed Consent
PLT	Patent Law Treaty
PVP	Philippine Plant Variety Protection
QOV	Quasi option values
RPGs	Regional public goods
SACRO	Save Costa Rica´s Orchids
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SCBD	Secretariat of the Convention on Biological Diversity (CBD)
SINAC	System of Conserved Areas
SMTA	Standard Material Transfer Agreements (MTA)
TEV	Total economic value
TK	Traditional knowledge

TPGs	Transnational public goods
TRIPs	Agreement on Trade-Related Aspects of Intellectual Property Rights
UK	United Kingdom
US	United States (of America)
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UPOV	The International Union for the Protection of New Varieties of Plants
UV	Use value
WCMC	World Conservation Monitoring Center
WCPA	World Commission on Protected Areas
WDCM	World Data Centre for Microorganisms
WHC	World Heritage Convention
WIPO	World Intellectual Property Right Organization
WSSD	World Summit on Sustainable Development
WTO	World Trade Organization
XV	Existence value

1 Introduction

1.1 Background

During the past twenty years the enormous global loss of biodiversity has received growing attention not only by biologists because it is one of the world's most important resources. Biodiversity serves many important purposes as life-support systems, ecosystem services, and cultural objects but also as production inputs and goods.

Today, genetic resources are regarded highly potential inputs of research and development. Due to the latest enormous technical progress, especially in the area of biotechnology, genetic resources have become more important for commercial sectors including the agribusiness, the pharmaceutical as well as cosmetics and natural products industries.[1] Genetic resources and the technology used for their exploitation are not equally distributed in the world. Biodiversity hotspots, being centers of highly diverse but threatened genetic resources, occur mainly in tropical forests located in developing countries. Industries using genetic material for research and development are settled in industrial countries. Due to this unequal geographical distribution of resources and technology, the international trade in genetic resources has significantly increased in recent centuries. But already in the past, trade in genetic resources has played an essential role. Plant collections and informal and commercial trade in biodiversity and genetic resources have been at all times an integral part of the socio-economic and cultural evolution.

In the 1990s, the increased demand and the promising potential of the future use of genetic resources have thus been recommended as a source of funds for habitat preservation. For the first time in 1991, the idea was applied when Costa Rica's National Biodiversity Institute (INBio) and the pharmaceutical company Merck & Co., Inc. announced an access-for-fee-agreement. The concept expanded into the Convention on Biological Diversity (CBD), adopted in 1992, aiming to promote both biodiversity conservation and sustainable development. In the past, genetic resources were treated as open access resources in the

[1] One well-known example is rosy periwinkle (*Catharanthus roseus*), a tropical dry-forest plant from Madagascar. Two drugs derived from the rosy periwinkle, vinblastine and vincristine, are successfully used in the treatment of Hodgkins' disease and leukemia.

sense of common heritage of humankind. Consequently, the resources could be acquired free of charge and without any approval. The adoption of the CBD implicated enormous changes. The Convention seeks to increase biodiversity's use and access to it, but also to conserve biodiversity by recognizing the states' sovereignty over their biological resources and claiming the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. Since then, potential users have been required to seek consent of providers of biological diversity or their representatives and to negotiate mutually agreed terms on access and benefit-sharing (ABS) before they can bioprospect. Bioprospecting is understood as the specific search and exploration of biological material or information of social and economic value. The underlying idea is that through bilateral market-like contracts genetic resources are exchanged for shares of the generated benefits, which incentives resource conservation and promote economic development in the provider countries. The CBD is only a framework agreement and needs to be implemented by national or regional regulations. Today, 28 countries have already adopted measures to regulate ABS with regard to their own biological resources and many more are in the stage of developing such measures (CBD 2007c).

Despite of the extended implementation of ABS regulations in provider countries and the improvements through gained experiences and higher scientific interest, many parties of the CBD, mainly developing countries, express their discontent with the existing situation. Plant genetic resources have been collected, used for research and development and protected by intellectual property rights (IPRs), but the provider countries have not approved the use and have not received any share. Natural products of neem and basmati rice are prominent examples where patents have been awarded for products not meeting the conditions of patents (e.g., novelty and invention). Besides these, many cases of misappropriation have been reported (McGown 2006). Such incidents have raised concern over the limitations of the present ABS regulation with regard to the effective protection of provider countries' interests.

In the recent years, demands on user countries have been expressed more explicitly, urging them to stand up for the implementation of the CBD regulations on ABS. The group of megadiverse countries emphasized the fact, that they do not consider themselves capable of enforcing ABS without the support of user countries. Therefore, they call for the creation of an international regime, which induces user countries to also undertake adequate measures for the realization of ABS according to the CBD. The idea to develop an international regime was accepted at the World Summit on Sustainable Development (WSSD), held in 2002 in Johannesburg, and subsequently included as an objective in the final report. The CBD members are requested to negotiate an international regime to promote and safeguard the fair and equitable sharing of the benefits arising from the utilization of genetic resources (UN 2002, 44o). This means that today's users of genetic resources have to be considered and involved even more as important actors in the development of comprehensive international conservation concepts.

1.2 Objectives

The overall objective of this study is to analyze how the CBD's approach of ABS has to be designed to be an effective concept to ensure the conservation and sustainable use of biodiversity, to facilitate access to biodiversity and to ascertain the fair and equitable sharing of the benefits arising out of the commercialization of genetic resources. In short, what are the determinants of the effectiveness?

The analysis is led by three assumptions. Firstly, the ABS concept, which is based on bilateral agreements, sets incentives to conserve biodiversity, but it has side-effects (e.g., economical, social), which have to be taken into account. Secondly, critical factors have a significant influence on the ABS concept and its goals. The effectiveness of the ABS concept depends on how these factors are shaped. Thirdly, the ABS concept can only be realized through an international regime, i.e., provider and user measures have to be in place.

The study aims to establish an analytic framework to measure the effectiveness of the ABS concept on the national and regional level. In this study the effectiveness is defined as the capability of the ABS regime i) to set incentives for the sustainable use and the conservation of biodiversity, ii) to facilitate access to plant genetic material and iii) to enhance a fair and equitable benefit-sharing, which also implies the prevention of the misappropriation and the unapproved use of genetic resources. To measure the realization of these objectives, their determinants, so-called critical factors, they have to be defined. They are derived from the application of economic theory to the loss of biodiversity and the ABS concept, and from the empirical findings of four ABS country case studies. These ABS case studies are to provide a comprehensive and a comparative analysis of national and regional experiences in developing and implementing ABS policies, laws, institutions and regulatory regimes. Three provider countries, Costa Rica, the Philippines and Ethiopia, are taken as case studies in order to derive the critical factors and to test their feasibility by analyzing how the critical factors are shaped in a country-specific context, whether they are already addressed and/or gaps still exist. On the user side, the European Union (EU) serves as an example of a group of user countries to identify and analyze potential user measures with regard to their feasibility, efficiency and their potential to address the critical factors. Since many EU measures are implemented on the national level, at some points a country perspective (Germany) is chosen to illustrate user country's action and possibilities.

Furthermore, the study aims to explore the perspectives for ABS regimes. The study analyzes the strengths and weaknesses of current ABS regimes in provider countries and user countries with a view to the critical factors. It ascertains options for developing measures that can be undertaken by countries in their capacity as providers and users of genetic resources to strengthen ABS governance and form an international regime.

The analysis of the effectiveness and the perspectives of the ABS concept allow deriving recommendations to improve and develop an international ABS regime. Measures that address the essential critical factors are identified and assessed. Furthermore, strategies are proposed how to implement such measures. The findings and results are not only limited to the investigated case studies. The analytic framework, consisting of the objectives and the critical factors, can be applied to a range of countries faced with the implementation of the ABS concept. Only with such an analytic framework, that this study intends to develop, a comparative analysis of different case studies is possible. The case studies provide insightful experiences for other provider and user countries. Since the underlying questions of this study are coherent with the questions international policy-makers are faced with, the results of the study support the political discussions and negotiations and propose options for further proceedings.

1.3 Methodological approach

The effectiveness of the ABS concept can be measured through the three objectives: conservation of biodiversity, facilitation of access and enhancement of a fair and equitable benefit-sharing. By analyzing the occurrence of the critical factors in a country-specific context the realization of the objectives are measured and the effectiveness of the ABS concept is assessed. Besides, the strengths and weaknesses of the approach are disclosed.

The analysis integrates a multilevel approach by examining the implementation of the ABS concept on the national and international level. The analytical framework of this study is derived through the application of new institutional economics theory's major aspects (i.e., property rights, bargaining solutions, transaction costs, and information asymmetries) to the ABS concept, and through the collection and analysis of empirical qualitative data of national and regional ABS regimes.

The main source of information of this study is qualitative data collected by the case studies, primary and secondary literature with focus on environmental and new institutional economics and biodiversity and biodiversity related topics, as well as information collected through the author's observation and participation in several political negotiations and international conferences related to ABS. The chronological order of the study does not reflect the research process. The empirical findings already contribute to the development of the analytical framework in chapter 5.

The empirical data of the four case studies (Costa Rica, the Philippines, Ethiopia and the EU) are the core of the study. They provide the practical insight to the problem of biodiversity loss and the ABS concept and they are the empirical bedding and completion for the development of the critical factors, which are derived from economic theory and the empirical case studies. Since the countries' geographical location (i.e., different continents) and their approaches to implement ABS differ extremely, the selected case studies appear to be very useful. Users are an indispensable part of an international ABS regime. Therefore, this study considers and integrates them through the EU case study. This case study is mainly a desktop study, but enriched with information gathered in workshops and conferences. The provider case studies are accomplished by field trips to the three developing countries. A qualitative approach with fieldwork data collection was chosen, since qualitative methods for data collection are regarded as an adequate method. They provide information useful to understand the processes behind the observed results and assess peoples' perception (Creswell 1994; Denzin / Lincoln 2000).

Silverman (1997) characterizes qualitative research as a method to collect and interpret "in-depth" material, which is more meaningful than quantitative survey research data. In qualitative research the reality is subjective of the analysis and differently seen by the interview partners. Therefore, it relies on the report of the different voices and the interpretation of the informants. The researcher usually interacts with those she/he studies and admits values and biases. The methodology allows inductive approaches. Categories emerge from the informants rather than being identified *a priori* by the researcher. This emergence provides "context-bound" information and can lead to patterns or theories that explain a certain phenomenon (Creswell 1994, 5-7). Therefore, qualitative research methods are usually applied when the research subject is new and theories need to be developed.

As a research topic ABS is not new. It has been analyzed from many different angles. However, it lacks an adequate theoretical framework for the analysis of the effectiveness of the concept. Therefore, it is necessary to develop a new analytical framework based on insights of new institutional economic theory, but also based on the findings from the case studies. Therefore, the approach applied in this study combines deductive and inductive reasoning processes to establish a new analytic framework. The new institutional economic theory was chosen because it appears as the most appropriate theory. It provides suitable approaches to analyze the problems that occur during the implementation of ABS and offers adequate solutions to these problems.

In order to analyze the country-specific context of ABS in the three countries, including the resource itself as well as the resource providers and users, the majority of relevant stakeholders or their representatives were identified and interviewed. The first field trip was undertaken in the Philippines between March and May 2002 and 27 stakeholders were interviewed. The second field trip took place in Costa Rica in November and December 2002, and 23 key informants agreed to provide information. The last field trip was conducted in Ethiopia in October 2003. 15 persons could be identified and interviewed.

The qualitative collection method varies depending on the research subject. The major methods are observation, textual analysis, interviews and transcripts (Silverman 1997, 9). The data collection procedure was the same in all three case studies. The applied method of gathering and analyzing the qualitative data in the respective countries are semi-structured interviews. They were conducted with a fairly open framework, which allow for focused, conversational, two-way communication. According to Creswell (1994), interviews provide indirect information filtered through the views of the interviewee and are useful when informants can provide some kind of historical information and share their experiences. Stakeholders' information and experiences are essential to analyze how ABS issues are perceived.

The semi-structured interviews were prepared by an interview guide, which lists a pre-determined set of questions or issues that were to be explored during the interview (cf. Appendix). The questions and issues are based on the pre-analysis of economic literature regarding to the loss of biodiversity and the ABS concept. The majority of questions were derived from the three general assumptions and further country-specific assumptions. Therefore, for each country the guide was adapted to the specific country situation and expanded by particular questions. For example, in the Costa Rican case the outsourcing of the application process to a non-state actor (INBio) was explicitly considered.

The interviews were conducted with great flexibility because the majority of questions was created during the interviews. The guide covered the following problem areas: biodiversity conservation, property rights, win-win solution, potential benefits, bureaucratic procedure, stakeholder interest, information distribution, political and legal situation, control and sanction mechanisms. The given structure of the interviews made the interviewing of a number of different persons more systematic and comprehensive, but did not delimit the issues to be taken up in the interview, since the majority of the questions were created during the interviews.

The interview partners were identified and chosen as stakeholders, key informant, or experts. A key informant is an individual, who has access to information valuable for the evaluator because of her/his knowledge, previous experience or social status in a community. This information is, e.g., insights about the functioning of society, their problems and needs. Key informants are a source of information, which can assist in understanding the context of a program or project, or clarifying particular issues or problems. The main stakeholders, who are involved in ABS issues in their countries or on the international level, were identified as key informants. They can be assigned to different groups, as for example government actors (civil servants), civil society groups, scientists, industry, local communities, farmers, and indigenous people.

The selection of key informants is not at random. At first, a set of people belonging to the identified groups was interviewed. They had been identified before the field research took place. Once the field research had started, the interviewed person recommended more interview partners. The author was aware that this principle might cause a bias. Therefore, interviewees were carefully selected and attention was made to integrate all important stakeholder groups.

All interviews were documented through minutes. The qualitative data in this study is used and transformed according to Wolcott's (1994) approach: "description", "analysis" and "interpretation". "Description" deals with the processing of the information in a descriptive way by sorting and filtering it. Once the empirical data had been collected, the information was allocated into different categories that had been derived from economic theory. Useless information was sorted out. The "analysis" uses this information and addresses the identification of essential features and the systematic description of interrelationships among them. In this phase the critical factors were defined and characterized. Apart from the factors that have been identified through theory, new categories could be identified by the consolidation of theoretical and empirical findings. Furthermore, the existing categories could be extended. Besides, the interlinkages between these factors were analyzed. The last step "interpretation" addresses processual questions of meanings and contexts. However, since the collected information was direct and significant, this is rarely used. In this study the analysis based on prior description is the main approach to transform the data.

1.4 Contribution and outlook

Since the CBD was adopted and the ABS concept was established, controversial discussions have been started, whether the approach is the most adequate to protect biodiversity, ensure fair and equitable benefit-sharing and support sustainable development. In the first years after the Rio conference, optimism was spread and the hope was raised to protect the world's biodiversity by commercializing the "green gold" of the tropical forests. But very soon it became obvious that the expectations were not fulfilled and benefits failed to appear. It seemed that the concept had not worked and the international negotiations during the political debate heated up.

At the same time the research on ABS issues has also increased, since the international policy-makers realized that they lacked the knowledge on important governmental and non-governmental actors, institutions, national regulatory and political frameworks, biodiversity economic values, the market for genetic resources (including users and providers) etc. Different from the Climate Convention, which has established the Intergovernmental Panel on Climate Change (IPPC) being a scientific advising committee, the CBD does not have such a body. Therefore, the research communities were called on to provide scientific, technical and especially socio-economic information. The Millennium Ecosystem Assessment (MEA), initiated by the U.N. Secretary- General Kofi Annan in June 2001 and completed in March 2005, is such a contribution. But until now, this report has received only modest attention, although it delivers some appalling results on the future of ecosystems and biodiversity.

In the ABS context the scientific environment has increasingly focused on the analysis of national or regional ABS regimes in provider countries mainly from the legal and policy perspective, concerning the development of national ABS laws in the past (cf. for example Reid et al. 1993; Columbia University 1999, Day-Rubenstein / Frisvold 2001). All these contributions have provided a useful catalogue of case studies and insights, but they lack the development of an analysis framework, which allows comparisons among different cases and drawing conclusions about the effectiveness of the CBD's promoted ABS approach. Their analyses are more descriptive and lack an evaluation of the socio-economic and ecological effects of ABS. Dávalos et al. (2003) attempt to evaluate ABS regimes on a comparative basis and come up with some interesting results. However, despite the examination of case studies, the conclusions and recommendations only partly encompass the whole ABS concept. They remain either very general or very specific and are not related to the impacts of ABS on biodiversity conservation and economic development. The report of the Organisation of Economic Co-operation and Development (OECD) mentions many very interesting aspects and attempts to draw a general economic picture of ABS, but unfortunately it is not based on empirical insights and remains very sketchily (OECD 2003a). Barrett and Lybbert (2000) provide an interesting commentary on bioprospecting, but it covers only some of the essential aspects, e.g. the lack of distributional equity for the benefits, and does not provide a general analytical framework. Some studies focus only on one aspect, which this study reflects in the critical factors, and analyze it isolated from the others. For example, Mulholland and Wilman (2003) only investigate the information problem in ABS contracts.

Other documents published (Simpson / Sedjo / Reid 1996; Rausser / Small 2000; ten Kate / A Laird 1999) estimate the private value of biodiversity as input into development and research or discuss the commercial use of biodiversity from the point of view of the demand side. It shows the industry's point of view, but does not attempt any evaluation from a societal point of view. Besides, the existing work focuses on either the provider or the user side. A comprehensive approach has not been applied so far. For example, Artuso (2002) investigates the relationship between national ABS programs and biotechnology capacity of provider countries, but the user side is totally excluded. Only little research has been undertaken with regard to user countries and user measures (Barber / Johnston / Tobin 2003; Dross / Wolff 2005; Sarnoff / Correa 2006), and most of these studies focus on single user measures or are very theoretical and not applied to an existing user country. All in all, the effectiveness of the ABS approach of the CBD related to its objectives and under an international regime is still not clarified.

With this study, a new focus is entered into the discussion. The effectiveness of the ABS concept is measured by its capability to reach the three objectives: conservation, access and benefit-sharing and operationalized by the identification of the critical factors. In the light of these factors and by applying a comparative approach the four case studies are analyzed. Through the perspective of an international regime, both sides, providers and users of biodiversity, are integrated.

Nevertheless, this study cannot give answers to all the questions and fill in all the gaps on ABS. This study can be seen as point of departure. Further research should be undertaken in several areas, e.g. the broadening the empirical basis, investigation of a multilateral system, and the assessment of the costs of user measures.

Three provider country case studies were conducted and examined within the study. To test and improve the developed analysis framework it should be applied to more case studies. A range of other countries are suitable for applying this approach. It would then stand on a broader empirical basis.

In this study the main focus of research is the bilateral system as suggested by the CBD. Further research could step back and evaluate the concept of ABS in a broader multilateral framework as suggested by the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). Furthermore, to determine the effectiveness of the ABS concept, it would be useful to evaluate the approach in comparison with other conservation concepts. The payment for environmental services appears to provide interesting results.

In this study the analysis on user measures still remains quite theoretical, but the investigation of user measures is very essential if the international community wants to establish an international regime. The knowledge on the practicality, feasibility and the costs of user measures is very limited. Even if the EU serves as example, only little information on the implementation of user measures is available. Pilot projects that aim to implement a certain measure in a specific sector (e.g., certificates of origin in microbial collections) could provide needed information. Moreover, assessments of the economic impacts and implications would provide fruitful information for the debates.

1.5 Study overview

Chapter 1 introduces the subject and the objectives of the study. The methodological approach including the analytical framework, the method of gathering information, and the use of the collected data, as well as the structure of the study are outlined. Chapter 2 presents the basic principles of genetic resources. It defines the terms “biodiversity” and “agrobiodiversity”, which are essential for this study. It describes the present state of genetic resources and the locations where genetic resources originate, where they are distributed, and where they are used. Furthermore, the chapter looks at the supply side of genetic resources, which is characterized by enormous decline and the demand side by assessing the importance of genetic resources and identifying the users of genetic resources as well as the users’ experience and awareness. Finally, the chapter investigates different biodiversity conservation concepts in order to identify the role of bioprospecting within these concepts. Chapter 3 sets out the institutional and political framework for international biodiversity conservation. On the one hand, conservation conventions as the CBD, the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) of the Food and Agriculture Organization of the United Nations (FAO) and further protection agreements are illustrated. On the other hand, the international regulations regarding IPRs are examined. Chapter 4 applies economic theory to the global problem of biodiversity loss and discusses the economic framework of the ABS concept. Approaches and problems of valuation, the relationship between biodiversity degradation and economic development, and the analysis of the market and policy failure as an explanation for the decline of biodiversity are analyzed. Moreover, the ABS concept is examined as a promising approach to conserve biodiversity conservation through biodiversity commercialization with a focus on its market-based character. The concept is integrated in the notion of sustainable development. The chapter discusses how the sovereignty principle and the bilateral system of benefit-sharing can contribute to the internalization of externalities. Chapter 5 builds the analytic framework for this study based on economic theory and the empirical information gathered through the case studies to measure the effectiveness of the concept. In accordance to the objectives, it derives and defines the critical factors (property rights, time lags, good governance, information asymmetries, administrative complexity, and market structure) of an effective ABS regime. Furthermore, it identifies possibilities how these factors can be addressed in biodiversity providing and using countries. Chapter 6 consists of the four case studies: Costa Rica, the Philippines, Ethiopia, and the EU with a focus on Germany. In each case study an overview over the general situation is given, including the legal and institutional setting, and the case study methodology is explained. The case study analysis investigates how the critical factors occur in the respective countries. It applies the derived analytic framework and analyzes how the factors are addressed. The major results from the case studies are summarized. Chapter 7 draws conclusions from the comparative analysis and formulates recommendations for ABS regimes on the national and international level as an instrument to protect biodiversity.

2 The basic principles of genetic resources regarding ABS

The term of biodiversity has become very prominent, since it was coined in the 1980s[2]. At this time, the observed rapid extinction rates raised concerns and it became obvious that human activities are the main threat to the diversity of life. Biologists, ecologists, environmentalists, political leaders, and concerned citizens started to broach out the issue of biodiversity loss as a major environmental problem of the 20th century worldwide. The discussion on biodiversity has raised awareness about the environmental problem among the society, its causes and has helped to understand in which ways biological organisms and processes are endangered. In the course of development and industrialization, humans interfered with the natural environment, in which important biological processes are embedded. Biodiversity is the base for life and for the functioning of the ecosystem. No environmental system is considered to be that complex, dynamic and varied than the diversity of living organism and no system is considered to experience such dramatic changes caused by humans. These changes do not only influence biodiversity, they also have tremendous impacts on human-well being (MEA 2005c, 18). Conserving biodiversity and using it in a sustainable way are the strategies developed to address this problem.

In order to fully understand the ABS concept and to estimate its opportunities and its limits regarding the objectives, it is necessary to understand the basic principles of the diversity of genetic resources. In the following, an overview over the basic principles of the diversity of genetic resources with regard to ABS is given. The central terms of this study as biodiversity and agrobiodiversity are defined and the major characteristics of genetic resources and their diversity are identified and illustrated. The present state of the world's genetic resources is highlighted. The distribution and origin of genetic resources are elucidated and the provision and utilization of genetic are characterized. Based on this information, the supply and demand situation – the potential market for genetic resources – is evaluated. The supply side is characterized by the increasing decline of biodiversity caused by various direct (e.g., habitat destruction, invasive species, climate change) and indirect factors (e.g., population growth, economic factors). The demand side consists of a very heterogeneous group of user

[2] Thomas Lovejoy coined the term "biological diversity" in 1980. The term "biodiversity" was used at the American Forum on Biological Diversity organized by the National Research Council (NRC) and it first appeared in print in 1988 when entomologist E.O.Wilson used it in the title of the forum's proceedings (Dybas 2006, 792).

sectors. The composition of this group and the awareness and perceptions are illustrated. At last, the chapter introduces different conservation concepts including bioprospecting.

2.1 Biodiversity and agrobiodiversity

Biological diversity, which is more commonly known as biodiversity, is a collective term aiming to describe the totality and variety of life on Earth (Samper 2006). The CBD defines it as the 'variability among living individual organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems' (CBD 1992, Article 2). Biological resources form this biodiversity. According to the CBD, it includes genetic resources, which are organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity. Consequently, genetic material is any material of plants, animal, microbial material or other material from another origin containing functional units of heredity. Therefore, genetic resources are genetic material of actual or potential value (CBD 1992, Article 2). These definitions are widely used and rooted in the CBD. The study follows this framework and uses the terms as defined there.

Agrobiodiversity differs from biodiversity. It is understood to be part of the biodiversity, which provides a base to nutrition, livelihoods and the maintenance of habitats, and is of great importance to peoples' life in the form of agricultural crops, productive livestock, raw materials, and medical plants (Wolff 2004, 338). Agrobiodiversity is not only used as whole systematic units contributing to people's livelihoods by providing food, medicine, feed for domestic animals, fiber, clothing, shelter or energy (Shand 1997, 5). Genetic resources are also used because of their genetic properties. Especially plant genetic resources with distinct characteristics play a major role for food security. Their genetic material is used in the production of new cultivars and breeds or as a reservoir of genetic adaptability buffering against potentially harmful environmental and economic changes (FAO 1996, 19).

The FAO defines plant genetic resources used for food and agriculture (PGRFA) "*as any genetic material of plant origin, including reproductive and vegetative propagating material, containing functional units of heredity"* (ITPGRFA, Article 2). The utilization of PGRFA is very broad. They comprise the diversity of genetic material contained in traditional varieties (land races) and modern breeds, as well as crop wild relatives and other wild plant species that can be used directly or are stored in collections and gene banks, and will be used in the future for food and agriculture or even other uses (FAO 2007).

This study focuses on biodiversity including agrobiodiversity in form of wild plant material (species level) and wild plant genetic resources (genetic level), which are of greater interest for research and development (ten Kate / A Laird 1999, 44-45). Animal genetic resources are also of great importance. Breeds of domesticated farm animal species are the primary biological capital for livestock development, food security, and sustainable rural development. However, the nature of animal genetic resources and the actual and potential measures to conserve them significantly differ from the approaches for plant genetic resources. The analysis of animal genetic resources is beyond the scope of this research and therefore animal genetic resources are excluded in this study. [3]

The same applies to traditional knowledge (TK) related to plant genetic resources. It is also used as input for research and development. TK and biodiversity are jointly negotiated on the international level. It is assumed that the same instrument, namely ABS, can protect TK and biodiversity. However, the analysis of TK, which is not a global environmental problem, but the loss of an essential cultural asset, differs distinctly from the analysis of the loss and protection of biodiversity. Therefore, the issue of TK is excluded in this study.

2.2 The present state of the world's genetic resources

How many species actually live on the planet? Today's estimates of the number of species on the Earth range from three to 100 million, indicating the difficulties in assessing the total amount of species. However, generally accepted estimates are between five and 20 million. The Secretariat of the CBD (SCBD) assumes that about 13 million species exist today of which 1.75 million have been described so far (SCBD 2000, 2). The estimates of the United Nations Environment Programme (UNEP) with 14 million unknown species are very close to this estimation. Out of the 1.75 million known species 270,000 plant species are already described (cf. Table 1).

[3] See Ecological Economics 2003, Volume 45, Issue 3, pp. 315 – 517, Special Issue on "Valuing Animal Genetic Resources" and Drucker 2004 for an overview over the issue.

Table 1: Number of described species

Species	Number
Bacteria	4,000
Protoctists (algae, protozoa)	80,000
Animals – invertebrates	1,272,000
Fungi	72,000
Plants	270,000
Total described species	1,750,000
Possible total including unknown species	14,000,000

Source: UNEP 2002, 120

The World Conservation Union (IUCN) regularly publishes statistics on globally threatened species and the Red List of Threatened Species. They come to the conclusion that 1.9 million species out of the five to 30 million species have been described (Baillie / Hilton-Taylor / Stuart 2004, 34). Most taxonomic work is concentrated away from the most species-rich taxa and regions and is declining in general. This explains the uncertainty related to the knowledge about the existence of species (MEA 2005a, 88).

According to FAO (1997) it is assumed that between 300,000 and 500,000 species of higher plants (i.e., flowering and cone-bearing plants) exist, of which approximately 270,000 have been described. Out of these about 30,000 are edible and about 7,000 have been cultivated or collected by humans for food and play a major role for food security. Despite that great number and vast diversity of PGRFA, only 30 crops provide 95 percent of dietary energy. Three crops, wheat, rice and maize, account for more than 50 percent of the world population plant-derived energy intake. Sorghum, millet, potatoes, sweet potatoes, soybeans and sugar account for additional 25 percent (FAO 1997, 14). Today, only 150 crops are commercialized on a significant global scale. The other species have fallen victim to agricultural simplification, a process that favored few crops instead of others because of their comparative advantages, as for example for the ability to grow in a wider range of habitats, their simple cultivation requirements, their easier processing, their storability, and their taste. These developments lead to enormous genetic erosion through a reduction of intra- and inter-specific diversity of crops. Therefore, the level of vulnerability among users, particularly the poorer societies depending on diversity in crops, has increased. Besides, the quality of food has decreased by narrowing the variety of nutrients (Padulosi et al. 2002, 1).

Local communities in developing countries use a wider range of the existing diversity. For example, in the Uxpanapa region in Mexico peasant farmers use 435 wild plants and animals and eat 229 of them, and people in a community in a Thai village eat 295 different local plants (Harrison / Pearce 2001, 159). Many minor species still exist, e.g., underutilized crops as leafy vegetables in Sub-Sahara Africa, and play a vital role in local farming systems and in human well-being at sub-national levels, but they disappear in statistical aggregations on the national level (Williams / Haq 2002, 2). In the recent years awareness about the neglected genetic treasures has risen and researchers, policy-makers and even the industry have recognized the need to maintain and improve the utilization of these underutilized or neglected crops, which are left aside by research, technology, marketing systems as well as conservation efforts (Padulosi et al. 2002, 1). As food security products in local and regional markets and as niche products in international markets underutilized crops have promising economic potential.

Underutilized crops are not emphasized in this research, since coffee was chosen as an example as to how crops and ABS can be reconciled. However, since the economic potential of these crops is not utilized, it seems that there is a strong demand for research in this area of underutilized crop and their role for benefit-sharing.

2.3 The supply side

This section characterizes the supply side. With regard to ABS, the supply side plays a key role. The countries that hold biodiversity are so-called “provider countries”. Countries where certain genetic resources originate are “countries of origin”. Both provider and user countries can be identified by analyzing the origin and the distribution of material. Generally spoken, genetic resources’ diversity and origin are the greatest in the southern hemisphere in developing countries, and they are mainly used and processed in the northern hemisphere in industrialized countries. Even if this simplification applies to many cases, it is necessary to take a closer look at the actual distribution, since the natural distribution is not always in harmony with the CBD’s understanding on ABS. The distribution of genetic resources is not bound to territorial borders but the CBD defines states as the responsible actors.

Furthermore, the subchapter investigates the loss of biodiversity and its drivers. The greatest threat of biodiversity is the human-induced habitat destruction for converting forest to agricultural land. This indicates that the decline of biodiversity is above all a question of opportunity costs. Other land uses are economically more attractive than biodiversity conservation. This shows that the ABS concept can be an adequate concept to counteract the on-going loss of biodiversity by providing economic incentives for conservation.

2.3.1 Origin and distribution

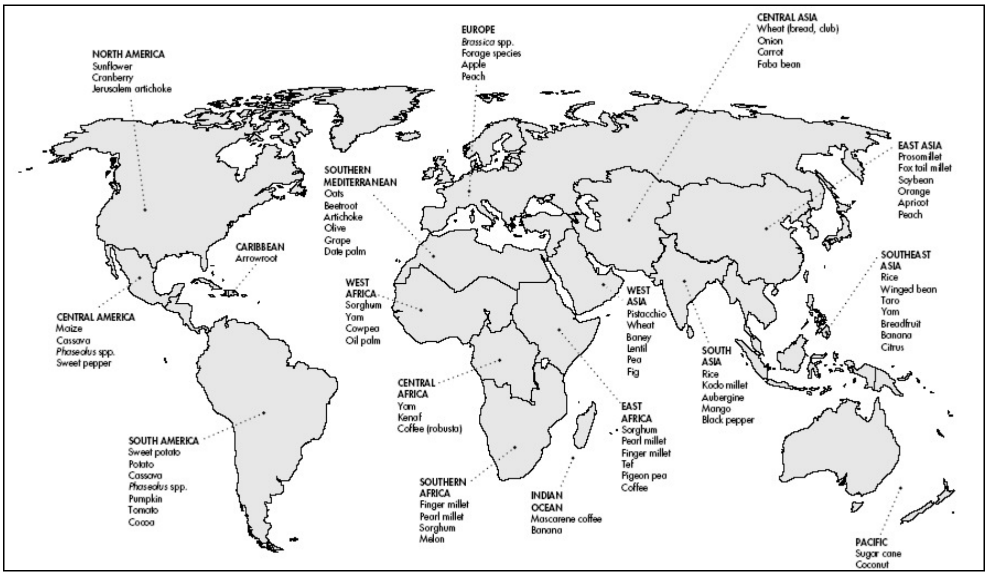
Species have been migrated on Earth for ages. Migration is one important aspect of evolution and the development of biodiversity. Especially crops have spread around the world through human interventions and activities. Also wild plant genetic resources have migrated in the course of time. Therefore, questions regarding the species' origin and today's distribution of genetic resources are legitimate.

The CBD relies on the concept of origin. In the CBD states agreed that the "country of origin of genetic resources" is the country, which possesses these genetic resources in in-situ conditions (CBD 1992, Art. 2). Whereas "country providing genetic resources" is the country, which supplies genetic resources collected from in-situ sources. These include populations of both wild and domesticated species, or populations taken from ex-situ sources, which may or may not have originated in that country (CBD 1992, Art. 2). This differentiation addresses the difficulties in determining the actual country of origin of a plant. When it comes to the ABS concept, the determination of origin and source is very essential. Countries of origin should be the recipients of the benefits (CBD 1992, Art. 15). Even if the CBD definition of "country of origin" leaves room for interpretation, its understanding is that only countries of real origin are concerned. This concept is very narrow because many species have left their countries of origin due to evolutionary process a long time ago. In many cases diversity was created and enriched in secondary countries and not in the countries of origin. In terms of the CBD, these secondary countries are only source countries.

The first noteworthy comprehensive attempt to identify the origin of major crops was in the 1900s. After many collection missions, the Russian scientist Vavilov identified centers of plants' origin. In 1926 he published his work "Studies on the Origin of Cultivated Plants", documenting his theories on the origin of crops. The main result of his research was that each crop has a characteristic primary center of diversity, which is also its center of origin. He argued that the degree of diversity was indicative of how long the crop had been grown in that area. Therefore, species vary genetically the most at or near the center of origin. According to his theory, from these centers all major crops were domesticated. Vavilov identified eight areas: China, India, with a related center in Indo-Malaya, Central Asia, the Near East, the Mediterranean, Abyssinia (Ethiopia), southern Mexico and Central America, and South America (Peru, Ecuador, and Bolivia), with two lesser centers - the island of Chiloe off the coast of southern Chile, and an eastern secondary center in Brazil and Paraguay (Hawkes 1997). Vavilov's centers have similarities, since they can be found at 20-45 degrees latitude in mountainous regions with temperate climate (Fowler / Mooney 1990).

Later Vavilov's theory was enlarged and modified. Today scientists agree that there are one or even more centers of origin where a crop is domesticated and that these are usually the primary centers of in-situ diversity for that crop (cf. Figure 1). The continued geneflow between crops and their wild relatives in these areas can contribute to new variability. Center of origin is not a synonym for center of diversity, and these centers are not necessarily the starting point of domestication. Certain varieties of crops have even originated outside of both centers of origin and diversity (FAO 1997, 20).

Figure 1: Regions of diversity for major cultivated plants



Source: FAO 1997, 21

In many cases it is difficult to determine the origin of plant genetic resources and assign them to regions or even countries. However, through technical advances in the field of molecular biology the identification of origin is more and more possible (Hardon / Vosman / van Hintum 1994, 13).

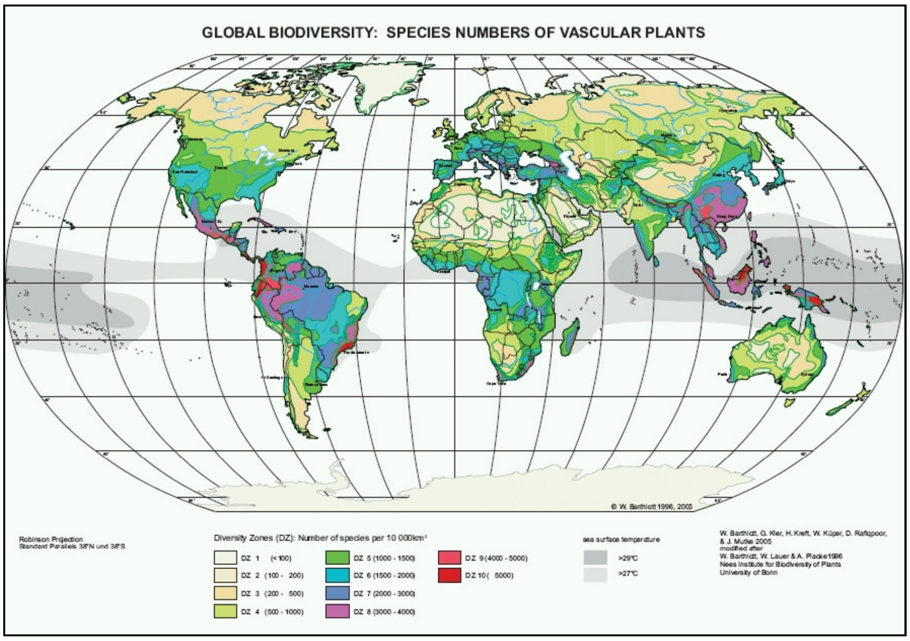
Territorial borders do not bind the existence of plants. In many cases plants exist in three or even more neighboring countries and plants have migrated and distributed through people and animals. For example, the origin of Guava (Psidium guajava L.) is assumed to be an area extending from southern Mexico into or through Central America. Traditionally it is used for diarrhea, gastroenteritis and other digestive complaints. Tamarindus indica, used as refrigerants in fevers and as laxatives, is native to tropical Africa, which consists of more than 40 countries (Morton 1987, 115ff/356ff).

The evolution, which Vavilov has already described for crops, also applies to biodiversity in general. Biodiversity is not evenly distributed in the world. In the context of biodiversity conservation, tropical forests are the areas specific for their rich diversity, whereas drier ecosystems are far more important for crop resources (FAO 1997, 20). As already mentioned, generally species density is greatest in the southern hemisphere. According to UNEP, 70 percent of the world's species is found in just 12 countries: Australia, Brazil, China, Colombia, Costa Rica, Ecuador, India, Indonesia, Madagascar, Mexico, Peru and Democratic Republic of Congo (UNEP 2002).

More than 25,000 plant species can be found in the Hindu Kush-Himalayan belt, which correlates with 10 percent of the world's flora (UNEP 2002, 131). Tropical forest ecosystems are the most species-rich environments. Although they cover less than 10 percent of the world’s surface, they contain 90 percent of the world’s species. Coral reefs and Mediterranean heathland are also highly species-rich. In some countries endemism is high. 98 percent of Madagascar's land mammals, 92 percent of its reptiles, 68 percent of its plants and 41 percent of its breeding bird species are endemic (Harrison / Pearce 2001, 167). The Amazonian flora has the highest tree diversity on earth: in 1000 km^2 of Terra Firme-forest near Manaus (Brazil) 1300 tree species were identified. The world record was discovered in the Peruvian lowland forest near Iquitos with 300 tree species on one hectare (Parolin 2002). These numbers indicate that biodiversity is distributed widely but not equally.

Different concepts have been developed to assess the existence and distribution of biodiversity. Mutke and Barthlott (2005) have developed a world map of the species numbers of vascular plants as an indicator of plant biodiversity (cf. Figure 2).

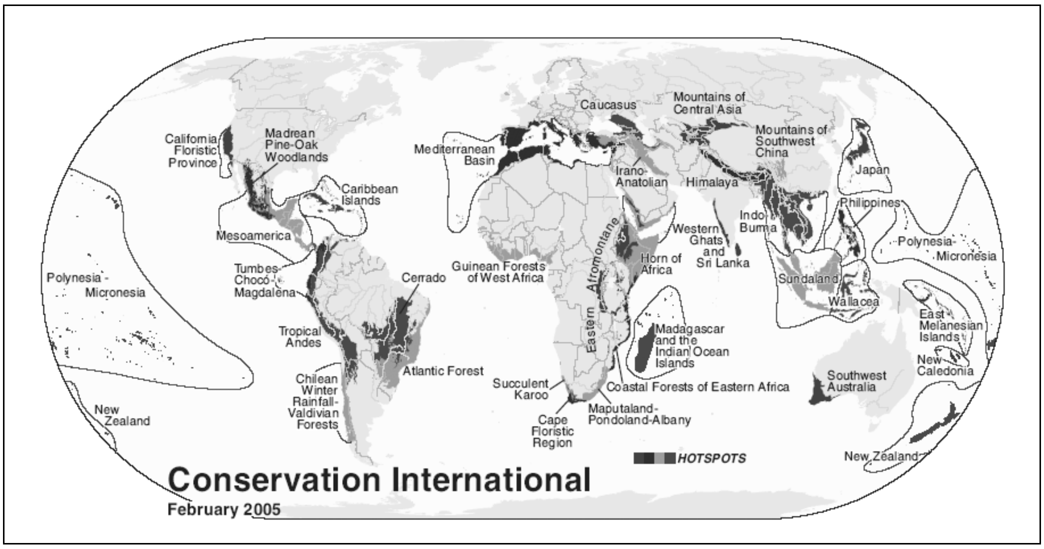
Figure 2: World map of the species numbers of vascular plants



Source: Mutke / Barthlott 2005, 525

The concept of “biodiversity hotspots” is another approach to identify biodiversity-rich areas. Originally, it was developed by Norman Myers in order to identify priority areas for biodiversity conservation. First published in 1988, biodiversity hotspots were characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. Later the concept was revised and the definition redefined. Today a hotspot is defined by at least 1,500 endemic species of vascular plants (> 0.5 percent of the world’s total), and by its loss of at least 70 percent of its original habitat. 25 hotspots were identified (Myers et al. 2000).

Figure 3: Biodiversity hotspots



Source: Conservation International 2005

The hotspot identification concept is evolutionary due to the changes in nature and the advances in science. In 2005, Conservation International published new figures. The number of biodiversity hotspots was extended to 34, showing the on-going loss of biodiversity. The key findings are:

- Over 50 percent of the world’s plant species are endemic to the 34 biodiversity hotspots, the 34 hotspots once covered 15.7 percent of the Earth’s land surface;
- 86 percent of the hotspots’ habitat have already been destroyed; intact remnants of the hotspots now cover only 2.3 percent of the Earth’s land surface;
- Hotspots hold at least 150,000 plant species as endemics, 50 percent of the world’s total;
- The overall number of species occurring in the hotspots is much greater - approaching four-fifths (Mittermeier et al. 2005).

Both concepts depend on the conventional measure to count species and the results are obvious. Most of the world's biodiversity is concentrated in a very small area within the tropics. Different reasons lead to species concentration. Stronger solar energy and higher variety of habitats and micro-climate in the tropics are good examples. Isolation as in the case of islands (e.g., Galapagos, Madagascar) promotes endemism. However, endemism also weakens species and makes them vulnerable to outside interference due to the limited spread and their weak resistance to diseases (Harrison / Pearce 2001, 167).

It has been questioned that the hotspot concept sets the right priority to conserve biodiversity, since species-richness hotspots do not necessary overlap with hotspots of endemic-species richness or of a high number of threatened species. Besides, the concept totally excludes social and economic factors, e.g., the cost of conservation action (Possingham / Wilson 2005, 920).

2.3.2 Decline of biodiversity

In the past, the extinction of certain species and the decline of biodiversity are caused by natural incidents as climate change or tectonic movements leading to continental interchange. Today, most of the world's supply of genetic resources is primarily affected by human activities. IUCN estimates that 99 percent of the threatened species are at risk due to human activities (IUCN 2006b).

What have we lost so far and at what pace have we lost it? To investigate the instrument ABS it is necessary to identify the problem of loss. The concerned genetic resources have to coincide with the resources ABS can affect. ABS focuses on the part of biodiversity that is relevant for the commercial use and research and development. Therefore, it has to be analyzed if these are the resources that are declining.

The decline in biodiversity is enormous. The current rate of species extinction is approximately 1,000 times higher than the natural rate (also called background rate), which has prevailed over Earth's history. Even if globally the net rate of conversion of some ecosystems has begun to slow (one reason is that there is only little habitat left for further conversion), it can be observed that across a range of taxonomic groups, the population size or range of the majority of species is declining (MEA 2005c, 3).

Information on extinction rates and the existence of species is provided by the IUCN 'Red Lists of Threatened Species'. It lists the species that are threatened with extinction. The actual 2006 Red List of Threatened Species indicates that about 16,119 species, of which plants and lichens are 8,394, are threatened with extinction.[4] In the major species groups, the percentage of threatened species ranges between 12 percent (birds) and 52 percent (cycads). Mainly concerned are species in the tropics, especially on mountains and on islands (IUCN 2006b). The described species are very relevant for ABS. All wild plants, especially those in the tropics, are of high interest for research and development.

In addition to species diversity, genetic diversity has declined globally, especially among domesticated species. The decline lowers the resilience and adaptability of domesticated species. Genetic erosion is the consequence of the replacement of local varieties by improved or exotic varieties and species. If old diverse varieties are substituted by newer homogenous varieties and if the total number of cultivated varieties is reduced by the introduction of commercial varieties in traditional farming systems, genetic erosion will occur. For example in Ethiopia, traditional barley and durum wheat varieties are suffering serious genetic erosion due to displacement by introduced varieties (FAO 1997, 33-35). With the “Green Revolution” the intensification of agricultural systems has significantly increased and led to a fundamental shift of intra-species diversity in farmers’ fields. Furthermore, specialization by plant breeders and the harmonizing effects of globalization have also led to a substantial reduction in the genetic diversity of domesticated plants in agricultural systems (MEA 2005c, 5).

Not only the amount of the total loss of biodiversity is alarming. The distribution of species has become more homogenous, meaning that species at very different locations resemble. This is caused by the facts that unique species experience higher extinction rates and extinct earlier and that invasions of alien species disperse at accelerating pace and swamp out other species (MEA 2005c, 4). For the use of genetic resources as input for research and development this development is very dramatic, since the amount and the quality of diversity increases the probability of finding new active substances or breeding material.

What are the drivers of biodiversity loss? Drivers are considered as natural or human-induced factors that directly or indirectly cause a change in an ecosystem. Direct drivers unequivocally influence ecosystem processes and the interrelationship is proofed. Indirect drivers operate more diffusely, by altering one or more direct drivers (MEA 2005b, 175). The identification of the drivers is crucial for the selection of adequate countermeasures. Instruments that increase the economic value of the resource are effective measures to respond to the decline of biodiversity if the drivers of biodiversity loss are reasoned in the

[4] IUCN considers this number as a gross underestimate because the Red List has assessed fewer than three percent of the world’s 1.9 million described species.

economic inferiority of the resource conservation towards other activities, e.g., land-use change due to agricultural production.

According to the Millennium Ecosystem Assessment (2005a), the most important direct negative impacts on biodiversity are habitat destruction, the introduction of alien species, overexploitation, disease, nutrient pollution, and climate change. Habitat change, loss and degradation are seen as the most affecting drivers of biodiversity loss but it is assumed that disease, nutrient pollution and climate change will play a more important role in the future. Furthermore, climate change and invasive species are considered as threats, which initiate irreversible processes (MEA 2005a, 96). These direct drivers heavily influence the state of biodiversity and will even more in future. The relative importance of these drivers differs between ecosystems. Land conversion is most intensive in tropical forests and less intensive in temperate, boreal and Arctic regions. Atmospheric nitrogen deposition is largest in northern temperate areas close to cities. The introduction of exotic species is related to human activity. Areas remote from human intervention generally have fewer introduced species (UNEP 2002, 121).

Habitat change through clearing or degradation (fragmentation) has been the major threat for terrestrial ecosystem and their biodiversity. The problem is the most apparent in areas where humans and species compete for space. We can observe two developments. Firstly, agricultural land is expanding. In the coming 30 years, developing countries will need an extra 120 million ha for crops, which is an overall increase of 12.5 percent. The rate varies from region to region, but Latin America, Sub-Saharan Africa and South and South-East Asia are mostly concerned. However, less new agricultural land will be opened up than in the past (FAO 2002, 3). Secondly, the world’s forests are diminishing. The FAO reports on the state of the forests (FAO 2003) and estimates that 0.38 percent of the world's forests were converted to other land uses (i.e. deforested) every year in the 1990s and that at the same time, large areas were being reverted to forest, thus leaving a net annual loss of 0.22 percent. Fragmentation is a visible consequence of habitat change. In the case of agricultural crops, intensification of agriculture by the utilization of agricultural chemicals, the building of large-scale irrigations, clearing of hedgerows etc., cause habitat destruction (FAO 1997, 36). The fact that human-induced habitat destruction and the intensification of agriculture are the major causes of biodiversity decline shows that the economic incentives for conservation are too low. ABS, which has an impact on the economic value, is a promising instrument.

In recent years, the ***introduction of alien species and diseases*** has increased enormously. Globalization of markets and population growth, visible through increased international trade and travel, supports the introduction of invasive species and pathogens. Alien species are non-native species that are introduced deliberately or unintentionally outside their natural habitats where they become established, proliferate and spread. Existing native population can be negatively effected. The same applies to the introduction of pathogens. Once a disease has attacked a population, a decline will follow that can result to a depopulation and even extinction. Invasive species and pathogens are recognized as one of the greatest biological threats to biodiversity - second only to that of habitat loss (MEA 2005c, 8; Reinhardt et al. 2003). Pimentel et al. (2001) estimated the annual economic and environmental costs caused by introduced pests in crops, pastures, and forests. Economic costs amount to nearly US$ 230 billion and environmental costs amount to US$ 100 billion in the United States (US), United Kingdom (UK), Australia, South Africa, India, and Brazil. ABS is not related to this problem.

Overexploitation of resources or unsustainable harvesting of, for example, wild plants for food, medicine and the ornamental flower trade and timber is another important cause of genetic erosion. Many of these wildlife products and derivates can be found in international markets and are in great demand. The pressure on resources has increased with growing population. Even if the trade in wild plants and animals and their derivatives are poorly documented, the costs are estimated to exceed US$ 160 billion (Traffic 2002). In the case of PGRFA, overexploitation appears as overgrazing (FAO 1997, 36). ABS can be relevant for this problem, since in some cases users of genetic resources, e.g., in the sector botanical medicine, depend on a large and continuous supply of genetic resources. In this case, ABS would reinforce the problem.

Climate change is likely to have considerable impacts on most or all ecosystems. The natural distribution limits for species can be affected due to changes of temperature (global warming), rise of sea levels, changes in precipitation patterns, and increased frequencies of extreme weather events. As a consequence, species may migrate in response to changing conditions, but in many cases natural or human-induced barriers will hinder the movement of species and consequently lead to the extinction of species. For example, most national parks and protected areas are surrounded by urban and agricultural landscapes, which prevent the migration of species beyond their boundaries. Scientists believe that the golden toad is extinct because of climate change (Pounds / Fogden / Campbell 1999, 611-615). Climate change does not affect all species in the same way. Some species are more vulnerable than others because they have different attributes (e.g., reduced mobility, isolated or small populations) and experience different barriers (e.g., restricted habitat requirements). It is assumed that the climate change trend will continue and the impacts on biodiversity will increase. Some scenarios indicate that as many as 30 percent of species will be lost as a consequence of such change (Thomas et al. 2004). ABS is not related to this problem. However, the problem of climate change indicates that there is urgent need for action.

Indirect factors that influence the state of biodiversity are of demographic, economic, sociopolitical, scientific and technological, and cultural and religious nature (MEA 2005b, 175). All these factors are related to ABS.

50 years after World War II, the world's population has grown immensely and multiplied more rapidly than ever before. The ***population growth*** is not evenly distributed in the world. High growth rates can be observed mostly in less developed countries, but also in the United States population growth will continue. Today more than 6.5 billion live on earth, twenty years ago there were only 4.2 billion. Estimations predict that by 2050 more than 9 billion people will live on the planet (Population Reference Bureau 2005). More people need more living space and resources to meet their demands and will increase the pressure on the environment. Increased land use changes are the consequence. More people will make the ABS issue more complex, since resource holders play an important role for the concept.

Economic aspects play a key role for the loss of biodiversity. Besides population also the world economy and per capita incomes have grown. Between 1950 and 2000, the world's Gross Domestic Product (GDP) grew by 3.85 percent per year on average, resulting in an average per capita income growth rate of 2.09 percent (MEA 2005b, 175). Economic growth is not equally distributed over the world and inequities in the distribution of wealth and resources continue. A rise of income implies increased consume and changes in consumption patterns. Economic growth depends on resources as, e.g., land and fossil fuels. Another consequence is an increased production of waste and pollutants. International trade will increase and economies will be more linked and aggravate the problem. The loss of biodiversity is also a problem due to the lack of economic incentives, which ensure the provision of biodiversity, or due to the existence of adverse incentives, which lead to depletion (Myers 1995, 111ff and chapters 4.1.3 and 4.1.4). Economic distractions caused by taxes and subsidies (e.g., to clear forests) may have negative impacts on the environment where they are produced, but also abroad. All these developments have a decisive impact on resources and the environment. ABS and the market for genetic resources is closely linked to other markets and compromised by distortions. ABS needs to ensure compensations that can reimburse the abandonment of other destructive activities.

The importance that is attached to biodiversity in a country also depends on how political leaders consider environmental issues. ***Sociopolitical factors*** have developed positively in many countries in the last decades (UNDP 2005, 19ff). Elected democracies have displaced authoritarian governments, local communities and indigenous people have gained rights and recognition, non-governmental organizations play an increasingly role in the decision-making progress and many environmental issues are discussed in multilateral fora, as for example the CBD (MEA 2005a, 74f). These developments put biodiversity on the agenda of the politics of many governments, but also made societies more familiar with the issue, even if the awareness is still on a very low level. International conflicts often imply the destruction of the natural environments in the area of conflict. In some countries, war and civil strife have contributed significantly to genetic erosion. In Angola and Cambodia they contributed to the loss of many traditional varieties as people moved from one area to another in search of safety. Farmers were unable to preserve their local varieties (FAO 1997, 38). Sociopolitical factors play also an important role for the ABS system and its critical factors. Only where the sociopolitical factors support such a system and it can function.

Besides the sociopolitical conditions, ***cultural and religious aspects*** can influence the perception of biodiversity, mainly positively. Cultural and religious drivers influence peoples' values, beliefs and norms and hence their behavior and consumption patterns. The loss of certain cultural and ethnic attributes in societies can be a negative impact on the status of genetic diversity (FAO 1997, 38)

2.4 The demand: utilization of genetic resources

In this chapter the demand of genetic resources is characterized by the importance of genetic resources for the demand side and by the actors (users) that operate in the market. Besides the providers, users are the most relevant actors in ABS. The scope and size of their demand is exemplarily shown for the pharmaceutical sector relying on natural inputs in order to illustrate, which role genetic resources play for research and development. The market is also shaped by the heterogeneity of users who are the relevant consumers. The main commercial user sectors of biodiversity are illustrated in this subchapter. They are the health care sector with pharmacy, botanical medicine, cosmetics and personal care, the agricultural sector with plant breeding and pest control as well as the sector horticulture and the sector biotechnology. They point up the different areas and possibilities of commercial utilization. These sectors differ regarding many aspects, as for example, market value, market structure, material acquisition, and benefit-sharing practices.

2.4.1 Importance of genetic resources for industry

Biodiversity is a treasured good. At a conference of the International Society of Chemical Ecology in Sweden 1990, it was recognized that *"Natural products constitute a treasury of* *immense value to humankind. The current alarming rate of species extinction is rapidly depleting this treasury, with potentially disastrous consequences"* (MEA 2005c, 273f). However, not all potential users of genetic resources acknowledge the importance of genetic resources. Especially today, users from private sectors stress that their need of genetic resources as input for research and development has significantly decreased.

The user industry of genetic resources can be generally described as research and development intensive industries, with over 10 percent of their gross revenues invested in the development of new approaches (Swanson / Goeschl 2000, 78). The pharmaceutical sector is the biggest and most promising user industry of genetic resources regarding its potential in monetary terms. To introduce all relevant sectors, which use genetic resources as input for research and development, would be beyond the scope of the study. Therefore, a short overview over one selected market, the market for drugs based on natural inputs, is given to show exemplarily the role of genetic resources for the devolvement of commercial products.

In the past ten years, companies de-emphasized natural product drug discovery arguing that the share of drugs that rely on natural inputs is relatively small and decreasing. Industries' interest in natural products drug discovery diminished because other technologies as combinatorial chemistry promised to be successful future solutions (Sittenfeld / Cabrera / Mora 2003). According to Newman et al. (2003), the trend began in the early 1990s and was led by primarily practical reasons. Advances in the drug discovery process (automation, robotics, fast personal computers, high-throughput screening) have required huge numbers of compounds for screening. Natural products drug discovery has not satisfied this demand, since the approach is slow and labor intensive. Besides, combinatorial chemistry libraries are more successful than natural product drug discovery in further developing or optimizing from hits of screens to leads and to approved drugs. But this is not the case for pure discovery and the development of *de novo* combinatorial compounds leading to an approved drug. Here, natural products drug discovery is still the main applied method. Moreover, it has become less difficult to apply through technological advances (e.g., separation technologies, speed and sensitivity of structure elucidation) (Newman / Cragg / Snader 2003).

The statistics prove these developments and the importance of natural products and genetic resources as input and sources for new drugs and lead compounds useful for further drug development. Butler et al. (2004) found out that natural products or related substances accounted for 40 percent in 2000, 24 percent in 2001, and 26 percent in 2002 of the top 35 worldwide prescription drug sales. A further indicator of the importance of certain groups of drugs is the number and economic value of prescriptions. According to Grifo et al. (1997) 84 of a representative 150 prescription drugs in the US fell into the category of natural products and related drugs.

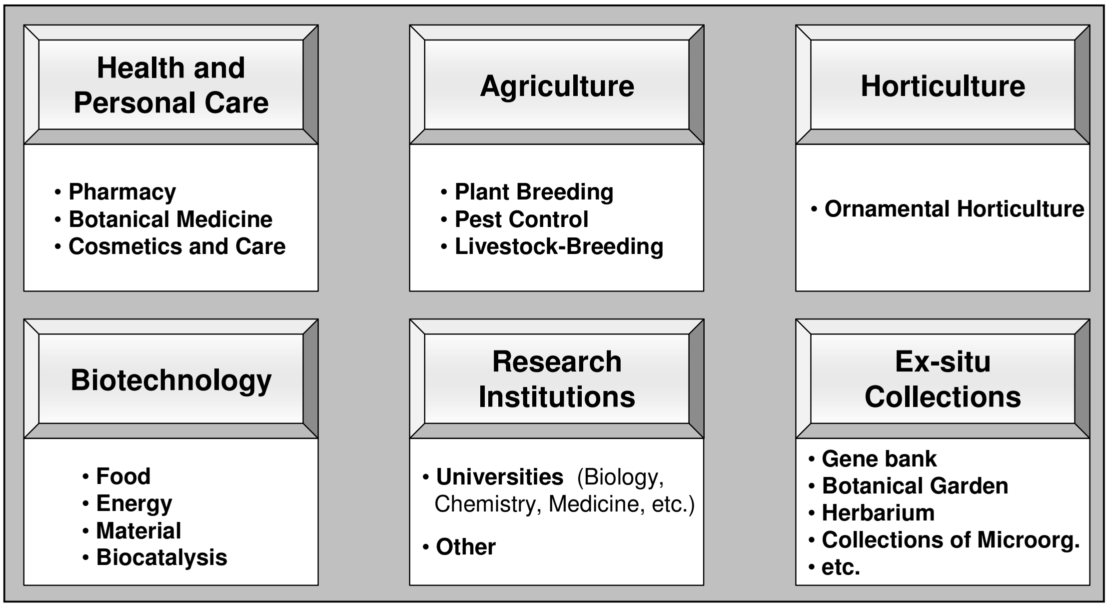
2.4.2 Users of genetic resources

The use of genetic resources for research and development depends on a wide variety of species, but it also involves a wide variety of users and users groups. Related to the utilization of biodiversity and especially ABS, the term “user” or “user country” is widely used. On the country level and compared to “provider countries”, it describes the amount of biodiversity in the country and the occurrence and development of biotechnological, pharmaceutical, and agricultural industry. Due to the unequal distribution of resources and research and development capacities in the world, biodiversity-rich developing countries are classified as provider countries and most of the industrialized countries, which have distinct biotechnology capacity, as user countries. However, the distinction and the generalization cannot be held in all cases. For example, Australia and Brazil are important providers and users of genetic resources (Barber / Johnston / Tobin 2003, 18). In this study, user countries are considered as countries that have high demand for genetic resources and capacity to use them in research, development and for commercialization, disregarding if they also provide biodiversity. On the individual level, it characterizes the agents on the demand side of genetic resources. Users are those agents that import or use genetic resources for commercial or scientific purpose. User countries reflect the competent legal and political authorities under which jurisdiction the user of genetic resources act and operate (Barber / Johnston / Tobin 2003, 18). Even if it is widely used, the term “user” seems to be too broad, since intermediaries or other agents also demand genetic resources. These are recipients of the material, but they are not necessarily the final users. However, in the international debate recipients are classified as users. To speak in the same language the term “user” is synonymously used with the term “recipient” within this study.

2.4.2.1 The user sectors

The health care sector, including pharmacy, botanical medicine, cosmetics and personal care, agriculture with plant breeding and pest control, horticulture and biotechnology, is the most relevant user sectors of plant genetic resources (cf. Figure 4). Research institutions (e.g., universities and research institutes) and ex-situ collections often act as intermediaries and forward genetic resources, derivatives or intermediary products to these sectors. They are more research- than development-orientated and can be assigned to the identified sectors. However, since more and more patents are based on innovations, which occur in universities, in future these users have to be considered as an important user group. The number of US academic patents quadrupled from approximately 800 in 1988 to more than 3,200 in 2003. The increase in patents was highly concentrated in life sciences applications (National Science Board 2006, 5-51). In 2005, the University of California received more than 390 and the Massachusetts Institute of Technology 136 patents for innovations (USOPT 2007).

Figure 4: User sectors



Source: Holm-Mueller / Richerzhagen / Taeuber 2005, 18

2.4.2.1.1 Pharmacy

Pharmaceutical companies invest a higher share of their profits in research and development than other innovative sectors. In general, these expenditures have significantly grown, but the companies are always looking for ways to decrease cost prices. Most pharmacy-related research and development take place in the US, followed by the UK and Switzerland. Estimations assume that the development of a new medicine costs about US$ 500 million and takes on average 15 years until the product reaches the market (ten Kate / A Laird 1999, 47).

The main technologies used for drug development are screening of libraries of synthetic compounds and natural products and rationale drug design through genomics. Both technologies are very elaborate and the probability of success is quite low. In case of screening, out of 5,000 to 10,000 synthetic compounds only one becomes an approved drug. The rate of natural products is only one in 30,000 or 40,000 (Onaga 2001, 264). However, the potential profits are remarkable. In 1997 more than 71 drugs earned more than US$ 500 million and 27 blockbuster drugs earned more than US$ one billion per year. Estimations for the pharmaceutical sector indicate an increasingly significant role of genetic resources for the development of pharmaceuticals. Today, more than half the drugs in the market are natural products or derived from natural products. It has been estimated that the pharmaceutical industry gains about US$ 32 billion in profits a year from products derived from traditional remedies (Harrison / Pearce 2001, 162).

According to a recent survey by Newman et al. (2003), 61 percent of the 877 small-molecule new chemical entities introduced as drugs worldwide during 1981–2002 can be traced to natural products. Natural products amount six percent, natural product derivatives 27 percent, synthetic compounds with natural-product-derived pharmacophores five percent, and synthetic compounds designed on the basis of knowledge gained from a natural product (natural product mimic) 23 percent. In therapeutic categories the share is even much higher. 78 percent of antibacterials and 74 percent of anticancer compounds are natural products or have been derived from or inspired by a natural product. Other important categories are anti-ulster, cholesterol-lowering, hypertension, antidepressant, hematologic, and antihistamine.

The most popular example of a natural-based drug is Taxol (paclitaxel), which was introduced by Bristol-Myers Squibb (BMS) in 1993, in order to treat ovarian cancer. The company earns about US$ 1.6 billion a year from Taxol. Its development is based on the bark of the Pacific yew tree (Firn 2003, 212). Other examples are vinblastine and vincristine from *Catharanthiis roseus*, the rosy periwinkle from Madagascar. In the 1950s, Eli Lilly and Company discovered that a leaf extract from *C. roseus* could affect the progress of leukemia. As a result, the pharmaceutical company introduced anticancer drugs known as vinca alkaloids in the 1960s. Vinblastine is used to treat Hodgkin disease, a cancer of the lymphatic system, and vincristine is used to treat pediatric leukemia, which is cancer of the bone marrow and other blood-cell-producing organs. The annual revenue exceeded US$ 200 million (Wilson 1992, 283).

In 2004 the pharmaceutical market topped US$ 500 billion (Wynberg / A Laird 2005, 7). This is a seven percent increase over 2003 and a 28 percent increase compared to 2001. The industry is concentrated in the US and Europe, followed by Japan. The already large and profitable pharmaceutical industry has been rapidly consolidating over the past few years. The top ten companies (by sale) cover 45 percent of the market (cf. Table 2).

Table 2: The top ten pharmaceutical companies, ranked by sales, 2004

Company	Revenues US$ billion	Market share (percent)	R&D spend US$ billion
Pfizer	50.9	9.25	7.5
GlaxoSmithKline	32.7	5.96	5.2
Sanofi-Aventis	27.1	4.93	3.9
Johnson & Johnson	24.6	4.47	5.2
Merck	23.9	4,35	4.0
Novartis	22.7	4.13	3.5
AstraZeneca	21.6	3.93	3.8
Hoffmann-La Roche	17.7	3.22	5.1
Bristol-Myers Squibb	15.5	2.82	2.5
Wyeth	14.2	2.58	2.5

Source: Diller / Satlas 2005

The greatest rate of growth can be observed in generic and biotechnology companies. However, the consolidation of the market had also some negative impacts on research and development and many companies have lower market shares in 2003 than the sum of their components in 1998 (Wynberg / A Laird 2005, 8).

The acquisition of genetic material in the pharmaceutical sector is mainly carried out via intermediaries. Few companies, mostly larger ones, collect raw material (i.e., wild plants or microorganisms) themselves in the countries of origin. Collections can be random and blind in a determined geographical area, ecology-driven and led by observations, chemotaxonomic based on knowledge on taxa or ethnobotanical using local people's knowledge about plant properties. Many companies own libraries of compounds, extracts and dried plant material. The amount of obtained material depends on the company's size and their research and development strategy. It is assumed that the users of this sector are relatively familiar with the CBD and adopt progressive procedures of ABS (ten Kate / A Laird 1999, 57-77).

2.4.2.1.2 Botanical Medicine

The Botanical Medicine industry is growing worldwide, and especially in Germany. In 1997 the German population accounted for approximately 30 percent of their consumption of non-prescription pharmaceuticals with botanical medicine. Besides Germany, the largest markets can also be found in China, Japan, the US, France, Italy, the UK, and Spain (ten Kate / A Laird 1999, 79).

In botanical medicines mainly whole plant-material is used. Prominent examples are *Ginko*, *enchinacae*, and Saint John's wort. The botanical medicine industry imports mainly the whole body of the plant. The botanical market in the US is estimated at approximately US$1.6 billion per year. It is estimated that Europe, annually, imports about 400,000 tons of medicinal plants with an average market value of US$ 1 billion from Africa and Asia. After Hong Kong, Japan and the USA, Germany ranks forth in the list of international importers. However, most of the used material is native to the region where it is sold. According to estimations, the global trade in medical plants is US$ 800 million per year (Horaeau / Da Silva 1999).

The plant material is collected from the wild or cultivation. Since the market is growing by more than ten percent per year, wild collections can have a negative impact on the environment and biodiversity. Products are sold as dried and fresh raw material, tinctures, extracts, and phytomedicines. China is so far the largest exporter of plant material, followed by India. The acquisition of the material is done through supply companies (i.e., cultivators, wholesalers, processing companies). On the way to the consumer it passes many hands as manufacturing companies and consumer sales. Traditional knowledge is widely used for the identification of promising material, whereas intensive research in the field of botanical medicine is limited due to the multi-compound characteristics of botanical medicine. The applications for patents seem to be unrealistic in these cases. Two-thirds of the 50,000 medicinal plants used worldwide come from the wild (wildcrafting) and provide the majority of plant material used in this sector. But now the trend is towards cultivated material, since continuation and quality are important criteria of supply (Schippman / Leaman / Cunningham 2002, 4f). ABS is not very common in this sector. Monetary benefit-sharing is mainly practiced by payments per weight unit of raw material, and only in few cases by advance payments and royalties (ten Kate / A Laird 1999, 78-116).

Devil's claw is a good example. In 1972 it was discovered that its extract derived from the roots has anti-inflammatory properties. From then on, the product boomed. In 1999 in Germany the sales amounted to €8 million, rising 113 percent the next year and again 59 percent to €27 million by 2001. All sales are based on collections from the wild, but it has become clear that these collections cannot maintain the supply in the long-term. The global market currently uses between 600 and 700 metric tons of raw materials each year, and the plant needs to grow for four years or more before ready for harvesting. Company-based cultivation projects were initiated to substitute wild collection and to teach collectors how to harvest the rhizome in a sustainable manner in order to preserve the populations. As a side effect it was discovered that the cultivated material is of a better quality to the wild plant in terms of purity, identity and active constituent content (Nutraingredients 2004). The amount of trade supposes that revenues are quite large in this sector. According to estimations, in

Germany the annual revenue of phytopharmaceuticals amounts to about € 900 million (BPI 2005, 37).

2.4.2.1.3 Cosmetics and personal care

With an eight to 25 percent growth rate per year the natural cosmetics and personal care industry grows disproportionately high within the whole cosmetics and personal care sector (three to ten percent). The natural segment anticipated up to ten percent of the whole sector. The industry uses wild or cultivated plant genetic material in a wide range of products, as for example, baby and skin care, cosmetics and hair products. The European and the US market for personal care was estimated to be worth US$ 86 billion in 2004 (Datamonitor 2006).

As in the sector botanical medicine active agents can be grouped into supply companies, manufacturers and marketers. Companies only seldom undertake their own collecting activities. Similarities between these two sectors are due to the identical raw material input, which are dried plants and oils from a wide variety of species. The users of this sector show a rather small demand for new genetic resources. One reason can be found in the large variety of plants already used, another one in the highly cost-intensive and time-consuming introduction of new ingredients. Yet, companies of this sector also include the use of new genetic material in their research and development strategy. If ABS agreements are concluded, providers will usually be compensated by prices per kilogram or samples (ten Kate / A Laird 1999, 276-292; Holm-Mueller / Richerzhagen / Taeuber 2005, 20).

2.4.2.1.4 Agriculture: seed industry

The seed industry has experienced structural changes in the last 30 years. Mergers and acquisition have created a new structure dominated by large companies. Already in the mid-1970s when the seed market was growing, many multinational companies, which earlier focused on pharmaceuticals and chemicals, entered the seed market. With the development of genetic engineering in the 1980s, many companies developed to “life science groups” using the strong potential for complementarity between crop protection and seeds. One prominent example of this complementarity is the product *Roundup Ready* from Monsanto[5] (UNCTAD 2006, 7).

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[5] Roundup Ready corn is designed to be tolerant to the Monsanto broad-spectrum herbicide Roundup. It allows farmers to drench both their crops and crop land with the herbicide so as to be able to kill nearby weeds without killing the crops. The company can use economies of scope by using this specific trait for many crops (e.g., soybeans, canola, and cotton) and offer a bundled package of products tied to each other.

The global commercial seed market is estimated to vary between US$ 21 and US$ 25.2 billion. As in the pharmaceutical industry, the domination of few companies with concentration strategies in the market can be observed (cf. Table 3). Ten companies control 49 percent of the market and four companies control about 30 percent (UNCTAD 2006, 8; ETC 2005, 2).

Table 3: The top four seed companies, ranked by sales and market share, 2004

Company	Seed sales (million US$)	Market share (in percent)
DuPont/Pioneer	2,624	10
Monsanto	2,277	9
Syngenta	1,239	5
Limagrain	1,239	5
Others	17,821	71
World	25,200	100

Source: UNCTAD 2006, 9

It is difficult to separate the sectors seeds and pest control because the same companies dominate the market. However, in addition to the large companies many small seed companies (about 1,500) also exist in the market, 600 of which are based in the US and 400 in Europe. In many countries the government still controls the provision and distribution of seeds. The public sector covers about 20 percent of the global seed market (James 1996, 18). Besides, international research organizations as the Consultative Group on International Agricultural Research (CGIAR) support agricultural research for food security.

The main actors in this sector are breeders of agricultural crops. Although most material used for breeding was taken from the wild, today most material is obtained from seed banks held by corporations, universities, botanical gardens, and regional, national, or international gene banks. Therefore, intermediaries are important actors in this sector. However, wild species are also essential for this sector. The existence of a wide gene pool is important for the breeding to adapt to future challenges of a changing environment. If certain wild plants had been extinct in the past, it would have been not possible to domesticate rice and wheat (Devlin / Grafton 1999, 95). The development of a wheat variety can involve thousands of plant breeding crosses and many different individual lines from many countries and over many centuries (MEA 2005c, 281). Other actors in the market are operating in the seed production, seed condition, and seed marketing and distribution.

The development of new varieties takes about eight to 15 years and costs in the range of US$ 1.0 to 2.5 million for a traditionally bred variety, and US$ 35 to 75 million for a transgene.

Wynberg and Laird (2005) assume that in this sector the CBD and ABS play an important role. Benefit-sharing by private companies is generally arranged through payments of license fees for the use of germplasm. Monetary benefit-sharing is not common among public institutions. They generally arrange the access to genetic resources on a mutual basis and often promote capacity building through the transfer of knowledge and technology to the countries of origin (ten Kate / A Laird 1999, 131-157).

Since the entry into force of the ITPGRFA, benefit-sharing arrangements are covered by this multilateral agreement. Bilateral contracts will only play a role when the crops used for plant breeding are not included in the treaty (cf. chapter 3.1.2).

2.4.2.1.5 Agriculture: crop protection

After long-time stagnation, the market for agrochemicals (i.e., herbicides, insecticides, fungicides and other agrochemicals) has been growing since 2002. The recent market value is estimated at US$ 32 million (UNCTAD 2006, 3). The concentration in this market is obvious. In 2004 six companies accounted for about 77 percent of the market, and three of them accounted for about 50 percent.

Table 4: The top six agrochemical companies, ranked by sales and market share, 2004

Company	Agrochem sales (million US$)	Market share (percent)
Bayer	6,155	19
Syngenta	6,030	18
BASF	4,165	13
Dow	3,368	10
Monsanto	3,180	10
DuPont	2,249	7
Others	7,519	23
World	**32,665**	**100**

Source: UNCTAD 2006, 3

Major concentrations of agrochemical industry are in North America, Europe and Japan. Production is left to the small group of companies, but other small companies, government agencies, universities and research institutions are involved in the research. In 1997 herbicides accounted for 48 percent of the market, insecticides for 27 percent and fungicides 20 percent (ten Kate / A Laird 1999, 189).

Costs to discover a new commercial chemical pesticide may be between US$ 40 and US$ 100 million and it takes up to 14 years to develop it. Out of 100,000 tested chemicals about two will result in a product. It is estimated that crop protection products, which are derived from genetic resources, comprise about 10 percent of annual global sales (ten Kate / A Laird 1999, 194-195).

It is most likely that the demand for access to genetic resources in the sector agrochemicals will increase in the future. All companies and institutions that work in this sector depend on the access to new genetic resources. The users obtain material by their own collecting activities in the countries of origin and via intermediaries but also by ex-situ collections. Many companies maintain libraries of genetic material. A genetic resource is often needed for a single screening, thus the extraction takes place only once. However, some methods of pest control require a regular large supply of genetic material because it constitutes a direct component of the product. Public institutions, universities, and research institutions ensure the traditional mutual exchange of genetic material, implementing research in co-operation with the countries of origin. Private companies mainly practice monetary benefit-sharing in form of single access fees or up-front payments (ten Kate / A Laird 1999, 210-227).

As agrochemicals, biological control aims at crop protection but relies much more on biodiversity and is seen as an alternative to chemicals because it uses predators, parasites or pathogens or their products to protect crops. No data is available to estimate the share of biological control in the crop protection sector. Pimentel (1992) suggests using the cost of pesticide use for food production (e.g., health costs, veterinary costs, surface and groundwater contamination, and pollinator losses) in the US as reference. They were estimated to amount US$ 8 billion per year, which could be avoided by substituting agrochemicals with biological control agents (MEA 2005d, 279).

Crop protection is also performed in the sector of horticulture and thus could be assigned to this sector. Since its application in the field of agriculture takes place at a significantly higher level and in order to simplify matters, here crop protection is assigned to the agricultural sector.

2.4.2.1.6 Horticulture

Horticulture is a very broad field and includes intensive, large-scale and commercial production of vegetables but also gardening as a hobby. In this study only the part of horticulture is considered that uses genetic resources to develop new horticultural products. However, it is difficult to define its scope with regard to agriculture and the accuracy of available data is questionable. The horticultural market for vegetables is greater than the market for ornamental horticultural products. Annual sales of horticultural seeds, including flower and vegetable seed, amount to US$ 1.80 billion (A Laird / ten Kate 2002, 256). The issues regarding the access to genetic resources for vegetables are very similar to the issues discussed for agricultural seeds. In the case of ornamental horticultural (i.e., potted plants, bedding plants, cut flowers) things are slightly different and hence shortly illustrated here.

The major producing countries are the Netherlands, Japan and the US. Market concentration is also an important attribute of this sector. Ten multinational seed companies (e.g., Norvatis/Switzerland, PanAmerican/USA, Sakata/Japan, Goldsmiths Seeds/USA) account for 90 percent of the global sales of seed of ornamental varieties. The costs and the time to develop a new ornamental variety from scratch can range from almost nothing to US$ 5 million (average US$ 2 to 4 million) and from one or two years for up to ten years (ten Kate / A Laird 1999, 165).

Regarding the use of genetic resources, the sector of horticulture is divided into two groups. One group mainly uses breeding material that is already being used commercially. The use of wild plants as source of new genetic material is of rather minor interest for these breeders. The second group consists of those breeders who depend on the access to new genetic resources. Their sources include botanical gardens, national collections, or commercial providers. It is difficult to access the size of each group.

So far, this sector is characterized by ignorance of the CBD (Wynberg / A Laird 2005, 26). Benefit-sharing is relatively uncommon. Traditionally, plant material was exchanged free of charge between breeders. The mutual guarantee of access to plant material still constitutes an essential form of non-monetary benefit-sharing. There remain some cases where so-called royalty fees are paid for benefit-sharing (ten Kate / A Laird 1999, 172-187).

2.4.2.1.7 Biotechnology

Biotechnology is understood as the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services (OECD 2005, 9). The sector of biotechnology includes, e.g., activities in the fields of health and agriculture but also in energy, material, bio catalysis, functional food (novel food), and diagnostics. Its most important genetic resource inputs are microorganisms. In 2004 the revenues of the biotechnology industry amounted to US$ 54.6 billion. The US dominates the sector with 78 percent of global public company revenues. Biotechnology products had a 17 percent increase in market share. Here the consolidation is also obvious. 80 percent of the biotechnology market is held by ten companies (Wynberg / A Laird 2005, 8/13). Since the sector is diversified, it is not possible to assess time and cost of a new product. In the case of a novel enzyme product, it may take from two to five years and cost between US$ two and 20 million until it is sold on the market (ten Kate / A Laird 1999, 239).

The sector biotechnology also comprises both users who collect their genetic material themselves in the respective countries of origin and companies and research institutions that obtain their genetic resources mainly from intermediaries, as for example collections (Wynberg / A Laird 2005, 16).

In the sector of biotechnology various monetary and non-monetary benefits are provided in exchange for rights to use genetic resources. These measures can be described as benefit-sharing, even though the users rather consider them as expenditures for important input factors (ten Kate / A Laird 1999, 242-261).

2.4.2.1.8 Other minor sectors

Biomimetics describe biologically inspired technologies developed by industry. Prominent examples are shells of various mollusks, which have inspired the ceramic industry, or the lotus leave, which repels water droplets and particles of dirt. Biomonitoring is an industry that is needed to track down sources of pollution. This would require a vast amount of instrumentation, but monitoring of the status of the environment can also be conducted by using organism that sample the environment. Freshwater can be monitored by, e.g., fishes and mussels, soil by earthworms and air by bees (MEA 2005d, 279-281). These two sectors are examples for minor relevant sectors compared to the others and it is difficult to assess annual sales and market potential. But these emerging markets are growing and may play a more important role in future.

2.4.3 Experiences, awareness and participation of users

In 1999 ten Kate and Laird (1999) analyzed basic trends and differences within European user sectors. An important result of the study is that the majority of users among all sectors is insufficiently informed about the CBD and its associated legal framework regarding the use of genetic resources. Positive attitudes towards the CBD are most common among those companies, which are already participating in the political process. Among other things, the following expectations from the CBD are being expressed: the improvement of legal security for issues of access and use of genetic resources, and more clearness in questions of property rights to genetic resources. According to some users' point of view, the CBD can assist in developing guidelines for best practice in the use of genetic resources, thereby tackling image problems of the user sector (ten Kate / A Laird 1999, 296). The users' experiences with the impact of the CBD have led to a more critical attitude towards the CBD. The problems and disadvantages users mention are the insufficient level of information, inconsistent implementation of access regulations by the different countries of origin, excessive bureaucratic expenses, unrealistic expectations on part of the countries of origin regarding the sharing of benefits, negative incentives for research and development and in general the disadvantage of high transaction costs due to complicated regulations (ten Kate / A Laird 1999, 296-300).

As to the CBD regulations on benefit-sharing, the users tend to hold the opinion that the actual value of a genetic resource arises only from the users' capital expenditure in the context of research and development. Therefore, users are inclined to offer transfer of knowledge and technology in exchange for access rights, rather than consider themselves capable of and willing to practice monetary benefit-sharing. Besides, the industry always argues that they have alternative approaches to product discovery other than using genetic resources and that the demand for access will decrease in the future (ten Kate / A Laird 1999, 6-7).

Until recently, the comprehensive study on the EU undertaken by ten Kate and Laird was the only work that attempted to identify the structure of the user sector, users' awareness and their perceptions. This information is essential for undertaking any user-orientated measures and formulating any policies with regard to genetic resources. Now, some user countries' governments (e.g., Germany in 2004, UK in 2004, and Belgium in 2006)[6] have initiated studies in order to assess the user structure in their countries, the users' attitude, as well as the level of awareness and participation. The survey on users of genetic resources in Germany was the first that was published in this series and its major findings are illustrated here. Its results confirm many of the results formulated by ten Kate and Laird in 1999, but they also brought some new insights on users of genetic resources.

In Germany the majority of users receives their material from trade partners rather than collect or reproduce it themselves. The same applies to the UK (Latorre 2005, 6). Providers from the countries of origin and from other countries constitute the most important supply sources for all sectors. Above all users at universities and other research institutions, as well as ex-situ collections and users from the field of biotechnology carry out „own collecting“ activities.

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[6] The UK study is published as Latorre 2005, Review of the Experience of Implementation by UK Stakeholders of Access and Benefit-sharing Arrangements under the Convention on Biological Diversity, Department for the Environment (Defra), the German study is published as Holm-Mueller, Richerzhagen, Taeuber 2005, Users of Genetic Resources in Germany, Awareness, Participation and Positions regarding the Convention on Biological Diversity, BfN-Skripten 126, Bonn, and a summary of the major findings is published as Richerzhagen, Holm-Müller, Täuber (2006): Users of genetic resources in Germany – Awareness, Participation and Positions regarding the Convention on Biological Diversity, in: Ute Feit et al. (2006), Access and Benefit-Sharing of Genetic Resources, 19-29.

Most users directly approach providers in the countries of origin, establish co-operation in the countries of origin and/or contact ex-situ collections. Only a few users obtain prior informed consent from authorities in the country of origin before using genetic resources or concluding material transfer agreements with the countries of origin.

The main reason for German researchers and companies not to work with genetic resources is the difficulty to find an appropriate responsible contact person for the arrangement of access modalities in the country of origin and the image problem arising from the use of genetic material.[7] The problem of excessive costs resulting from benefit-sharing is not identified as a major problem. This seems rather unexpected, since especially commercial users often complain about disproportionate expectations of monetary benefit-sharing.

The most relevant result of the study is that many German users do not know the CBD and the obligations arising from the agreement. They consider themselves to be insufficiently informed about the international regulations on ABS. Users are apparently aware of the lack of information. The study cannot confirm the assumption that larger companies and institutions tend to be better informed as stated by ten Kate and Laird. Groups of users that have a similar size and structure do not automatically have the same level of information. In all sectors the majority of users is not informed about the CBD. Ex- situ collections are most familiar with the CBD, followed by universities and other research institutions. The awareness of survey participants from the private sector turns out to be considerably lower than the awareness of users from the public sector. Regarding the question whether the users consider their interests to be represented in the international CBD negotiations, the statements differ and do not give a clear picture. The most important sources of information about the CBD include, in descending order, the internet, associations and scientific journals. Firsthand information from German authorities (e.g., National Focal Point, delegation members) can only be consulted by few users.

In the UK, the picture is slightly different. The level of awareness of the CBD and ABS provisions is higher, even if the majority of users appears to lack detailed understanding. Large organizations seemed generally more knowledgeable and experienced on ABS. However, they also rely mainly on intermediaries to obtain material (Latorre 2005, 6).

More than 50 percent of the interviewed users believe that it has become more difficult for German users to gain access to genetic resources, since the CBD entered into force. The same is experienced in UK (Latorre 2005, 5). However, the majority of the users reports an

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[7] In the past, incidents where genetic resources were illegally obtained have led to a negative impact on the image of using such material, as well as on the image of the users themselves.

approximately constant use of genetic resources. In future, the importance of genetic resources for users will increase. This result is surprising, since many private sector users stress the decreasing importance of "wild" plant genetic material for research and development.

2.5 Conservation concepts

How can we bridge the gap between the immense decline of biodiversity and the increasing demand and importance, and which role plays ABS among other conservation concepts?

At the World Summit in Johannesburg in 2002 the international community realized that the on-going loss of biodiversity has not been halted and put biodiversity protection and the 2010 target on the priority list. This target formulated by the CBD's Conference of the Parties in 2002 is now an essential component of the Convention's implementation, and it implies that the Parties aim to achieve a significant reduction of the current rate of biodiversity loss at global, regional and national level by 2010 (CBD 1998, Decision VI/26). A series of global and outcome-orientated targets are adopted in order to facilitate the monitoring of the progress towards 2010. They cover the focal areas: understanding and documenting plant diversity, conserving plant diversity, using plant diversity sustainably, promoting education and awareness about plant diversity, building capacity for the conservation of plant diversity. The targets are very ambitious. They include, for example, conservation of 10 percent of each of the world's ecological regions, 50 percent of the most important areas for plant diversity, 60 percent of the world's threatened species conserved in-situ, and 70 percent of the genetic diversity of crops and other major socio-economically valuable plant species and associated indigenous and local knowledge maintained. 30 percent of plant-based products should be derived from sources that are sustainably managed, no species of wild flora should be endangered by international trade, and the importance of plant diversity and the need for its conservation should be incorporated into communication, educational and public-awareness programs (CBD 2004, Decision VII/30).

Different conservation concepts exist and are applied to stop the on-going loss. ABS is only one of them. The main conservation concepts can be categorized in two groups: in-situ and ex-situ conservation. In-situ conservation is "the conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties", whereas ex-situ conservation means "the conservation of components of biological diversity outside their natural habitats" (CBD

1992, Art. 2). Ex-situ approaches are seen as complementary approaches to in-situ approaches rather than as rivals because it is recognized that both methods address different aspects of genetic resources. None alone is sufficient and adequate to conserve the total range of genetic resources that exist. In-situ conservation is essential for several reasons. Not all elements of crops, e.g., wild and weedy relatives of crops, as well as perennials and species with recalcitrant seeds, can be contained in ex-situ facilities. Ex-situ institutions can store certain genetic material of a plant and maintain the material in the state in which it was collected but not the surrounding ecosystem, which influences the generation of it. In-situ conservation can support the maintenance of a changing system, which also allows the loss of certain species (Brush 2000, 7f).

In order to understand the role of ABS among other conservation concepts, the different approaches and possibilities are categorized in this subchapter. Especially the characteristics of in-situ conservation compared to these of ex-situ is of high importance for the later analysis of ABS, since ex-situ collections appear as competition for provider countries.

2.5.1 In-situ conservation

Protected areas are the strongest instrument for the in-situ protection of biodiversity. These areas are like a genetic reserve, in which genetic diversity of natural wild populations is conserved within defined areas. Since the late 19th century the establishment of protected areas has been the leading response to these threats. The increased technical capacity to design protected areas as well as the insight that protected areas have the potential to effectively contribute to the protection of forests have led to the consolidation and expansion of the network of protected areas (Adams et al. 2004, 1146). The 2003 United Nations List of Protected Areas lists[8] 102,102 protected areas, which cover 18.8 million km^2. This figure is equivalent to 12.65 percent of the Earth's land surface. In 1962, protected areas only amounted to 9,214 sites and 2.4 million km^2. In 1992 there were 48,388 sites and 12.3 million km protected. 4,116 protected areas of these areas contain marine and coastal elements, covering 4.3 million km^2. The largest marine protected area is the Great Barrier Reef Marine Park in Australia (345,400km^2) (Chape et al. 2003, 21/26/27).

The CBD sees the establishment and the effective management of a global series of protected areas as a key instrument to protect biodiversity. The CBD defines a protected

[8] The UN List is prepared jointly by the IUCN World Commission on Protected Areas (IUCN-WCPA) and UNEP-World Conservation Monitoring Center (WCMC).

area as: "*a geographically defined area which is designated or regulated and managed to achieve specific conservation objectives*." IUCN has formulated a broader definition in order to include cultural aspects. It views protected areas as "*areas of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means."* (IUCN 1994, 7).

Protected areas play a key role for reaching the CBD's objectives. The seventh Conference of the Parties (COP) of the CBD ended with a major advance on protected areas when it adopted a programme of work on protected areas. The overall purpose of the programme of work on protected areas is to support the establishment by 2010 for terrestrial and by 2012 for marine areas of an effective global network of protected areas. The programme of work on protected areas recognizes that the least-developed countries and those with economies in transition need help to strengthen their own skills to implement the adopted objectives and measures (CBD 2004, Decision VII/28).

Protected areas serve the purpose to support in-situ conservation, but also to provide the sources for bioprospecting (A Laird / Lisinge 2002, 127). In some countries, as for example Costa Rica, bioprospecting material is only collected in protected areas and with the growing implementation of the ABS concept, the demand for samples from protected areas will grow in future. In the past, protected areas have yielded valuable inputs for research and development. In 1969, US scientists reported a new species of bacteria, which they named *Thermus aquaticus*. This thermophilic organism was isolated from hot springs in Yellowstone National Park and contributed to the significant developments in biotechnology. The bacterium is the source of the enzyme Taq DNA (Deoxyribonucleic acid) Polymerase, which is one of the most important enzymes in molecular biology and widely applied for industrial and scientific research. Yellowstone's thermophilic bacteria attract many researchers and many research projects are undertaken in the National Park. In 2001, 49 microbiology research projects were undertaken in Yellowstone (YCR 2002). Another example is cyclosporine, which is derived from a soil sample taken from Hardangervidda National Park in Norway in 1969. As an immunosuppressive agent it is used to reduce the body's natural immunity in patients who receive organ transplants. It was the 33rd top-selling drug worldwide in 2000, with sales of US$ 1.2 billion (Mulongoy / Chape 2004, 45*).*

In-situ conservation can be directly or indirectly financed and promoted. Since it became clear that developing countries, which have the most diverse biological resources, do not have sufficient resources to maintain them, industrialized countries have assumed some responsibility and contributed to conservation activities in these countries to alter the behavior. While in industrialized countries conservation initiatives emphasize more direct investments (e.g., performance payments, tax relief, land purchases and easements), conservation in developing countries has emphasized more indirect approaches as integrated conservation, development projects and community-based natural resource management. These projects aim to encourage rural communities to maintain biodiversity but using it sustainably. They seem to achieve both conservation and development objectives. Although many of such conservation projects have been conducted, biodiversity is still declining (Ferraro / Kiss 2002, 1718f). The indirect approach has been criticized, since in most developing countries the political, social and economic conditions to establish indirect incentives are not given. Therefore, it has been suggested to switch from indirect to more direct investment forms and pay people directly for conserving biodiversity because they have less institutional demands, stimulate local markets and are more cost-efficient (Ferraro / Simpson 2001, 17f).

Bioprospecting is characterized as a more indirect investment like eco-tourism, sport hunting and wild coffee production because markets are supportively established to commercialize biodiversity goods and it is hoped that the commercialization sets incentives for conservation. Biodiversity conservation is only a by-product (cf. chapter 4.2).

Payments of environmental services such as carbon sequestration, biodiversity conservation, watershed protection and landscape values, is another indirect approach. Here, private land users are compensated for the environmental services they contribute to. By selling the services provided by, e.g., carbon sequestration by forests, funds are generated to increase the private benefits of forest conservation to individual land users and change their incentives or to generate resources that can be used by the government or public (Landell-Mills / Porras 2002, 193; Pagiola / Bishop / Landell-Mills 2002, 4). Especially for biodiversity, the concept is promising. Much of the world's biodiversity is not represented in protected areas, but in surrounding and neighboring areas. Therefore, it is necessary to find solutions for biodiversity outside of the protection zones. Costa Rica is not only a prominent example for pioneering efforts regarding ABS but also for payments for environmental services.

Dept-for-nature swaps are a financial instrument, which may be used for funding either direct or indirect approaches (Ferraro / Simpson 2001, 20). It is an instrument to channel financial support from industrialized countries or NGOs to developing, poor but biodiversity-rich countries. These initiatives reduce debt obligations and generate funds for the environment. They typically involve restructuring, reducing, or buying a portion of a developing country's outstanding debt, with a percentage of proceeds being used to support conservation programs within the debtor country (Sheikh 2004, 1). Recent examples are dept-for-nature swaps that aim at the protection of forest areas. They have been pursued by the US with El Salvador (US$ 14 million), Belize (US$ 9 million), and Thailand (US$ 9.5 million) (Grafton et al. 2004, 445).

On-farm conservation, being understood as the sustainable management of the genetic diversity of locally developed traditional crop varieties along with associated wild and weedy species or forms within traditional agricultural, horticultural or agri-silvicultural cultivation system, is a direct approach (Dhillon et al. 2004, 558). On farm-conservation can be realized automatically when farmers maintain genetic resources in form of local, diverse crop varieties (landraces) in their natural environment by their daily farming practices. If farmers choose to cultivate modern, broadly adapted, or higher yielding varieties instead, on-farm conservation has to be financially supported by specific projects and programs. National governments, international programs, and private organizations directly finance these programs and projects. These measures are an attempt to encourage farmers to continue to select and manage local crop populations (Brush 2000, 4). However, also indirect approaches have been established, e.g., the development of markets for niche products. One example of a successful green marketing program for promoting in-situ conservation has been established in the US to maintain and utilize ancestral maize by Cherokee farmers in North Carolina. Another market approach would be the sale of landraces' genetic resources under ABS agreements.

However, from an conservationist's point of view direct payments for conservation might be the most effective instrument in the short-term but in the long-term others factors are also relevant. Direct payments will depend on ongoing financial commitments. They might also just shift the pressure from one site to another that was not previously being exploited. Another aspect are property rights. In developing countries land tenure is often ambiguous. For funding agencies these conditions are quite unattractive because they want to know how their investment is used (Nicholls 2004).

2.5.2 Ex-situ conservation

Biological resource centers (BRCs) are the heart of ex-situ conservation but also for the use of genetic resources for research and development. They contain collections of culturable organisms (e.g., microorganisms, plant, animal, and human cells), replicable parts of these (e.g., genomes, plasmids, viruses, cDNAs), viable but not yet culturable organisms, cells and tissues, as well as databases containing molecular, physiological and structural information relevant to these collections and related bioinformatics." BRCs can be microbial culture collections, viral repositories, herbaria, botanical gardens, zoos and ex-situ plant and animal genetic resource collections (OECD 2001b, 11/14). However, with a view to the analysis of the ABS concept ex-situ plant collections, botanical gardens and microbial collections are of highest importance, as will be illustrated in the following.

In the past, the ex-situ conservation of plant genetic resources was the main instrument for conservation. Material was mostly stored in botanical gardens and seed banks. In the early 1960s, the FAO strongly promoted ex-situ conservation of crop genetic resources and in the 1970s and 1980s germplasm collecting was intensively executed. It is estimated that today the existing global ex-situ collections contain approximately six million accessions of plant genetic resources for food and agriculture. About 600,000 of these accessions are maintained within the CGIAR system, while the remainders are stored in regional or national gene banks (SCBD 2001, 205). CGIAR is a group of countries, international and regional organizations, and private foundations supporting 15 international agricultural centers (e.g., the International Plant Genetic Resources Institute and the International Rice Research Institute).

Ex-situ collections are not equally distributed in the world. Twelve countries hold more than 45 percent of the germplasm accessions held in national collections. Most genebanks are in Europe and Asia. Ex-situ collections can be seed gene banks, in vitro collections and field gene banks. The storage of seeds is the most common and most cost-effective way of plant conservation for orthodox seeds. Seed storage accounts for about 90 percent of total accessions held ex-situ (Dhillon et al. 2004, 557). Over 40 percent of all accessions in genebanks are cereals, whereas minor crops, e.g., yams, are poorly represented (FAO 1997, 90f).

The ex-situ collections differ regarding the type of material they preserve. Botanical gardens conserve living plant material, seed banks preserve seeds and microbial collections store microorganisms. There are more than 2000 botanical gardens in 153 countries with more than 6 million accessions (BGCI 2001, 5/28). Many of them also maintain germplasm collections for the conservation of ornamental species, indigenous crop relatives and medicinal and forest species and some of them conserve germplasm of cultivated species, including landraces and wild food plants, and other non-cultivated species for local use. Such species frequently lack in other ex-situ germplasm collections and therefore, botanical gardens play an important complementary role in ex-situ collection systems (SCBD 2001, 206). Due to their task to conserve a broad spectrum and conserve as many species as possible, botanical gardens conserve considerable amounts of inter-species diversity, but only little intra-species genetic diversity (FAO 1997, 84).

The majority of botanic gardens is in developed countries in Europe and North America. According to estimations, 90 percent of all living plant collections in botanical gardens was collected and stored prior CBD. Therefore, the ABS regulations do not apply to these collections (BGCI 2001, 5f).

Most developed countries and a few developing countries maintain national collections of microorganisms as an essential resource for science and industry. There are 483 culture collections in 65 countries registered in the World Data Centre for Microorganisms (WDCM). Together these collections maintain over 1.1 million microbial cultures including around 11,000 species or sub-species of bacteria (445,000 cultures), 20,000 species or sub-species of fungi (375,000 cultures), 10,000 virus collections, 10,000 cell lines and 277,000 other microbes. Microbial collections handle thousands of transactions per year. For example, the Agricultural Research Service (ARS) Culture Collection in Illinois distributes 4,000 subcultures per year and acquires 1,000 to 2,000 new accessions per year to its collection of around 85,000 cultures. The Institute for Fermentation (IFO) in Japan maintains around 18,000 strains and distributes around 8,000 samples per year (Cunningham et al. 2006).

BRCs can be hold publicly or privately. Public collections usually depend on public funding. It has been reported that many of the BRCs, especially in developing countries, have problems to obtain adequate funding to maintain and develop the collections (Day-Rubenstein et al. 2005, 21). Public collections are publicly accessible whereas private industrial collections are withheld from public access to protect financial investments and industrial secrets. In many cases, private industrial biological resources are made accessible to the wider scientific community only when patents protect them or when they are no longer deemed to be of specific economic value (OECD 2001a, 37).

3 Institutional and political framework of international biodiversity conservation

The institutional and political framework of international biodiversity conservation is influenced by two regimes: the regime for the conservation of biodiversity and the regime for the protection of IPRs. The major international agreements, which are the pillars of the two regimes, are on the one hand, the CBD and the ITPGRFA and on the other hand, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) and the International Convention for the Protection of New Varieties of Plants (UPOV Convention). It has been debated that these two regimes are counterproductive and undermine each other. The two regimes are not contradictory, but they pursue totally different goals and take effect in totally different policy fields. Hence, there is a possibility that conflicts arise. When formulating ABS policies, the existences of the IPRs regime and the reciprocal influences have to be considered. Then, synergies can be used and the ABS concept of the CBD can even benefit from and make use of the IPRs regime.

3.1 Conservation, sustainable use and benefit-sharing

Several multilateral agreements aim at biodiversity conservation. The first to name is the CBD. It is a pure biodiversity convention, which attempts to conserve biodiversity not only through protection, but also through sustainable use and the sharing of benefits arising from the resource's utilization. The ITPGRFA has similar objectives, but it only applies to a specific group of crops that are highly relevant for food security. This study takes a closer look at these agreements. Further conventions that have protection objectives are the Ramsar Convention on Wetlands, the World Heritage Convention (WHC), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and the Convention on the Conservation of Migratory Species of Wild Animals (CMS).

3.1.1 The Convention on Biological Diversity (CBD)

Between the 1970s and 1980s, it became obvious that neither the public nor the private sector in biodiversity-rich countries - mostly developing countries - could provide sufficient funds for nature and especially biodiversity conservation. The concern and general willingness within the international community to conserve biodiversity was not sufficient to counterbalance these deficiencies. In 1987 a discussion was started within the scope of the United Nations Environment Programme on the elaboration of an international agreement on the conservation of biodiversity (Henne 1998, 114). After long-lasting negotiations, the CBD was adopted during the Earth Summit in Rio de Janeiro in 1992. The essential objectives of the CBD are the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources (CBD 1992, Article 3). This includes facilitated access to genetic resources and appropriate transfer of relevant technologies. Today (as of April 2007) the CBD has 190 parties (CBD 2007e). Due to the fact that the majority of all countries are members, the protection of biodiversity is considered as one of the biggest environmental priorities in the world. However, the US have signed, but not ratified the CBD.

The agreement covers all fields of biodiversity: ecosystems, species, and genetic resources. It includes in-situ biodiversity and biological material that has been stored in ex-situ collections after the adoption of the CBD (CBD 1992, Article 2). It links traditional conservation efforts to the economic goal of using biological resources sustainably. Contrary to the classical protection concepts claiming for not using the resources at all, the CBD recognizes that biological resources can be simultaneously conserved and used while ensuring its protection (SCBD 2000, 8). According to its objectives, the agreement sets principles for the fair and equitable sharing of benefits arising from the use of genetic resources. To reach this goal the CBD is based on a bilateral system of exchange of genetic resources and compensation. This concept is illustrated and analyzed in chapter 4.2. It also covers the rapidly expanding field of biotechnology addressing technology development and transfer, benefit-sharing and biosafety.

The CBD's governing body is the Conference of the Parties (COP), consisting of all governments and regional economic integration organizations having ratified the Convention. The COP can make amendments to the Convention, create expert advisory bodies, review progress reports by member nations, and collaborate with other international organizations and agreements. Non-parties can also be admitted to attend the COPs as observers. The CBD is not a static entity but rather an agreement that constantly advances through the regular general meetings (COPs) and expert meetings (e.g., Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) and Working Groups). Table 5 gives an overview about the COPs that have taken place so far.

SBSTTA is a committee composed of experts from member governments and a subsidiary body of the COP. It provides scientific advice and information to the COP on scientific and technical issues related to the CBD, as for instance scientific and technical assessments of the status of biological diversity or innovative, efficient and state-of-the-art technologies.

Table 5: The Conferences of the Parties since the adoption of the CBD

Conference of the Parties to the CBD	Location	Major themes and outcomes
COP VIII	Brazil (8 – 19/05/2006)	Island biodiversity, Dry and sub-humid lands biodiversity. Global Taxonomy Initiative, ABS, Education and public awareness, Article 8(j) and related provisions (planned)
COP VII	Kuala Lumpur, Malaysia (9 – 20/02/2004)	Mountain ecosystems; Protected areas; Transfer of technology and technology co-operation
COP VI	The Hague, Netherlands (7 – 19/04/2002)	Forest ecosystems; Alien species; Benefit-sharing; Strategic plan 2002-2010 Adoption of the Bonn guidelines on access to genetic resources and the fair and equitable sharing of the benefits arising from their utilization
COP V	Nairobi, Kenya (15 – 26/05/2000)	Dryland, mediterranean, arid, semi-arid, grassland and savannah ecosystems; Sustainable use, including tourism; Access to genetic resources Reconvention the Panel of Experts on ABS Decision to establish an Ad Hoc Open-ended Working Group with the mandate to develop guidelines and other approaches Decision to establish an open-ended Expert Workshop on Capacity-building for ABS
ExCOP I (First Extraordinary Meeting of the Conference of the Parties to the CBD)	Cartagena, Colombia & Montreal, Canada (22 – 23/02/1999 & 24 – 28/01/2000)	Adoption of a protocol on biosafety to the Convention on Biological Diversity
COP IV	Bratislava, Slovakia (4 – 15/05/1998)	Inland water ecosystems; Review of the operations of the Convention; Article 8(j) and related issues (traditional knowledge); Benefit-sharing Decision to establish a regionally balanced panel of experts appointed by Governments, composed of representatives from the private and the public sectors as well as representatives of indigenous and local communities
COP III	Buenos Aires, Argentina (4 – 15/11/1996)	Agricultural biodiversity; Financial resources and mechanism; Identification, monitoring and assessment; IPRs;
COP II	Jakarta, Indonesia (6 – 17/11/1995)	Marine and coastal biological diversity; Access to genetic resources; Conservation and sustainable use of biological diversity; Biosafety
COP I	Nassau, Bahamas (28/11 – 9/12/1994)	Guidance to the financial mechanism; Medium-term program of work

Source: CBD 2007a

The Secretariat of the CBD (SCBD), based in Montreal, organizes meetings, drafts documents, assists member governments in the implementation of the program of work, coordinates with other international organizations, and collects and disseminates information. A recent paper on the Secretariat's work attests that it is well organized and managed, but it also shows that it has only modest effects on external stakeholders and other actors as national governments, industry, and NGOs (Siebenhuener 2007, 271).

The COP also establishes working groups, as for instance the Working Group on Article 8(j)[9] and the Working Group on ABS, to address more specifically the implementation of the CBD's traditional knowledge and ABS articles. This shows that TK and ABS are the central issues of the CBD that are too complex to be handled by the COP alone.

COP 4 established a regionally balanced panel of experts appointed by governments and composed of representatives from the private and public sectors, as well as representatives of indigenous and local communities to *"draw upon all relevant sources, including legislative, policy and administrative measures, best practices and case-studies on access to genetic resources and benefit-sharing arising from the use of those genetic resources, including the whole range of biotechnology, in the development of a common understanding of basic concepts and to explore all options for access and benefit-sharing on mutually agreed terms including principles, guidelines, and codes of conduct of best practices for access and benefit-sharing arrangements."* (CBD 1998, Decision IV/8, 3).

The Ad Hoc Open-ended Working Group on ABS was established by COP 5 to develop guidelines and other approaches for submission to the COP and to assist Parties and stakeholders in addressing for instance, the clarification and definition of terms. The major result of the first meeting was the development of the Bonn Guidelines on access to genetic resources and the fair and equitable sharing of the benefits arising from their utilization, which were adopted by COP VI. They give guidance to providers and users when implementing the CBD's ABS specifications. Table 6 gives an overview about the CBD meetings related to ABS.

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[9] CBD 1992, Article 8j: Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.

Table 6: CBD meetings related to ABS

Meeting	Location	Major themes
Fourth meeting of the Ad Hoc Open-ended Working Group on ABS (WG-ABS-4)	Granada, Spain (30 January - 03 February 2006)	Continuation of discussions in WG-ABS-3
Third meeting of the Ad Hoc Open-ended Working Group on ABS (WG-ABS-3)	Bangkok, Thailand (14 - 18 February 2005)	International regime on ABS: nature, scope, potential objectives and elements to be considered for inclusion in the regime Other approaches, including consideration of an international certificate of origin/source/legal provenance Measures, including consideration of their practicability, feasibility and costs, to support compliance with prior informed consent of the contracting party providing genetic resources and mutually agreed terms on which access was granted Use of terms, definitions and/or glossary, as appropriate. Strategic Plan: future evaluation of progress – the need and possible options, for indicators for ABS
Second meeting of the Ad Hoc Open-ended Working Group on ABS (WG-ABS-2)	Montreal, Canada (1 - 5 December 2003)	Use of terms, definitions and/or glossary, as appropriate Measures, including consideration of their feasibility, practicality and costs, to support compliance with prior informed consent of the Contracting Party providing such resources and mutually agreed terms on which access was granted in Contracting Parties with users of genetic resources under their jurisdiction Its consideration of any available reports or progress reports arising from the present decision Needs for capacity-building identified by countries to implement the Guidelines
Ad Hoc Open-ended Working Group on ABS (WG-ABS-1)	Germany, Bonn (22 - 26 October 2001)	Terms for prior informed consent and mutually agreed terms Roles, responsibilities and participation of stakeholders Relevant aspects relating to in-situ and ex-situ conservation and sustainable use Mechanisms for benefit-sharing, for example through technology transfer and joint research and development; and means to ensure the respect, preservation and maintenance of knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity, taking into account work by the World Intellectual Property Organization on IPRs issues
Second Meeting of the Panel of Experts on ABS	Montreal, Canada (19 - 22 March 2001)	Assessment of user and provider experience in access to genetic resources and benefit-sharing and study of complementary options Identification of approaches to involvement of stakeholders in access to genetic resources and benefit-sharing processes
First Meeting of the Panel of Experts on ABS	San Jose, Costa Rica (4 - 8 October 1999)	ABS for scientific and commercial purposes, review of legislative, administrative and policy measures at national and regional levels, review of regulatory procedures and incentive measures, capacity building

Source: CBD 2007d

Besides the Working Groups and the SBSTTA, the work of the COP is also supported from the CBD's Clearing House Mechanism (CBD-CHM), an internet-based network. The CBD-CHM aims to ensure universal access to the Convention's official records, but also to additional information as case studies, national reports etc. It increases public awareness of Convention programs and issues. Furthermore, it supports providers and users to establish contacts to start co-operation and to facilitate the dissemination of information (SCBD 2005, 222ff).

The CBD is based on some major principles that are elucidated here. The Convention recognizes every state's sovereignty over its own biological resources and assigns the responsibility for the conservation and sustainable use of biodiversity to the provider countries (CBD 1992, Article 3). The CBD states that governments have the accountability to establish national regulations on dealing with their biological resources and regulating ABS and that users have to recognize the sovereign rights of states over their natural resources (CBD 1992, Article 15.1). The definition and the consequences associated with the principle of state sovereignty are still not very clear though. It is the government's decision to establish and design national ABS regulations, as well as to define and to assign property rights over biological resources, but the conditions have to ensure facilitated access to genetic resources (CBD 1992, Article 15.2). The difficulties arising from this principle are brought forward in chapter 5.1.2. Access to valuable biological resources must be carried out on "mutually agreed terms" (MAT) and be subject to the "prior informed consent" (PIC) of the country providing the genetic resources (CBD 1992, Article 15.1/4/5). These important criteria are not regulated in more detail in the CBD. The determination of rules and regulations concerning the "prior informed consent" is the responsibility and burden of the national governments. Furthermore, the CBD stresses that scientific research should be conducted to the greatest extent possible in the country of origin of the genetic resource and with the participation of the Contracting Party. The benefits resulting from any use of genetic resources should be shared with the country providing the material under mutually agreed terms and in a fair and equitable way (CBD 1992, Article 15).

The PIC and benefit-sharing provisions of the CBD are established with respect to the "country providing genetic resources" and not the "country of origin". "*Access to genetic resources shall be subject to prior informed consent of the Contracting Party providing such resources, unless otherwise determined by that Party*" (CBD 1992, Article 15.5). "*Each Contracting Party shall take legislative, administrative or policy measures, as appropriate, […] with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources. Such sharing shall be upon* *mutually agreed terms*" (CBD 1992, Article 15.7). This clarification is important for the implementation of any ABS regulation in provider and user countries. The CBD demands benefit-sharing with the provider countries of in-situ material and necessarily with the countries of origin.

Since the adoption of the CBD, its implementation has focused more on the establishment of ABS regulations in biodiversity-rich provider countries addressing the agents' behavior in the provider countries. That has led to an imbalance regarding the efforts of the provider and user countries in order to realize the Convention's objectives. However, when the CBD determines that access to valuable biological resources must be carried out on MAT and be subject to PIC of the providing country, it addresses the users' behavior in provider countries (CBD 1992, Article 3, 15). The agreement also places responsibility on the user countries to contribute to its implementation. The realization of the third objective, the fair and equitable benefit-sharing by the transfer of monetary or non-monetary benefits, as for example, technology, requires measures that are carried out in user countries. Especially, the transfer of technology and biotechnology to the providers of the resources has to be promoted and carried out by users (CBD 1992, Article 15(7), 16, 19).

The CBD places emphasis on the recognition of and consistency with IPRs, especially patents in the area of biotechnology (CBD 1992, Article 16). The Convention confirms the existence and extension of IPRs as a precondition for bioprospecting as sustainable form of exploitation. IPRs play a major role in the biotechnology industry and have a high impact on the developments in these knowledge-intensive sectors. In 2002 biotechnology patents already accounted for about seven percent of all US patents (OECD 2006b, 45). The possibility to protect inventions with high research and development costs by IPRs is considered to be a guarantee for on-going developments (Lele / Lesser / Horstkotte-Wesseler 2000, 7). The relationship between ABS and IPRs is analyzed in chapter 4.2.2.

However, although the CBD is in place for fifteen years now, the decline of biodiversity could not be stopped and the effectiveness of the Convention can be challenged. During COP VI the Parties decided to adopt the Strategic Plan for the Convention on Biological Diversity to guide its further implementation at the national, regional and global level. The main objective is to effectively stop the loss of biodiversity so as to secure the continuity of its beneficial uses through the conservation and sustainable use of its components and the fair and equitable sharing of benefits arising from the use of genetic resources (CBD 2002, Decision VI/26). The Parties aim to achieve by 2010 a significant reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to benefit the whole society.

The financial system of the CBD is based on a multilateral system, providing support for capacity building and for investing in projects and programs in biodiversity-rich, developing countries. The Global Environment Facility (GEF), established 1991, finances projects in developing countries which forge international co-operation and finance actions to address four critical threats to the global environment: biodiversity loss, climate change, depletion of the ozone layer and degradation of international waters. The projects are managed by the Implementing Agencies, which are the United Nations Environment Programme (UNEP), the United Nations Development Programme (UNDP) and the World Bank. GEF has financed 752 projects in 155 countries worth $2.2 billion through fiscal year 2006. A total of $5.17 billion has been leveraged in cofinancing. All together, the total contribution of GEF's initiatives in biodiversity conservation is about US$7.3 billion (GEF 2006, 4).

The recent discussions within the COPs and the Working Groups urge for more responsibility on the user side. The group of megadiverse countries claimed for an international regime, arguing that provider countries are not capable of enforcing ABS without the support of user countries. This claim was adopted by the WSSD in Johannesburg in 2002. The Johannesburg Plan of Implementation calls upon the parties of the CBD to negotiate an international regime to promote and safeguard the fair and equitable sharing of the benefits arising from the utilization of genetic resources (UN 2002, 44o). The Bonn Guidelines, which were adopted in 2002, also address providers' and users' roles and responsibilities according to ABS. They propose a range of measures that user and provider countries should consider when implementing the CBD's ABS specifications. At COP7 the parties decided to mandate the Ad Hoc Open-ended Working Group on ABS to elaborate and negotiate an international regime on ABS with the aim of adopting instruments to effectively implement the provisions of Article 15 and Article 8(j) of the Convention and the three objectives of the Convention. At COP8 it was decided to continue the elaboration and negotiations of the international regime and the ABS Working Group was instructed to complete its work at the earliest possible time before the COP10 in 2010.

These developments indicate that demands on user countries have been expressed more explicitly, urging them to stand up for the implementation of the CBD regulations on ABS. This means that today users of genetic resources have to be considered and involved even more as important actors in the development of comprehensive international conservation concepts.

3.1.2 The International Treaty on Plant Genetic Resources

Even before, but especially since the adoption of the CBD, the international community has been looking for a structured way to regulate the conservation, and ABS for PGRFA. But why? The CBD alone is not sufficient to regulate ABS of PGRFA. The rationale behind a separate regulatory framework for PGRFA lies in their distinct characteristics, especially the attribution of the country of origin and the need for an unrestricted access to a wide genetic base for future crop improvements against the background of sustainable agriculture and food security.

This study only deals with the ABS concept of the CBD. However, in order to give recommendations for the future design and improvements other approaches have to be taken into account. The ITPGRFA is an excellent example, since it follows another approach (i.e., a multilateral approach) as the CBD. The acquisition of genetic resources on a case-by-case and bilateral basis as stipulated by the CBD often involves high transaction costs. Besides, the CBD leaves the issue of ex-situ collections conserving material that was collected before the adoption of the Convention unsettled (Moore / Tymowski 2005, 11-12). By addressing ex-situ collections the ITPGRFA fills this gap. Therefore, the consideration of the new international ABS framework for PGRFA is indispensable for the analysis of the CBD's ABS concept.

The ITPGRFA is the result of a long-lasting process. Following the Earth Summit and the adoption of the CBD, already in 1993 the Food and Agricultural Organization of the United Nations (FAO) decided to revise the International Undertaking (IU) on Plant Genetic Resources, which had been adopted by the FAO Conference in 1983. It was the first comprehensive international agreement dealing with PGRFA and aimed to promote international harmony in matters regarding access to, use and conservation of PGRFA (Cooper 2002, 1). Based on the principle that plant genetic resources are considered as a heritage of mankind the IU aimed to ensure that plant genetic resources of economic and social interest, particularly for agriculture, will be explored, preserved, evaluated and made available for plant breeding and scientific purposes (IU 1983, Article 1). In June 2002, 113 countries had adhered to the Undertaking. The secretariat of the IU was the FAO Commission on Genetic Resources for Food and Agriculture (CGRFA), an intergovernmental forum that was also created in 1983 to facilitate the policy dialogue and technical discussions on genetic resources of relevance to food and agriculture. Initially, its mandate was limited to plant genetic resources, but it was broadened in 1995 to cover all components of agro-biodiversity of relevance to food and agriculture.

In 1993 following the Rio Earth Summit and the adoption of the CBD, the FAO decided to revise the IU to harmonize it with this new international agreement on biodiversity conservation. The negotiation process was set up in the CGRFA and took more than seven years to be completed. This negotiation process reflects the complexity in ensuring facilitated access to PGRFA and a fair and equitable benefit-sharing while balancing the interests of the different stakeholders reaching from farmers and public- and private-sector breeders to life science and biotechnology companies (Cooper 2002, 1).

In November 2001 the FAO Conference approved the ITPGRFA. It was opened for signature, ratification, acceptance or approval and accession by all members of the FAO and any states that are not members of the FAO, but that are members of the United Nations, or any of its specialized agencies or of the International Atomic Energy Agency (ITPGRFA, Article 25, 26, 27). The treaty could only enter into force after the deposit of the fortieth instrument of ratification, acceptance, approval or accession by FAO members. With the ratification of twelve European countries and the European Community this obligation has been reached and the ITPGRFA finally entered into force 29 June 2004.

The ITPGRFA is a legally binding instrument, which aims at the conservation and sustainable management of PGRFA, as well as at the fair and equitable sharing of the benefits arising from their use (ITPGRFA, Article 1.1). As the CBD, the ITPGRFA recognizes the sovereign rights of states over their own PGRFA and the rights of the national governments to determine access to those resources resting with national governments (ITPGRFA, Article 10.1). However, the ITPGRFA establishes a different system as the CBD.

The key component of the treaty is the multilateral system of ABS, which includes all plant genetic resources for food and agriculture listed in the annex of the treaty that are under the management and control of the Contracting Parties and in the public domain, but it is aimed to enlarge the pool of genetic resources covered by the treaty by including plant genetic resources of other holders (ITPGRFA, Article 11.2-3). PGRFA held in the ex-situ collections of the CGIAR and in other international institutions are also included. The list comprises 35 crops including most major food crops (e.g., cereals and grain legumes) and some 80 forages. The selection of crops is based on criteria of food security and interdependence. However, a number of crops that might be covered by the criteria are not included, as for example soybeans and sugar cane. The list is the result of the specific interests of the negotiated parties (Moore / Tymowski 2005, 15).

The treaty consists of general provisions (ITPGRFA, Article 4 to Article 8) regarding the conservation and sustainable use of PGRFA, which apply to all crops and not just the listed ones, and specific regulations and procedures regarding the multilateral system. Within the multilateral system Parties of the international treaty give up their individual sovereign rights to negotiate ABS terms under MAT and PIC, instead, the exchange of genetic resources is based on standard terms.

The inclusion of farmers' rights is an essential component of the international treaty. They recognize the continuous contribution of local and indigenous communities and farmers of all regions of the world, particularly those in the centers of origin and crop diversity, for the conservation and development of plant genetic resources, which constitute the basis of food and agriculture production throughout the world (ITPGRFA, Article 9). The treaty mandates the responsibility of realizing, protecting and promoting these rights to national governments. Regarding the issue of saving, using, exchanging and selling farm-saved seed the treaty is neutral but supports national regulations which assign these rights (ITPGRFA, Article 9.2).

In the multilateral system access should be provided to legal and natural persons under the jurisdiction of any Contracting Party and solely for the purpose of utilization and conservation for research, breeding and training for food and agriculture, provided that such purpose does not include chemical, pharmaceutical and/or other non-food/feed industrial uses (ITPGRFA, Article 12.3). In these cases, the bilateral system of the CBD is applied.

Access to PGRFA is provided in accordance with national ABS legislation, or, in the absence of such legislation, in accordance with such standards as may be set by the Governing Body of the treaty (ITPGRFA, Article 12.3). The Governing Body is composed of all Contracting Parties and its responsibilities range from advancing the implementation of the treaty, administering its budget and establishing co-operation and maintaining exchange with other relevant organizations. The CGRFA acts as an Interim Committee for the international treaty. Until now, the Interim Committee has met in October 2002 and November 2004.

Benefits accruing from accessing PGRFA in the multilateral system are shared fairly and equitably. The main emphasis is placed on non-monetary benefits. Following mechanisms of benefit-sharing are considered:

- Exchange of information;
- Access to and transfer of technology;
- Capacity-building;
- Sharing of the benefits arising from commercialization, which addresses monetary benefits (ITPGRFA, Article 13.2).

Exchange of information concerns the availability of catalogues and inventories and the provision of information on technologies, results of technical, scientific and socio-economic research, including characterization, evaluation and utilization of PGRFA.

Access to technologies for the conservation, characterization, evaluation and use of PGRFA and to improved genetic material should be realized through different measures, such as the establishment and maintenance of, and participation in, crop-based thematic groups on utilization of PGRFA, all types of partnership in research and development and in commercial joint ventures relating to the material received, human resource development, and effective access to research facilities.

Capacity-building is probably the main category of non-monetary benefits and can be reached through scientific research and stronger facilities and programmes for scientific and technical education and training in conservation and sustainable use of PGRFA in biodiversity-rich countries, especially developing countries and economies in transition (ITPGRFA, Article 13.2 c).

Access has been realized and formalized through standard material transfer agreements (SMTAs), containing the main provisions on ABS in the treaty. The SMTA conditions persist even if the material is transferred (ITPGRFA, Article 12.4). With a view to IPRs, the treaty demands that recipients of genetic resources shall not claim any intellectual property or other rights that limit the facilitated access to the PGRFA, or their genetic parts or components (ITPGRFA, Article 12.3 d).

Benefits from commercialization are shared through the deposit in a trust account, which is managed by the Governing Body. Commercialization activities should be increased by stronger involvement of private and public sectors through partnerships and in research and technology development (ITPGRFA, Article 13.2 d).

Since 2004, negotiations on the implementation instruments of the treaty went on. In June 2006 the First Session of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture took place in Madrid. Important decisions for the final departure of the treaty were taken. The parties could agree on a SMTA, which is the cornerstone of the ITPGRFA. It lays out the conditions for access to genetic materials within the multilateral system and specifies the modalities and levels of payment for benefit-sharing (ENB 2006, 12).

According to the newly adopted SMTA, the recipient has the possibility to choose between two types of payment. The first is based on a broad definition of products and requires benefit-sharing payments of 1.1 percent of sales of all PGRFA products that incorporate material obtained from the multilateral system and to which access is restricted by IPRs. Alternatively, recipients can choose to make payments of 0.5 percent on all commercial products of a certain Annex I crop, regardless of whether access to these is restricted and whether they incorporate material from the multilateral system. This latter option enables the multilateral system to generate income right away, because it applies to products that are already on the market, while the first option applies only to new products that will not be ready for commercialization for another seven to 15 years. Besides, the Parties agreed on a funding strategy, on the rules of procedure and on compliance. The establishment of a compliance committee operating with provisional compliance procedures and mechanisms was decided (ICTSD 2006; ENB 2006, 12).

3.2 Intellectual property rights protection[10]

After identifying the international framework of biodiversity conservation, which characterizes and strengthens the provider side, it is necessary to take a closer look at the IPR protection regime, which characterizes and strengthen the user side. The protection of IPRs is not a new concept. According to Greek records dated already 200 B.C. inventors could apply for monopoly privileges. In Europe more systematic protection forms for intellectual property were developed in the medieval times. With the advance of free trade, industrialization, the development of natural sciences and technologies in the 18th and 19th century, patents were used more frequently as instruments for the protection of IPRs. Different forms of patent laws were developed in many countries. In Germany the first comprehensive patent law and the first patent office were created in 1877. At this time, nutritional, pharmaceutical or similar products were excluded.

A first attempt to harmonize the protection of IPRs on the international level was the adoption of the Paris Convention for the Protection of Industrial Property in 1833. This Convention was of great importance because it contains the principle of "national treatment" in Article 2.1 (OECD 1998, 12). According to this principle, if a country grants a particular right, benefit or privilege to its own citizens, it must also grant those advantages to the citizens of other countries, which are members of the Convention. Later, more international agreements related to IPRs were concluded, for example the Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure

[10] The following chapter is mainly based on Richerzhagen, C., Virchow, D. (2007): Sustainable Utilization of Crop Genetic Diversity through Property Rights Mechanisms? The Case of Coffee Genetic Resources in Ethiopia, in: International Journal of Biotechnology 9 (1), 60–86.

(Budapest Treaty), the European Patent Convention (EPC), and the Patent Cooperation Treaty (PCT).

The protection of IPRs with regard to plant genetic resources and plant varieties developed independently and not consistently with the described evolutions of general intellectual property law. This can be explained by the complexity and difficulties of protecting living materials. The introduction of high-yielding hybrid varieties in the 1930s in the US was an important step towards the protection of IPRs. The re-use of these high yielding hybrid varieties results in an enormous decline of yields.

After the Paris Convention had been adopted and plant breeding had been improved, plant breeders asked for the equal treatment of their products and products of industrial inventors. Central aspects of their claims were the allocation and protection of IPRs. Consequently, between 1920 and 1940 in some European countries and the US regulations about the protection of new plant varieties were introduced, as for example, the patent law of 1930, which provides the possibility to patent asexual reproductive plants (Overwalle 1999, 159).

The first endeavors to extend and harmonize plant breeder rights were reflected in the congress of the "International Association of Plant Breeders for the Protection of Plant Varieties", which took place in Austria 1956. The congress led to the adoption of the International Convention for the Protection of New Varieties of Plants (UPOV Convention) 1961 in Paris (cf. chapter 3.2.2).

Although the frameworks of IPR protection of industrial and agricultural technologies have differently developed, it is obvious that the overall level of protection has increased in the course of time. This development can be explained by the identical concern about the economic losses of inventors or breeders, caused by the increasing disregard of IPRs. Until 1988, 115 countries provided some kind of patent protection, but more than 50 percent excluded biological inventions as plants and animals (Lesser 1991). However, with a view to the increasing importance of biotechnology, the different forms of protection of industrial and agricultural technologies are compatible through the application of patents to plants and other living organisms in developed countries, or through revisions of the UPOV Convention. Striking influence had the Chakrabarty versus Diamond case in 1980. The US Supreme Court decided that a live, human-made microorganism is patentable. The first patent for a plant variety was granted in the USA in 1985 and in Europe in 1988 for a transgenic plant (Joly / de Looze 1996).

According to the growing importance, the institutional level of IPR protection has been extended. In 1967 the World Intellectual Property Right Organization (WIPO) was founded. Later in 1974, WIPO became a specialized agency of the United Nations system of organizations. Her mandate is to administer intellectual property matters recognized by the member States of the UN. Today (as of April 2007), the organization has 184 members and administers 23 international treaties dealing with different aspects of intellectual property protection (15 on industrial property and seven on copyright, plus the Convention creating WIPO), including the Budapest Treaty, Paris Convention etc. (WIPO 2007). WIPO aims at promoting the worldwide protection of IPRs by administering the international treaties on the protection of intellectual property, supporting members in implementing the agreements und harmonizing national regulation regarding the protection of intellectual property (Centre for European Agricultural Studies 2000, 7).

During the negotiations of the Uruguay Round, the US supported by the EU and other developed countries persisted on their opinion that the lack of protection of IPRs have to be considered as non-tariff barriers. For the first time the IPRs were linked with international trade (Bhat 1996, 208). Hence, the protection of IPRs were extended and strengthened by the adoption of the TRIPs agreement in 1994. The competence to generally regulate the protection of IPRs has been moved from WIPO to the newly created World Trade Organization (WTO). However, WIPO remains as an implementing agency that develops and administers international intellectual property law.

3.2.1 The WTO Agreement on Trade-related Intellectual Property Rights (TRIPs)

With establishing the WTO and adopting the TRIPs agreement in 1995, the national regulation and competence of IPR protection has been harmonized, complemented and covered by an international agreement. It was negotiated under strong pressure by industrialized countries for several reasons. Knowledge and technology have become of growing importance in the trade and international competition. The reduction of trade barriers, which promoted exports, and the increasing losses of the US and other industrialized countries through piracy and counterfeiting activities, were the main reasons to push the reforms (Correa 2000, 3f).

Since its adoption, the TRIPs Agreement has received a growing level of criticism from developing countries, academics and NGOs. The main controversies concern the impact of TRIPs on the provision of AIDS drugs in Africa and the Article 27, which deals with the patenting of life forms, which also very relevant for ABS issues.[11]

[11] The concerns had been growing that patent rules might restrict access to affordable medicines for populations in developing countries in their efforts to control diseases of public health importance, including HIV, tuberculosis and malaria. In the Doha declaration on TRIPs and public health, the minister tried to address these concerns. It stressed that TRIPs should support public health and promote access to existing medicines

TRIPs is only one of three major agreements of the WTO. The General Agreement of Tariffs and Trade (GATT) and the General Agreement on Trade in Services (GATS) are the other two. Today (as of April 2007), the WTO has 150 members (WTO 2007a). Every member of the WTO has to implement IPR protection according to TRIPs to comply with its obligations instituted by the agreement. However, developing countries and countries in transition were allowed to implement the requirements in a broader timeframe. They could implement the agreement within a five-year-period (until 2000), and least developed countries within eleven years (until 2006). This time limit was extended through the Doha declaration to 2016 for pharmaceutical patents.

TRIPs sets minimum standards for national IPR laws. It co-ordinates and integrates already existing provisions on the protection of IPRs, and adjusts and restructures applicable measures to the demands of an ever increasing interdependency in the field of international trade (Senti / Conlan 1998, 99). The agreement also specifies enforcement procedures, remedies, and dispute resolution procedures. However, it leaves scope for the member countries to develop their IPR laws to promote their national interests but staying within the spirit of the agreement (Ganguli 2000, 168). The agreement's objectives are to contribute to the protection and enforcement of IPRs, to the promotion of technical innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technical knowledge, as well as to social and economic welfare and to a balance of rights and obligations (TRIPs, Article 7). Unlike other international agreements on intellectual property or environmental protection, TRIPs has a powerful enforcement mechanism. Non-enforcement of the TRIPs obligations can be prosecuted by the trade sanctions, which are determined through the WTO dispute settlement mechanism (Benedeck 1998, 31f).

TRIPs covers all forms of IPRs: copyrights, geographical indications, industrial designs, integrated circuit layout-designs, patents (including the protection of new varieties of plants), trademarks, and undisclosed or confidential information. In the case of plant genetic resources, patents are the most relevant IPRs. Patents are regarded as the political and economic most significant part of the TRIPs agreement and explicitly regulated (Pacon 1995, 878).

The WTO's agreements are not directly related to environmental issues. However, GATT Article XX(b) provides an exception for measures "necessary to protect human, animal or plant life or health". Nevertheless, TRIPs contains an article, which relates the agreement to

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and the creation of new medicines. To fulfill this purpose countries receive more flexibility to implement TRIPs. If necessary they can allow compulsory licenses and parallel imports to reduce drug prices. Furthermore, the transition period for the LDCs for implementation of the TRIPs obligations from 2006 to 2016 was extended (WTO 2001a).

biodiversity. Article 27.3(b) is one of the most controversial parts of the agreement, because it deals with the patenting of life forms and the protection of plant varieties (Tappeser / Baier 2000). It defines the inventions governments are obliged to make eligible for patenting, and the exceptions. Inventions that can be patented include both products and processes, and should generally cover all fields of technology. Already during the Uruguay Round negotiations it was agreed that a review of the provision should take place in 1999. The article 27.3(b) states that

“Members may also exclude from patentability [...]

(b) plants and animals other than microorganisms, and essentially biological processes for the production of plants and animals other than non-biological and microbiological processes. However, members shall provide for the protection of plant varieties either by patents or an effective sui generis system or by any combination thereof.”

Therefore, countries have the possibility to exclude plants, animals and essentially biological processes from patenting, but they are obliged to patent microorganisms, microbiological and non-biological processes. Additionally, they also have to grant plant variety protection through the patent system, through an effective *sui generis* system or any combination of the two. The Convention of the International Union for the Protection of New Varieties of Plants (UPOV) is such a *sui generis* system and is described in the following subchapter 3.2.2.

The review of TRIPs started in 1999. In 2001 the Doha declaration made clear that the review should focus on the relationship between TRIPs and the CBD, the protection of traditional knowledge and folklore, and other relevant new developments that member governments raise in the review of the TRIPs Agreement (WTO 2001b).

Therefore, the Council[12] deals with the questions whether there is conflict between the TRIPs Agreement and the CBD and whether something needs to be done on the TRIPs side to ensure that the two instruments are applied in a non-conflicting and mutually supportive way. The opinion of the WTO members regarding these issues is not uniform. A certain group of countries, including Australia, Japan, Canada, Korea, US, Switzerland, sees no conflict between TRIPs and CBD and stresses that they can be implemented in a mutually supportive way through national measures. They even regard the implementation of the TRIPs Agreement as a supportive instrument that can implement the obligations of the CBD most effectively. In their view patents are critical for ABS, because the requirements of the patent system can prevent bad patents. They give the control over production and

[12] The Council for TRIPs is the body, open to all members of the WTO that is responsible for administering the TRIPs Agreement, in particular monitoring the operation of the Agreement.

distribution to patent owners and their licensees and therefore facilitate the sharing of technology (WTO 2006, 4f).

Another group of countries (e.g., Andean Community, Brazil, China, Indonesia, Pakistan, the Philippines) shares this view, but puts forward that further study is required to determine whether any international action in relation to the patent system is called for in order to ensure or enhance the implementation and the mutual supportiveness of both agreements. One instrument that is intensively discussed is the disclosure of the origin and source of biological material and associated traditional knowledge. Several countries made proposals regarding disclosure. They range from a TRIPs or WIPO obligation to obligations outside of the patent law. These suggestions are discussed in more detail in chapter 5.2.2.2.

The last view (e.g., shared by the African group) sees an inherent conflict between the two instruments. This group insists that the TRIPs agreement will be amended to remove such conflict. The main argument is that TRIPs establishes a framework for the appropriation and the use of genetic resources that is inconsistent with the sovereign rights of countries over their genetic resources as provided for in the CBD by requiring that certain genetic material be patentable or protected by *sui generis* plant variety rights. Besides, it is stressed that TRIPs does not ensure that the provisions of the CBD are respected (WTO 2006, 8).

3.2.2 The International Convention for the Protection of New Varieties of Plants

The International Union for the Protection of New Varieties of Plants (UPOV[13]) is an intergovernmental organization whose mission is to provide and promote an effective system of plant variety protection in order to encourage the development of new varieties of plants. Established by the Convention for the Protection of New Varieties of Plants (UPOV Convention), the Union coordinates and implements plant breeders' rights. Plant breeders' rights protect new varieties of plants by granting exclusive commercial rights to market a new variety or its reproductive material (Swanson 1998, 10).

The UPOV Convention provides a *sui generis* form of intellectual property protection in terms of TRIPs Article 27.3 (b). It has been specifically developed for the process of plant breeding long before TRIPs was negotiated. Developing countries that are a member of the WTO have the choice of either adopting the existing regime proposed by the UPOV Convention or to develop their own plant variety protection system. Since 1994, few countries have joined UPOV. The majority has decided to adopt their own plant variety protection laws. However, in a number of cases, these laws draw directly and significantly from the UPOV regime

[13] L'Union internationale pour la protection des obtentions végétales

(Cullet 2003). The application for variety rights through the UPOV Convention is more simple and at a lower cost than the one for patents. Besides, it guarantees to fulfill the TRIPS obligation to be an effective *sui generis* system.

In 1961 the UPOV Convention was signed in order to address the problems arising from the protection of IPRs of plant breeders. The existing patent system could not be applied to innovative achievements in the field of crop breeding because it did not take into account the special needs of the breeding sector, explained later in this subchapter (Dutfield 2000, 27). Since then, the agreement regulates the international protection of IPRs for plant varieties.

Initially, only developed countries were members of UPOV (Centre for European Agricultural Studies 2000, 24). With the accession of, for example, Kenya, Bolivia, and China the unbalanced participation has changed. However, most of the members are countries in Europe, North America, Latin America and Australasia. As of April 2007, UPOV has 63 members who have ratified different versions of the Convention (UPOV 2006). The UPOV Convention has been revised three times, 1972, 1978 and 1991. The UPOV Convention 1961 entered into force in 1968, UPOV 1972 in 1977, UPOV 1978 in 1981, and the UPOV Convention 1991 on 24 April 1998.

Most countries are Parties to the 1978 Act and to the 1991 Act of the Convention. According to UPOV 1991 Article 3(1)-(2), new members and members who already signed an earlier version are encouraged to ratify the revised version of 1991. Pursuant to Article 37(3) UPOV 1978 became closed to further accessions with the entry into force of UPOV 1991. However, even after the coming into force of the 1991 Convention, countries were able to access UPOV 1978 under certain requirements for one year (FAO 2000).

In general, the UPOV Convention 1991 provides a more defined but extended scope of protection than the UPOV Convention 1978. The requirements for protecting plant varieties differ from the ones in patent law. Plant breeders' rights can only be granted if the varieties are new, distinct, homogeneous, and stable (UPOV Convention 1991, Article 5). The protection of plant breeders' rights covers production and reproduction, propagation, sale and marketing, import and export, and stocking (UPOV Convention 1991, Article 14). While the UPOV Convention 1978 limits these conditions to propagating material, the UPOV Convention 1991 extends them to the commercial use of all material of the variety, e.g., harvested material (including entire plants and parts of plants) and products made directly from harvested material of the protected variety (FAO 2000).

Regarding the nature of the protected material the UPOV Convention 1978 is much broader. As long as a variety is distinguishable, homogeneous, and stable, it can be protected independently of the origin and of the initial variation from which the concerned variety is derived. This includes the mere discovery of a new plant variety. The UPOV Convention 1991 considers a “breeder” as a person who bred, or discovered and developed a variety. The breeder must also have developed and not only discovered the variety in order to be entitled to the protection.

The main two elements of the UPOV Convention regarding more flexibility in IPR protection are the breeder’s exemption and the farmer’s privilege. The breeder’s exemption acknowledges the importance of the use of existing varieties for development and breeding of new, improved varieties. It guarantees the unrestricted utilization of protected varieties as an initial source of variation for the purpose of generating other varieties and for the marketing of such varieties. The UPOV Convention 1991 like the UPOV Convention 1978 contains the breeder’s exemption, but in a more defined and weaker form. Here the protection plant breeder right is extended and transferred on varieties that are derived from protected varieties.

Contrary to the UPOV Convention 1991, earlier versions of the UPOV Convention limited the scope of plant breeder’s right to the commercial use of propagating material (OECD 1996, 22). Consequently, farmers are allowed to use harvested material of protected varieties (farm-saved seeds) for subsequent sowing on their own farms and to produce subsequent crops. However, this “farmer’s privilege” is only implicitly recognized under the UPOV Convention 1978 and allows a broad interpretation and implementation. UPOV directs the responsibility to national governments to decide whether they should permit farmers to use protected varieties for propagation purposes within reasonable limits and to safeguarding the legitimate interest of the breeder (UPOV Convention, Article 15.2). Therefore, it narrows the privilege and transforms it to an optional exception (FAO 2000). Farmers’ Rights recognizing “*the … contribution that the local and indigenous communities and farmers of all regions of the world, particularly those in the centers of origin and crop diversity, have made and will continue to make for the conservation and development of plant genetic resources which constitute the basis of food and agriculture production throughout the world*” (ITPGRFA, Article 9.1) were keenly discussed in the process of the negotiations of the ITPGRFA and finally included.

The major differences between UPOV 1978, 1991 and TRIPs as already explained are listed in Table 7.

Table 7: Main provisions of Plant Breeder Rights under UPOV 1978, 1991 and TRIPs

	UPOV 1978	UPOV 1991	TRIPs
Protection coverage	Plant varieties of nationally defined species	Plant varieties of all genera and species	Inventions
Requirements	Novelty Distinctness Uniformity Stability Variety denomination	Novelty Distinctness Uniformity Stability Variety denomination	Novelty Inventive step Industrial application Enabling disclosure
Protection term	Min 15 years	Min 20 years	20 years
Protection scope	Minimum scope Commercial marketing Offering for sale Marketing of propagating material	Minimum scope Producing, conditioning Offering for sale Export, import	Product/ process Making Offering for sale Using Import
Breeders' exemption	Yes, but restrictions for hybrids	Yes, but restrictions for hybrids and derived varieties	No
Farmers' privilege	Yes	Up to national law	No
Prohibition of double protection	Yes	No	Up to national law

Source: adopted from Dutfield 2000, 30

The UPOV Convention 1991 is taking a strong position in the breeders' exemption, while weakening the farmers' privilege. The free availability of plant germplasm for further research and development is a prerequisite for future successful breeding. This existing UPOV principle is doubly contradictory: it demands free access to PGRFA in-situ and ex-situ as well as the free and unrestricted availability of protected varieties for further research and development. Consequently, UPOV's principle offends the Farmers' Rights of the ITPGRFA as well as CBD's country's sovereignty over genetic resources. On the other hand, UPOV's objective of free access to protected varieties for research and development conflicts with TRIPs' patent system.

Another potential conflict arises between the UPOV Convention and TRIPs for countries, which are members in both institutions. A double protection for different varieties of one crop species may occur due to different protection systems for different varieties of one crop, conflicting the breeder and farmer with respect to why the breeders' exemption and farmers' privilege exist for one variety but not for the other. The new concept of 'essentially derived variety' is the first attempt to solve a problem arising through technological change. Essentially derived varieties are varieties with single gene changes introduced by backcrossing or genetic transformation as defined by the 1991 UPOV Convention

(Semon 1995). The breeders' exemption is coming to its limit if modern biotechnology is utilized in plant breeding, provoking an inequality in competition. If a breeder inserts a patented gene into a protected variety, she/he may protect and commercially exploit the modified variety, whereas if a breeder inserts a foreign, patented gene into his own variety, she/he either has to pay royalties to the owner of the patent or could be prevented from exploiting the modified variety. Due to the concept of 'essentially derived variety' both breeders must seek to reach agreement with the other involved breeder.

The TRIPs agreement sets only minimum standards for the crop plant protection for all member countries of the WTO. Every member country must evolve an IPR protection system. However, this can be adjusted to a specific situation in a specific country. In contrast to the UPOV Convention, TRIPs is not an institution solely aimed at the breeders and representing their interests of protecting newly bred varieties. Hence, the *sui generis* legislation is the protection system, which might incorporate the compensation idea from the concept of Farmers' Rights and enabling the partially realization of benefit-sharing (Leskien / Flitner 1997). For instance, in 2001 India developed its own *sui generis* legislation with the Protection of Plant Variety and Farmers´ Rights Act, hailed as progressive, pro-developing country legislation. The law recognizes the necessity of protecting the rights of farmers in respect of their contribution made in conserving, improving and making available PGRFA for the development of new plant varieties (Sahai 2003).

The potential of plant protection to support conservation of landraces is very limited. It seems unlikely that existing plant protection can be successfully used to define and enforce rights over traditional varieties because of the high variability and segregation of landraces that point towards a fundamental difference from protected varieties under the distinct, uniform, and stable criteria of the UPOV Convention (Lesser 1994). Additionally, the patenting of landraces is not possible, because a patent must meet the criteria of (at least commercial) novelty, which is difficult to certify for these genetic resources. A more feasible way is the definition of remuneration rights, based on collective administration organizations. Remuneration rights are established and applied in many countries in the area of copyrights because of difficulties in exercising exclusive rights. Exclusiveness cannot be achieved but a compensation for contributions made by communities. One example are royalties for blank audio tapes, which ensure compensation of title-holders of works published on audio tapes for copying and counter the impossibility of controlling private copying (FAO 1994).

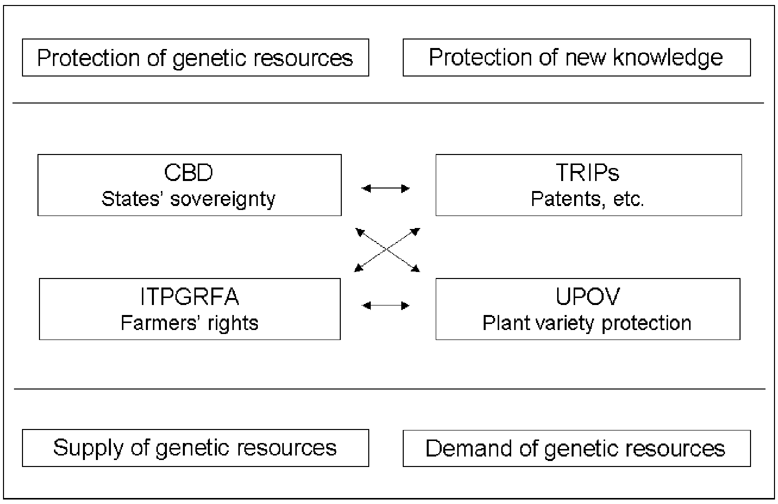
3.2.3 Coherence between the two regimes

On international level, it has been heavily debated if the international regimes and agreements on biodiversity and IPRs are coherent or conflicting. It is important for biodiversity policy to consider both the positive and negative effects of the establishment of IPR systems and try to overcome potential conflicts between them by finding an adequate degree for the protection of these rights. The relationship between IPRs and biodiversity is investigated in depth in chapter 5.1.2, but a short outline should be given here.

At first sight, IPRs are positive for the ABS regime. They provide exclusive rights for inventions and products derived from the use of genetic resources. Usually they are combined with the liability for disclosing the knowledge on the invention. From the users' point of view, the exclusivity is a prerequisite and incentive to conclude a bilateral ABS agreement. Exclusive rights mitigate the risk of investment for the potential user of genetic resources. An increase in research and development activities in the area of plant breeding and biotechnology creates new possibilities for using and commercializing genetic resources. A successful commercialization raises the value for the biological material and gives incentives for both the conservation and sustainable use of biodiversity if a fair and equitable sharing of the benefits arising of the utilization of genetic resources is applicable. Besides, TRIPs offers exceptions to address the concerns related to biodiversity (Anuradha 2001, 28).

However, it can be said that both TRIPs and the UPOV Convention generally support the demand side for genetic resources, whereas CBD and the ITPGRFA advocate the suppliers of genetic resources in their objective of benefit-sharing (cf. Figure 5).

Figure 5: Emerging conflicts between international agreements



Source: based on Virchow 1999

This is reasoned in their divergent policy objectives. IPRs regimes aim to protect new knowledge through exclusive rights, whereas biodiversity regimes aim to protect genetic resources through market-based mechanisms. On the provider side, IPRs may have negative effects. IPR protection can result in restricted access to genetic resources, e.g., if the resources are subject to a patent that threats food security. IPR protection may also distort the benefit-sharing if the resource holder cannot participate in these rights (Rosendal 2006, 90). Furthermore, the protected product may have intellectual similarity with traditional products and IPRs may limit or prevent traditional consumers from continuing using the biological resources. It is also possible that the new commercial product is a substitute for a traditional product, because it is cheaper and drives the traditional producers out of the market. If the IPR protection entails greater marginal loss to a local provider, she/he will have fewer incentives to conserve the resource (Bhat 1999, 392/402).

Furthermore, there are concerns that IPR protection encourages biopiracy (Anuradha 2001, 27). Many cases have occurred where nations had to challenge natural product patents on the basis of traditional knowledge, motivated by principles of justice rather than the economic forces usually underlying patent disputes. For example, a 1995 patent, "Use of Turmeric in Wound Healing," was cancelled in 1998 after an investigation established that use of turmeric to promote wound healing had been known for generations in India (Gollin 2001).

IPRs have been widely criticized because of ethical concerns. Throughout history biological resources, related technologies and knowledge have been exchanged freely and still millions of people depend on these inputs in their daily life. Therefore, the patenting of life forms is regarded as unethical and sometimes entitled as “intellectual colonialism” (Bhat 1996, 207).

4 The economic framework of the ABS concept

ABS has been mainly discussed from a legal or political perspective. The aim of the study is to contribute to the international debate by shading light on the approach by choosing an economic point of view. The ABS concept has been developed as an instrument to stop *inter alia* the decline of biodiversity. To analyze ABS from an economic point of view and assess the effectiveness it is necessary to step back and put the loss of biodiversity in an economic framework. Therefore, this chapter firstly explores the economic issues of biodiversity loss. The relevant economic issues are valuation, economic development and poverty, market and policy/institutional failures. The first subchapter describes the problems and the results of attempts of economic valuations of biodiversity. Different studies have been undertaken to assess the pharmaceutical value of biodiversity; only few studies assess agricultural values of genetic resources. However, these studies come to the conclusion that certain economic values for genetic resources exist. Besides, the chapter explores the link between biodiversity conservation, ABS and poverty. ABS is an instrument that has the potential to contribute to poverty alleviation. Finally, the subchapter identifies market and policy/institutional failures as being responsible for the loss of biodiversity. By investigating the promise of ABS to contribute to biodiversity conservation and economic development, the second subchapter establishes the economic framework of the ABS concept. The characterization of this framework follows the first assumption of this study, which states that the ABS concept, based on bilateral agreements, sets incentives to conserve biodiversity. However, the concept has side effects (e.g., economical, social) that have to be taken into consideration (cf. chapter 1.2).

4.1 Economic issues of biodiversity loss

This subchapter starts with an outline of the economic issues of biodiversity loss. The assessment of the economic value of biodiversity as resource or as input for research and development is the basis for decision-making regarding conservation activities. The chapter outlines the important approaches and results of biodiversity valuation studies and shows the difficulties of assessing biodiversity's value. Having discussed the economic value, the link between biodiversity conservation and economic development or rather poverty is elaborated. Finally, the subchapter discusses market failure and policy failures as underlying causes of the loss of biodiversity.

4.1.1 The difficulties of valuing biodiversity

"The value of biodiversity is the value of everything there is. It is the summed value of all the GNPs of all countries from now until the end of the world. We know that, because our very lives and our economies are dependent upon biodiversity. If biodiversity is reduced sufficiently, and we do not know the disaster point, there will no longer be any conscious beings. With them will go all value--economic and otherwise." (Norton 1988).

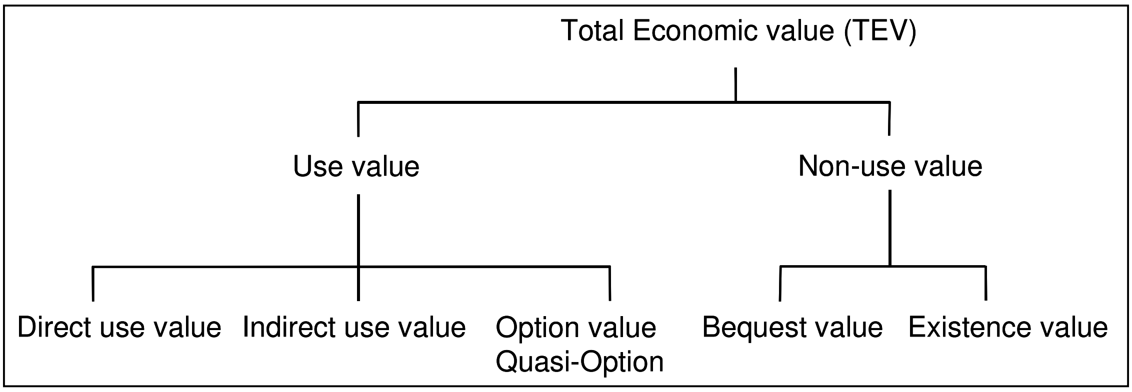
Today, the future relevance of biological diversity for the global economy and the social welfare cannot be estimated. Biodiversity has many benefits, which are still undiscovered, and the conservation of this resource can thus be justified by the precautionary principle. But even today many values of biodiversity can be identified. Biodiversity has values in itself, spiritual and intrinsic as well as existence and bequest values, but it also contains values generated by its use as inputs. The resource plays an important role within the planet's life-support system and maintains at the same time many ecosystem services: mitigation of greenhouse gases, watershed protection, and the protection of scenic beauty (Sedjo 2000, 110). Beyond, biodiversity and especially wild plant genetic resources are used as production inputs in research institutions and in "life science" companies, combining pharmaceutical, food, seed, and chemical divisions. Important markets for genetic resources are established by the pharmaceutical, the crop protection, the agricultural seed, the horticulture, the botanical medicine, and the cosmetic and personal care sector (A Laird / ten Kate 2002, 246). Through the enormous technical progress, biotechnology has become ubiquitous in industry, and its wide use raises the expectations that in the near future the potential of biodiversity will be tapped more efficiently. The economic value of biodiversity for commercialization has increased.

But why should we identify the economic values of biodiversity? Biodiversity protection generates costs or the non-use of the resource prevents the capturing of benefits (e.g., logging prohibitions). Biodiversity conservation activities often compete with other human-induced activities that harm the environment. The identification of the values of the competing activities is necessary in order to decide whether some values and benefits of resource use are more important than others. Economic valuation of biodiversity can support, for example, decisions on land-use options for conservation or other uses, the raising of awareness, the setting of priorities for biodiversity conservation, the assessment of biodiversity losses, and the choice of instruments to conserve biodiversity (OECD 2002, 23f).

After identifying and disclosing biodiversity's commercial value, the idea came up to develop the ABS concept. The assessment of this commercial value is essential for the ABS concept and the negotiations between users and providers regarding the fair and equitable benefit-sharing. Only valuation can put negotiation on a solid basis.

However, the commercial research and development value of biodiversity and genetic resources determines only a small share of the total economic value (TEV) of biodiversity, which comprehends all the values of biodiversity including plants and plant genetic resources. The ABS concept aims to internalize this value (cf. chapter 4.2). As Figure 6 shows the TEV consists of the use value (UV) and non-use value (NUV). The use value arises from the actual use of the resource. According to Pearce and Moran (1994), use values can be divided into direct use values (DUV), which refer to actual uses of biodiversity for food, clothes etc., indirect use values (IUV), which refer to the benefits deriving from ecosystem functions, option values (OV) and quasi option values (QOV), which are like an insurance value and approximate an individual's willingness to pay to safeguard the option of using it in future.

Figure 6: The Total Economic Value



Source: OECD 2002, 83

The direct use value describes the value that reflects elements of biodiversity, which can be directly consumed, traded or used as an input to commercial activities. Direct use values can generally be estimated by the identification of the market prices of a specific product or close substitutes. In case of biological diverse resources, it can be, for instance, the use of a forest for timber or recreation, or the use of plant genetic resources for biotechnological research and development. Use values are usually realized on the individual level if property and use rights are clearly assigned and tradable (OECD 1999, 29). The commercial use of genetic resources is also carried out on the individual level by economic agents that benefit by the use.

Indirect use values are delivered to humans on the local, regional, or global level by ecosystem services, as for instance, flood control, the purification of water supplies or carbon sequestration. There are not recognized on an individual level. Therefore, their provision requires the action on a broader level. Measuring indirect use values is more difficult than measuring use values, because it is difficult to measure the quantities of services, such as carbon sequestration, and to differentiate between several ecosystem inputs of produced goods. Indirect values can be assessed by calculating the amount that is necessary to invest in technologies to substitute for them (Brown et al. 1993, 13; OECD 1999, 29).

The option and the quasi-option value describe the values contained in having the ability to make choices in an uncertain future. The option value addresses the possibilities of options if preferences change in the future, whereas the quasi-option value concerns maintaining the ability to react to future information, independently of preferences. Both option and quasi-option values reflect all direct and indirect use values of biodiversity. Benefit-sharing contracts for genetic resources try to capture the option value of these resources (OECD 1999, 31).

The definition and estimation of NUV are more problematic. NUV are differentiated in the bequest value (BV) and the existence value (XV) (Pearce / Moran 1994, 12). The bequest value concerns the possibility to maintain the concerned resource for future generations, and the existence value concerns the value of a resource due its existence (OECD 1999, 31). In environmental policy the existence value of biodiversity is addressed by bilateral and multilateral transfers from industrial, biodiversity-poor countries to developing, biodiversity-rich countries through international organizations and funds such as the GEF.

The single values add up to the total economic value of an environmental resource such as biodiversity: TEV = UV + NUV = (DUV + IUV + OV + QOV) + (XV + BV)

It has been realized that the application of the TEV is problematic, because the single categories cannot be separated in any case and are partly overlapping each other. This can cause double counting. Besides, one has to be careful, since some values cannot be added because they are mutually exclusive (Baumgaertner 2002, 11). Some argue that the existence value is not relevant for economic valuation, because it might represent counter preferential values based on moral concern, obligation, duty etc. (Brown et al. 1993, 13). However, the concept has been widely accepted to illustrate the different benefits that an environmental good has and that have to be considered for its valuation.

To point up the share of the commercial value of biodiversity of the TEV, two prominent studies are illustrated that attempt to estimate the TEV. Costanza et al. (1997) published a paper in *Nature*, estimating the value of the world’s ecosystem services and natural capital, based on few original calculations and the analysis and synthesis of more than 100 studies, which estimated the monetary value of ecosystem goods and services. They estimate the current economic value of 17 ecosystem services for 16 biomes. They concluded that the value of the entire biosphere is in the range of US$ 16–54 trillion per year, with an average of US$ 33 trillion per year, whereas the global Gross National Product (GNP) total is around US$ 18 trillion per year.

Another approach was published by Balmford et al. (2002) in *Science* that compares the economical gains and losses of sustainable and converted ecosystems of five case studies. Based on the five case studies they come to the conclusion that the TEV of sustainably used ecosystems is higher than the TEV of converted ecosystems, because the loss of ecosystem services, such as flood protection, carbon sinks, and tourism, outweighed the marketed private benefits that came with conversion. In the beginning, conversions may have some benefit to local society, but on the global level costs exceed the benefits of conservation. According to the estimations, the TEV of the intact ecosystems ranged from 14 percent to nearly 75 percent higher than the converted ecosystem values.

Looking at the value of plant genetic material for research and development, the debate is very lively and mainly characterized by two distinct views. The first stating from a social point of view, which is mainly put forth by conservationists, that the economic value of plant genetic resources with pharmaceutical potential is huge, and the second suggesting from a private point of view that the value is very marginal when converting it to economic values per hectare. This argument is often supported by the industry (ICC 2004; Finston Kling 2004).

Pearce and Moran (1994) have roughly calculated the economic value of tropical forests. Their results suggest that a tropical forest area on the local level can yield anything from US$ 300 – 9000 per ha in present value terms per ha (cf. Table 8). Minor forest products (e.g., honey, nuts, rattan, rubber) and medical plants play the greatest role for the economic value. However, the results are quite imprecise and the authors regard the upper range of the results as unrepresentative.

Table 8: Economic values of biodiversity - tropical forest (values US$/ha 1992)

Benefit	Local	Global	Local and Global
Use value: direct			
Medical Plants	250-750	12-250	262-1000
Tourism	20-1250		20-1250
Minor products	>0-7000		>0-7000
Use value: indirect			
Carbon fixing	0?	500-1500	500-1500
Flood control	23		23
Non-use value	+	5	+5
Total	>293-9023	1017-4255	1310-13278

Source: Pearce / Moran 1994, 90

In their study Costanza et al. (1997, 256) estimated the economic value of genetic resources as inputs for medicine, products for material science, genes for resistance to plant pathogens and crop pests to amount US$ 79 per hectare per year.

Three distinct studies have estimated the value of plant species as a source of leads in new product research by questioning what companies may be willing to pay to preserve threatened genetic resources. A paper by Simpson et al. (1996) argues that the commercial value of the "marginal species" is likely to be extremely small, thus leaving little incentive for companies to invest in habitat conservation. Their result is based on a static model that assumes that the probability that any given species contains commercially valuable information is independent and identical across species. The used model calculates the value of a species by deriving its incremental contribution to the probability that a particular product of commercial value will be discovered. A restriction is that it is assumed that the different products derived from different species are either perfect substitutes or absolutely unrelated.

Simpson and Craft (1996) try to avoid this weakness by using a different approach assuming that different products derived from different species can be imperfect substitutes for each other. Furthermore, they attempt not only to capture the value of genetic resources for the pharmaceutical companies, they also try to estimate the social welfare, i.e., both consumer surplus and profit of bioprospecting. Though, they come to the conclusion that social values of biodiversity prospecting might motivate habitat conservation in some areas. These values are likely to be small relative to land value in other uses in even some of the more biologically rich regions of the world.

Rausser and Small (2000) challenge these findings by noting that firms focus their research efforts on the most promising species, and that auspicious leads command an information rent because of their role in lowering search costs. For the most promising ecosystems, they find that the value of preservation may be much more promising than suggested in the previous study by Simpson et al. (1996) and can be large enough to support market-based conservation of biodiversity. As Table 9 shows the undertaken studies suggest that plant genetic material with pharmaceutical potential can raise the values of certain land areas up to several hundreds or even thousands US dollars per hectare.

Table 9: Pharmaceutical values of marginal hectares of land (US$/ha)

"Hot spot"	Simpson et al. 1996	Social value (Simpson and Craft 1996)	Rausser and Small 2000
Western Ecuador	20.6	2,888	9,177
Southwestern Sri Lanka	16.8	2,357	7,463
New Caledonia	12.4	1,739	5,473
Madagascar	6.9	961	2,961
Western Ghats of India	4.8	668	2,026
Philippines	4.7	652	1,973
Atlantic Coast Brazil	4.4	619	1,867
Uplands of western Amazonia	2.6	363	1,043
Tanzania	2.1	290	811
Cape Floristic Province of South Africa	1.7	233	632
Peninsular Malaysia	1.5	206	539
Southwestern Australia	1.2	171	435
Ivory Coast	1.1	160	394
Northern Borneo	1.0	138	332
Eastern Himalayas	1.0	137	332
Colombian Choco	0.8	106	231
Central Chile	0.7	104	231
California Floristic Province	0.2	29	0

Source: Simpson / Sedjo / Reid 1996; Simpson / Craft 1996; Rausser / Small 2000

Among practitioners these results have started an intense debate on values. For example, Barrett and Lybbert (2000, 295) state that in order to analyze whether the calculated rents are sufficient to provide an incentive for conservation, it has to be regarded that the estimations are very context-specific and can only be answered by empirical research. Firn (2003) provides food for thought from an empirical side of the natural sciences. He argues that the current biotechnological developments will further erode the value of bioprospecting, since they will loosen the dependence on biological resources.

Costello and Ward (2006) assert that the studies of Simpson et al. and Rausser and Small only differ because different parameter and not because different search methods were assumed. They recalculate the marginal values of land for bioprospecting from 34 hotspots based on a new and updated set of parameters. They conclude that marginal land values are too small to provide conservation incentives. Assuming homogenous leads (all species are homogenous) they estimate the values to amount US$3.18/ha (mean estimate) and US$5.70/ha (upper 5% quantile). Under ordered search of heterogeneous leads (i.e., some species are known to be more likely than others to yield a success) their estimates climb up to US$14/ha (mean estimate) and US$65/ha (upper 5% quantile). However, they expect that in future, with an increasing extinction rate, values will rise, too.

But not only for the pharmaceutical sector plant genetic material has played an important role. Swanson (1997) indicates that wild and unknown species amount to six percent as a source of germplasm in the plant-breeding sector and definitely contribute to genetic enhancement of crops. A study by Hein and Gatzweiler (2006) estimate the value for Ethiopian coffee genetic resources for breeding programs in terms of disease resistance, low caffeine content and increased yield to amount US$ 1,459 million at a five percent discount rate and US$ 420 million at a ten percent discount rate. Successful examples of the use of wild relatives in crop improvement are the introduction of resistance to potato late blight, the increased soluble solid content in tomatoes (a trait worth US$240 million per year), and the development of a rice variety being resistant to a virus, which highly threatened the Asian rice crop in the 1970s (IPGRI 2005, 28; Heal 2000, p. 11).

The value of wild species for plant breeding is estimated much higher than this percentage indicates, because wild species have a maintenance function for the whole breeding system. Wild relatives and early landrace varieties have been recognized as the essential pool of genetic variation that will be critical for future plant improvement (McCouch 2004, 1508).

4.1.2 Biodiversity conservation, ABS and poverty

Does ABS have the potential to alleviate poverty? When the CBD and the ABS concept were adopted, poverty alleviation was not the policy-makers' primary concern. It was developed to conserve biodiversity, but conservation measure should not comprise poverty. A good deal more, it should have a positive impact on poverty and it is still seen as such an instrument. Both the direct conservation of biodiversity and ABS have positive effects on poverty. Therefore, it is necessary to analyze the relationship between ABS and poverty in a broader framework, including biodiversity loss and conservation.

ABS is a new income opportunity for poor countries. If local resource providers are partners in ABS activities, the concept can alleviate poverty. Monetarizing of biological resources offers new income opportunities for developing countries and the transfer of benefits in form of technologies, money, or capacity from resource users to providers will bring them in a better position to elude from poverty (Barrett / Lybbert 2000, 293; Henne et al. 2003, 58). If bioprospectors establish research institutions, train local staff, and produce drugs or new breeds in provider countries, ABS has the potential to promote economic development. However, development may threat biodiversity as examples from the past show. Biodiversity has been suppressed and decreased because countries' development objectives have attempted to be realized through intensification of, e.g., land use, urbanization, infrastructure development, or food production. Habitat destruction has been identified as the major threat of biodiversity (cf. chapter 2.3.2).

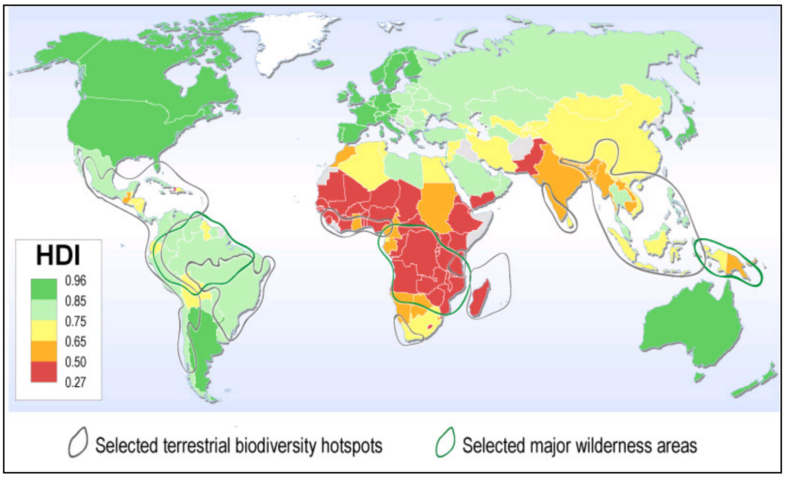
Looking at biodiversity decline and conservation the relationship with poverty is clear. Biodiversity loss exacerbates poverty and since poverty is a major threat to biodiversity, it's a vicious circle. Biodiversity provides the basis for the life for many people, especially for poor people. According to the Human Development Report 2005, one in five people in the world, which are more than one billion people, still survive on less than US$ 1 a day. This is a level of poverty that threatens survival. Another 1.5 billion people live on US$ 1 to US$ 2 a day. This means that more than 40 percent of the world's population is faced with poverty. Income poverty is closely linked to hunger. More than 850 million people, including one in three preschool children, are still trapped in a vicious cycle of malnutrition and its effects (UNDP 2005, 24).

Biodiversity plays an important role for poor people related to food security and health, income generation and livelihoods, reduced vulnerability to shocks, as well as cultural and spiritual values. Poor people's life depends directly on the availability of a wide range of natural resources and ecosystem services and therefore, they are most affected by their degradation. The conservation of biodiversity, but also access to the resource is a condition for the survival of many people. In low-income countries, environment-based wealth accounts for 25 percent total wealth compared to less than four percent in OECD countries (OECD 2006a, 9). Biological resources are still the basis for consumption and production in many developing countries and a major source of economic income. Twenty-two percent of the world's population works in the agricultural sector, relying heavily on biodiversity and ecosystem services. An estimated 1.6 billion poor people rely heavily on forests for their livelihoods, including food security (i.e., fruits and vegetables), health (i.e., medicinal plants), shelter (i.e., building materials) and energy (i.e., fuel wood and charcoal). Harvesting and trading in fisheries, fuel wood, wild fruits, and nuts, bush meat and other natural resources provide informal and formal employment, trading opportunities and jobs. As already mentioned, other sectors, such as tourism, medicinal plants, and herbs, generate billion of dollars per year. Bioprospecting has a substantial share of these activities. For many indigenous and traditional people, nature and biodiversity is directly linked with identity, culture and spirituality (IUCN 2006a, 33).

Besides, biodiversity protection supports and secures ecosystem resilience. It alleviates vulnerability towards changes such as climate changes or pests. Mangroves and coral reefs can slow down coastal storms and cyclones and reduce the vulnerability of the local people to extreme weather events (IUCN 2006a, 33). For example, in Bangladesh Hoar swamp forests have been cleared in favor of agricultural lands and human settlements. This has led to the disappearance and depletion of biodiversity and natural barriers. The forests have protected the population against the unavoidable wave action during the monsoon. As a consequence, people have been compelled to increase spending every year to protect their tiny homesteads (Steele / Oviedo / McCauley 2006, 224).

Poor people are most affected by biodiversity loss. They do not have the resources, the ability and the choice to substitute or offset local losses of biodiversity and its services by shifting their production and harvest to other regions or switching to other income possibilities. Another important fact is that developing countries are most vulnerable to environmental degradation, but they are also the riches in biodiversity, i.e., there is a geographical overlap between biodiversity and poverty. Mapping global development and biodiversity shows that some of the world's least developed countries (LDCs) are located in hotspot areas of high importance for biodiversity. Figure 7 displays the Human Development Index (HDI)[14] as a development indicator and hotspot regions. It is obvious that the HDI is very low in most of the important biodiversity hotspots and wilderness areas.

Figure 7: Global development and biodiversity



Sources: UNEP/GRID-Arendal 2004

[14] The HDI, published annually by the UN, ranks nations according to their citizens' quality of life. The criteria for calculating rankings include life expectancy, educational attainment, and adjusted real income.

Although the benefits of biodiversity conservation are high for the local population, Brockington and Schmidt-Soltau (2004) remark that the impacts of conservations measures (e.g., protected areas) on the poor are often negative due to the loss of income opportunities and living space. The creation of protected areas denies farmers future land use options and causes potentially significant economic opportunity costs. Conservationists are conscious about the problem. In 2003 at the World Parks Congress it was stressed “that many of the costs of protected areas are borne locally – particularly by the poor communities – while the benefits accrue globally” (WPC 2003). However, there is still a strong body of opinion that poverty elimination and conservation can be combined under the concept of “pro-poor conservation”, but that in reality the realization of such win-win solutions is difficult (Adams et al. 2004, 1147).

Adams et al. (2004) identify four models how poverty alleviation and conservation can jointly be implemented. ABS reflects the third model. Firstly, poverty and conservation can be regarded as separate policy realms. Focusing only on the preservation of biodiversity, this conception leads to conservation strategies aiming at the establishment of protected areas or of approaches such as direct payments for conservation carried out by the state or private owners. Secondly, poverty can be viewed as a critical constraint on conservation. In this case, poverty reduction is only undertaken to achieve more conservation. Conservation measures can be park outreach strategies (e.g., employment of local people) and income-generating projects (e.g., sharing the revenue from tourism in protected areas) in order to address poverty of critical protected-area neighbors. Thirdly, it can be argued that conservation should not compromise poverty reduction. Compensation of the opportunity costs arising from conservation measures and social impact assessment of protected areas are measures in line with this concept. Another possibility is the generation of income through non-extractive use (e.g., ecotourism, sustainable harvest, and bioprospecting). Fourthly, poverty is the center of attention when it is assumed that poverty depends on living resource conservation. In this case conservation is a tool for achieving poverty reduction and might lead to the rejection of protected areas and the priority of sustainable use concepts to optimize economic return for poor people. Not the preservation of species but the sustainable harvest would be aimed for. Projects would, for example, promote the local management of common-pool resources.

4.1.3 Biodiversity loss through market failure

The current extent of biodiversity decline is a consequence of market failure. Market failure is a situation in which existing markets do not efficiently allocate resources because their full costs and/or benefits are not reflected in the prices. The costs to conserve biodiversity are borne by the entity being in charge of the resource management. This can be a landowner, a local community or a governmental agency depending on the distribution of property and use rights regarding biological resources. The benefits of biodiversity and its conservation accrue on the same level but also beyond. On the global level the world population benefits from biodiversity's contribution through non-use and use values, as for example aesthetical importance and ecosystem stability. The market failure is caused by

- Externalities and
- Public goods characteristics.

These two causes and their impacts are explained in the following subchapters.

4.1.3.1 Externalities

The market for biological diversity fails because of the existence of externalities. Externalities occur when a decision causes costs or benefits to individuals or groups other than to the person making the decision. In this case the decision-maker does not bear all of the costs or reap all of the benefits from his action. In other words, externalities arise from the disparity between the private and social costs and benefits of biodiversity use and conservation (Dixon / Sherman 1990). Biodiversity conservation has positive externalities in forms of benefits and biodiversity decline has negative externalities in form of costs, which are only separated by a baseline. On the private level, the direct user or provider of biodiversity perceives the private benefits of conservation or costs of loss, whereas on the social level the whole society perceives the social benefits or cost.

The individual decision of a private landowner or a governmental agency may be rational and optimal from her/his point of view, but sub-optimal from the societal point of view. The private costs of exploiting species and converting habitats do not include the opportunity costs of foregone global biodiversity benefits. In the case of biodiversity, externalities are spill-over effects arising from the "production" and conservation of biodiversity. Biodiversity is locally maintained, but it causes global positive externalities (Barbier 2000, 80). These externalities are achieved especially by the indirect use-values and non-use values of biodiversity. If biodiversity is conserved in a tropical forest, not only the local population benefits, but also the population in other countries benefits because of its existence values or because it contributes to important ecosystem services.

Since the individual's benefits and the private value of producing the good are less than the benefits gained by society (i.e. the social value) in a competitive market, an insufficient amount of biodiversity will be provided from the society's point of view. The outcome is not socially optimal. The private value of biodiversity and its components varies from individual to individual. This private value is critical for biodiversity conservation because it determines decisions and economic behavior regarding the handling of biodiversity (Simpson 1999). People convert biodiversity-rich forests to cultivated land if this allows them to increase their income. Conservation of biodiversity can only be obtained if the private benefit of conserving biodiversity exceeds the private benefits of cultivating land or of any other biodiversity damaging activity (e.g., commercial logging).

$[B_c-C_c] > [B_a-C_a]$	B_c: benefits of conservation	C_c: costs of conservation
	B_a: benefits of activity	C_a: costs of activity

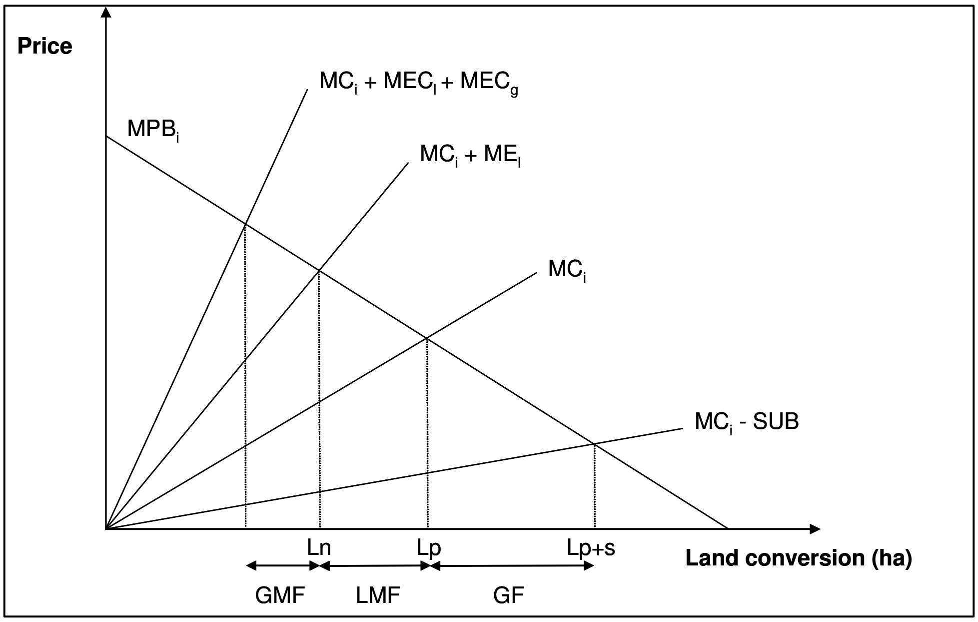
The difference B_a-C_a reflects the opportunity costs of conservation. The provider of biodiversity needs to receive a compensation for conserving biodiversity, which equals at least these opportunity costs, otherwise she/he will convert the concerned areas for alternative land-uses and not conserve the species.

Pearce and Moran (1994) distinguish between local market failure and global market failure. Local market failure characterizes the inability of markets to capture local, regional, national benefits of biodiversity conservation, or in other words local market failure refers to the failure of markets to take into account the external costs of biodiversity loss because of, e.g., land conversion. They consider global market failure as a result from the fact that biodiversity conservation yields external benefits, which are received on the global level by other than the decision-makers.

Figure 8 illustrates the market failure. The horizontal axis shows the amount of land converted to, e.g., agricultural land. The vertical axis shows the price. MPB_i are the marginal private benefits of land conversion, which are the extra revenue a farmer receives by converting the land from forest to agriculture. MC_i are the marginal cost accruing to the farmer by converting the land. The "rational" farmer will equate MC_i and MPB_i in order to maximize profits and the amount of land conversion that actually takes place is LP. If the farmer is subsidized to convert the land, the private costs are lowered and the marginal cost curve will be shifted from MC_i to MC_i - SUB where SUB refers to the subsidy. The amount of land conversion will be expanded to LP+S. The distance LP - LP+S is a measure of government failure (GF). The issue of government failure is explained in chapter 4.1.4.

However, the LP and LP+S are not the optimal decisions on land use, since they are based on the private costs and benefits of the farmer. If the social costs of land conversion, including the externalities that are accrued to the local area, are known, a better result of land use can be achieved. By internalizing the externalities and making the farmer to account for them by taxation or by paying fees because the land is zoned for conservation a higher level of conservation Ln is realized, since the cost curve is shifted from MC_i to MC_i+MEC_l. The distance Ln - LP is a measure of the local market failure (LMF). Less land is converted. By internalizing even the social costs of the whole society the cost curve is even more shifted to $Mc_i+MEC_l+MEC_g$ and the global market (GMF) failure can be prevented. Internalizing the externality of land use involves less land conversion and, hence, more biodiversity conservation.

Figure 8: Measuring the economic failure



Source: Pearce / Moran 1994

In reality, the externalities of land conversion are only internalized in very rare cases and biodiversity decreases as a consequence of incomplete and missing markets, which fully reflect the full cost and benefits of biodiversity.

4.1.3.2 Publicness of biodiversity

In the economic literature biodiversity is often characterized as public good, but is this true? In order to answer this question, the following subchapter identifies the characteristics of biodiversity and compares it with the classification of goods.

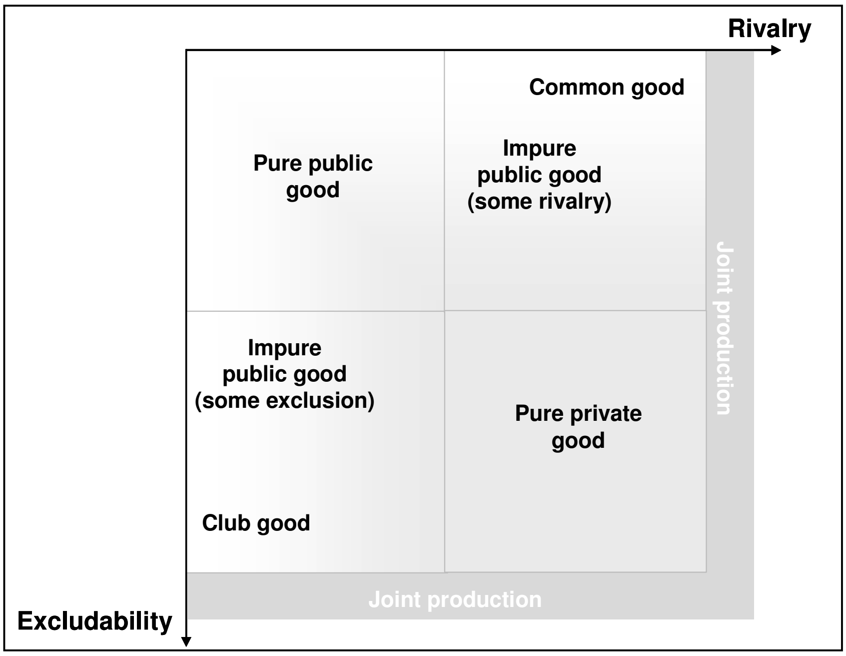
Public goods are characterized by a particular kind of externalities. The benefits of public goods are available for everyone. A pure public good can be characterized by non-excludability and non-rivalry, meaning that no one can be excluded from the good's consumption and the good can be consumed by one person without affecting its simultaneous consumption by another. Public goods can yield benefits on all levels. They are differentiated in local public goods (LPGs), national public goods (NPGs), regional public goods (RPGs), transnational public goods (TPGs), and global public goods (GPGs). In contrast to NPGs, TPGs provide nonrival and non-excludable benefits to people in two or more countries. If they provide global spillovers, they are called GPGs. If the benefits are confined to a well-defined location in two or more countries, the good is called RPG. For example, cleansing a local ecosystem is such a RPG (Sandler 2006).

Private goods are excludable and rival in consumption, meaning a person who does not pay for a good or does not fulfill certain access criteria can be excluded from its consumption, and a good consumed by one person cannot be consumed by another person. Impure public goods represent in-between cases. They possess benefits that are either partially non-rival and partially excludable or partially rival and non-excludable (Sandler 2001, 10). Club goods are one category of impure public goods. If a good is excludable but non-rival it is a club good. Difficulties arise from setting the right price for accession, from determining the group of users who can share the good, and from balancing the gain from additional users to the potential loss from increased use.

Another group are common property resources. These are goods that are subject to rivalry, but nobody can be excluded from its use. Common property is usually shared in an uncontrolled manner amongst its owners, but others can be excluded; or it may take the form of an open access regime where it is difficult to put any restriction at all on use (OECD 2003b, 14). Hardin (1968) already described in his article “Tragedy of the Commons”, published in *Science*, the consequences of an open access resource. In his opinion only two institutional arrangements - centralized government and private property - could sustain common-pool resources, such as air, water, and forests, in the long run. To illustrate his point, he used an example about the use of public lands by herdsmen. The pasture is open to all. This arrangement works for a while, even for centuries, until each herdsman realizes he can make a profit by adding more and more cattle to his herd. Hardin concludes that in a world in which resources are scarce and individuals pursue their own best interest, the freedom of commons brings ruin to all.

Hardin’s theory can also be applied to the problem of biodiversity loss. If biodiversity appears as a common-pool resource, e.g., in form of a common access forest, it will be exploited and biodiversity will decline. In 1999 Ostrom et al. (1999) revisited the commons and challenged Hardin’s theory. The authors think that Hardin’s assumption is not correct to view users as being pictured as trapped in a situation, they cannot change and the external authorities need to address the problem. They argued that many social groups have been successful to manage common-pool resources and have often devised long-term, sustainable institutions for governing these resources. Furthermore, they indicate that private and state managed resources have also been subject to failures and define the conditions for durable and successful institutions managing common-pool resources.

Figure 9: Characterization of goods



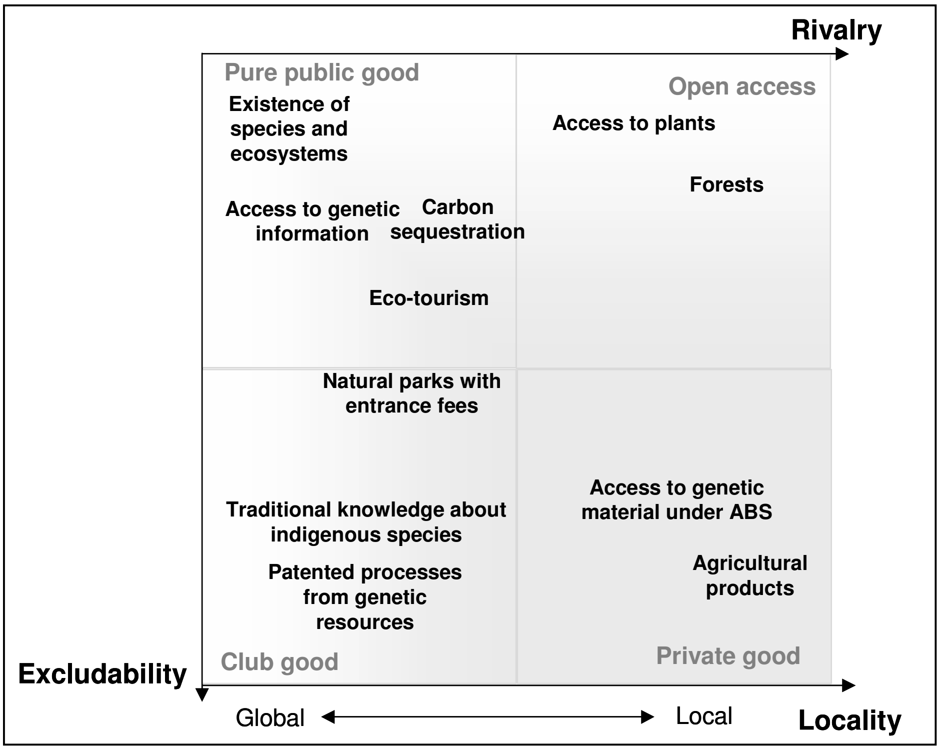
Biodiversity can appear in the four categories: pure public good, common good, club good and private good. Looking at ABS, especially the problems of the commons as well as that of club goods are relevant. Biodiversity and its components have characteristics of public and private goods. While many of the benefits of biological diversity accrue to the public as a whole, some benefits have a private character and can only be captured privately (OECD 2003b, 23ff). The existence of ecosystems and the provision of local ecosystem services are often pure public goods, i.e., they are non-rival in consumption and non-excludable, whereas individual components of ecosystems are often private goods, e.g., eatable plants. However, the category of these private values that can be privatized and sold on the market, generate only a small return (Heal 2000, 110).

Biological resources in forms of wild plants are rival in consumption. If they are harvested in greater quantities, as for example wild coffee or wild medical plants, they become scarce and if they are not subject to property rights, no one can be excluded from its use. In this case they are common goods and even open access resources.

Non-rival are genetic resources whose information is used, just as a blueprint. If the structure of an active chemical compound is known, it can be used in various forms and each additional use has no impact on the previous user (OECD 2003a, 11). In the case of biodiversity, it can be distinguished between two levels of excludability. The first level refers to the physical access to biodiversity. The one who holds property rights over the resource can exclude others from its use. If a state controls the access to its biological resources or biodiversity is protected in national parks, which are only accessible through entrance fees, biodiversity is exclusive and only available to a certain group of individuals. Domesticated and cultivated plants, which are already widely distributed, cannot be made exclusive. The second level refers to the genetic information contained in the biological resource. Information is excludable if the technology to extract this information is not available (e.g., protected by IPRs). In this case, biodiversity can be characterized as a club good.

Since biodiversity cannot be allocated definitely to one of the four categories (private good, public good, common good, club good), the resource is an impure public good. Some of its benefits may be captured privately, others may accrue to everyone (Perrings / Gadgil 2003, 535). According to Cornes and Sandler (1984), public goods that provide private and public benefits are the result of joint production and called joint products. They yield two or more outputs that vary with the degree of publicness. Jointly produced outputs may be purely public, impurely public, or private. Tropical forests are considered as such a joint product. Actions to preserve the forest not only yield local public goods (e.g., watershed, ecotourism, and local climate stability) but also global public goods (e.g., biodiversity existence and carbon sequestration). The provision of joint products depends on the ratio of excludable benefits (i.e., the contributor-specific and the club good benefits compared with the total benefits). If the share of excludable benefits is high, markets and clubs will evolve to efficiently allocate the resource. If the share is low and all jointly produced benefits are non-excludable, underprovision or overutilization will result and an intervention is needed. However, joint products offer the opportunity to reduce the usual problem of underprovision of public goods in a decentralized economy. By augmenting private and excludable benefits, incentives to potential supporters can be provided (Sandler 2006). ABS is a concept that relies on biodiversity as a joint product.

Figure 10: Characteristics of biodiversity goods and services



Source: based on OECD 2003b, 30

As other goods with public good characteristics, biodiversity and its conservation suffers from free riding. Countries and individuals have the incentive to a free ride on the efforts of others, since they can enjoy additional benefits without paying for it. As long as no other rules are in place, conservation efforts of countries and individuals are determined by the private value they can capture by the use or existence of biodiversity. Without international coordinated action, both individuals and countries will not undertake conservation measures that go beyond their own interests. Free riding appears on the local and global level (Perman et al. 2003, 131f).

These discussions show that the property and institutional form under which resources are governed can have a decisive impact on the conservation and the sustainable use of the resources. Property rights, no matter if they are private, communal, or state, are essential to address the problem of non-excludability and for the maintenance of the resource (Coase 1960; Barzel 1997, 7). The underlying conception is that holders of property rights have a long-term view of their asset and therefore use it in a sustainable manner. No property rights (i.e., open access) will lead to the depletion of the resource whereas private, communal and state property rights can be an adequate basis for negotiations and have the potential to institute incentives for conservation measures. The property rights arrangements have distinguished characteristics. Open access describes a situation where no controls are placed on how much individuals consume of a resource and no restriction exist on the number of individuals that use the resource, i.e., no property rights exist over the resource. State rights refer to property rights that are vested in a central governing authority. These rights can co-exist with other property rights regimes, as for example open access, if the state chooses not to exercise its rights. Community rights are one of the earliest forms of property rights over natural resources. Often these rights prohibit persons outside of the communities to use the resource and establish rules how the resources should be used and exploited. Private rights describe the rights individuals have to the ownership, control and enjoyment of the things they own and the right to sell, rent or exchange it or part of it (Devlin / Grafton 1999, 73ff). IPRs are a special category of private property rights. Their role regarding biodiversity is analyzed in chapter 4.2.2.

The different property rights arrangements have different allocation and distribution effects. Private, state and communal property are promising property rights regimes, but they also may have some negative aspects and problems as shown in Table 10.

Table 10: Allocation and distribution effects of different property rights regimes

Property rights arrangement	Allocation	Distribution effects	Problems	Solutions
Open access	Unlimited extraction	Depends on "who comes first"	"Tragedy of the unmanaged commons"	Assignment of property rights
Private property	Investment in appropriate values	Intergenerational unfairness	Doubtful preservation of non-appropriable values	Restrictions
National patrimony	Depends on political decisions	Possible problematic in regard to local people	Weak governments lead to open access problems	International, political and financial support
Communal property	Depends on communal decisions	The ones who control the asset benefit	Can lead to open access problems without regulation	Set of regulations within the common property
Patents	Include incentives to invest in biological resources	Can effect "North-to-South flows"	Ethical concerns against "patent on life"	Patent law must be embedded in environmental regulation

Source: Lerch 1998, 292

4.1.4 Biodiversity loss through policy and institutional failures

Besides market failure, biodiversity degradation is also a consequence of missing policies and institutions. The above described market failure and the undervaluation of diverse resources, which lead to the decline of biodiversity, can be addressed through governmental actions. The government is often in a position to intervene and correct the market failure.

These interventions can be the development of policies and instruments aiming at biodiversity conservation and the development of institutions, which assume the responsibility to implement such policies and to manage the resource. Examples are the creation or the improvements of property rights and the recognition of social benefits (Grafton et al. 2004, 447).

In reality, it can be observed that governmental interventions often do not stop environmental degradation. Often the appropriate policies are absent or compete with other policies, which have adverse effects on biodiversity. Most of them seek to promote economic development and ignore environmental impacts. For example, agricultural subsidies and land grants may promote agricultural production and the conversion of land thereby increasing the loss of biodiversity. Such a conversion is the consequence of the overvaluation of the converted assets, which generates the same result as the undervaluation of biodiversity (Swanson 1995, 6).

Part of the difficulties that governments have in establishing effective biodiversity policies is reasoned in the lack of a global and a national consensus on the biodiversity preservation priorities and the influence of changing societal preferences on policy-making.

The CBD suggests four different types of policy measures that offer orientation for national policy-makers. The first type are positive incentives for conservation like monetary inducements paid to landowners to reimburse them for providing biodiversity. The second category are disincentives to adjust economic decisions. Disincentives are for example realized through the polluter pays principle and the imposing of costs (e.g., through user or polluting fees) upon actors who damage biodiversity in order to discourage these activities. If the new financial resources are channeled to other actors, e.g., farmers and landowners, to incentivise biodiversity conservation, a double dividend can be achieved. The third type of policy measures are indirect incentives. These incentives are constituted by a mechanism that creates or improves market signals, which encourage conservation and allow receiving benefits from values of biodiversity. ABS is such an indirect incentive as well as the afforestation programs, which aim to obtain benefits from carbon sequestration. The last category is the removal of perverse incentives to accelerate biodiversity conservation. This includes the reform of agricultural policies and the reduction of production subsidies (Grafton et al. 2004, 448).

The nature of policy failures may appear differently and vary among countries. In many developing countries policy-making and policy-implementing institutions, especially in the case of environmental protection, are often weak or not even established. Besides, public participation in the policy-making processes is often not very high. Either an environmental regulation is not in place or if developing countries are able to formulate comprehensive environmental regulations, they lack institutions, resources, and sometime the political will to implement them. Policy failures are also observed in developed countries. However, there institutions are stronger, but biodiversity is turned over to other pressures. The consumption and the standard of living are much higher and aggravate the pressure on natural resources (Bhattarai / Hamming 1998, 12).

Biodiversity does not only rely on policies. Effective policies and policy instruments require efficient and strong institutions that implement them. According to North (1990), institutions reduce uncertainty by providing a structure for political, social and economic interactions. They affect the performance of the economy by affecting the costs of exchange and production, including transaction costs, and determine the profitability and feasibility of engaging in economic activity. Hence, institutions provide the incentive structure of an economy. Property rights are considered to be such institutions. Effective biodiversity policy needs effective institutional structures that provide the needed incentive structures to stakeholders.

4.2 The promise: biodiversity conservation by biodiversity commercialization

The promise of the ABS concept is biodiversity conservation by biodiversity commercialization. Besides, it implies that the commercialization will lead to economic development. This chapter outlines the essential aspect of the promise and analyzes them. ABS is regarded as an instrument that can foster sustainable development. Since ABS internalizes the commercial benefits of users of genetic resources, it can also be described as a market-based approach. The central elements of the concept are i) the state's sovereignty principle, which is characterized by the allocation of a quasi property right to countries over their biological resources and ii) bilateral contracts between providers and users of genetic resources on the exchange of these resources and compensations. Even if the theory suggests that bilateral contracts are a pareto-optimal solution, practical experiences indicate that many factors hinder the optimal outcome. Therefore, the subchapter shades light on a multilateral approach. IPRs are special category of property rights and eminently important for the ABS concept. The debate on the pros and cons of IPRs is sketched at the end of this subchapter.

4.2.1 ABS a market-based approach for sustainable development

ABS and sustainable development are closely linked, but what is sustainable development? Only few concepts have made a fast and pervading career in policy discourses as sustainable development. It was introduced with the Brundtland report in 1987 and defined as "*development that meets the needs of present generations without compromising the ability of future generations to meet their own needs*" (WCED 1987). During the Rio Summit in 1992 sustainable development was the main concept around which the debates crystallized. The main Rio documents, the Rio declaration and the Agenda 21, further defined the concept and gave it a more policy-orientated content. The balancing of economic, social, and environmental issues became the emphasis of concept. The overarching policy goal of the international community should be the creation and maintenance of a stable economy that produces sufficient welfare for the whole society and distributes the benefits in an equitable way. Since the Rio conference in 1992, the concept has been embedded in many policy agendas. The main principles of sustainable development include policy integration, equity regarding the costs and the benefits of production and consumption, intergenerational solidarity, internalization of social costs and benefits and participatory policy-making (Bruyninckx 2004, 266ff).

The CBD is one of the Rio agreements and reflects the concept of sustainable development. Firstly, the CBD is a global multilateral agreement that takes the conservation of biodiversity into account. It requires global coordinated action due to its global externalities. Secondly, the CBD's main mechanism to conserve biodiversity is a bilateral, market-based instrument, which aims to combine conservation and development efforts by conserving biodiversity through the commercialization of plant genetic resources.

Biodiversity-rich countries alone are not able to preserve their resources. In 1995, Norton-Griffiths and Southey estimated the opportunity costs of biodiversity conservation in Kenya from the potential net returns of agriculture and livestock production and compared them with the net returns from tourism, forestry, and other conservation activities. They found out that at the national level, agricultural and livestock production in the parks, reserves and forests of Kenya could generate gross annual revenues of US$ 565 million and net returns of US$ 203 million, being the opportunity costs of biodiversity conservation to Kenya. In 1995, the combined net revenues from wildlife tourism and forestry were US$ 42 million and inadequate to cover the opportunity costs to land. The authors come to the conclusion that Kenya alone – illustrating many developing countries - is not able to solve this problem and that there is a strong need for international co-operation. Developed countries benefit from the conservation efforts of developing countries, and they have to contribute towards these costs if they want to maintain these efforts (Norton-Griffiths / Southey 1995).

But even before such calculations, international policy-makers realized that the biodiversity-rich countries, being mostly developing countries, were not able to provide sufficient funds for nature and especially biodiversity conservation. It was clear that innovative financial instruments were needed to tackle the problem. Already between the 1970s and 1980s scientists, stakeholders from different developing and industrialized countries, and representatives of environmental non-governmental organizations began to develop strategies to stop the ongoing loss of resources. Market-based approaches were the focus of attention because they offered policy-makers new cost-efficient ways to reach conservation objectives, since they use market forces to achieve their objectives. Command and control approaches became less popular. The underlying idea of market mechanisms is to capture the global, external benefits of biodiversity (Heal 2000, 21ff). These approaches were especially driven by the change of exploitation and the change of the property rights status of biodiversity and particular genetic resources.

The market-based approach has been manifested not only in the adoption of the CBD and the ITPGRFA, but also through other conventions aiming at conservation and sustainable use of resources. Examples are the United Nations Framework Convention on Climate Change (UNFCCC) and GEF, which channels financial resources from industrialized to developing countries in order to support conservation activities. The perception of the necessity to integrate industrialized countries in conservation strategies in developing countries is one important reason that has advanced the concept: biodiversity conservation by biodiversity commercialization.

4.2.1.1 The sovereignty principle

The recognition of the principle of state sovereignty is the basis of the CBD's market approach. By assigning property rights and responsibility over biodiversity, the exclusivity of the biological resource is increased. In the case of crop diversity, the principle of state's or national sovereignty or the assignment of private property rights had existed before it was stipulated in the CBD. During the colonial times, ownership was exercised on potentially valuable plant species. With advances in breeding in the mid-1950s, the points of economic values of biological material shifted from the species to the variety level. There was a reallocation from the colonial claims of national sovereignty to the declaration of "common heritage". Biological materials belonged to humans in general. However, ownership could only accrue only to the creator of a new, distinct, uniform, and stable variety (Petit et al. 2001, 4).

Wild genetic resources, which can be accidentally found in forests, on grassland etc., always continued to be regarded as “common heritage of mankind”. The “common heritage” status of the wild genetic resources remained until its abolishment by the CBD and later reaffirmed by the ITPGRFA, recalling the principle of national sovereignty. The principle is regarded as a legal regime and as a precondition for the introduction of bilateral market-like contracts between holders and users of biodiversity (Boisvert / Caron 2002, 152).

From an institutional economic point of view, the adoption of the CBD and the ITPGRFA, affirming the principal of state’s sovereignty over genetic resources, is the result of the improved technologies to use genetic resources. Demsetz (1967) recognized that property rights emerge to internalize externalities, caused by open access, if it becomes economic to internalize the externalities. Only if the benefits of internalization exceed the costs of internalization, property rights will emerge. He describes two effects that can change the cost-benefit ratio. Firstly, an increased value of a certain asset increases the benefits or gains from ownership and lead to the creation of property rights. For example, new property rights can evolve through value enhancement driven by technical progress. Secondly, a decline in costs of implementing property rights also positively affects the cost-benefit-relation of establishing property rights. Demsetz’s theory is based on empirical observation of the development of land ownership of Indians in the Quebec region in the 18th century. Increased trade and value of fur resulted in the definition of property rights over beaver populations and some form of privatization.

Lerch (1998, 285) applies Demsetz’s theory to the case of genetic resources. The demand for genetic resources and their utilization have increased as a result of the technical progress in the field of biotechnology. Consequently, the benefits arising out of the use of genetic resources have increased, regardless which parts of the genetic resources are used (i.e., the tangible or the intangible part). This stands to reason for the creation of property rights of genetic resources and the adoption of the sovereignty principle by the CBD and the ITPGRFA, or private IPRs. Besides the increase of value, the cost side also influences the emergence of property rights. This does not occur on the level of the biological material, but on the processed and advanced level where the genetic information comes into effect. The transaction costs for the assignment and enforcement of such rights have decreased by the establishment of property rights institutions, as for instance, IPR protection systems. The existence of such created institutions or regimes facilitate the emergence of IPRs in the area of genetic resource utilization (Sedjo 1992, 207f)

4.2.1.2 Internalization of commercial externalities

The innovative framework of biodiversity management under the CBD and the ITPGRFA takes up different developments of the last 20 years: the increasing loss of species, new insights about biodiversity conservation, but also the technical progress in the area of biotechnology and the increasing demand for biological material. This includes access to genetic resources and appropriate transfer of relevant technologies.

To recall the results from the previous subchapter: biodiversity and its components have characteristics of public and private goods. While many of the benefits of biological diversity accrue to the public as a whole in the form of cultural, social, and economic benefits, a number of its components have private values (OECD 2003b, 23ff). It assumed that the public value of biodiversity is very large (cf. chapter 4.1.1). Starting from there, every endeavor would be made to conserve the planet's life-support system or certain ecosystem services. However, the private value of any specific status of biodiversity varies and depends on the institutional settings. But it is this private value that determines decisions and economic behavior regarding the handling of biodiversity (Simpson 1999). People convert biodiversity-rich forests to cultivated land if this allows them to increase their income. The conservation of biodiversity through market-based incentives can only be obtained if the private benefit of conserving biodiversity exceeds the private benefits of cultivating land or of any other biodiversity damaging activity (e.g., commercial logging).

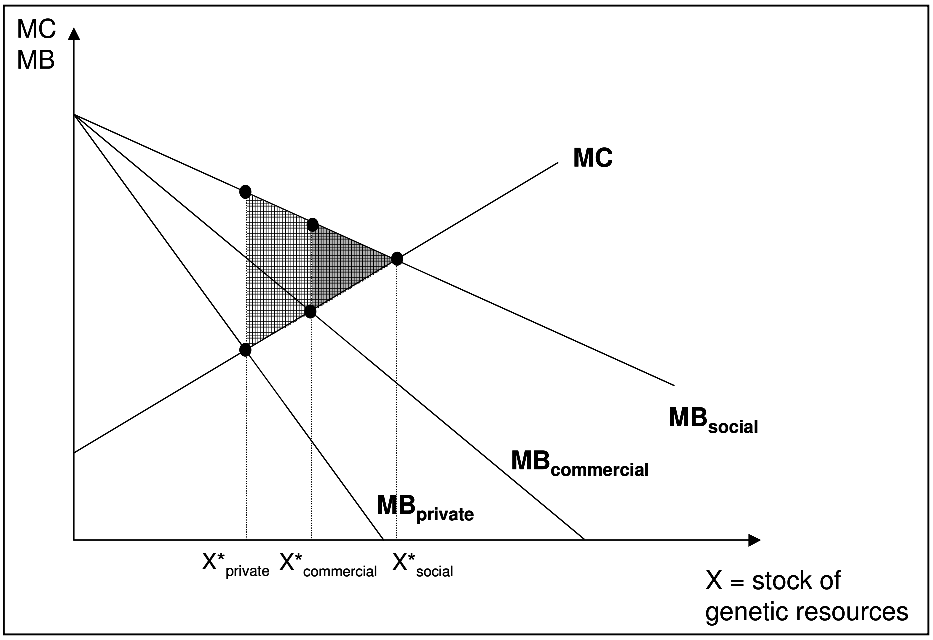
The utilization of biodiversity as an input in research and development embodies a private value. Due to evolution and the selection process, nature provides a number of successful strategies that can be used against the dynamic occurrence of existence-threats, for instance, pests and predators of the primary food system or non-curable diseases. Therefore, diverse wild plant genetic resources are of high interest (Swanson 1996, 3). The main user sectors are the pharmaceutical industry, the crop protection sector, the agricultural seed business, the horticulture, the botanical medicine, the cosmetic and personal care sector, and so-called life science companies, combining pharmaceutical, food, seed and chemical divisions. All these sectors have a high interest in obtaining genetic resources for research and development. This was already shown in chapter 2.4. The demand function for genetic resources is not well known. Already Reid et al. (1993) stressed that the demand for biochemical resources for the pharmaceutical industry is likely to be elastic in response to price changes, meaning that if the price for access to natural products rises, pharmaceutical firms can respond with increased investment in synthetic chemistry and reduced investment in natural products research.

The contribution of natural products to sales in the world's top pharmaceutical companies ranges from 10 to more than 50 percent. Of the 25 best-selling drugs worldwide in 1997, 42 percent of sales came from natural products, with a total value of US$ 17.5 billion (ten Kate / A Laird 1999, 34). Therefore, the potential of the commercial use of genetic resources is obvious. Even if some companies have recently scaled down or closed the section of natural product development, all leading companies still run natural product programs within the company or through subsidiaries (A Laird / ten Kate 2002, 249).

The market structure of the sectors using and providing biodiversity is characterized by an asymmetric distribution of resources and technology. The sectors having the potential to commercialize and demand genetic resources are mainly located in industrial countries, whereas most of the provider countries can be identified as developing countries (Myers et al. 2000, 855). The ABS concept is a response to this situation by aiming at a participation of provider countries in the economic gains stemming from their biological resources.

ABS internalizes the private commercial value of genetic resources, which is one value within a bundle of values determining the social benefits of biodiversity. If biodiversity is conserved only based on individuals' private value (private marginal benefits $MB_{private}$), the maintained stock of genetic resources is much smaller ($X^*_{private}$) than it would be optimal from a societal point of view (X^*_{social}). If the commercial value is internalized by making users of genetic resources pay for access and share benefits the conserved stock is much greater ($X^*_{commercial}$). However, the conserved amount is still much smaller than the socially optimal amount.

Figure 11: Internalization of the commercial value



In theory, the concept of ABS seems to be promising. The creation of a market for the product “biodiversity” and the trade of biological resources make it possible to protect biodiversity by using it in a commercial but sustainable way. This approach is the opposite of the classical protection concepts, claiming for not using the resources at all. This concept does not only address biodiversity conservation. The commercialization of genetic resources is regarded a new source of income and biodiversity comes out as a joint product, which is reasoned in its character as an impure public good. It is expected that ABS contracts provide sufficient flows of investments and technologies in the area of biotechnology to promote economic development and allow countries to establish an industry sector related to the use of genetic resources (Reid et al. 1993, 33). New capacity building and economic development are closely linked to poverty issues, which has been identified as the major underlying reason for converting biodiversity-rich habitats. The commercialization of biodiversity promises to serve the dual purpose of alleviating poverty and sustaining natural resources at the same time (Simpson 1999).

4.2.1.3 The bilateral approach

The CBD has established a bilateral system for the exchange of genetic resources. Within this system access to genetic resources and the commercial use are regulated and aligned with access and use costs. A country, being rich in biodiversity, is supposed to allow access to genetic resources in exchange for monetary or non-monetary benefits as technologies and especially biotechnologies (Bonn Guidelines 2001, Appendix II). According to the CBD, the competence for regulating ABS is assigned to the national governments, owning the genetic material. The exchange depends on negotiations between the provider and the user of genetic resources until they agree on a contract about the planned bioprospecting activities and the benefit-sharing procedure. This contract provides a framework for determining rights and obligations, and, in particular, attributing property rights and regulating the sharing of benefits in the case of the discovery of products or processes with new commercial applications. Shared benefits are usually payments beforehand for the right to explore, or royalty payments deriving from the use of material discovered for a given period, or both. Contractors obtain, in exchange, the right to patent, or otherwise exclusively exploit materials discovered. Table 11 gives an overview of the potential benefits and costs of users and providers.

Table 11: Types of costs and benefits arising out of ABS

Providers' benefits – Users' costs	Users' benefits – Providers' costs
Non-monetary	**Direct**
Technology transfer	Biodiversity conservation
Free access to technology and products	Access to genetic resources
Co-ownership of IPR	Legal security
Acknowledgement in publications	Non-exclusive or exclusive user rights
Joint research and increased scientific capacity	
Participation in planning and decision-making (including research results)	
Control of samples	
Voucher specimens deposited in national institution	
Increased conservation capacity	
Monetary	**Indirect**
Bioprospecting fees	New inputs for research and development of products and processes
Per-sample fees	Increased profits by new products and processes, protected by IPR
Percentage of research budget	Technical progress
Royalties as percentage of net sales or net profits	Increase in information and knowledge
Development of alternative income generating schemes	Publications
Commitment to reinvest in source country	
Specific funds	

Source: based on Columbia University 1999; Bonn Guidelines, 2001

The legal basis of such contracts between a user and a provider, regulating questions of ABS, are clear property rights. Most of the countries, harboring high diverse genetic resources, are members of the CBD and the state sovereignty principle applies. If the state has the quasi-ownership over the genetic resources, it has the mandate to negotiate with interested parties and is the beneficiary of present and future profits. The local level only participates by giving the PIC. To what extent the local level will benefit depends on national regulations. However, one part of the possible profits realized by the commercialization of genetic resources, for example in the pharmaceutical and seed industry, should flow back to the provider of the resources and give an incentive to continue conserving biodiversity. Through such compensations, alternate land uses that destroy biodiversity become less economical.

In order to create incentives for biodiversity conservation and assure a continuous supply of genetic material, the benefits earned through commercialization have to be channeled to the landowner or local community in charge of the resource management and bearing the conservation costs. Then, these benefits create a new source of income for these agents and biodiversity comes out as a joint product. This underlines the important role of the national institutions defining property rights and thus distributing income opportunities.

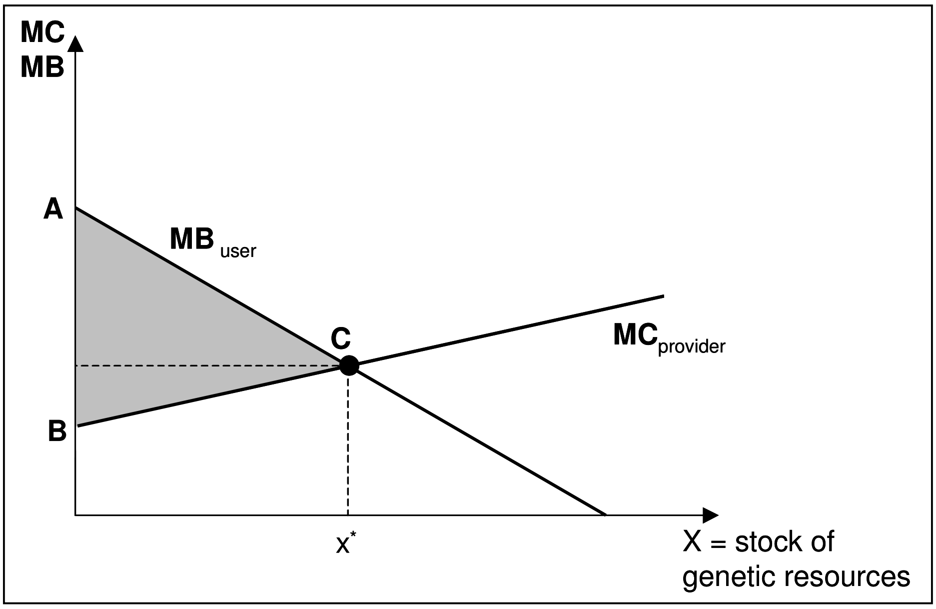
A central statement of the property rights theory justifies the CBD's claim for a bilateral approach. Bargaining solutions are regarded an internalized strategy for externalities. Coase (1960) suggests in the so-called "Coase Theorem" that bilateral bargaining based on well-defined and assigned property can internalize externalities if a number of assumptions are satisfied, including the absence of transaction costs and having fully informed market participants. Within that conceptual framework, property rights contribute to achieving economic efficiency, which maximizes the overall welfare of society. The distribution of rights has no influence on the outcome. If the transaction costs are too high and prevent bargaining, the efficient use of the resources will depend on how property rights are assigned. Therefore, the Coase Theorem calls for laws that should be structured so as to remove the impediments to private agreements or to minimize the obstacles to private agreements over resource allocation. It is assumed that the parties are in the best position to know how much they value the property right under negotiations. Abstracting from some restrictions (which will be discussed later on), bilateral ABS contracts as suggested by the CBD can be interpreted as "Coase solutions" (Sedjo 1992, 208f; Lerch 1998, 296ff; Boisvert / Caron 2002, 152).

The Coase Theorem and its assumption initiated the development of transaction costs economics that deal with the costs that occur when an economic exchange is undertaken. When the exchange involves many agents or agents being separated by time or space, the transaction costs might be too high. In that case the outcome would depend on the specific nature of the initial allocation of rights (Swanson / Goeschl 2000, 76).

The Hobbes Theorem formulated by Cooter (1982) considers the case that people are seldom rational enough to agree on a division of the cooperative surplus, even when there are no serious impediments to bargaining. Therefore, the law has to be designed to minimize the harm caused by failures in private agreements by allocating property rights to the party who values them most (Janssen 1999, 317). Besides, Coase's assumptions of distributive effects are not always applicable. In the case of biodiversity, the distribution of property rights is critical for the outcome of ABS (OECD 2003a, 22). This aspect is examined in chapter 5.1.2.

The bargaining between the provider and the user of genetic resources can end in a pareto-optimal allocation of protected biodiversity (X*) if the marginal benefits (MB) of the user equal the marginal costs (MC) for biodiversity protection of the provider. The outcome of such a negotiation is a social surplus (ABC), which can be shared between the participating parties.

Figure 12: The Coase theorem applied to the trade of genetic resources



Source: adopted from Janssen 1999, 316

In theory, bilateral contracts on bioprospecting seem to be a perfect solution because externalities are internalized, a social welfare benefit accrues, and - as joint product - biodiversity conservation is realized. Therefore, from an incentive point of view a fee-for-access regime provides an effective system, especially in case of rare and geographically isolated wild genetic resources of high interest as input for research and development.

Nevertheless, Coase already indicated that transaction costs and other factors exist that make the bilateral bargaining system ineffective and prevent optimal solutions. Information asymmetry and the relevance of transaction costs, imperfect competition, as well as the uncertainty about the global and intergenerational value of genetic resources are important reasons hindering the achievement of agreements. These problems are closely investigated in chapter 5.1. All these issues and reasons are preventing the optimal production of "biodiversity conservation" through bilateral benefit-sharing.

4.2.2 The role of intellectual property rights

Within bilateral agreements, the exclusiveness of IPRs for products derived from collected samples of genetic resources plays a major role. But what is the main idea of IPRs?

Today innovations and technologies that promote economic development are becoming increasingly intellectual rather than material in nature. Biotechnological inventions, computers, and chemicals based on renewable resources are examples for goods with a high degree of intellectual content (Bhat 1996, 206). These intellectual goods are based on knowledge that can also be characterized by the two criteria of public goods: non-rivalry and non-exclusivity. Private investments in knowledge do not pay-off if the new knowledge becomes public and has no restriction for its access after it has been developed. The consequence is the dilemma of public goods: a non-optimal supply of knowledge and a decrease in research and technical progress (Maskus 2000, 29). IPRs have been established to address the public good dilemma and provide incentives for research and the realization of technical progress. The assignment of IPRs, e.g., patents, grants the recipient a temporary supply monopoly, so that she/he can realize a monopoly profit by the selling of her/his products. In return, the inventor has to reveal to the public the information necessary to build upon and commercialize the invention when the IPR protection has expired. Without the incentive it is most likely that the inventor would keep secret the knowledge on the invention (OECD 2001a, 13). However, welfare losses are the result of such monopolies rights. In comparison to a situation of perfect competition, the price of such a protected product is higher and the supplied amount is less in static sense.

The impact of IPRs depends on the product they protect and on the level of economic development of the concerned country (OECD 2001a, 12). The proponents argue that protection is especially needed in the case of knowledge-intensive products whose research and development take a long time and require large investments, whereas whose duplication has very low costs. This holds true for the pharmaceutical sector as well as for the crop breeding sector where the development of a new drug/variety can take up to 15 or more years and for products that can be easily copied.

On the one hand, for countries that are technologically advanced, IPR protection is more likely to have a positive impact on the economy, since it ensures a return. On the other hand, for those economies that are predominantly consumers of protected intellectual property (i.e., low-income countries), the impact may, in the short-run, turn out to be negative by lost jobs and decreased production of patented products (Bhat 1996, 207). The proponents of IPRs argue that in the longer-term the impact on low-income countries is positive because they will benefit from enhanced foreign direct investment, increased research activities, technological advancement and increases in trade (OECD 2001a, 12). However, IPR protection does not increase investment in traditional technologies because developing countries lack the fundamental prerequisites as monetary funds, research facilities, and human resources (Bhat 1996, 207).

Another negative effect occurs in the low-income countries from the establishment costs. Most developing countries do not have any IPR system in place. These countries have to invest huge financial and human resources to establish such an IPR system. Consequently, these resources are detracted from other uses that might support economic development (Hilpert 1998).

In the case of agricultural crop protection, Droege and Soete (2001, 161) come to the conclusion that developing countries will maximize their welfare if they protect traditional cultivation methods (farmers' rights) and demand royalties but refuse international patent protection. If both protection regimes are established industrialized countries have a higher pay-off. Industrialized countries also benefit from the protection regime in developing countries because only then biodiversity is conserved. Therefore, these countries should favor a combination of different regimes. Evenson (1999, 1635) comes to a similar conclusion. Even if IPRs are expanded to crops only in developed countries, it will have deleterious effects on developing countries. Janssen (1999, 320) concludes that if in provider countries biodiversity is an open access resource, IPR protection will aggravate the already inefficient global provision of biodiversity, but if efficient property rights regimes are established to complement IPRs, the decline of biodiversity will be halted.

5 The effectiveness of ABS: critical factors and addressing measures

With the adoption of the CBD, provider countries started to develop ABS regimes to implement the Convention. The realization of the ABS concept has mainly depended, so far, on the performance of provider countries. Meanwhile, more than 50 countries are in the process of developing and implementing laws and policies on the subject (Barber / Johnston / Tobin 2003, 15). The process of infusing the international agreement into national legislation is long and difficult. Even if the concept has been implemented, successful cases are rare, and in the international community discontent emerges. Complains on both sides, providers and users, about the functionality of the approach have arisen. The international negotiations indicate that users will have to assume more responsibility in future. However, no agreement about a future regime has been concluded.

This study contributes to the debate by analyzing whether and how the CBD's approach of ABS is an effective concept to ensure the conservation and sustainable use of biodiversity, to facilitate access to biodiversity and to ascertain the fair and equitable sharing of the benefits arising from the commercialization of genetic resources. After having characterized the economic framework of ABS in chapter 4 it is possible to progress with the main goal of this study. This chapter establishes the analytic framework (cf. Figure 13) to measure the effectiveness of the ABS concept, which is defined as the capability of the ABS regime

i) to set incentives for the sustainable use and the conservation of biodiversity;

ii) to facilitate access to plant genetic material; and

iii) to enhance a fair and equitable benefit-sharing (prevent misappropriation).

This means that an effective ABS regime has the capability to establish an environment in which the biodiversity in provider countries is successfully protected, in which biological resources in provider countries with a commercial value are sustainably used (i.e., access is demanded and granted), and in which the benefits of this utilization are equitably shared between providers and users of the material. If an ABS regime, be it national, regional or international, has the capability to set incentives, facilitate access and enhance benefit-sharing, it will be effective.

To measure these capabilities their determinants, so-called critical factors, have to be defined. These critical factors are derived in chapter 5.1 by an approach, which combines the results from the identification of the economic framework of ABS in the previous chapter (cf. chapter 4), the application of new institutional economics theory's major aspects (i.e., property rights, bargaining solutions, transaction cost, and information failures), and the empirical findings of four ABS country case studies (cf. chapter 1.3). These are based on the collection and analysis of empirical qualitative data of national and regional ABS regimes in Costa Rica, the Philippines, and Ethiopia. To complement the analytic framework from a user perspective, the EU serves as an adequate case study. The structure of this analysis does not reflect the chronology of the research. The findings of the case studies, which are illustrated in chapter 6, have already contributed to the analysis in this chapter.

The identified critical factors are property and intellectual property rights, information asymmetries, time lags, good governance, administrative complexity, and market structure. They impact and shape the outcome of the three objectives of effectiveness.

Firstly, biodiversity will only be conserved if incentives are established that can stop the destructive use of biological resources. Property rights or intellectual property rights must be placed at those levels that are most effective at maintaining and investing in the concerned asset and compensation payments must occur real-time to make other destructive uses (e.g., logging) less profitable.

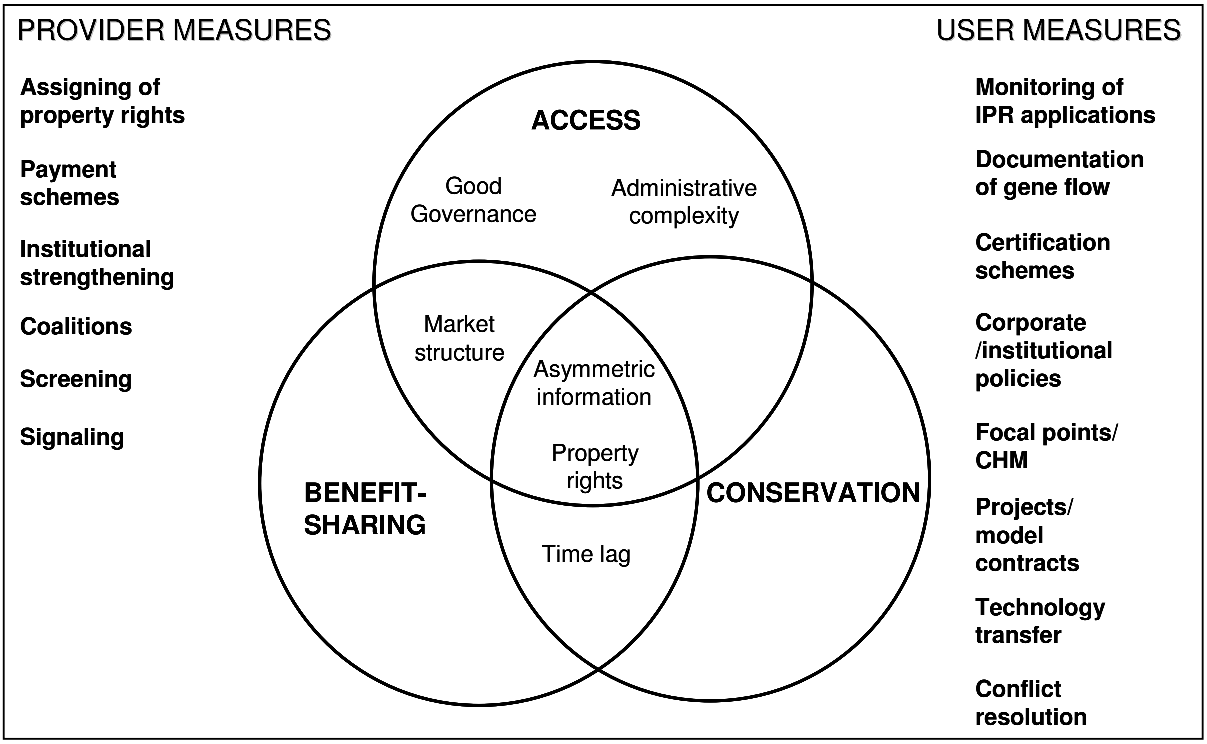
Secondly, access has two dimensions. It only takes place if users and providers are interested and can agree. One the one hand, access will only be granted if provider countries can expect benefits. Therefore, compliance of users must be ensured and informational deficiencies between providers and users have to be abolished. Moreover, time lags between sampling and commercial success must be accounted for (by, e.g., sampling fees, non-monetary benefits). Consecutive behavior due to information deficiencies results in over-regulation (meant to ensure benefit-sharing) that negatively affects local research.

On the other hand, access will only be demanded if users cannot use alternative sources. Here, ex-situ collections and similar alternative sources pose a problem. Besides, access will only be demanded, if (transaction) costs for obtaining access are not prohibitively high. Transaction costs arise for various reasons. Uncertainty about ownership and good governance leads to difficulties in obtaining PIC, in negotiating and concluding contracts, and decreases demand for access. Complex ABS application procedures also increase transaction costs.

Thirdly, the ABS concept is only effective if the holders of the resource in question receive fair and equitable benefits. To fulfill this condition these agents must be defined and identifiable. Benefits should address the needs of the local communities and address the problems arising from time lags. The received benefits have to compensate the conservation costs. The distribution of benefits and thus the CBD objective “fair and equitable benefit-sharing” is strongly affected by the distribution of bargaining power, which is closely linked to market structure. Compliance with contracts must be ensured in user countries.

These critical factors positively or negatively impact the effectiveness depending on their implementation. In this chapter the case studies are not yet analyzed in their country-specific context. They all rather provide input to develop a general theoretical framework that can serve to analyze a large number of different country-specific cases. The analysis of the effectiveness of the ABS concept allows deriving recommendations to improve ABS governance. Therefore, this chapter also deals with measures that address the essential critical factors affecting the effectiveness.

Figure 13: Analytical framework to measure ABS effectiveness



Various measures, e.g., the assignment of property rights, compensation schemes, contracts, coalitions etc., are identified and assessed, and strategies are proposed how to implement such measures. They are separately analyzed from the critical factors in chapter 5.2. It is assumed that these measures are the most promising to address the critical factors.

Following the international debate, it is distinguished between measures that need to be initiated by provider countries (i.e., provider measures) and measures that have to be implemented in recipient countries (i.e., user measures). So far, the focus of ABS implementation has been on provider countries. However, it has been become clear to the international community that only both user and provider measures can effectively implement ABS. This has been formulated by the call for the development of an international regime. After the theoretical examination of the critical factors and potential measures, the established analytical framework will be applied to four case studies in the following chapter (cf. chapter 6).

Even if ABS has been looked at from different research fields (mainly law), an adequate theoretical framework for the analysis of the effectiveness of the concept is still lacking. So far, most of the research has focused on the general economic framework of ABS as discussed in chapter 4 or on single problems of ABS. Only the OECD has published a more comprehensive approach in 2003. This report compiles economic issues of ABS, which are more of a general kind and not based on empirical findings. It also considers asymmetric information as major problem of contributing to market failure and the loss of biodiversity in addition to non-rivalry and non-excludability. This assessment cannot be agreed with. Non-rivalry and non-excludability are a general problem contributing to the loss of biodiversity, whereas asymmetric information is a problem of ABS. Therefore, in this analysis information deficiencies are identified as a critical factor. Other issues, which the report sketchily discusses, are property rights, the sharing of benefits, contracting, participation of local stakeholders, and capacity building. This study considers the OECD results, but does not follow the proposed framework.

This study considers and integrates existing approaches and publications that analyze these single aspects. For example, Swanson and Goeschl (2000) analyze the distribution of property rights and its impact on efficiency. Mulholland and Wilman (2003) investigate how contracts have to be designed and which payments schemes have to be included to guarantee that risk-averse host countries provide high quality genetic material. Gehl Sampath (2005) applies transaction costs economics and economies of contracts to bioprospecting contracts on traditional knowledge and genetic resources.

This chapter fills this gap by developing and establishing a new analytical framework based on insights of new institutional economic theory, but also based on the findings from the case studies. Therefore, the approach applied in this study combines deductive and inductive reasoning processes to establish a new analytic framework.

5.1 Critical factors of an effective access and benefit-sharing regime

This chapter derives the critical factors based on the application of new institutional economic theory and the insights that could be gained through the case studies. Relevant theories are property rights and contracts theory, as well as transaction cost theory and the theory on imperfect competition. The applied theories give also a hint, which instruments and measures can solve the problems concerning the critical factors.

5.1.1 The derivation of the critical factors

Six factors determine the effectiveness of ABS. How have these factors been derived?

To answer the question, we have to recall the results of chapter 4. Before the CBD was adopted and ABS was introduced, there was no market and genetic resources were not traded. User unilaterally obtained the needed material without the consent and approval of the resource holders. Therefore, these were not compensated for the provision. At the same time, the loss of biodiversity went on. The economic analysis of the loss of biodiversity comes to the conclusion that mainly two underlying causes explain the decline of the genetic resources: market failure and policy failure (Swanson 1995, 1-10). The CBD was adopted and ABS was chosen as an instrument to address these problems and establish a market for biodiversity.

The market for biodiversity fails because the provision of the resource has externalities and public good characteristics. Biodiversity is not conserved because it produces positive externalities that are not considered by private agents. Since the individual's benefits and the private value of producing the good are less than the benefits gained by society (i.e., the social value) in a competitive market, an insufficient amount of biodiversity is provided from the society's point of view. The outcome is not socially optimal. Besides, the protection of biodiversity is non-exclusive and non-rival and suffers from free-riding. This also contributes to the market failure and the amount of biodiversity is not sufficient (see chapter 4.1.3).

The market for biodiversity also fails due to policy and institutional failures that describe a situation where appropriate policies and institutions are lacking. The market for biodiversity only functions well if policies and institution provide incentive structures to the agents and their transactions (North 1990, 3f).

By allocating sovereignty rights to provider countries and requiring a fair and equitable benefit-sharing, ABS establishes a market for biodiversity (OECD 2003b, 48). The theory suggests that ABS is a promising concept to stop the decline of biodiversity. Following the Coase Theorem, under certain assumptions the bilateral trade of genetic resources is a bargaining solution that internalizes externalities (Sedjo 1992, 208f; Lerch 1998, 296ff; Boisvert / Caron 2002, 152). Theoretically, it can lead to a perfect solution because the internalization generates social welfare benefits and biodiversity conservation is realized as a joint product.

However, it seems that the theory is not working in practice. The ABS concept has been developed in 1992, and since then its contribution to stop the decline of biodiversity is very limited. Many providers and users complain about the approach. Providers criticize that they have not received benefits, but that their material is used without approval. Users argue that access and use have been impeded. These statements are in contrary to the objectives of the CBD. We still observe a market failure.

Nevertheless, the problems that appear in the bilateral negotiations and hamper the trade of genetic resources are not very surprising – even before analyzing the empirical cases. Taking a closer look at the theory gives us a hint why certain problems occur and how they can be addressed. The theory offers different explaining models. Market failure can be caused by externalities, transaction costs and information asymmetries, and imperfect competition due to the market form.

Coase (1960) already formulated certain assumptions under which his model works. He already indicated that transaction costs and other factors exist, which make the bilateral bargaining system ineffective and prevent optimal solutions. Therefore, he excluded them or stressed the need of their existence. He assumes that property rights are well defined and the costs of transacting are zero, which implies that all agents in the market are perfectly informed.

These assumptions are not valid for the case of ABS. Even under ABS the market for genetic resources is not a perfectly competitive market (Gehl Sampath 2005, 65). Certain imperfections can be identified that distort the trading activities or cause a market failure. This statement seems quite surprising, since the ABS concept was introduced to remove the existing market failure. Some of the problems arise through the ABS concept itself, but some are reasoned in the predetermined conditions and the environment, in which the ABS concept is applied.

Property rights theory

Property rights play an important role because ABS creates a market to trade genetic resources for compensation. This exchange also involves a transfer of property rights as already described by Coase. The question of the assignment, the distribution and the strength of property rights is the most relevant. According to the theory, private property rights contribute to an efficient allocation of resources and increase social welfare (Alchian 2007; Richter / Furubotn 1996, 81). As long as externalities still exist, because property rights are not well defined, the market of genetic resources will fail.

The OECD report (2003a, 27f) stresses the importance of property rights and the way national governments translate the principle of national sovereignty into some other property right form. It proposes the forms public property or public interests; the latter form gives room for private property rights. Swanson and Goeschl (2000, 77) analyze the case of crop genetic resources and come to the conclusion to place property rights for efficiency purposes at those levels, being more effective at maintaining and investing in the concerned asset. Looking at the value chain it is obvious that at all stages of the production process, potential right holders are present. The levels can be providers – private or communal landowners on the local level and/or governments – and users in form of companies and researchers/research institutions, depending on the processing level of the material. Swanson and Goeschl use the UPOV Convention as an example to show that the IPRs systems do not have a positive impact on the supply of genetic resources to the plant industry. They have created incentives to invest in research and development in the plant-breeding sector (i.e., at the end of the value chain), but they have not generated investments in local farmers conserving local landraces and therefore maintaining crop diversity. The reasons are that the local farmers so far have not received benefits from the use of their varieties. Hart and Moore (1990) call it a property rights failure when the best investor in an asset is not the property right holder.

The case studies underline that in the ABS concept property rights are not necessarily well defined. The CBD allocates property rights to the states, but not to the landowner or resource holder. It depends on the state how property rights are distributed within the country and the state does not necessarily give the resource holders a share of the benefits. Therefore, the adequate response to this critical factor is the assignment of property rights.

Contract theory and transaction costs

At the heart of the exchange of genetic resources and benefits are contracts because contracts reallocate rights between contracting parties (Barzel 1997, 33). Contracts document the exchange of relative property rights between persons. Relative property rights are property rights that are directed to a certain person, the contract partner. Absolute property rights are rights over property that everybody has to respect (Richter / Furubotn 1996, 79ff).

The incentive structure of contracts is very important for the compliance of the contract. The creation of such an incentive structure can be difficult if both transactions do not take place at the same time. Such a time lag is very relevant for ABS, since the acquisition of genetic resources and the generating of benefits do not coincide. Besides, transaction costs are significantly relevant for contracts. The main problems that can arise out of the existence of transaction costs and the time lag between the conclusion of the contract and the accomplishment are i) asymmetric information and ii) transaction-specific investments related to the frequency and the uncertainty of the transactions (Richter / Furubotn 1996, 92).

Williamson (1985, 52) identifies asset specificity, the frequency, and uncertainty as important characteristics of transactions, when he says, „The principal dimensions with respect to which transactions differ are asset specificity, uncertainty, and frequency. The first is the most important […] but the other two play significant roles.“. An asset is specific if it is worth much more within a certain transaction than outside it. Parties cannot easily switch to another partner after some investments have been made. Williamson (1983, 526) differentiates four types of specific investments: site specificity (i.e., physical proximity), physical specificity (e.g., investments in machines), human asset specificity (e.g., learning by doing), and dedicated assets due to expectations of high demand. Frequency has also an impact on transaction cost. If the transactions are frequent, the parties will invest in some governance structure that decreases transaction costs and makes these transactions efficient (Gehl Sampath 2005, 69). However, the trade of genetic resources is not characterized by asset specificity. Wild and so far undiscovered genetic resources that are collected for screening purposes usually have no specificity. A provider country can offer their resources to any company interested in the use and companies can approach any provider country. Site specificity can be relevant in cases where a pharmaceutical company asks for a specific plant in a specific country or region. Long-term relationships between companies and countries (e.g., in the case of Costa Rica) can be characterized by human specificity. However, looking at the case studies asset specificity does not prove to be of such an importance to justify a closer investigation. Therefore, this factor is not selected as a critical factor.

Transaction costs can be i) search and information costs, ii) bargaining and decision costs, and iii) monitoring, renegotiation and enforcement costs. Search and information costs comprise the costs that arise when looking for a contractual partner. Contractual partners usually face bargaining and decision costs when negotiating. This process takes and requires consultations. Monitoring, renegotiation and enforcement costs result from the need to monitor the fulfillment of the contract, to renegotiate the conditions and to enforce the contract (Richter / Furubotn 1996, 52).

In the case of ABS, the three categories of costs appear in the form of uncertainty and asymmetric information, which are intensified by opportunistic behavior. Uncertainty arises because the contractual partners cannot predict the future. They have to make a decision without knowing the consequence of their decision. If contracts can adapt to new or unexpected situations, the allocation result will improve. Uncertainty is closely related to information. The level of information can be different among the contractual partners. It is very likely that one party knows more than the other according to a certain issue relevant for the contract. Opportunistic behavior can occur before and after a contract has been concluded. Since the parties have an incentive to behave opportunistically after the contracts have been concluded, the theory suggests ex ante measures to ensure the efficiency of the allocation, as for example, screening or signaling. Through these mechanisms the uninformed party can obtain additional information (Richter / Furubotn 1996, 92). Screening allows the uninformed party to induce the other party to reveal their information, and signaling allows the informed party to signal their willingness to comply. Any measure that provides additional information to the uniformed party can address the asymmetrical information.

Provider and users have search costs because before they can conclude a contract they have to look for appropriate partners they can trust. During the bargaining process, users and providers have asymmetric information. Providers have no information about the benefits users expect. Users lack information on the exclusiveness and on the quality of the material. Both users and providers have monitoring cost due to asymmetric information. Providers cannot observe the use of the material when it has left their territory and users cannot observe how the shared benefits are used and whether the provider countries invest it biodiversity conservation.

The transaction costs in ABS are mainly caused by asymmetric information. Therefore, asymmetric information is derived as a critical factor. Additionally, some other sources of transaction costs have to be mentioned. Search cost can arise due to the difficulties of users to identify reliable and suitable providers. In the German user study users state that they have difficulties in finding appropriate partners due to lack of support and information. This means that their search costs are high. The bargaining and decision costs are also impacted by the institutional arrangements in the provider countries. In the German user study it is illustrated that some users find the administrative ABS procedures time-consuming, bureaucratic, and complex (Holm-Mueller / Richerzhagen / Taeuber 2005, 46). The case studies also provide some insights regarding these issues. The Philippine regulation has been very complicated and bureaucratic. Many Philippine stakeholders agree that this is the reason why ABS has not taken place so far and have recently improved the ABS regulations.

The problem of administrative complexity and the associated transaction costs appears in the case studies very relevant. Therefore, it was chosen as an independent critical factor and not united under the category “transaction costs” together with asymmetric information. Besides, not all three categories of transaction costs are equally relevant.

The transaction costs are very important, but also the environment, in which transaction costs arise, is essential. According to Davis and North (1971), new institutional economics are divided into two parts: the institutional environment and the institutions of governance. Williamson (1991) argues that the institutional environment is a set of parameters (i.e., political, social, and legal) that establishes the basis for economic transactions (i.e., production, exchange and distribution). If they are changed, they will lead to shifts in the comparative costs of governance. In the case of ABS, good governance is such an institutional environment. Good governance comprises for example political stability, control of corruption, rule of law, and accountability (Kaufmann / Kraay / Mastruzzi 2006, 4). Therefore, good governance is chosen as another critical factor.

Imperfect competition

It is obvious that the market of genetic resources suffers from imperfect competition due to the market structure. A market that operates under conditions of perfect competition is characterized by three conditions: i) numerous participants (i.e., many buyers and sellers), ii) freedom of exit and entry, iii) perfect information, iv) homogenous products (Baumol / Blinder 1994, 222). The second and the fourth conditions are not relevant in the case of ABS. Everybody can enter and exit the market and at the stage of collection wild genetic resources are homogenous goods, since the quality and potential are unknown. The third condition fails, since both users (i.e., buyers) and provider (i.e., sellers) are not perfectly informed. This problem was already mentioned in the previous section. The first condition is also not met. If sellers and buyers do not equally participate, we can differentiate between four forms of market participation: a) monopoly, in which there is only one seller, b) oligopoly, in which there is a small number of sellers, c) monopsony, in which there is only one buyer, and d) oligopsony, in which there is a small number of buyers.

In the case of ABS, we observe a small number of relevant buyers that acquire genetic resources for commercial purposes while the number of sellers is quite large. Mergers in the pharmaceutical and agricultural sectors have created large life science companies that dominate the market (Braga 1996, 360). According to the different described categories, the market for genetic resources is characterized by an oligopsonistic competition. The users in the market have a strong bargaining position and power. Especially for the negotiating process of ABS contracts, the market structure is relevant. Measures that strengthen the position of the weak party are an adequate response. Due to its importance, the market structure was chosen as a critical factor.

In the following subchapters, the six critical factors are separately analyzed. The results from the case studies are integrated in the analysis; they have deepened and broadened it.

5.1.2 Property and intellectual property rights

The strength and the distribution of property rights is the most critical factor of ABS effectiveness, since property rights impact all three elements of ABS effectiveness: conservation, access, and benefit-sharing. Property rights enable property owners to market their resources. Only if the agents, being responsible for conserving biodiversity, have adequate property rights over the biological resources they can grant access, and they are in the position to receive benefits that in the next step establish incentives for biodiversity conservation.

According to genetic vocabulary, biodiversity can be divided into two parts: the phenotype that is the tangible biological material and the genotype that is the genetic and biochemical information of the resource. The assignment of property rights over these two forms of biological material varies. Tangible resources (e.g., plants) in general are subject to private property rights through landowner rights or to communal property rights through state or community property rights. Intangible resources such as products of research and development can be protected by IPRs, e.g., patents or plant breeder rights (Sedjo 2000, 111).

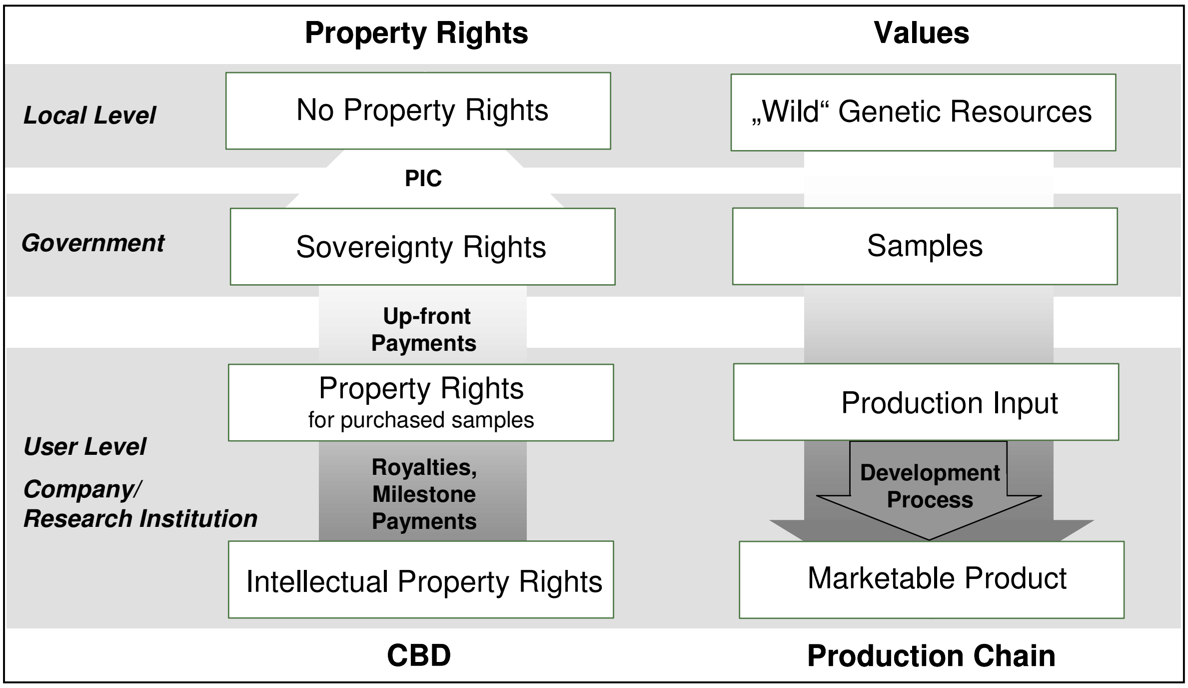
Property rights are transferable. In most cases, companies or research institutions that sign ABS contracts with provider countries receive property rights for the purchased, tangible material in exchange for access and sample fees and up-front payments. These property rights are usually restricted by obligations regarding the utilization. In case of successful development, research and commercialization, the inventor can receive IPRs over the intangible material. The contribution of provider countries to the invention is rewarded by royalties and milestone payments (milestone payments are made if the sample has evolved in the research and development process to a more valuable substance), or other non-monetary transfers, affecting national research and development, local economic development, and capacity-building (cf. chapter 4.2.1.3 and Columbia University 1999, 75). A necessary condition for the effectiveness of the ABS concept is that the benefits, either monetary or non-monetary, can compensate the costs related to the conservation activities and set an incentive for conservation.

However, the absence of clear property rights on the level of resource managers can hinder the realization of profits and consequently, biodiversity protection, because there are no incentives for conservation. The CBD does not put weight on property rights on this level. Apart from the confirmation of the state's sovereignty over its biological resources and the emphasis on the existence of IPRs, no other property right allocation is demanded by the CBD. The definition and assignment is in the responsibility of the national governments. Whether they transfer their authority and rights to other stakeholders depends on the national legislation.

Looking at economic theory, Coase opened the discussion for the new discipline "economics of transaction costs" and questioned the impact of the initial allocation of property rights. Different forms of property rights systems over biological resources exist. The status of these rights and changes in these rights may generate changes in the value of the property (OECD 2003a, 28). In the case of state property, in first place the government manages the country's biodiversity and is responsible for its provision. The state receives the benefits if it can enforce its property rights towards users of biodiversity. Sharing benefits with individuals or communities who contributed to the existence of biodiversity in the past or even in the present may be important in terms of equity and fairness (Bonn Guidelines, 2001). It is not important from an incentive point of view though (and therefore the equity dimension is not considered in this analysis). However, if the local level is in charge of the resource management and the supply, its participation in the benefits arising out of the use of genetic resources is indispensable. The CBD demands only the PIC of the local stakeholders. This consent is a rather weak form of participation and can be organized without any form of benefit-sharing with the local agents. Then without a strong participation in the benefits, the agents will estimate the value of wild genetic resources to be very low, even if the private use value of genetic resources is high to the companies in the users sectors. If the local level participates not only through PIC but also in benefit-sharing the incentives to conserve and sustainably use genetic resources are established.

The relationship between property rights and values of biodiversity depends on the stage of process of genetic resources in the production chain and plays an important role for the effectiveness of the ABS concept (cf. Figure 14).

Figure 14: The distribution of property rights and values among stakeholders



By comparing property rights of the different stakeholders (i.e., individuals, local communities, government, intermediary, companies, and researchers) allocated by international regulation, it can be concluded that level by level, the strength of property rights of the concerned party increases as well as the economic market value. By granting IPRs over developed, marketable products, companies and research institutions receive strong property rights for high valued goods. Governments have also strong rights over their biological resources that are confirmed by the state's sovereignty principle of the CBD. This principle considers that on a global level provider countries' governments are in a better position to negotiate with users and yield greater benefits in ABS contracts than local landowners. However, it is necessary that the state transfers these benefits to the local level (Barrett / Lybbert 2000, 296). As already mentioned, the Convention does not allocate rights to the local level. If national governments do not regulate the property rights situation in their countries at all, the open access status of genetic resources and the on-going degradation will remain. Resource holders will have an incentive to conserve nature only if national legislation fills this gap left open by the CBD. Thus, strong IPRs as patents and plant breeder rights on the user level for the marketable product will not be sufficient for biodiversity conservation. Conservation incentives in the form of rights or benefits have to be instituted for the economic agents who decide on the use of the biological resources. If these are local agents, national legislation has to ensure that they benefit from any ABS contract.

5.1.3 Information asymmetries

Besides property rights, information asymmetries, in form of pre-contractual and post-contractual problems, are the most important critical factor that impact all three elements of effectiveness. Already in the access phase information asymmetries can be identified as a major cause of unsuccessful negotiations, resulting in insufficient contracts under which a low flow of benefits can be expected or the breakdown of the talks. If access or benefit-sharing does not take place no incentives for conservation are established by the ABS concept.

The information asymmetries can be identified as pre- and post-contractual principal agent problems. Under the presence of two-dimensional asymmetric information each bargaining partner has private information on his activities (OECD 2003a, 16). This is the case in bilateral ABS contracts between users and providers of genetic resources. If an intermediary is involved, the transaction is more complex. In this case, user and provider do not negotiate directly. Property rights, genetic resources and information, but also information deficiencies are channeled through the intermediaries. The existence of intermediaries even intensifies the problem of asymmetric information.

The problem of asymmetric information is also described by the OECD (2003a, 16) and Gehl Sampath (2005, 75f). The OECD observes that users have private information on their potential interest, the costs of research and development, and the availability of alternatives. Providers have private information on reliability, quality, and diversity. These aspects are considered in the following analysis, but they are aggregated and the subsequent analysis is much deeper. It is looked at how these asymmetries arise and what the consequences are.

Gehl Sampath derives three forms of transaction costs that arise of asymmetric information: search and information costs, bargaining and decision costs, and monitoring and enforcement costs. She regards the problem of uncertainty about product quality as search and information costs in the market for genetic resources that is less important for pharmaceutical drugs, but more important for botanical medicines. Bargaining and decision cost arise from the uncertainties in the drug research and development process, the legal uncertainties and the renegotiations. Monitoring and enforcement costs are due to the two-sided principal agent relationships between a company and the provider country as well as between government and local communities in the provider country (Gehl Sampath 2005, 76ff). The suggested classification has not been applied in this study because not all the criteria are identically applied. For example, legal uncertainty (as one component of good governance) is here considered as the transaction costs environment and not as an element of transaction costs, and the lack of knowledge regarding the quality is here not identified as search costs, but as costs that arise during the bargaining process.

5.1.3.1 Pre-contractual information deficiencies

Pre-contractual problems occur because providers have information deficiencies that affect the planned exchange of genetic resources for benefits before a contract has been concluded. Providers lack information on the potential benefits of the provided genetic resources. Users have an incentive to hide their information regarding the benefits they expect to receive by the genetic resources. The benefits of commercialization and not the costs of conservation are the important factor in the negotiations. Providers' costs consist of opportunity costs and costs for protection measures. They are important for any conservation concept, since resource holders are usually compensated for providing environmental services based on the costs. However, the CBD's ABS concept is not based on the costs that arise through the conservation of biodiversity, but on the benefits arising out of the commercialization. This is reasoned in the CBD's goal not only to conserve biodiversity but also to reach justice and to equally share the benefits. When the CBD was adopted, the expectation on the monetary profits arising from the commercial use of biodiversity was high. Genetic resources were even called "green gold". Therefore, ABS negotiations focus on the benefits and how they are shared (Barrett / Lybbert 2000, 294).

If a potential user supposes or even knows that the commercialization of the genetic resources realizes high benefits, she/he will have an incentive to hide the willingness to pay in order to pay a smaller compensation to resource providers and reap a profit. On the other hand, providers suspect high benefits through the research and development of genetic resources. In the end, the expectations regarding the ABS contract diverge in such a way that the negotiations fail. In this case, access, conservation and benefit-sharing are unsuccessful.

5.1.3.2 Post-contractual information deficiencies[15]

Post-contractual problems arise in form of two-dimensional moral hazards on the provider and the user side. Firstly, information deficiencies and missing control mechanisms on part of

[15] The problem of information deficiencies on the quality has been analyzed in more detail in Richerzhagen, C. (2005): Certificates of origin: economic impacts and implications, UNU-IAS Working paper and Richerzhagen, C. (2007): Certificates of origin: economic impacts and implications, in: U. Feit / F. Wolff (eds.), European regional meeting on an internationally recognized certificate of origin / source / legal provenance, report of an international workshop hosted by the German Federal Agency for Nature Conservation, Isle of Vilm, Germany, 24-29 October 2006, 46-48.

the provider can result in over-regulation in the form of very restricted access. This over-regulation increases users' transaction costs and prevents successful negotiations on ABS. If resources are not accessed and benefits are not shared, no incentives for conservation are established.

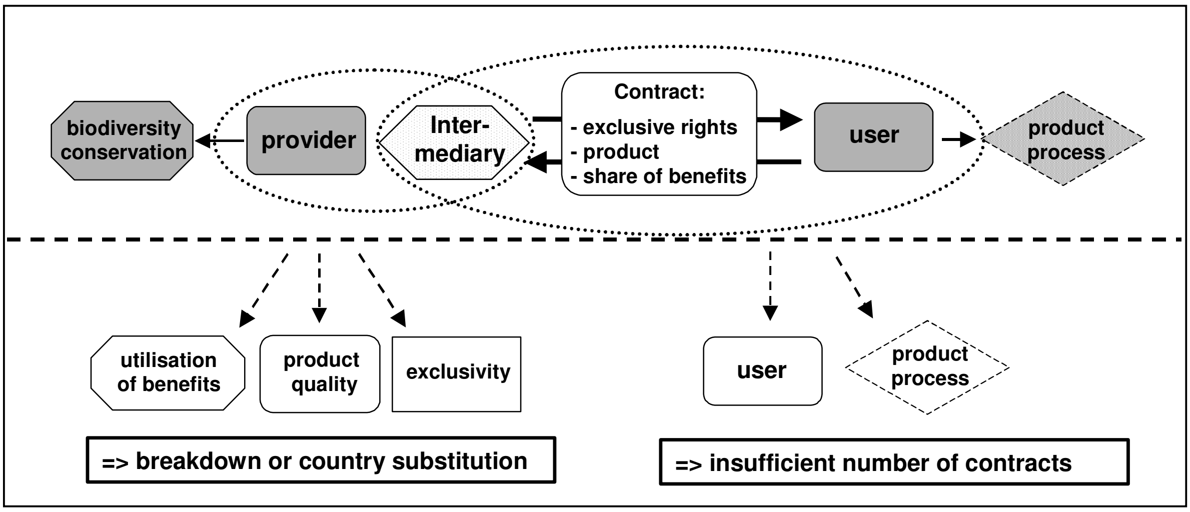
Providers experience moral hazard regarding the use of the collected material. For provider countries it is important to ensure that in return for access to biological material, companies fulfill their obligations arising out of the bilateral agreements regarding the acquisition of material, liability and payments (Reid et al. 1993, 38). The capacity of national regulations to monitor the use of the provided material is very limited though. The final utilization of genetic resources, the advanced research and development, as well as the marketing of the products take place outside of the provider country. The providers are unable to observe the research and developments activities of users as soon as they have left the country with the collected samples of genetic resources even if though contracts have been concluded. The bioprospecting activities defy any control of the country of origin due to the prohibitive transaction costs. There exist numerous possibilities to cross borders and to exit a country, especially in countries, as for example, the Philippines with more than 7,000 islands. National governments are not even able to observe all on-going contractual bioprospecting activities within their territories. It becomes even more difficult if the material has been transferred to another country. Acquired resources may be passed on to another company without the provider's consent or the user may develop products and processes without declaring it to the provider country. In this case potential benefits get lost. Besides, IPRs, as for example, patents and plant breeder rights are generally not issued in the provider countries but in industrialized countries having the biggest sales markets. These markets cannot be observed by providers.

Bad experiences or worries of the provider countries can lead to a very strict and complicated over-regulation, making access almost impossible and prompt foreign interested parties to move their investigations to another country with a bioprospecting-friendly climate. The unapproved acquisition of genetic resources bioprospecting has build up a bad image of users and bioprospecting, resulting in a low acceptance within the provider countries or non-governmental organizations in industrialized countries. “Biopiracy” is the expression often used to describe the illegal obtaining of biological material. In many countries environmental and indigenous groups object to the implementation of the ABS concept, because they feel that PIC and a fair and equitable benefit-sharing is not ensured by the present legal and policy environment (A Laird / ten Kate 2002, 243). It is mainly criticized that the CBD promotes IPRs as basic elements of benefit-sharing, while indigenous rights and traditional knowledge, often inputs for biotechnological innovations, are not protected. They propose the introduction of an additional property rights system (*sui generis* rights system), for example, intellectual community rights, which will give communities the opportunity to protect their resources and knowledge.

Not only commercial users suffer from biopiracy and associations that come with it. Today, the definition of the term biopiracy is very broad and describes almost any commercial activity associated with genetic resources. Consequently, researchers and companies consider it as a serious impediment of research. They fear to be entitled as biopirates and loose image (Wynberg / A Laird 2005, 31).

A strict legislation, implemented by provider countries, negatively affects the research in the own country at local universities and research institutions (Richerzhagen / Virchow 2007, 76). Some countries do not differentiate between academic and commercial research and interest and apply the same standards for both purposes. This also leads to very restrictive regulations, which may cause essential research grind to a halt (Dávalos et al. 2003, 1520).

Figure 15: Two-dimensional information deficiencies



The second moral hazard case is experienced by the users. Users lack information on i) the quality of the provided material and ii) the exclusiveness of the material. Another third factor that can concern users is the iii) misallocation of the received benefits. This factor is only relevant if users depend on a long-term, continuous provision of material.

1. Users lack information on the quality of the provided genetic resources. Mullholland and Wilman (2003) analyze this dimension of information deficiencies more closely. In their view users cannot perfectly monitor host-country's inputs into the drug discovery process because host countries do not only control access to the resources but also to the information on the quality of the material. They propose that companies need to design

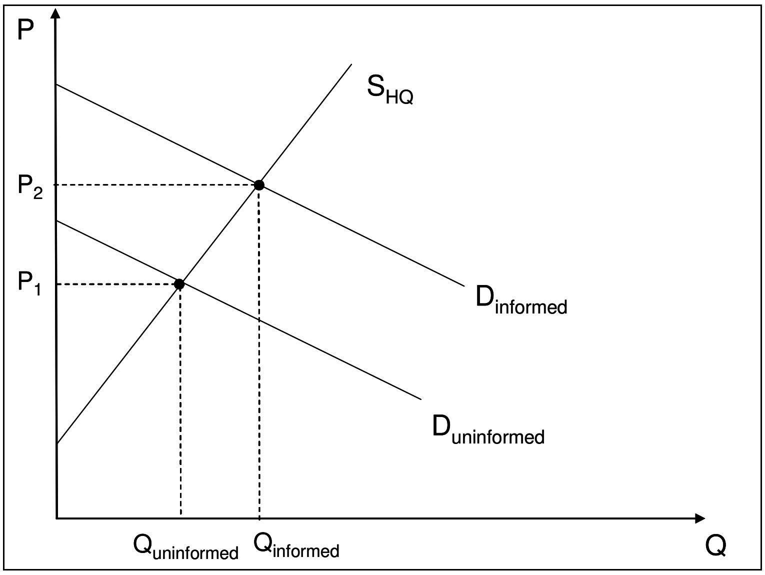
contracts that provide incentives for the host countries to deliver an amount of bioprospecting output that maximizes the company’s output. Their proposal is discussed in chapter 5.2.1.5. Surprisingly, from the empirical side this case of asymmetric information is less relevant so far. In all the interviews and in the conducted user study (Holm-Mueller / Richerzhagen / Taeuber 2005) the argument that companies feel not sufficiently informed about the material only slightly appeared. They complained more about their lack of knowledge regarding the regulations and the weak institutional infrastructure. However, companies obtain material from intermediaries but these second-level providers are often not based in the host countries. They are brokers in the international markets. Therefore, it seems to be appropriate to take a closer look at the problem, whereas Mullholland and Wilman (2003) assume the problem as given and concentrate more on the solution (i.e., contract design). At this point the study goes more into detail.

The market for genetic resources suffers from under-consumption due to adverse selection. Users can receive a variety of benefits by the use of genetic resources, and the composition of benefits is differently evaluated by users. Valuation depends on the specific characteristics that determine the quality. Users are only willing to pay for these benefits if they can be sure that they exist. Therefore, information on these characteristics provided to the user is also a criterion for quality. Passport data on genetic resources, as for instance, indication of the origin, the location where it was collected, description of specific biological traits, but also the legal guaranty that PIC was obtained, can be such criteria for quality.

As long as consumers cannot differentiate quality levels of genetic resources, they are not willing to pay more for “better” genetic resources. Users who obtain genetic material through brokers have to trust these intermediaries. A company or a research institute cannot control whether PIC has been appropriately obtained and whether an ABS agreement has been concluded. Other characteristics as the origin and known traits are also concealed. If the material is directly obtained from the country of origin and not collected by the users themselves, they have to trust the information given by providers. For example, they have to trust that PIC of a local community was obtained and the geographical indication is correct.

A user who cannot identify the quality of the genetic resources puts less value on the material. Consequently, the demand of an uninformed user and the purchased quantity is less than the demand of an informed user. In Figure 16 the demand curve of the uninformed user ($D_{uninformed}$) is below the demand curve of an informed user ($D_{informed}$) and the traded quantity is lower ($Q_{uniformed}$) because of the existence of information deficiencies.

Figure 16: Informed and uninformed users in the market of genetic resources

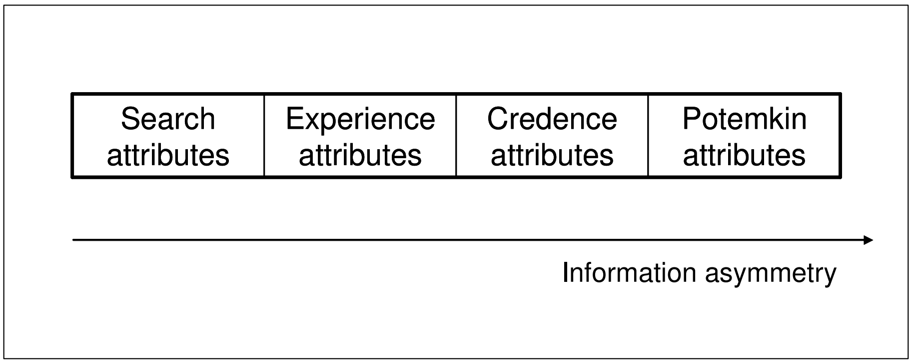


Source: adapted from Borooah 2003

In this situation under-consumption occurs and consumer and producer rents decrease. Consumer rent measures the difference between the amount users are willing to pay and the amount they actually pay. Producer rent measures the difference between the amount providers are willing to accept and the amount they receive. Both rents would be higher if the user got the additional information on the good. If users knew about the quality they could differentiate between the genetic resources of high and low quality. Consequently, more resources would be demanded.

In economic theory, goods can be classified by the level of lack of information of a consumer regarding the product's quality and the level of information needed to identify the quality (Nelson 1970). The quality has to be identified through the product. A good has search attributes if it is a product with features easily observable before purchase. It has low pre-costs of detection and thus allows users, for example, to differentiate the specimen (i.e., plant, animal, insect, etc.) by simple inspection. If the price for the inspection exceeds the marginal benefit of the additional information users reject the specimen. In the case of experience attributes, user can only detect certain product qualities after buying and using the product. Goods with experience attributes have high pre-costs and low post-cost of detection because the relevant information can only be obtained as a by-product of use after buying it (Nelson 1970). However, this information is the basis for decisions regarding repeated purchases. Credence attributes are attributes that consumers cannot evaluate even after purchasing the product. They have high pre-costs and high post-costs of quality detection. The consumer has to rely on third-party judgments that are able to detect the product or trust the provider regarding the goods' quality (Darby / Karni 1973). The last category are potemkin attributes that describe process-orientated qualities, which are hidden for third parties as well as for customers at the end product level. It is impossible to detect them on the product level, even with the involvement of a third party (Tietzel / Weber 1991; Spiller 1996).

Figure 17: Information asymmetry in markets



Source: Jahn / Schramm / Spiller 2004

Genetic resources have mainly experience attributes regarding their quality in terms of commercial potential. The material has to undergo some research before the user is finally able to evaluate its potential and decide whether the product will be marketed. Therefore, material that has already been tested and processed by the provider has more value to the user than the material that is obtained without any prior scientific analyses. It has been observed that in provider countries, as for example, Costa Rica, which does not provide raw material but processed samples, the demand for genetic resources is much higher (Richerzhagen / Holm-Mueller 2005, 453ff). However, the provision of additional information is aligned with additional costs for a provider. For example, collections in provider countries have to be undertaken more systematically. Especially advanced scientific knowledge and skills in documentation, cataloguing and databasing are needed in order to provide such information.

But not all quality characteristics can be detected after utilization. In many cases it is not possible to identify the origin of the material. In this case, the origin is a potemkin attribute. The user can only trust the provider or intermediary that the material was obtained as it is indicated. If the detection is possible, it is often aligned with high costs and the involvement of a third party. For example, microbial collections are frequently asked to assist users in identifying the origin of the used material. In this case, origin is a credence attribute.

The proof that PIC has been obtained is a potemkin attribute, which can not be revealed even with the support of a third party. No analysis of the genetic material can identify whether PIC has been obtained. Users have to trust the intermediary or provider if they were not involved in the PIC and ABS process.

2. Users have information deficiencies related to exclusive rights. In general, the user wants the legal and secured access to genetic resources but also the exclusiveness of this access. By signing an ABS agreement users receive exclusive rights for a special region and a certain period of time. The user, however, has only limited information and control whether the provider country offers the same samples of genetic resources to other competing users. Because of the lack of information or security, users will react with a country substitution if other countries offer the same resources (Richerzhagen / Virchow 2007, 76).

3. Users lack information on the allocation of the shared benefits. According to the underlying idea of the CBD and the Bonn Guidelines (Bonn Guidelines 2001), the benefits arising out of bilateral agreements should be allocated for biodiversity conservation measures in the provider country. Often national short-term interests in biodiversity-rich countries differ from the objective of a long-term conservation and sustainable utilization of genetic resources. Due to these short-term interests, the benefits (in terms of royalties or up-front payments) derived from the access to and the utilization of genetic resources may not be reinvested in the conservation of biodiversity but allocated to other national activities. Hence, the long-term security of genetic resources may be at risk. In this case, a problem of asymmetric information exists as well. It is assumed that benefit-sharing is understood – at least partially – as incentive for further conservation and secured utilization of the genetic resources and it is assumed that users of genetic resources are interested in the appropriate use of the benefits, guaranteeing the conservation and further use of genetic resources. This does not apply to all users. Some may only be interested in single samples and not the continuous supply of diverse material. These users are not concerned by this problem. However, other users, having an interest in the conservation of biodiversity, are unable to control the allocation of the benefits at national level in the provider country. It seems that the crucial point of any bilateral ABS agreement is the risk that the provider country misallocates the received benefits, and threatens hereby the conservation and sustainable utilization of genetic resources. The practical conservation efforts or the

concrete threat to biodiversity are taking place at local level where the influence and sometimes the interest of national decision-makers is restricted or low. Hence, states are not always in control of maintaining and providing genetic resources, especially if adequate laws and institutions for genetic resources management are not designed and implemented. In this case the user will suffer in the specific situation under a moral hazard case.

5.1.4 Time lags

Time lags strongly impact the effectiveness elements of conservation and benefit-sharing. Time lags between the collection and provision of promising samples and the development of a marketable product make a fair and equitable benefit-sharing and the setting of incentives for conservation very difficult (Barrett / Lybbert 2000, 296f; Dutfield 1999, 2). The variation between industry sectors in the cost and the time it takes to develop a marketable product from a natural sample as well as the probability for a successful product is enormous. In the pharmaceutical sector, 10 to 15 years of research and development are necessary to discover and develop a drug. The costs of this process vary but range between US$ 231 million and US$ 500 million. The probabilities of success vary from one in 5,000 to one in 10,000. In the botanical medicine sector, the process can be less than two years and the cost can be less than US$ 1 million. However, this sector is still regarded as a niche sector. In the agricultural sector, it can take from eight to 15 years to develop a new variety and the cost amount to US$ 1-2.5 million for a traditional variety and US$ 35 to 75 million for transgenic characteristics. A new chemical pesticide can take from eight to 14 years to develop and cost US$ 40 to 100 million, whereas a biocontrol agent can be developed within two and five years and cost US$ 1 to 5 million (ten Kate / A Laird 1999, 10).

Benefit-sharing is the incentive for conservation and strongly depends on the successful development of products and the accumulation of profits. Experiences show that users of genetic resources are not willing to pay sufficient compensation as long as no product is developed and distributed in the market. However, income substitutions, which change economic activities and refrain from biodiversity damaging actions, have to be paid directly to be effective and not 15 years later. Otherwise, benefit-sharing will fail in instituting an incentive to conserve biodiversity. Therefore, time lags are highly critical for ABS.

5.1.5 Good governance in provider countries

Good governance in the provider country plays an important role for the transaction costs that arise in the access phase of ABS. This is also a result of the German user survey, which asked potential users about the main problems regarding the acquisition of genetic resources (Holm-Mueller / Richerzhagen / Taeuber 2005, 46).

Governance in general is a concept that has been developed and applied by two disciplines: political and social sciences as well as economics. Whereas political and social sciences concentrates on the changed forms of interaction and coordination mechanisms between the state and society, economics examines the institutional control of occurrences in the market and the social embedding of economic activities (Brunnengraeber et al. 2006, 8). The latter is the approach that is chosen in this study. As already mentioned, in economics the debate on governance has its roots in the new institutional economics. It is interpreted as the institutional environment of transactions and can also be applied to ABS.

Good governance is a strong factor of the environment of economic ABS transactions. The term good governance is a narrower concept than governance in general and found mainly in development policy. It refers to specific conditions to which international financial and development institutions such as the World Bank, the International Monetary Fund (IMF), or national ministries tie their development co-operation. The World Bank Governance Indicators cover 213 countries and territories and measure six dimensions of governance since 1996 until end-2005: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption.[16] They also form the environment where the negotiations and the bioprospecting take place. The detailed analysis of these indicators is beyond the scope of this study. However, the World Bank numbers are taken as a reference to indicate where the case study countries stand and to analyze their institutional environment.

The case study in Ethiopia shows that a lack of such good governance and political stability has even prevented the development of an ABS regime for a long time. Many provider countries are developing countries with instable political systems. The general political situation influences the countries' status as providers. If it is possible, users access the countries and their resources that signal reliability and provide political security. Besides,

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[16] *Voice and accountability* is the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media; *political stability and absence of violence* are perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism; *government effectiveness* describes the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies; *regulatory quality is* the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development; *rule of law is* the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence; *control of corruption*, the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (Kaufmann / Kraay / Mastruzzi 2006, 4).

many countries still have not implemented the CBD and its ABS obligations. They cannot provide any legal security to users regarding the utilization of genetic resources. Regulations and procedures are not clear or implemented. Focal points that can be approached by users are not established and in many cases legal access is associated with high transaction costs. Under such conditions users may obtain unapproved material or even stop any collecting and research activity in this country. It is also possible that if the company distrusts the legal security in a country, it will react with country substitution and move to a country with a transparent regulation or without any access legislation (Richerzhagen / Virchow 2007, 76). Countries without any ABS legislation, which harbor similar resources as neighboring countries that have implemented ABS regulations and charge access, provide interesting legal loopholes. It is a legal way for users to circumvent the ABS obligations of the CBD. If genetic resources are accessed in these countries, no conservation incentives will be established.

A country with no ABS regulation has negative impacts on the access demand but the developing process of regulations can also be difficult for users. Davalos et al. (2003, 1519) consider the period during which a country develops a ABS legislation or interpreting international agreements as the hardest and most insecure for users that want to obtain access.

Insecurity regarding national property rights might also be a problem. Even if an ABS regime is implemented, the absence of or the uncertainty about ownership in a provider country creates difficulties in obtaining PIC, in negotiating on ABS and in concluding contracts and raises the transaction costs of users. Any ABS regime is embedded in the national political and legal system of the respective country. They are main factors that influence the implementation and efficiency of ABS regimes and therefore the bioprospecting climate.

5.1.6 Administrative complexity

Administrative complexity is another form of governance: the governance that describes the reduction of bureaucratic procedures in the administrations and the adjustment of these procedures to the needs of the “customers” (Brunnengraeber et al. 2006, 3). Administrative capacity is highly linked with institutional capability and transaction costs.

Institutional capability is a major condition for an effective ABS regime and can be a weak point especially in developing countries. The case study in the Philippines shows that administrative complexity has a major impact on the access process and the users’ transaction costs. Competent, multifunctional institutions are required to design and allocate rights, to manage conservation areas, to coordinate activities, to negotiate ABS contracts, to control compliance and sanction misappropriation regarding the use of genetic resources. In many developing countries such institutions do not exist. Adequate funding is needed for their establishment and maintenance. For many countries the establishment of an ABS regime is a challenge and aligned with high costs and transaction costs arising, for instance, from the additional need for consultation, work, employing extra staff, and creating of institutions (Liebig et al. 2002, 72). The implementation of the CBD, which affects many different areas, requires legal and technical capacity. The concern of provider countries of not being able to cope with the complex ABS issue and becoming exploited can also result in an over-regulation of ABS (Richerzhagen / Virchow 2007, 76). Developing countries develop and implement very strict laws whose scope is often beyond the actual needs. Many companies regard ABS legislations in some countries as unclear, bureaucratic, time consuming and expensive to comply with and intend to relocate their research activities (ten Kate / A Laird 1999, 7). On the policy level, this problem has already been addressed. For example, the Bonn Guidelines (2001) were adopted by the members of the CBD as an instrument to guide both providers and user through the ABS process. They stress the importance of National Focal Points to inform applicants about the specific ABS procedures (Bonn Guidelines, 2001, IIA/13).

5.1.7 Market structure

The market structure also affects the access phase. It affects especially the negotiations, since bargaining power is not equally distributed between users and providers. In addition, the benefit-sharing is concerned. Benefit-sharing is only fair and equitable if equal partners negotiate.

The bioprospecting market is characterized by a diverse structure. The market is dominated by a small number of large buyers and can thus be described as an oligopsonistic competition. In the past years, mergers between agro-chemical, agro-seed, and pharmaceutical firms have created large, global life science companies and strengthened their position in the market (Braga 1996, 360). Some examples are listed in the Table 12.

Table 12: Mergers in the pharmaceutical sector

Rank	Company	2002 prescription sales (US$ billion)	Merged entities (sample)
1	Pfizer	41.2	Warner-Lambert, Pharmacia, Parke-Davis, Searle, Upjohn
2	GlaxoSmithKline	28.9	Burroughs Wellcome, Smith, Kline, French, Beckman, Norcliff Thayer, Beecham, Sterling
3	Merck	20.0	Merck Sharp & Dohme
4	Johnson&Johnson	28.6	Roc, MacNeil, Janssen
5	Astra Zeneca	8.1	Astar, IC1/Zeneca, Stuart
6	Norvatis	16.6	Sandoz, Ciba-Geigy
7	Aventis	14.3	Rhone-Poulenc, Hoechst, Connaught Labs, Merieux
8	Bristol-Myers Squibb	14.3	Mead-Johnson, DuPont Pharmaceuticals
9	Roche	12.5	Hoffman-LaRoche, Nicholas, Synex
10	Wyeth	11.7	American Home Products, Ayerst, Lederle

Source: Oligopoly Watch 2007

Apart from these companies, a large number of small biotech firms exist in the market, but their influence seems to be limited. There is a growing tendency of large, established pharmaceutical, agricultural and other life science companies cooperating with smaller, start-up biotechnology research companies. Through this arrangement, large companies receive the innovative research critical to the development of new products. They then use their financial and technological capacity to manufacture and market the products. This in turn allows biotechnology research companies to receive additional revenues for funding expensive research efforts (Hill 1999). Due to this relationship, large life science companies still dominate the market for genetic resources, but the flow of genetic resources passes through many stations. These developments increase the bargaining position of users and point to another category of problems: it is essential though perhaps difficult to keep track of the movement of genetic resources between users, otherwise the fair and equitable benefit-sharing cannot be ensured.

Due to evolutionary migration in many regions, genetic resources are very similar in neighboring countries and geographically widely spread. Companies can always threaten to move their research activities to another country. In addition, companies often have better negotiations skills and legal assistance supporting them in the ABS negotiations than provider countries. This results in an unbalanced bargaining process.

The position of provider countries is often weakened by the argument that the importance of natural product research and development in traditional user sectors as pharmaceutics and biotechnology recently declines. However, in other sectors including horticulture and botanical medicine research and development continue to exert significant demand for genetic resources (EC 2002, 34).

The topical study on users of genetic resources in Germany by Holm-Mueller et al. (2005), shows that genetic resources are still of great importance today and will be in future as they have been in the past. The major part of respondent users does not consider activities in the field of genetic resources as the most important area of their company or institution. German companies and institutions indicate that it has become more difficult for German users to gain access to genetic resources since the CBD entered into force. Especially users based at ex-situ collections, universities and other research institutions, and users working in the horticultural sector belong to this group. However, the majority of the users report an increased or constant use of genetic resources in the last five years and since the CBD entered into force. According to the results of the study, genetic resources will continue to play an important role in the future. The majority of users answered that they are likely to expand their use in the future or will at least continue at a constant level.

Wynberg and Laird (2005, 9f) come to a similar conclusion. In the 1990s the potential of natural products was overshadowed by other chemical approaches (e.g., combinatorial chemistry) and the introduction of high-throughput screening using synthetic libraries. Besides, advances in molecular biology, cellular biology and genomics as well as the declining emphasis among pharmaceutical companies on infectious disease therapy supported the turn down of natural product research. Now the trend is reversing due to new technologies and the absence of the promised success of the other approaches.

The existence of ex-situ collections is also an important aspect of benefit-sharing (Mulholland / Wilman 2003, 419). Many users acquire research material from gene banks and other collections and not through direct collecting activities in countries of origin. If material has been stored for a long time, it can often be very difficult to determine the country of origin and the appropriate recipient of shared benefits. Even though some material from ex-situ collections is only accessible through Material Transfer Agreements (MTA), which provide a basis for tracking the transfer of the material and establish terms for benefit-sharing, the majority of material can still be accessed without any commitments to share benefits due to the weak implementation of ABS regulations. Genetic material that was acquired before the entry into force of the CBD is excluded from ABS regulations. However, national governments can strive to introduce regulations that fill the gap.

5.2 Measures addressing the critical factors in provider and user countries

After the determination and analysis of the critical factors and the assessment of their relation with ABS effectiveness (conservation, access and benefit-sharing), this study proceeds with the identification and analysis of measures that address the critical factors and that are potential solutions. Provider and user countries can establish measures and make use of certain instruments to address the critical factors within their territory or beyond it. According to the international discussions on provider and user measures, the analysis of measures also differentiates between these two categories. The responsibility for the implementation of the measures is in most cases with either the provider countries or the user countries. However, some of the measures require efforts by both, providers and users. In chapter 5.1 the critical factors have been identified. They are property rights, information asymmetries, time lags, good governance, administrative complexity, and the market structure.

5.2.1 Provider countries

Provider countries can initiate measures to address the problems disclosed by the critical factors. The assignment of property rights, the development of compensation schemes, which consider the time lags between the discovery of the material and the development of a product, capacity and institutional strengthening, screening of users through contracts, trust and reputation building, as well as the building of coalitions have the potential to alleviate some of the problems. The application of these instruments neither can be considered as “one problem/one instrument” solution nor are the discussed instruments exhaustive. However, the author considers these measures as the most feasible and effective instruments. It has to be taken into account that only a mixture of the instruments can be effective and support any ABS regime. The selection as well as the intensity of the measures should always depend on the specific shape of the critical factors and adapted to the specific situation in the respective country.

5.2.1.1 Assigning property rights to resource holders

Property rights have been characterized as the strongest critical factor. The possibility to apply for patents creates a strong (intellectual) property right at the end of the production chain and an effective instrument to ensure the accumulation of profits. The benefits arising out of the use of the genetic material should be shared with the providers to establish incentives. However, in order to implement the ABS concept, resource holders have to be legally entitled to receive compensations for their conservation activities and for the stopping of destructive activities, e.g., deforestation. The CBD allocates sovereignty rights over genetic resources to the countries and leaves it to national governments to set the incentives through national property rights system. In order to fulfill the concept's objective governments of provider countries have to assign property rights to land and resource holders that allow them to participate in benefit-sharing arrangements. As the theory suggests the respective government should participate in or monitor negotiations and the benefit-sharing process to ensure that ABS contributes to conservation. In the case the material is obtained on state property, the government should be involved in the negotiations and be the one who benefits.

In case the national property rights system does not allocate property rights to the resource holders, a national trust fund is an appropriate instrument as suggested by Moran (2000, 143). Such a trust fund should acknowledge the sovereign rights of the provider countries, but it should not undermine the independence of a trust fund. The proposal of a trust fund is elaborated in the next subchapter.

Some countries have not established private ownership concepts regarding, for example, land or biological resources. If these countries do not intend to change the property system and biological resources remain in the public domain or are vested with the state, the national ABS regime has to ensure that incentives are still established.

5.2.1.2 Compensation schemes and funds

From an incentive point of view, the timeframe in which benefits are shared and compensations are paid is very important. Therefore, the time lags between the collection of samples and the development of a marketable product pose another critical factor and adequate compensation schemes or funds can address them. Research and development as well as product approval and patenting processes are very time-consuming. If benefit-sharing takes place 15 years after the collection, no immediate conservation incentives are established. Only if compensation is paid at the time when resources are managed and conserved, the desired effect will be reached. Adequate compensations mechanisms, in form of appropriate compensation schemes and funds, have to be developed and applied in ABS contracts because they help to overcome the factual time lags. A biodiversity tax has also been suggested as an instrument that can provide additional funds to overcome the financial gap.

In terms of monetary compensation, different forms of compensation exist. Mulholland and Wilman (2003) differentiate between three forms: an advanced payment (up-front payment), a price per sample (sample fee), and a royalty rate based on a successful outcome. In their paper, they come to the conclusion that royalty payments do not set adequate payoff to risk-averse host countries in order to set incentives for the optimal provision of biodiversity and related information.

In practice, all three forms are widely used and identified in the provider country case studies, but also non-monetary compensation forms play an important role there. Sample fees are based on market activities and only cover the supply costs, as for example, field collection, documentation, packaging, processing, and shipping. Usually these fees follow the fees that are asked for by collections. Up-front payments are an impediment to users because they are a risk investment. Users have to make a prior concession although they cannot be sure that the received sample will lead them to a marketable product or patent. Some up-front payments cover operational costs. Others involve a trade-off in lower royalty rates, but provide some up-front benefits for provider countries. They are the least prioritized form of payments among users. Milestone payments depend on the stages of the research and development process. For example, they will be due if the user identifies an active compound or applies for a patent based on the use of the collected material. Royalties are closely linked to the outcome. The percentage of royalties (in most cases related to the gross profit of the particular product) can be fixed in the initial ABS contract or be subject of negotiations, once the research and development process has progressed. The amount of royalties can be influenced by various factors, as for example, information provided with the samples, novelty or rarity of the species, and the relationship between final product and collected material (ten Kate / A Laird 1999, 66).

The diversity of non-monetary benefits is greater, but they require a greater co-operation between users and providers, which goes beyond the pure exchange of genetic resources and monetary compensation. From a development policy perspective, they are very useful, since they have great capacity-building potential. They include joint publications, training and joint research, and technology and knowledge transfer. Up-front payments and non-monetary benefits that are transferred shortly after the conclusion of an ABS contract can bridge the gap, which is caused by the time lags. Non-monetary benefits also provide benefits that can sufficiently compensate and establish conservation incentives. Providers have to consider their importance during the negotiations. On the other hand, milestone payments and royalties come too late in order to set an incentive for conservation.

The case studies and the existing literature show that it is difficult to estimate the factual rate of benefit-sharing. Most of the details of ABS contracts and partnerships - especially the compensation rate - are confidential. Partly published contracts and users' data indicate that monetary benefits include sample fees, up-front payments, milestones and royalties, which usually range from one to five percent on net sales.

However, benefits have only been paid in a few cases where genetic resources have been used for commercial purposes. It has been estimated that even if only two percent royalty were charged on all genetic resources, being used for research and development in the agricultural and medical plants sector, the users of genetic resources would owe more than US$ 300 million in unpaid royalties for farmers crop seeds, and more than US$ 5 billion in unpaid royalties for medical plants (Anuradha 2001, 32).

So far, a fund solution has not been seriously discussed in the international CBD negotiations. However, a biodiversity trust fund can address the problem of time lags because it can accommodate the long-term timeframe of bioprospecting projects and the time lag between collection of material and the development of a product. Furthermore, it also addresses problems arising from the information deficiencies. Embedded in national and international law a trust fund can manage and allocate benefits arising out of the use of genetic resources. Transparently governed by stakeholder representatives, including governmental and non-governmental organizations, scientists, industry, communities, it can be a successful instrument that establishes trust among the partners. An initial payment has to be made by a group of users or even all users using genetic resources. The payment can be interpreted as a compensation for all the material that has been used for free. Once a trust fund is established, users who have concluded ABS agreements with providers can transfer monetary benefits at the agreed date: up-font payments in the beginning, milestone payments, and royalties later on. The bilateral relationship between provider and user remains. A trust fund can even address the property rights problem and offset a missing national regulation on the distribution of benefits to the resource holders. So far, the distribution of benefits depends on national legislation, the local government, and the country's property rights system. These regulations do not always ensure that incentives are set (Barrett / Lybbert 2000, 295). By channeling benefits in a controlled and consistent matter, independent from governmental decisions, the trust fund can alleviate the problem arising from the users' information deficiencies. The trust fund can ensure that benefits are distributed to the areas from which the material was collected and to those who contributed to its conservation and provision. If private or public donors are willing to contribute initial payments to create a start-up fund, resource holders can be directly compensated for their conservation activities by the fund. Royalties and milestone payments can flow later into the fund and compensate other resource holders. Initial payments would only be necessary for the first generation of ABS agreements. Later on, payments that arise out of the commercialization of genetic resources can compensate current resource holders and providers. The fund can work like an intergenerational contract. Through the trust fund the direct relationship between provider and user is suspended. At trust fund can be established at regional, national, or international level, but it has to be applied on the same level on which the ABS regulation takes effect. In case of regional ABS laws it should be on the regional level, in case of national ABS laws on the national level.

A multilateral fund like the ITPGRFA, which is not linked to bilateral negotiations, would be another option. But in this case the direct relationship between provider country and user and the direct negotiations, which can result in an outcome close to the optimum, are abandoned.

A biodiversity tax as suggested by Parry (2004) could be another compensation mechanism. It is independent from compensation schemes realized within bilateral ABS agreements. This approach abandons the task of trying to trace all the uses of genetic material to identify benefits and beneficiary. Instead, users of genetic resources should pay three to five percent of the profit ratio to all products, which are sold in the market and based on collected natural material. A global, voluntary agreement could provide the legal framework. A smaller tax should be paid for products derived from gene and knowledge databases. A global institution as the GEF is considered to be an adequate management authority to channel the incoming payment to conservation projects.

5.2.1.3 Creation and improvement of institutional infrastructure

Both administrative complexity and political and legal insecurity are transaction costs-relevant critical factors. If transaction costs are too high, users resign from applying for access. Therefore, the creation and the strengthening of institutional infrastructure is an important instrument to decrease transaction costs and facilitate access.

Any ABS regime relies on institutional infrastructure and capacity. It is impossible to create or maintain a regime if the implementing institutions are missing, if they are too weak or overloaded. An institution, which is responsible for ABS-related issues in a country, needs sufficient time and capacity to efficiently implement them. Most likely governmental departments are already operating at full capacity. Such institutions, which are responsible for the negotiations, the collections and provision, the conclusion of the contracts etc., need the ability to multitask. According to the Costa Rica case study, it is an advantage if the ABS institution in a provider country is detached from governmental bureaucracy and procedure and has a self-interest in the ABS activities. A research institution dealing with biodiversity is a good option. Expertise and resources are already established. Such an efficient focal point can attract more users and strengthen the country's bargaining position.

5.2.1.4 Coalitions

The unequal bargaining power of providers and users has been identified as a critical factor for the demand for and supply of access to genetic resources. For many years, the idea of a biodiversity cartel has been proposed in order to outweigh this unbalance (Vogel 2000). Cartels are usually a combination of independent (business) organizations formed to regulate production, pricing, and marketing of goods by the members as well as to limit competition. In general, cartels are economically unstable due to the incentive for members to cheat and sell more or at a lower price than agreed. Each member has to agree to produce a certain amount to control the price. Once the price has increased, it becomes tempting for each member to offer secrets discounts in order to overtake some of the profits of other members. Therefore, the members usually control each other and transparency is needed. This cannot be ensured if the concerned goods and prices vary and it is almost impossible to compare them (Baumol / Blinder 1994, 294).

How could an oligopoly over natural resources and traditional knowledge related to it look like? The idea is that a cartel of all biodiversity-rich states agrees on a price (fixed royalty rate) and not the output, as it is in the case of other cartels, as for example, the cartel of Organization of the Petroleum Exporting Countries (OPEC). The received benefits, which arise out of ABS contracts, are shared among all countries that are theoretically able to provide the same resource. But the question remains if an international cartel can effectively contribute to the realization of the CBD's objectives.

Looking at the biodiversity market it can be observed that a group of countries already has initiated a coalition: the Megadiverse Group. This coalition could be developed to a cartel. In 2002, 17 countries, rich in biological diversity, and associated traditional knowledge have formed a group known as the Like Minded Megadiverse Countries (LMMC). These countries are Bolivia, Brazil, China, Colombia, Costa Rica, Democratic Republic of Congo, Ecuador, India, Indonesia, Kenya, Madagascar, Malaysia, Mexico, Peru, Philippines, South Africa, and Venezuela. The group was formed as a mechanism of consultation and co-operation to promote common interests related to the conservation and sustainable use of biodiversity. The LMMC Group holds nearly 60-70 percent of all biodiversity. Therefore, they already have a great market share. Besides, it is well recognized as an important negotiating block in the CBD and other international fora. Nevertheless, throughout international negotiations it is obvious that the group is very diverse and not agreed, especially regarding its objectives and approaches. Until now, it is more a voice of biodiversity-rich countries, making positions and raising concerns, than an economically concerted body.

The enforcement of a cartel can be aligned with high costs, especially if the concerned product is not homogenous, the market is not concentrated, prices are invisible and there are only few buyers as in the case of genetic resources. Monitoring of the members selling activities and cheating is more difficult in the case of heterogeneous products (Baumol / Blinder 1994, 294). It is impossible to determine one fixed royalty rate for all genetic resources that can be sold as raw plant material, processed samples, or DNA and to monitor the trade of these resources by cartel members. Due to the confidential character of many ABS contracts, prices are not visible so far.

Market concentration and organization on the supply side, in form of associations or like-minded groups, can initially facilitate the negotiations on a cartel agreement and later support monitoring and control, but the supply side of genetic resources is not concentrated. Resources can be obtained from locations around the world. However, the existence of the Megadiverse Group could definitely facilitate the negotiations of an agreement among the members. On the other hand, concentration on the demand side hinders the disclosure of fraud, but as mentioned before the market of genetic resources can be characterized by as oligopsony with few buyers. Nevertheless, the cartel concept is not a promising instrument to strengthen provider countries bargaining position due to its characteristics.

5.2.1.5 Screening through contracts

Two problems of asymmetric information exist that can be addressed by a certain contract design. These information deficiencies hinder the efficient outcome of ABS negotiations and agreements. They impact the access, but also conservation and benefit-sharing. Firstly, there is the private information of users about the expected benefits. This is a pre-contractual problem. In any case, users have an incentive to hide the information on the amount of benefits they expect in order negotiate a lower price for the genetic resources. Secondly, there is private information of providers (and/or intermediaries) on the quality of the provided material.

Screening of partners through specific contract design is an instrument that can address the principal-agent problem. Through screening, the uniformed party (principal) provides incentives to which the more informed agent responds and acts, as the principal would like in order to maximize profit. In the case of ABS, the incentives are contracts. Screening applies before contracts are concluded (i.e., ex ante). Other forms of screening are the obtaining of additional information through third parties. However, this is not considered in this study.

Two models are analyzed here, which apply this instrument to the two cases: i) users' private information on benefits and ii) providers' private information on quality. Although this subchapter deals with provider countries and the opportunities they have to address certain problems, a user measures, dealing with providers' information. is analyzed here because it is very similar to the prior explained provider measure.

I. Users' private information on benefits

The following model, which is based on Illing (1992), is used to illustrate the problem of asymmetric information in ABS negotiations and to show how specifically designed contracts can alleviate the problem. Illing analyzes the validity of the Coase Theorem in the presence of private information about the cost function of a polluter as one kind of transaction costs. It is shown that under asymmetric information, the distribution of property rights has a predictable impact on efficiency. The allocation is distorted in the direction of the one who is in charge of the property rights. Considering this result, Illing draws the conclusion that in a bargaining situation under asymmetric information the predictions of the Coase Theorem do not apply. In the case of ABS, the presence of private information about the benefit function of a commercial user (e.g., pharmaceutical company) has to be considered. Therefore, the approach of Illing is applied to the problem of information deficiencies on part of the provider regarding the benefits of users.

The model

There are two bargaining partners: Y and Z. Y represents a provider country of genetic resources, and Z represents a user of genetic resources. The land use activities of Y influence the existing amount of areas x (in hectare), rich in biodiversity, in a positive or negative way and impose an externality on Z, respectively her/his profit B(x). By omitting activities, having a negative influence on these areas or taking preventive actions, Y can increase x. But this implicates costs C(x) for Y. It is assumed that $C(0) = 0$; $MC = C'(x) > 0$; $C''(x) > 0$; $B''(x) < 0$. Following the state sovereignty principle of the CBD and assuming that the provider country considers genetic resources as state property, Y owns all biological resources and biodiversity within her/his country. Thus, without any compensation, Y has no incentive to take steps against the loss of areas, rich in biodiversity, and the status quo q of biodiversity is kept or decreases as a result of continuous degradation. However, commitments on international agreements and environmental projects impose a minimum conservation, so that $q > 0$.

According to economic theory, it is not efficient to conserve the status quo of biodiversity. If the conditions of the Coase Theorem (i.e., exclusive property titles are defined and transferable, no transaction cost exist and perfect information is ensured) are complied with, a bargaining solution among the different users will result in a pareto optimal allocation of biodiversity. In this situation, the provider country (Y) and the user (Z) have an incentive to bargain and trade at least temporary property rights because both parties can improve their situation by getting a share of the rents arising from a more efficient level of biodiversity. Whereas the allocation is independent of the definition of property rights, the distribution of income is not. However, in this analysis income effects are so far excluded. The pareto optimal allocation is achieved if both parties agree upon the optimal amount of biodiversity rich areas x*, following the condition MB (x*) = MC(x*). Here the total surplus [B(x) – C(x)] for the contracting partners is maximal. But in the presence of asymmetric information this result can change. As soon as one party has private information about her/his benefit or cost function, the allocation will be distorted. For the ongoing analysis it will be assumed that the benefit function of Z for an increased amount of biodiversity rich areas is B_L (low benefits) or B_H (high benefits) and following the first-order condition, the efficient levels of biodiversity are x_L*; x_H* with $x_H > x_L$. Both contracting partners are risk neutral. For all amounts of biodiversity x it is valid: $B_L(x) < B_H(x)$; $B_L'(x) < B_H'(x)\ \forall\ x > 0$. Z knows his benefit function, whereas Y only knows the probabilities high and low benefits are realized p_L; p_H ($p_L + p_H = 1$).

Asymmetric Information and Screening

In the following, a bargaining game between the two parties is analyzed. Y owns the property rights over biodiversity. The status quo is q > 0. In the first stage, Y makes an offer. Z can accept or reject it. Then the game ends.

Not perfectly informed about the true benefits of Z, Y has to embark another strategy. If Y offers only a contract with a compensating payment equal the average expected total benefits, only Z with B_H will accept the offer. In this case it would be optimal for Y to offer two contracts Ri = [$\hat{x}$i; T($\hat{x}$i)]: one for a low benefit (B_L) and one for a high benefit user (B_H). In dependence of each contract, a specific level of biodiversity rich areas x with corresponding compensation payments T(x) is realized. $R_L = [x_L^*, T(x_L^*) = (B_L^*)]$ and $R_H = [x_H^*, T(x_L^*) = (B_H^*)]$ with the efficient outcomes are x_L^* and x_H^*. If Y offers these contracts, Z as a high benefit user has an incentive to underestimate her/his own benefit and her/his willingness to pay in order to keep the price down and reap a profit (BCD): $B_H(x_L^*) – B_L(x_L^*)$. If Y wants to avoid this situation, she/he must design the contracts in a certain way, so that a low benefit and a high benefit user choose that contract designed for their specific type.

The optimization problem of Y is to maximize the payments, which can be received less the accruing conservation costs.

(1) $$\max_{x_i, T(x_i)} p_L\, T(x_L) + p_H\, T(x_H) - p_L\, C(x_L) - p_H\, C(x_H)$$

It is assumed that the maximization of provider country's profits will lead to a higher protection level of biodiversity.

I. Participation constraint

(2l) $B_L (x_L) \geq T (x_L)$

(2h) $B_H (x_H) \geq T (x_H)$

The conditions (2) ensure participation (individual rationality). For both types of companies (B_H, B_L) it must be attractive to accept the contract rather than not to accept it and realize the status quo. But a high benefit company can always pretend to be a low benefit company to get an extra benefit: $B_H (x_L) > B_L (x_L) > T (x_L)$. Thus, only condition (2l) is plausible and consequently binding: $B_L (x_L) = T (x_L)$.

II. Incentive compatibility

(3l) $B_L (x_L) – T (x_L) \geq B_L (x_H) – T (x_H)$

(3h) $B_H (x_H) - T(x_H) \geq B_H (x_L) - T(x_L)$

The conditions (3) ensure the incentive compatibility. A low benefit user will never claim to be a high benefit user because this would reduce her/his total benefits [after paying T(xi)]. Thus, only condition (3h) is plausible and consequently binding $B_H (x_H) - T (x_H) = B_H (x_L) - T(x_L)$. Then, the optimization problem with constraints can be transformed to the following unconstrained maximization problem.

(4) $$\max_{x_l, x_h} p_l\,[B(x_L) - C(x_L)] + p_H\,[B(x_H) - C(x_H)] - p_H\,[B_H(x_L) - B_L(x_L)]$$

Under asymmetric information, the optimization problem of Y has changed. It is not longer interested in maximizing the payments, which can be received less the accruing conservation costs. Rather Y has to consider the required costs to ensure that a high benefit user (B_H) does not pretend to be a low benefit user (B_L). By renouncing a payment $B_H (x_L) - B_L (x_L)$ Y gives Z, being a high benefit user, an incentive not to pretend to be a low benefit company. These payments have to be made with probability p_H.

The first order conditions are:

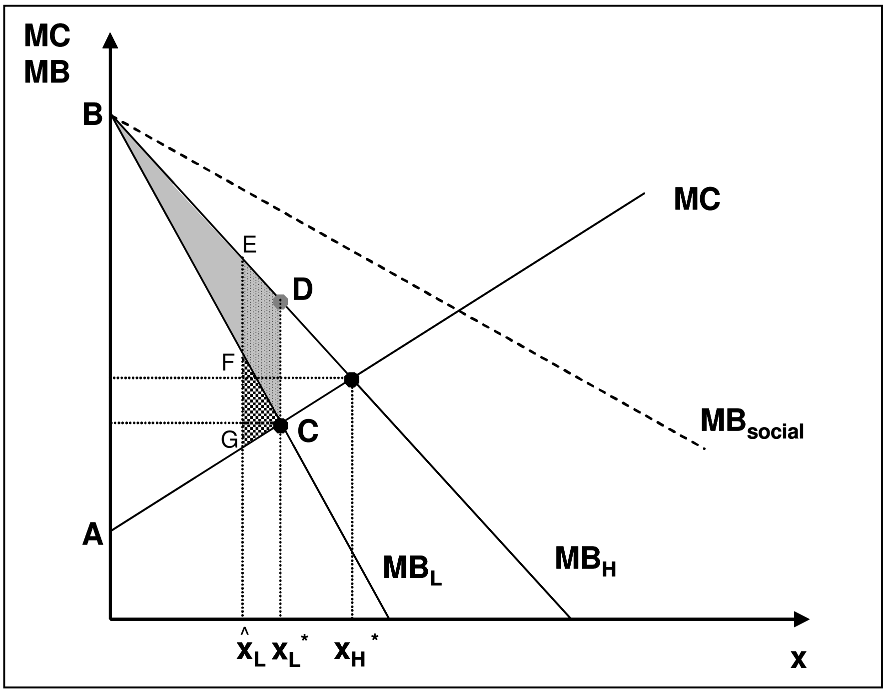
(5l) $$p_L\left[\frac{\partial B}{\partial x_L} - \frac{\partial C}{\partial x_L}\right] = p_H\left[\frac{\partial B_H}{\partial x_L} - \frac{\partial B_L}{\partial x_L}\right]$$

(5h) $$\frac{\partial B}{\partial x_H} = \frac{\partial C}{\partial x_H}$$

It is assumed $\hat{x}_l$ is the solution of equation (5l). If Z can realize high benefits the efficient outcome will be $x_H = x_H^*$ even in the presence of asymmetric information. Y can not acquire the first expected surplus because she/he has to consider the payment of the information rent $B_H(x_L) - B_L(x_L)$ (BCD). Thus, $T(\hat{x}_H) = T(x_H^*) - B_H(x_L) - B_L(x_L)$. But this is only a redistribution in favor of the informed party (Z).

In the case that Z is a low benefit user, the allocation will be distorted. To simplify matters it is assumed that $p_L = p_H = 0.5$. Y still can acquire a surplus (ABFG), but the offered amount of biodiversity is inefficiently low because $\hat{x}_L < x_L^*$. According to (5l) and the constraints of the benefit function $p_H\left[\frac{\partial B_H}{\partial x_L} - \frac{\partial B_L}{\partial x_L}\right]$ is positive as well as $p_L\left[\frac{\partial B}{\partial x_L} - \frac{\partial C}{\partial x_L}\right]$. This can only be the case if $\hat{x}_L$ is smaller than the efficient outcome x_L^* and MB > MC. Y will take a loss of surplus only if she/he is not worse off. Y deviates from the contract if the expected marginal loss of surplus (FG) is equal to the expected marginal savings of payments (EF), it renounced before. CDEF represents the savings and CFG the loss of surplus of Y.

Figure 18: The Coase Theorem under the presence of asymmetric information



Source: adopted from Illing 1992

Thus, under the presence of private information the payment of an information rent to a high benefit user results in a not pareto optimal contractual offer to a low benefit user. The information rent prevents a high benefit user from pretending to be a low benefit user.

Providers cannot reduce the information rent by deviating from the presented contract for a high benefit user design. Consequently, a pareto optimum is realized, in opposite to the case of a low benefit company.

Results

The Coase Theorem is only valid if certain information structures are present. If a provider country is not completely informed about the expected benefits of a user, the result will not be consistent with the predictions of the Coase Theorem. Firstly, in case the partner is a high benefit user, the outcome will be pareto optimal, but the distribution of the benefits has changed compared to a bargaining situation in the presence of complete information. The provider country does not receive the whole surplus and the high benefit user receives an incentive payment. Provider countries are not able to solve the problem of asymmetric information, but they can alleviate it. They can offer different contracts for the different types of companies and, hence, screen users. By considering the participation constraint and the incentive compatibility, providers can maximize their revenues. The maximization has a positive impact on the conservation of biodiversity. Thus, under the presence of asymmetric information a screening of the applicants by a specific contract design can improve the situation. Secondly, in case the partner is a low benefit user, the outcome won't be pareto optimal as already shown in the model. Though the provider can get the whole surplus, the amount of protected biodiversity is too small and the allocation of the resource is not efficient. In both cases, the benefits of the provider are smaller than they would be under the presence of complete information because the benefits are distributed in favor of the informed party and because the resources are misallocated.

II. Providers' private information on quality

Mullholland and Wilman (2003) analyze information deficiencies on side of the users. In their view, providers have private information on their inputs into the companies' drug discovery process because they do not only control access to the resources but also to the information on the quality of the material. In this case, they propose that companies need to design contracts that provide incentives for the host countries to deliver an amount of bioprospecting output that maximizes the company's output. In their model, it is assumed that provider country agents are typically poor developing countries and risk averse and that users are risk-neutral principals. Compared to the case that is analyzed in the previous chapter, here risk aversion plays an important role. If both principal and agent are risk neutral, the principal will design the contract in a way that the agent has to bear the risk. If the agent is risk averse, they have to share the risk.

Host countries will only sign a contract that provides them with enough expected utility to overcome their reservation utility. The expected utility will depend on the payoff they will receive and the utility that they will receive as a function of those payoffs. To convince a host country to sign a contract, the principal must offer adequate payoffs. For the principal there is a trade-off between providing full insurance to the agent and full incentive compatibility (Varian 1992, 441ff).

In the Mulholland and Wilman model the users demand biodiversity resources and access to information. The production process is assumed to be random due to the unpredictable research and development outcome. They consider time lags between collection and outcome and ABS contracts as an instrument that provides insurance. They model the contract as a principal-agent relationship. In their model the provider country controls both, access to the resources and the related information on the potential. The bioprospecting output Q is a function of the stock of biodiversity Z and the stock of information related to the pharmaceutical potential G. The biodiversity stock Z depends on the conservation measures undertaken by the host country I that thwart destruction or degradation of biodiversity, which occurs at the rate δ.

$$Z = I - \delta Z$$

The information stock G depends on the agent's efforts during the collection and processing (e.g., screening and identification), which are e. The degradation rate of the information stock is ε.

$$G = e - \varepsilon G$$

The function for the bioprospecting revenue is R (G, Z) = πQ (G, Z). π is the competitive price[17]. Since a random variable ω has to be considered that is not influenced by the principal or agent but that is a state of nature the bioprospecting revenue is W (ω, G, Z) = ωR (G, Z). As already mentioned, the production process of W, which is carried out by the agent, cannot be fully observed by the principal. Therefore, the agent has an incentive to provide less e, G, I, and Z.

The pharmaceutical company, as a risk neutral principal, aims to design a contract that induces the providers to produce an amount of resources and information that maximizes her/his output. Therefore, the contract needs to fulfill the incentive-compatibility to induce the provider as an agent to behave in the desired way, but also the participation constraint that guarantees that the agent be no worse off than she/he would be if she/he had chosen

[17] Q, $Q_g>0$, $Q_z>0$, $Q_{gg}<0$, $Q_{zz}<0$, $Q_{gz}>0$ and $Q_{zg}>0$.

another option. Sample fees, advanced payments, and royalty rate are considered as potential payoffs. The principal can choose the levels of any of these payments. However, empirical data show that in the classical case (i.e., provider country negotiates with user) the contracts are usually the result of a bargaining process between users and providers and that provider countries can influence it. But it has to be considered that today more and more intermediaries enter the market. Then, the classical situation occurs less frequent, since host countries are not necessarily involved in the negotiations and transfers. In the model the royalty rate α is chosen by the principal and paid to the agent out of the profits from any products developed. It is based on an observed successful outcome, but the price Pe and the advance payment Φ (G, Z)[18] depend on variables G, e, Z and I that are not perfectly observable.

They come to the conclusion that if the principal uses royalties in the payment schedule for a risk-averse agent the marginal benefits are reduced and lower levels of I, e, G and Z will result. With regard to the participation constraint, the agent's risk aversion reduces the payment contribution of the royalty rate. Therefore, it is more costly for the principal to meet the participation constraint than through other means. Sample fees and advance payment acknowledge the agent's risk. One suggestion is to earmark advance payments for investments in G and Z. That means host countries have to use the compensation payments for conservation measures or for training and technology development. These conclusions are also very relevant for the compensation schemes that are discussed in chapter 5.2.1.2. Empirical insights show that users highly prefer to compensate providers through royalties. But only if the agent is risk-neutral royalty payments can provide incentives for the optimal level of G, Z, e, and I. These insights have to be considered especially when designing model contracts.

5.2.1.6 Reputation-building

The transaction costs of the access phase are high due information deficiencies. Providers have private information on the allocation of the received benefits and on the handling with the provided material, especially on exclusivity of the provided material. The case study in Costa Rica indicates that the way provider countries deal with such private information is important for their attractiveness. They can signal that they are reliable partners despite their informational advantage.

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[18] $\Phi_g > 0$, $\Phi_z > 0$, $\Phi_{gg} < 0$, $\Phi_{zz} < 0$, $\Phi_{gz} > 0$, $\Phi_{zg} > 0$.

Reputation building is a quite strong form of signaling and can alleviate the problems arising from uncertainty and information deficiencies on both sides; on part of the providers and users. However, in this subchapter only signaling on the provider side is considered. The following chapter 5.2.2 on user measures deals with the user perspective.

According to Spence, “Market signals are activities or attributes of individuals in a market which, by design or accident, alter the beliefs of, or convey information to, other individuals in the market.” (Spence 1974). A signal is a characteristic that is observable and can be influenced by the individual through his behavior and action. Provider countries that have implemented ABS regulation and regard themselves as reliable partner users should trust, can signal this by different ways. They can participate in international meetings, workshops, projects etc., and present their ABS regulations and offer their support. Through their long-term experiences and reliable co-operation, provider countries appear as very attractive collection sites. It is more likely that users and providers will conclude or renew contracts with known partners than looking for new, unknown providers. Long-term partnerships are a specific investment and reduce information gaps and transaction costs.

5.2.2 Recipient countries

Since the adoption of the CBD, its implementation has focused more on the establishment of ABS regulations in biodiversity-rich provider countries, addressing the agents’ behavior in the provider countries. The above-described measures are examples for such provider measures. This situation has led to an imbalance regarding the efforts of provider and user countries in order to realize the Convention’s objectives. By establishing the ABS concept and its requirements for PIC and MAT, the CBD determines the users’ behavior in provider countries. However, users have also a responsibility to contribute to its implementation, especially when it comes to the third objective, the fair and equitable benefit-sharing.

On the political level, some steps have been taken to integrate users in the process and allocate them more responsibility. The voluntary Bonn Guidelines concretize the idea of an international ABS regime and address both provider and user countries by proposing certain measures that should be implemented to reach the fundamental objectives of the CBD. These measures serve as a basis for the following evaluation. Besides, the action plan of the WSSD requests governments to an international regime in which users play a more important role.

In the following subchapters, user measures are analyzed regarding their potential to address the critical factors and impact ABS effectiveness. Furthermore, it is investigated whether the proposed instruments are feasible and practicable with a view to implementation.

5.2.2.1 Documentation of the flow of genetic resources[19]

The documentation of the flow of genetic resources as a monitoring system can address the critical factor asymmetric information and administrative complexity. The critical factor analysis indicates that assignment and distribution of property rights have a strong impact on access, conservation, and benefit-sharing. Especially, the inappropriate assignment of IPRs (i.e., biopiracy) poses a problem. If genetic material is acquired outside of any ABS agreement, no benefits will be shared and no conservation incentives will be established. Many related cases have been reported.

To avoid the misappropriation of genetic material the ABS process has to be monitored. It can be monitored at different stages: the access phase (i.e., in the field or in ex-situ collections), the import of the genetic resources, the research and development phase, the application for IPRs, and the final product approval. Apart from the access phase these activities usually take place in user countries and depend on user countries' willingness to monitor the behavior of the users.

A traceability system for genetic resources can monitor the appropriate use of the material. Certificates of origin are seen as an instrument of such a traceability system. Irrespective of their form they can be used to monitor trade and movement of resources at different checkpoints and discourage unapproved and illegal use of genetic resources.

The concept certificate of origin was originally developed for the use of patent applications procedures to ensure the compliance with the CBD and its ABS obligations (Tobin 1994). The original idea was that the patent offices should require the disclosure of the origin of genetic resources and associated traditional knowledge as a condition for receiving applications for grant of patents. It was suggested that the establishment of a standardized certificate of origin, which would act as evidence of PIC, exempt patent officers from the need to examine all of the documentation related to an ABS agreement to verify compliance with the CBD. It was also suggested that such requirements could extend to product

[19] The main ideas in this subchapter are based on Richerzhagen, C. (2005): Certificates of origin: economic impacts and implications, UNU-IAS Working paper and Dedeurwaerdere, Louafi, Richerzhagen and Tobin (2005): Roundtable on Practicality, Feasibility and Cost of Certificates of Origin, Workshop Summary, IDDRI-UNU/IAS-CPDR, Richerzhagen, C. (2007): Certificates of origin: economic impacts and implications, in: U. Feit / F. Wolff (eds.), European regional meeting on an internationally recognized certificate of origin / source / legal provenance, report of an international workshop hosted by the German Federal Agency for Nature Conservation, Isle of Vilm, Germany, 24-29 October 2006, 46-48.

approval procedures, and act as an interim measure to protect the rights of indigenous and local communities over their traditional knowledge (Barber / Johnston / Tobin 2003, 38f).

The certificate concept has been considered in the international negotiations. At COP6, COP7, and COP8 the parties of the CBD decided to further examine an international certificate scheme regarding its feasibility, operational functionality, and cost effectiveness (CBD 2002; CBD 2004; CBD 2006). Rosendal (2006, 441) even interprets the discussion on certificates as a step forward to a multilateral system.

Despite several preliminary investigations and discussions at international meetings, there is still no clear understanding of how a certificate of origin system could operate in practice, or what should be the scope or nature of such system. At COP8, the Parties generally agreed on the need to establish a group of technical experts that could examine options for the form and intent, practicality, feasibility and costs of an international certificate of origin, source, or legal provenance (ENB 2006, 5). This group has met in January 2007 in Lima (ICTSD 2007).

However, even if the opinions on certificates diverge, the international discussion about a certificate scheme seems to agree on a multi-objectives scheme for certificates that is consistent with the CBD. It should

- Support efficient implementation of the CBD's ABS objectives,
- Track the flow of resources and being applied as control mechanism to restrict unapproved use, and
- Facilitate access by the consolidation of national permitting procedures and the reduction of complexities associated with access to and use of resources.

A further argument for introducing a certificate system is its potential to facilitate access. Existing procedures for access, collection, export of resources are highly regulated and involve a plethora of approval processes and permitting procedures: the administrative complexity is high. Basic research in particular suffers under these conditions. A majority of the genetic and biological resource uses is not for commercial industrial purposes, for example, 95 percent of resource use in Mexico is for basic non-commercial research. A certificate system should not add to the administrative complexity and raise transaction costs but help to rationalize it. If it is the latter, this will require capacity and political will in provider countries to streamline processes and overcome existing tensions amongst government departments for control over access issues.

A certificate can play an important role in the entire ABS process. Like a passport, it can accompany the genetic resources from the collection phase until the marketing of the product and give information about the origin of the material. It can be monitored and verified at different stages of access and use as well as across different jurisdictions beyond that of the providing country (Ruiz / Fernandez / Young 2003, 5). In accordance to the existing infrastructure, different checkpoints can be considered along the innovation line to decrease the costs resulting from the establishment of a certificate system. Some potential checkpoints are customs, patent and product approval authorities, the international depository system within the Budapest Treaty, research funding organizations, and scientific journals. At these checkpoints a certificate can provide information on the origin and in case of certificates of legal provenance evidence of the legitimate obtaining of genetic resources. By the submission of journal articles, the authors would be required to submit the certificate in addition to the information on the used material, which is already required. Research funding organization can require this information during the funding period, once the collection start. Patent and product approval authorities can make the submission of the certificate as a requirement during the application process (cf. chapter 5.2.2.2). A registry on the national or international level has to be established to record the transfers of genetic material. A certificate system should cover all users and uses of genetic resources. Certificates have to be reproducible to account for transformation and splitting of the material for multiple users and uses. Flexibility within the scheme is needed to adapt to the changing nature of resources as they move through various stages of research, development and transformation, thereby modifying the circumstances under which the certificate was originally granted. This means a certificate must be applicable to tangible and intangible material. However, it has to be as comprehensive as possible to ensure that it provides security to the providers (Dross / Wolff 2005, 136).

A certificate scheme has not necessarily to be mandatory. It stipulates an incentive to participate. A mandatory system comprehensively monitors all flows of genetic material, but the price would be relatively high. All users would be enforced to implement such the system regardless their individual costs and benefits. A voluntary system already institutes adequate incentives for participation. If users can decide about their participation, it is ensured that benefits of the system outweigh the costs.

The term ‘certificate of origin’ has been seen by some as problematic, implying as it does establish a link with countries of origin of genetic resources as defined under the CBD. Attention has been drawn to the complexities of identifying the origin of many resources that have been in circulation for decades, if not centuries. Alternatives terms have been suggested such as a ‘certificate of source’ (indicating where the material comes from) or a ‘certificate of legal provenance’ (providing evidence of the legal acquisition of the material) or a comprehensive system of certificates involving all three (Tobin / Cunningham / Watanabe 2004). In the latter case a certificate of origin would most probably be granted by a national authority in the country of origin for primary acquisition. A certificate of legal provenance could be issued by a biological collection, or a national authority in a country other than the country of origin for secondary acquisition, and a certificate of source would be provided to accompany any transfer of resources for basic non-commercial research.

However, the distinction between “country of origin” and “country providing the resources” is significant related to the disclosure obligation, in case the certificate is used as an evidence. Correa (2003) suggests with a view to existing disclosure requirement (e.g., in India and the EU) and the CBD obligations that the certificate should refer to the source and the providing country as understood under the CBD. The Lima expert group recommends implementing a certificate of compliance, since this is its main objective (CBD 2007f, p. 7).

Certificates also provide distinctive advantages from an economic point of view. They can alleviate the problem arising out of information asymmetries by serving as labels. The market for genetic resources is characterized by under-consumption due information deficiencies regarding the quality of the demanded material. The quality of genetic resources being potential inputs for commercialization consists of different elements as origin, biological traits, but also CBD compliance through PIC. Users cannot differentiate whether the provided genetic resources comprise these elements. They estimate a value of which existence they can be sure. This value is usually underestimated.

By indicating the origin, a certificate can supply further information about the provided material to users of genetic resources, as for example, biological and geographical information. Providing the good with such information converts genetic resources from simple commodities into higher-valued differentiated products. By increasing their value, a certificate scheme would create incentives for the provision of genetic resources and their conservation.

Certificates of origin, which indicate the origin of the obtained resources and provide a legal title to the users who obtains the material, can close the information gap. As labels they can inform users about the quality characteristics of the product and enable users to identify the appropriate value of the resource. The additional information provided by certificates transforms credence and potemkin attributes of genetic resources to search attributes. By providing additional passport data of the provided material, the value and the price users are willing to pay would be even higher.

Certificates of origin give providers of high quality material the opportunity to signal the user the quality of the good. The demand for low quality genetic resources is reduced as well as the output of these resources because adverse selection is prevented. Less material is supplied that was not obtained in compliance with the CBD. On the one hand, it seems unnecessary to establish a market mechanism that aims at a goal that should be already enforced by law. On the other hand, there is still a lot of material in the market that does not fulfill the CBD criteria because many countries have not implemented the CBD's ABS provisions yet, because of the existence of ex-situ collections, which collected material before 1992, or because some providers exist who do not follow the international and national law and offer illegally obtained material.

Often provider countries lack human and technology capacities to collect and transfer these quality data. Therefore, it is important to enable provider countries through capacity-building training, knowledge and technology transfer to collect and transfer data in an appropriate format. This would benefit both providers and users.

A certificate scheme has effects on the trade of genetic resources. If certificates of origin are instruments of a mandatory certificate scheme, supply of genetic resources will negatively affected due to higher costs. The costs depend on existing frameworks and procedures and how they correspond with the introduction of a certificate scheme. However, if a certificate scheme helps to streamline ABS procedure in country without rising costs. They might even have a positive effect. The demand is positively affected because certificates can reveal resources' real value. Besides, during the exchange of material, they can reduce search and information costs. However, research and development costs can immensely increase by implementation and enforcement.

When discussing about certificates of origin one has to keep in mind the heterogeneity of users. The public and private sectors benefit by having an appropriate instrument to differentiate the quality of provided material and gaining certainty of legal title to genetic resources. These benefits are much higher for the private sector, which uses the material for commercial purposes, because they can actually recoup the costs caused by the implementation and enforcement of a certificate scheme. Public sector users do not make profits by using the material, but due to their function, they are involved in many more international transfers.

A survey on German users of genetic resources revealed that German users are critical to the introduction of certificates of origin, source, or legal provenance. Although the majority of users obtain the genetic material through intermediaries, legal uncertainty is reported as a major problem. Therefore, the implementation of this instrument would require specific preparations, in particular it would be necessary to inform users and initiate stakeholder consultations (Holm-Mueller / Richerzhagen / Taeuber 2005, 71-73). The same can be observed in Japan. A study on Japanese users puts light on the utilization and documentation procedures in place and the Japanese users' attitude towards the different certificate scenarios (i.e., subject matter, type, format, checkpoints and registry) regarding practicality, feasibility, and costs. It shows that certificates of origin are critically judged among users of both the private and the public sector, which also supports the argument to establish a voluntary regime. There, paper and electronic formats are probably the most common form of documentation of used material that is already in place. To reduce costs they should be the most preferred ones. Certificates of source are considered as least critical of all three forms. All proposed checkpoints are positively evaluated and an international registry is preferred to the national registry (Richerzhagen 2005, 24ff). More of such studies have to be conducted to analyze the structure of the user sectors regarding certificates.

A future certificate of origin scheme has the potential to address information problems in the market of genetic resources. However, when implementing such a system existing infrastructure and attitudes have to be taken into account. Only then such a system will be effective regarding practicality, feasibility, and costs.

An important Convention that has to be considered for the creation of a certification system is CITES which regulates the transboundary movement of certain specimens, and parts and derivatives of protected species of plant and animal since 1975. CITES ensures that international trade in specimens of wild animals and plants does not threaten their survival by subjecting international trade in specimens of selected species to certain controls. These require that all import, export, re-export, and introduction of species covered by the Convention have to be authorized through a licensing system (CITES, 1973).

Experience in CITES suggests that a computerized, paperless and centrally administered system might be preferable. Any system should provide a means for cost recovery for certificate administration by provider countries, but these costs should not be so high that they will serve as a disincentive for basic research. Capacity-building, awareness arising and the consideration of security issues (authorized signatures/seals, special paper or stamps, protocols) as being important for the success of a certificate system, but unlike in the case of CITES the subject matter of a certificate may change substantially during research and development activity (Dedeurwaerdere et al. 2005).

5.2.2.2 Monitoring of intellectual property rights applications[20]

The monitoring of IPRs application has been identified as a possible checkpoint in a traceability system. Therefore, it is an adequate instrument to address the problems arising from the information deficiencies providers have regarding the use of their provided genetic resources and to address the high transaction costs due to administrative complexity. At the same time, it can balance the unequal property rights distribution. By mentioning the origin of genetic resources in IPRs application, the providers do not become holders of such rights, but at least they are cited in the IPR and therefore have the legal basis for demanding benefit-sharing. On the political level these potential functions of a disclosure of the origin requirement have also been realized. Even the Bonn guidelines recommend that CBD Parties implement disclosure requirements for patents based on the use of genetic resources because they can support the monitoring of ABS activities in user countries during the application of IPRs or product approval (CBD 2002 VI-24; Gollin 2005).

Disclosure already plays an important role in patent law. Only if the invention is fully disclosed a patent can be granted. According to the TRIPs agreement, applicants for a patent have to disclose the invention sufficiently clear and complete for the invention to be carried out by a person skilled in the art. It may require the applicant to indicate the best mode for carrying out the invention known to the inventor at the filing date or, where priority is claimed, at the priority date of the application (TRIPs, Art. 29.1).

A study on patents using biological source material revealed that in cases where plants are well known and widespread, as for example, oat or lemon, the origin is not specified in the patent application for plant extracts, but if the object of the patent is a rare or exotic, the applicant usually provides information on the origin (WIPO 2001). However, usually it is the choice of the applicant whether to disclose the origin of the used material.

A first proposal regarding disclosure of the country of origin emerged in 1994 jointly with the proposal for certificates of origin. It tried to link the IPR system and ABS and put forward the idea to require the disclosure of origin in patent applications (Barber / Johnston / Tobin 2003, 29). The idea is that an inventor who applies for a patent, which is based on the utilization of genetic resources, has to provide additional information on the material's source or even proof of its legal acquisition (Tobin 1997).

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[20] Many ideas in this paragraph are based on Dedeurwaerdere, Louafi, Richerzhagen and Tobin (2005): Roundtable on Practicality, Feasibility and Cost of Certificates of Origin, Workshop Summary, IDDRI-UNU/IAS-CPDR.

What are the arguments supporting such a system? Outside of the patent system, the disclosure of origin can help the provider countries to fill the information gap, strengthen their position, promote compliance with their access legislation, increase their confidence in users and prevent the loss of potential benefits by its functioning as a control mechanism. Through the establishment of a disclosure requirement providers would be enabled to keep track, at the global level, of all patent applications with regard to genetic resources.

Within the patent system a disclosure requirement could improve the examination of patent applications by facilitating the determination of prior art, and improve the determination of inventorship by the patent office or courts. In some cases, as for example, endemic biological material, it may even facilitate the execution of the invention (Correa 2003, 3). Considering that the verifying of IPR applications places additional burdens on the patent offices, the importance of other control systems (e.g., a certificate of origin) becomes evident.

The debate on disclosure requirements has been intensified during the TRIPs review, which is still persistent (cf. chapter 3.2.1). WIPO has been invited by the CBD to prepare a technical study on methods within the patent system for requiring disclosure relevant to genetic resources and traditional knowledge and therefore collected and analyzed positions and proposals from its Member States. Many countries made proposals how to realize such a control instrument. A group represented by Brazil and India, including Bolivia, Colombia, Cuba, Dominican Republic, Ecuador, Peru, Thailand, and supported by the African group and some other developing countries, intends to amend TRIPs. They propose that the patent applicants are required to disclose the country of origin of genetic resources and traditional knowledge used in the inventions, PIC and the benefit-sharing agreements. Switzerland has proposed an amendment to the regulations of WIPO's Patent Cooperation Treaty so that domestic laws may ask inventors to disclose the source of genetic resources and traditional knowledge when they apply for patents. Failure to meet the requirement could hold up a patent being granted, or when done with fraudulent intent, could entail a granted patent being invalidated. The EU's position includes a proposal to examine a requirement that all patent applicants disclose the source or origin of genetic material, with legal consequences of not meeting this requirement lying outside the scope of patent law. The US has argued that the CBD's objectives on ABS could best be achieved through national legislation and contractual arrangements based on the existing legislation, which could include commitments on disclosing of any commercial application of genetic resources or traditional knowledge (WTO 2007b).

Sarnoff and Correa (2006) recommend the establishment of an international system of mandatory disclosure of origin requirements, which is linked to TRIPs. According to their analysis, an international disclosure system is consistent with international intellectual property treaties and can only provide sufficient benefits if it is mandatory because national disclosure systems are limited to the national jurisdiction.

Today, some national or regional IPR, biotechnology, or biodiversity regulations include some forms of disclosure requirements or encouragements. The frameworks differ widely and range from mandatory requirements for disclosure of origin and legal access to disclosure requirements that only encourage to disclose but do not involve any legal consequence in cases of non-compliance (Baummueller / Vivas-Eugui 2004, 21).

Certain problems arise in the preliminary stage of discussion on this instrument and are closely related to certificates of origin. The exact characterization of the country of origin is difficult due to a possible multiplicity of genetic resources. Some genetic resources can be found in more than one country or region or have acquired specific distinctive and genetic characteristics not in the same country where it was collected. Often genetic resources are not directly provided by the country of origin, but by ex-situ collections (e.g., gene banks, microbial collections, or botanical gardens). In these cases provider country and country of origin do not correspond.

The legal nature and the aligned consequences are controversially discussed and differently handled. A disclosure requirement can be a formality in the patent procedure or even a patentability criterion. However, since many members of the CBD are also members of WTO the legal implications of the TRIPs agreement have to be considered. Dedeurwaerdere et al. (2005, 5) state that a disclosure of origin requirement is only compatible with the TRIPs agreement as it is ruling now in a system where

- Disclosure of origin is only a formal requirement for patent application (and not a substantive criteria for patentability, which determines the eligibility of the invention such as novelty),
- The disclosure obligation only holds if the origin is known (so no requirement that the patentee has to do further research on the origin),
- And where the sanctioning mechanisms lie outside the patent system, for example, a system of fines for commercialization on basis of non certified genetic resources or financial advantages for the certified ones.

Sanctions outside the patent system for non-compliance with disclosure requirements include criminal and civil sanctions. By placing sanctions outside the patent system, penalties can be imposed without paralyzing research and development activities. In some cases sanctions might require the transfer of rights over a patent to an aggrieved party, in particular an indigenous or local community whose knowledge had been appropriated. Developing countries such as the Andean community have developed more rigorous requirements on disclosure with sanctions that fell within the patent system.

A disclosure requirement for genetic resources needs definitions and standardized procedures to be effective. Clear regulations and sanctions in case of non-compliance have to be developed to make the system feasible. However, as many uses of genetic resources are non-IPR related any system must consider a range of regulatory and non-regulatory procedures for monitoring the use of genetic resources in product development and commercialization as already indicated by the previous chapter.

5.2.2.3 Certification schemes for institutions

Economic theory suggests certification as an instrument to address information asymmetry (Fritsch / Wein / Ewers 2003, 297). It is some form of screening because the principal tries to get additional information to compensate the deficiency. The critical factors show that providers lack information on the users' behavior, which results in disproportionate and complicated regulations. Certification can be a signaling mechanism for users. Companies' compliance with the principles formulated in the CBD and the Bonn Guidelines can be ensured through the participation in a certification system. In addition, it can improve the user's reputation and provide the basis for provider countries to feel more confident about their potential partners.

Certification systems voluntarily verify practices of organizations. They might be self-implemented or implemented by a second party with an interest in the organization's practices. Alternatively, the operations of the concerned private or public organization are assessed against a standard set of criteria by an independent third party. The use of the certification by an independent third party has become the norm because of the importance of credibility of the certifiers (Kanowski / Sinclair / Freeman 1999, 14). Important aspects for the implementation of a certification system are the creation of an independent standard-setting body, an agreed procedure for the certification assessment, the issuance of a written certificate that confirms the compliance with the standards, and the establishment of an appeal possibility for certification decisions (Barber / Johnston / Tobin 2003, 23). Voluntary certification schemes are widely and successfully used, for example, under the International Organization for Standardization (ISO). The organization's work program ranges from standards for traditional activities, such as agriculture and construction, to mechanical engineering, to medical devices, or even the newest information technology developments. Alternative specialized schemes have been implemented for timber products extracted from sustainable managed forests, fisheries, organic food, and other environmental and social sectors (Barber / Johnston / Tobin 2003, 23).

5.2.2.4 Corporate and institutional policies and codes of conduct

Corporate and institutional policies and codes of conduct are another signaling instrument, which users can apply in order to signal their will to comply with the CBD. In the past, it was observed that some users of genetic resources have developed their own ABS policies, either individually or jointly, including whole sectors (ten Kate / A Laird 1999, 309). These users operate in the private sector (e.g., companies) or in the public sector as non-profit research institutions (e.g., botanical gardens). Corporate and institutional policies and codes of conduct developed in the framework of the Bonn Guidelines are measures that can assist in the development and implementation of ABS arrangements.

Corporate and institutional policies and codes of conduct are voluntary measures initiated by the users or their representatives (A Laird / Wynberg 2002, 39). The interventions in the activities of a research institution or a company caused by such measures are relatively small. Once such policies or codes of conduct have been developed and successfully applied in an institution or company, they can be disseminated at low transaction costs in the entire sector concerned. They can provide sufficient flexibility to respond to the circumstances of specific research sectors and users of genetic resources if their design is appropriately adjusted. Both users and providers can benefit from their establishment. The application of corporate policies and codes of conduct increases user transparency and therefore the provider countries’ trust in their partners. The use of codes of conduct can facilitate access to genetic resources for the members and reduce the need of other compliance procedures (Barber / Johnston / Tobin 2003, 22). Control mechanisms, which apply to the early stages of research and development, can be established at lower costs than those that take effect in later phases. Corporate policies and codes of conduct have the potential to alleviate uncertainty and decrease the transaction costs for users and providers, which might arise from the asymmetric distribution of information between them. However, according to a recent study, only very few companies realize the ABS provisions and therefore implement such policies or code of conducts (Busch / Kern 2005, 86).

5.2.2.5 National Focal Points, Clearing House Mechanisms

National focal points and the Clearing House Mechanism (CHM) are institutions that, once they are established, impact asymmetric information and administrative complexity. The Bonn Guidelines give high importance to the provision of information in the ABS process for both providers and users. National focal points and the Clearing House Mechanism are important for the collection, provision, and dissemination of information, and they play an essential role in raising awareness in user countries.

According to the Bonn Guidelines, each party of the CBD should designate one National Focal Point for ABS. The National Focal Point should provide users with information regarding the CBD and the Bonn Guidelines, as well as regarding national ABS laws and regulations in provider countries. In this way, applicants for access to genetic resources can acquire information on procedures for achieving PIC and MAT (including benefit-sharing) and on competent national authorities and relevant stakeholders (Bonn Guidelines IIA/13).

National Focal Points in user countries can support the exchange of information and experiences in ABS issues. More transparency and facilitated access to information in the market of genetic resources can alleviate the consequences resulting from asymmetric distribution of information, as e.g., complicated and restricted access. The provision of information can benefit both users and providers and can decrease their transaction costs. Therefore, the negotiations between users and providers can be considerably improved.

National Focal Points in user countries can establish contacts to focal points and authorities in provider countries and facilitate the establishment of contacts among the users. The threshold of entrance for first time users is lowered and providers have access to better information about potential benefits that can be expected. Important is also the collaboration between National Focal Points to decrease costs and facilitate information exchange. Through the initial work of the focal points in user countries, the competent authorities in provider countries that are often overburdened with the complex ABS issues can be relieved. To date, 42 parties of the CBD have nominated ABS National Focal Points (CBD 2007b).

The CHM provides a possibility for user registration. The register can improve the reputation of users, since the registration of a fully-fledged ABS policy in compliance with the CBD would be evidence of a good sense of corporate social responsibility (EU Commission 2003, 4). National focal points in user countries can assume some of the responsibility of the focal points in provider countries and relieve them. The problems caused by administrative complexity can be addressed. Additionally, the CHM can be used to increase the effectiveness of other user measures. Corporate policies and codes of conduct can be publicized through the CHM and can be provided for biodiversity-rich countries.

The CBD has established its own CHM. The first priority of this portal is to ensure universal access to the Convention's official records, but also additional information such as case studies, national reports etc. It seeks to increase public awareness of Convention programs and issues. The internet-based system supports and facilitates greater collaboration among countries through education and training projects, research co-operation, funding opportunities, access to and transfer of technology, and dissemination of information. Experts are being linked to facilitate joint work programs. The CHM can support scientific and technical co-operation through the provision of an information management and exchange system and can therefore support technology and knowledge transfer (SCBD 2005, 222ff).

5.2.2.6 Projects and standardized contracts

Governments of user countries can support the development and execution of projects by aiming at the promotion of co-operation between users and providers and the development of standardized material transfer agreements. Supported projects and standardized model contracts decrease transaction costs arising from administrative complexity and decrease information deficiencies. Furthermore, the bargaining position of provider countries is consolidated. Governmental institutions monitor these projects and can ensure that users comply with the CBD. Providers will be more confident about their partners if the ABS negotiations take place in the framework of such a project. By participating in such projects, users can gain reputation and constitute a positive example. The developed contracts can be made available for other users. The Bonn Guidelines already identify high transaction costs and legal uncertainty as major problems in ABS negotiations and regard the development of standardized material transfer agreements and benefit-sharing arrangements for similar resources and similar uses as important instruments to address these problems (Bonn Guidelines IVD/42, b iv).

An interesting approach is the initiative International Cooperative Biodiversity Groups (ICBG), which was launched already in 1992 by three agencies of the US Government (National Institutes of Health, National Science Foundation, and US Agency for International Development). The program supports bioprospecting projects between public and private US institutions and provider countries (Boisvert / Vivien 2005, 466). The projects underlie a certain design that includes the active participation of host country individuals and organizations from the planning stage onward, multi-disciplinary research on diseases of both local and international significance, local training and infrastructure development in drug discovery and biodiversity management, biodiversity inventory and monitoring, and equitable intellectual property and benefit-sharing arrangements (Rosenthal 1996, 1996).

5.2.2.7 Technology transfer

Technology transfer from user countries to provider countries is seen as a major element of the benefit-sharing process and necessary to set incentives at the local level to conserve and sustainably use biodiversity. Technology transfer is a non-monetary benefit-sharing instrument and has the potential to bridge the gap, emerging from the time lags between the bioprospecting activities and the development of a marketable product. If provider countries are enabled to contribute to the research and development phase of a product, their bargaining position and market power is strengthened.

Technology transfer into different sectors, e.g., agriculture, fishery, or forestry, does not only support benefit-sharing but also the other two objectives of the CBD: conservation and sustainable use of biodiversity. Only with the relevant technologies, countries are able to fulfill these objectives.

A meeting, organized by UNEP and Norway, on technology transfer within the CBD identified problems, which need to be addressed to support the CBD objectives by technology transfer:

- Insufficiently receptive social and economic conditions to allow successful technology transfer and capacity building;
- Inadequacy of information on available technologies;
- Uncertainty with respect to terms under which technology transfer could and should be undertaken;
- Lack of appropriate regulatory, financial, and institutional frameworks at the local, national, regional and international levels;
- Achieving improved and better-targeted technology transfer and capacity building will require developing concrete targets and improved synergies between biodiversity and development policies, with obligations and needs under other conventions, and between sectors at the national level.

Technology transfer depends on the enabling environment. Legal and political security has to be ensured, responsible institutions established and property rights defined and assigned (UNEP 2003, 9).

Depending on the countries' initial situation, different forms of technology transfer are required. Simple technologies, for example, improving agriculture and forestry techniques, help to alleviate urgent environmental problems and poverty. Transfer of advanced technologies, e.g., biotechnology promoting more value added research and development activities with genetic resources, enable provider countries to strengthen their position in the market by offering more developed and advanced products instead of raw genetic material. Besides, the provision of processed material would make it easier to certify the resources being accessed within a certificate scheme.

5.2.2.8 Implementation of conflict resolution, arbitration and redress mechanisms

Monitoring deficits are a major problem that leads to asymmetric information and its consequences. Adequate conflict resolution, arbitration and redress mechanisms can mitigate this problem. For instance, if providers can be sure that they can enforce their rights, they will not react with over-regulation. ABS agreements contain contract terms that can be violated by both providers and users. Providers are usually the first who meet the contract conditions by the provision of genetic material. They usually do not have the capacities to control the meeting of the commitments of the users of genetic resources. The difficulties even increase, once the genetic resources have left the jurisdiction of the country of origin. Being aware of this situation provider countries often react with establishing more restricted access regulations.

Control mechanisms as the monitoring of IPRs applications and the assistance of third parties (i.e., access to information, communication of patent applications, additional investigation of infringement, provision of visas and legal aid) can help to identify infringements on the part of the users and to provide important information to the countries of origin whose laws have been violated. User countries' focal points could play a facilitator role by providing information, including the legal system of their country (EU Commission 2003, 22). With the support of these instruments conflict resolution, arbitration and redress mechanisms can be applied.

In many user countries redress mechanisms for breaches of contracts already exist and enable providers to take legal action against misappropriation of genetic resources. The applicable law and the competent authority are usually defined in the ABS contract and belong to the juridical system of the provider or user states. Despite the regulation, problems can arise if one party wants to enforce its claims by legal action (EU Commission 2003, 21). If the law of the provider country is the applicable law and the competent authority is also settled there, the prosecution of the violation of national ABS law by a foreign company can be impossible or difficult in case the company has no assets in the provider country and is not available for court procedure. Then, provider countries depend on the enforcement of the court decision in user countries. The handling of the enforcement of a foreign court decision is possible, but it is different in the user countries. Whether a court decision will be enforceable or not, usually depends on various factors (e.g., procedural fairness, reciprocity).

The decision is made from case to case (Barber / Johnston / Tobin 2003, 36). If the prosecution is carried out in the user countries, difficulties that arise out of the enforcement of foreign court decisions can be avoided. Additionally, the opportunities of higher awards in case of tort actions have to be considered (Barber / Johnston / Tobin 2003, 37). But this approach probably fails due to the lack of financial and human capacity on the part of the provider countries to enforce their rights in the user country.

The procedure of alternative systems, as for example, arbitration or the establishment of an independent ombudsman at the CBD Secretariat, can also be considered. They are normally faster, less costly, do not necessarily require legal representation, and do not hold the risk of high costs if the lawsuit is lost. Probably the most important advantage is that both parties have to consent to the process and the arbitration result (Barber / Johnston / Tobin 2003, 36).

Arbitration in the framework of the United Nations Convention on the Recognition and Enforcement of Foreign Arbitral Awards and the Convention on the Settlement of Investment Disputes between States and Nationals of Other States is an alternative instrument that could be used to address infringements of the users and solve a dispute between providers and users of genetic resources (Barber / Johnston / Tobin 2003, 36).

An ombudsman or a complaints authority associated with the CBD at regional and national levels provides an interesting possibility for the development of alternative dispute resolution mechanisms. An ombudsman office at the level of CBD may be linked to series of regional structures for monitoring compliance with the CBD and Bonn Guidelines in ABS agreements (UC 2003).

6 Implementation of ABS regulations in provider and user countries

This chapter applies the developed analytical framework to assess ABS effectiveness to four case studies and analyzes which of and how successfully the identified measures for addressing the critical factors are already implemented. Hereby, it allows analyzing the strengths and weaknesses of current ABS regimes in provider countries and user countries. It ascertains implemented methods and future options for measures that can be undertaken by countries in their capacity as providers and users of genetic resources and therefore, explores the perspectives for ABS governance under an international regime. The main source of information of these case studies are qualitative interviews with relevant stakeholders in the respective countries.

The study applies a multilevel approach by examining the effectiveness of global ABS governance. Whereas the previous chapters focused on the general global framework conditions, this chapter centers the attention on the national and regional level where the implementation takes place. The findings and results are not only limited to the case studies investigated in this study. The analytic framework, consisting of the objectives and the critical factors, can be applied to a range of country case studies that are faced with the implementation of the ABS concept. Only with such an analytic framework a comparative analysis of different case studies is possible. The case studies provide insightful experiences for other provider and user countries. Since the underlying questions of this study are coherent with the questions international policy-makers are faced with, the results of the study support the political discussions and negotiations and propose options for further proceedings.

The four case studies (the Philippines, Costa Rica, Ethiopia, and the EU) together with the analytical framework in chapter 5 are the core of the study. They provide the empirical insight to the problem of biodiversity loss and the ABS concept and they are the empirical bedding and completion for the development of the critical factors, which are based on both economic theory and empirical findings.

The regulations in Costa Rica and the Philippines have been taken as an example to provide insights into existing ABS regimes. Both countries implemented the ABS provisions of the CBD quite early. Costa Rica established the institutional infrastructure and concluded ABS agreements even before the CBD was signed. A legal framework was only adopted in 1998. The Philippines were the first country finalizing and implementing a legal ABS framework, which has already been revised in the beginning of 2005. These two countries look back on long lasting but different experiences. Costa Rica is internationally regarded as a model nation with a view to ABS and environmental measures, whereas the Philippines had major difficulties in realizing the CBD objectives. In the following, it is analyzed how the critical factors, which have been derived from the theoretical framework, in these countries are shaped and how their ABS regulations address them. Ethiopia has only very recently adopted an ABS regulation. However, the awareness of the Ethiopian government regarding ABS is high. Especially on the international level, Ethiopia is an important actor. The drafts of ABS laws have been discussed for a long time but in the beginning of 2006, the Ethiopian government finally adopted a regulation. Therefore, Ethiopia represents many of the countries being rich in biodiversity and being a party of the CBD but having political and institutional difficulties to implement its provisions.

Since the countries' geographical location and their approaches to implement ABS differ extremely, the selected case studies appear to be very useful. Users are an indispensable part of an international ABS regime. However, only little information is available on user issues. Therefore, this study considers and integrates them. The EU serves as an example of a user country community. This case study is mainly a desktop study, but enriched with information gathered in workshops and conferences. Many European member states have a strong research and development capacity and distinct and diverse user sectors, including a wide range of different sectors, as for example, pharmaceuticals, agribusiness, cosmetics. At the same time the EU has been actively involved in the negotiation within the CBD and tried to support communication between users and providers. The last subchapter investigates if the introduction of certain user or user country measures in the EU can fulfill the requirements, which are derived from the identified critical factors.

6.1 The Philippines

The Philippines is the first case study that was undertaken. In the following subchapters, the analytic framework, comprising the critical factors and the potential measures, is applied. First of all, the case study methodology is shortly presented. Then, the introduction to the Philippine case is given and the regulatory environment, including the legal and institutional setting, is illustrated. The main part of the Philippine analysis is the application of the critical factors to the country-specific case. Taking into account the established analytic framework regarding the effectiveness (cf. chapter 5), it is looked at how the critical factors are shaped and how they are already addressed in the Philippines. The analysis of the first case study finishes with the country-specific conclusions.

6.1.1 Case study methodology

The Philippines serve as a country case study because the ABS implementation is ambivalent. On the one hand, the country has a long-time experience in ABS implementation. On the other hand, the implementation seems to be very ineffective. Since 1995, only two bioprospecting agreements have been concluded; one for scientific research and one for commercial uses. In order to address the implementation problems the Philippines have revised their ABS regulation and recently adopted the second generation of ABS laws. That experience gives them a considerable lead over other provider countries.

The case of the Philippines is evaluated by using the critical factors identified above. It is analyzed whether the critical factors or their interdependency can explain the obvious low effectiveness of the Philippine regime: low access rate, on-going loss of biodiversity and no benefit-sharing. The development of the new ABS regulation is considered although it was adopted after the interviews took place. The data are based on expert interviews, conducted in the Philippines between March and May 2002. Semi-structured interviews were used as the method of gathering and analyzing qualitative data (cf. chapter 1.3). Throughout the interviewing process, different thematic areas in line with the identified critical factors were addressed. 27 experts were interviewed who represent the variety of stakeholders, including individuals, communities, government, universities, NGOs, scientific institutions and industry involved in the ABS process or having expertise related to the ABS issue (cf. list in the appendix). Additionally, secondary literature, including books, journal articles, and reports, is used to complement the information gained from the interviews.

6.1.2 Introduction

The Philippines belong to the so-called “biodiversity hotspots”. They have regions with high biodiversity and a remarkable number of endemic species. Nevertheless, these regions can also be described as areas, having a high decline of habitats of these species (Myers et al. 2000). The extinction rates in the Philippines are unparalleled in Southeast Asia.

The diversity of ecosystems in the Philippines is extraordinary. About 13,500 plant species can be found in Philippine forests. They represent five percent of the world’s flora. The flowering plants are estimated to be between 8,000 and 12,000 species in 200 families and 1,500 genera; 20 percent is unknown while 27 to 75 percent is endemic (PAWB 1998, 2).

Beside plant diversity, the diversity of animals (i.e., vertebrates and invertebrates), freshwater ecosystems, costal and marine ecosystems, and agricultural plants is very high. The spectra of ecological niches or habitat types support high species diversity. The number of species is estimated to be more than 53,577. High species endemism is observed among flowering plants, algae, lycopsids, ferns, amphibians, birds, and mammals.

Protected areas amount to 7.8 percent of the total land area in the Philippines (WRI 2003). Nevertheless, Philippine forest cover has been reduced from more than 50 percent to less than 24 percent between 1948 and 1987 (PAWB 1998, 1-4). Today 19.4 percent of the land is covered by forests. According to FAO estimations, the annual deforestation rate is 1.4 percent (FAO 2003). Only about five percent of the country's coral reefs remain in excellent condition and about 80 percent of its mangrove areas have been lost. It has been estimated that about 50 percent of national parks are no longer biologically important (PAWB 1998, 1-4).

The major threat for biodiversity in the Philippines is the habitat destruction due to conversion of forest and grasslands for agricultural and urban use and due to overexploitation (i.e., over-logging) (Liebig et al. 2002, 31). Governmental and non-governmental organizations reacted in the late 1980s and developed strategies to halt the loss of forests and biodiversity. Various environmental policies and biodiversity conservation programs have been formulated. In 1992 the National Integrated Protected Areas System (NIPAS) Law was adopted and laid down the basis for a comprehensive protected area system (Benavidez 2004, 154). In order to effectively implement such conservation measures the Philippines depend on external support. The same applies to ABS regulations. The development of ABS laws and their implementation have been supported by development agencies, e.g., Gesellschaft für technische Zusammenarbeit (GTZ)[21]. In the Philippines a legal ABS framework was developed and adopted shortly after the adoption of the CBD. But it seems that actual implementation could not keep up with the legislative input and was not able to effectively address the problem of biodiversity loss.

The establishment of the ASEAN (Association of South East Asian Nations) Regional Centre for Biodiversity Conservation (ARCBC) in the Philippines indicates again a strong commitment to the increasing willingness to actively address the problem of biodiversity loss. The centre serves as an institutional linkage among ASEAN member countries and between

[21] The GTZ has supported several projects that aim at advancing the implementation of the CBD, for example, "Support in Implementing Presidential Executive Order EO 247 on the Access to Genetic Resources", "Supporting Local Initiatives in Palawan at Implementing National ABS Regulations" and the "Bioprospecting Programme", which has the objective to raise awareness among indigenous and local communities about the impacts of bioprospecting (cf. http://www2.gtz.de/biodiv/english/index.html).

ASEAN and EU partner organizations to enhance the capacity of ASEAN in promoting biodiversity conservation. It aims to support biodiversity conservation through improved co-operation in the Asian region, by assisting in setting up a network of institutional links among ASEAN countries and between ASEAN and EU partner organizations. The centre should assist the ASEAN member countries in developing a framework for improving technical and institutional approaches through regional co-operation for managing biodiversity conservation (ARCBC 2006).

6.1.3 Regulatory environment: legal and institutional setting

In 1995 the Philippine government reacted as the first country to the adoption of the CBD's ABS provisions and implemented them by the Presidential Executive Order 247 (EO 247)[22], which was still a general framework. One year later the Department Administrative Order 96-20 (DAO 96-20)[23] was developed as the EO 247's implementing rules and regulations. Before their implementation, an administrative coordination and permitting system, which was executed by the National Museum of the Philippines but which was not in compliance with the CBD, regulated the collection of wildlife species (Benavidez 2004, 154).

EO 247 is based on the constitution's provision, which vests the state the responsibility to preserve the environment and assigns the ownership over wildlife, flora, and fauna to state. It covers the prospecting of biological and genetic material in the public domain, including natural growths in private lands. Consequently, the state regulates ABS for biological resources, existing within the Philippine territory. EO 247 aims to regulate bioprospecting in compliance with the CBD. It should benefit the national interest and promote the development of local capability in science and technology to achieve technological self-reliance in selected areas (EO 247, Section 1). Its scope is very comprehensive. It covers the prospecting of biological and genetic resources, their by-products and derivatives for scientific and commercial purposes. The DAO 96-20 defines bioprospecting as research, collection and utilization of biological and genetic resources, for purposes of applying the knowledge derived there from for scientific and commercial purposes (DAO 96-20, 2.1 h).

[22] EO 247: Prescribing Guidelines and Establishing a Regulatory Framework for the Prospecting of Biological and Genetic Resources, their By-Products and Derivatives, for Scientific and Commercial Purposes, and for Other Purposes.

[23] DAO 96-20: Implementing Rules and Regulations on the Prospecting of Biological and Genetic Resources.

The regulation system of the EO 247 contains four basic elements:

- Scheme of mandatory research agreements between the government and collectors,
- Setup of an Inter Agency Committee for Biological and Genetic Resources (IACBGR),
- Regulation on achieving PIC from local communities, and
- Requirements to conform with environmental protection (La Vina / Caleda / Baylon 1997).

To carry out bioprospecting activities, the Philippine government and the applicant have to negotiate an agreement based on mutually agreed terms. Such a contract can cover either scientific research or commercial research. Contracts about scientific research, called Academic Research Agreement (ARA), are usually concluded with national research institutions (e.g., universities) and valid for five years, whereas contracts about commercial research, called Commercial Research Agreements (CRA), are concluded with national and international companies as well as international scientific research institutions for a period of three years. In this case, the collection and use of the material is categorized as commercial even if a foreign research institution intends to collect the material only for scientific purposes. In order to enter an agreement the foreign applicant has to establish and financially support a research co-operation with Philippine researchers. ARAs provide more flexibility than CRAs. For example, local researchers who are affiliated to an institution holding an ARA are allowed to conduct research under the agreement. However, these researchers have to comply with the obligations of the ARA, as for example, obtaining of PIC (EO 247, Section 3).

PIC plays an important role in the Philippine bioprospecting regulation and in the application process. The submission of a PIC certificate is a precondition for the conclusion of any agreement and consequently for the access and collection permission. The applicant has to obtain the declaration of consent, depending on the distribution of property rights, from indigenous or local communities, private landowners or in the case of nature protection areas from the Protected Area Management Board. Therefore, she/he has to inform these concerned groups about her/his intentions and the scope of the bioprospecting activities and ask them for consent (DAO 96-20, Section 7).

Under the EO 247 the IACBGR is responsible for the implementation and enforcement of the ABS regulations. The committee consists of representatives of the affected government departments (Environment, Agriculture, Science and Technology, Health and Foreign Affairs), the science communities as well as non-governmental and people’s organizations. Supported by a technical secretariat, the IACBGR is responsible for the application process.

Besides, it advises the affected government departments with reference to the final signing of the contract and supervises the compliance. Since 1996, the IACBGR has processed eight applications for CRA and 17 for ARA. Only one CRAs and one ARA have been approved so far (Benavidez 2004, 157).

The commercial agreement has been signed between the Marine Science Institute of the University of the Philippines and the US Utah University. The project, named “Anti-Cancer Agents from Unique Natural Products Sources” aimed at the collection of funicates, sponges, and other invertebrate samples for biological assays to screen for potential bioactive compounds. The application was submitted in February 1997 and the project was approved June 1998. In the other cases, the applications have been withdrawn or are still pending. The ARA was approved for the University of the Philippines on “Conservation-related studies as part of thesis requirements” in 1998. The commercial agreement has not lead to a marketable product so far, and the Philippine government as the contracting partner hasn’t received any monetary compensation, apart from a low bioprospecting fee.

The approach of the EO 247 and its implementation has been widely criticized by national and international users of genetic resources. Many local scientists criticized EO 247 for its very broad scope (Liebig et al. 2002, 38). The law regulates not only bioprospecting, but also collecting and sampling. Any kind of collection, research and utilization of biological resources, including research on conservation, is covered by it. As a consequence, access to biodiversity is impeded as well as any national and international research related to biodiversity. Local scientists who were interviewed stressed that foreign users of biodiversity complain about the time-consuming, intransparent, bureaucratic, and costly application process. Therefore, they opt to other countries.

In 2001, the Republic Act No. 9147 Wildlife Resources Conservation and Protection Act (hereafter Wildlife Act) was adopted to respond to the problems that were aligned with the EO 247. The Wildlife Act is a general wildlife protection law with focus on biodiversity conservation. It aims at conserving wildlife and habitats, enhancing biodiversity, regulating collections and trade of wildlife, implementing international commitments and supporting scientific research in the area of biodiversity. Its implementing rules and regulations were developed in 2004 through the Joint DENR-DA-PCSD[24] Administrative Order No. 1.

The Wildlife Act deals only in two section (14: bioprospecting and 15: scientific researches) with bioprospecting. However, it enormously changes the existing procedures. It defines

[24] Department of Environment and Natural Resources (DENR), Department of Agriculture (DA), Palawan Council for sustainable development (PCSD)

bioprospecting as research, collection, and utilization of biological and genetic resources for purposes of applying the knowledge derived there from solely for commercial purposes (Wildlife Act Section 5a). Any bioprospecting activity requires the negotiations of MAT and the obtaining of PIC of the concerned person or community.

The Department of Environment and Natural Resources (DENR) has the jurisdiction over all terrestrial plant and animal species. The Department of Agriculture (DA) has the jurisdiction over all declared aquatic critical habitats, all aquatic resources. In the province of Palawan, comprehensive jurisdiction is vested to the Palawan Council for Sustainable Development (PCSD). In case bioprospecting takes place, the Chairperson of the PCSD, as authorized by the Council, shall be a co-signatory to the bioprospecting agreement (Wildlife Act Section 19).

As far as bioprospecting is concerned, the Act addresses most of the concerns or criticisms made against EO 247 (Benavidez 2004, 165). It amends the provision on ARAs under the EO 247 in a way that a permit system in accordance with the Wildlife Act covers non-commercial research using biological resources. It explicitly delegates the power to decide about the approval of applications to the secretary of DENR or DA who are supported by a technical committee of experts. Thus, the IACBGR created under the EO 247 is deemed dissolved. PIC and provisions for benefit-sharing as well as the emphasis of the participation of local researchers in the bioprospecting, research and development activities remain as primary requirements for bioprospecting.

In the beginning of January 2005, Guidelines for Bioprospecting Activities in the Philippines (hereafter Bioprospecting Guidelines) have been approved to harmonize the inconsistency between EO 247 and the Wildlife Act. The Guidelines aim to streamline the procedure for access and to facilitate compliance thereto by legitimate resource users, to provide guidelines for obtaining PIC and for the negotiations, and to establish a cost-effective, efficient, transparent and standardized system for monitoring compliance with the ABS provisions (Bioprospecting Guidelines, Section 4).

The Guidelines, jointly signed by DENR, DA, PCSD, NCIP[25], set a uniform procedure for evaluating and granting access to biological resources as well as avoiding the potential problem of inconsistency of bioprospecting regulations for various components of biodiversity under the management jurisdiction of different government agencies (i.e., DENR, DA and PCSD). Elements of the streamlining process are, for example, the reduction of the

[25] National Commission on Indigenous Peoples (NCIP) was added as co-signatory to the joint Administrative Order to ensure that the bioprospecting regulations shall apply to ancestral domains covered by the Indigenous Peoples Rights Act, 1997.

bureaucratic process in the review and approval of applications; the reduction of the number of days to review (from 30 days to 15 days) and the determination of a definite time line for the approval of bioprospecting applications (within 30 days).

Regarding benefit-sharing, the Bioprospecting Guidelines determine that a bioprospecting fee, minimum amount of US$ 3,000 for each bioprospecting undertaking, accrue to the national government and should flow to the Wildlife Management Fund or Protected Area Fund. Local users that are not supported by foreign collaborators or investors pay only ten percent of this amount. Up-front payments shall accrue to the resource providers. An annual user's fee - US$1,000 per collection site - goes to resources providers directly. If a product is derived from the collected material, royalties shall be shared between the national government and the resource providers; and local governments shall share in the amounts received by the national government, consistent with the provisions of the Local Government Code[26] (Bioprospecting Guidelines, Section 14). The royalties amount to two percent of global gross sales of products (minimum); 25 percent goes to national government and 75 percent to resource providers.

The bilingual annex of the Bioprospecting Guidelines provides helpful documents, as for example, standards terms and conditions, MTA, PIC certificate, checklist of process and content indicators, compliance to proper procurement of PIC and certificate of acceptance.

Instrumental penalties are, e.g., civil liability under contracts law, criminal liability under the Wildlife Act, a blacklist published locally and internationally, and a report to the CBD secretariat on misappropriation.

The ASEAN Framework Agreement

Besides the national framework, the Philippines are also integrated in a regional framework. The Association of Southeast Asian Nations (ASEAN) was established on 8 August 1967 in Bangkok by the five original Member Countries, namely, Indonesia, Malaysia, Philippines, Singapore, and Thailand. Today ten countries (Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam) are members. The association aims to accelerate the economic growth, social progress, and cultural development in the Asian region and to promote regional peace and stability. ASEAN deals also with transnational issues concerning the environment, as for instance, nature conservation and biodiversity.

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[26] The Local Government Code from 1991 establishes a system of provincial, city, municipal and barangay governments in the Philippines. It is the governing law on local governments.

In September 1997 at the 8th meeting of ASEAN, the Senior Officials on the Environment (ASOEN) requested the ASEAN Working Group on Nature Conservation (AWGNC) to develop a common protocol for member countries on access to genetic resources and IPRs. This process took quite some time and is not finalized yet. In June 2000 during the 10^{th} Meeting of the AWGNC, the member countries were requested to provide comments on the draft of a framework agreement with a view to finalizing the draft by the 11^{th} Meeting of the AWGNCB. Finally, at its 14^{th} meeting of ASOEN the draft framework agreement was reviewed and recommended for the consideration of the Ministers at their 8^{th} Informal ASEAN Ministerial Meeting on the Environment (IAMME). In October 2004 some countries requested more time to review and to consult at the national level and to complete the national process for signature. Therefore, at the 8^{th} IAMME the ministers agreed to expedite the signing of the Agreement due to the delay in the national signing processes.

The key provisions of the agreement are:

- The agreement's objectives broaden the CBD's provisions: the agreement aims to set minimum standards for regulating ABS, to strengthen national initiatives, to provide a forum for inter-regional co-operation, to strengthen the voice of Parties in related international agreements and negotiations;
- Transboundary existence of genetic resources: it is required that if biological and genetic resources are indigenous to two or more Parties, the Parties may collectively discuss the terms and conditions of ABS and how to share the benefits;
- Obligation of the parties to take legislative, administrative or policy measures to regulate ABS, to establish procedures for granting PIC (involve resource providers) and to disseminate information on access regulation, applications, etc.;
- Establishment of a regional Clearing House Mechanism: it should provide relevant information subject to appropriate confidentiality provisions, and terms and conditions that may be imposed by the Party providing the information; it should also provide technical and legal support to the competent national authorities, and it should be used to establish a database of biological and genetic resources and their associated traditional knowledge;
- Establishment of a common fund for biodiversity conservation, which is administered by the Secretariat but which depends on voluntary contributions (ASEAN Framework Agreement 2000).

6.1.4 Assigning property and intellectual property rights

In the Philippines all lands of the public domain, waters, minerals, coal, petroleum, and other mineral oils, all forces of potential energy, fisheries, forests or timber, wildlife, flora and fauna, and other natural resources are owned by the state (Constitution of the Philippines 1987, Art. XII). The state has the responsibility to preserve and protect the environment (Constitution of the Philippines 1987, Art. II). The Wildlife Act assigns the jurisdiction over the resources to DENR, DA and PCSD. They represent the resource providers in the negotiations. Although the definition and assignment is clear, interviewees mentioned that there are competing right holders. One example that was given is the island Palawan that is governed by special law according to biodiversity. Palawan has its own Council for Sustainable Development being responsible for environmental issues in the region, but the local government follows national government, because it is a province of the Philippines. Another example is the overlapping of ancestral domain and land rights and provincial access regulations.

In the interviews it became clear that many commercial users have criticized the Philippine ABS negotiations because of the unrealistic expectations regarding the potential benefits on the provider side. Nevertheless, it became also clear that most of the interviewed NGOs think that commercial users can pay more than they offer to do. The views on the expected benefits and the amount of compensation diverge. The EO 247 and the DAO 96-20 do not provide any indicator regarding the benefits for the negotiations and leave this to the negotiators. It is only stated that all discoveries of commercial products and technology derived from the resources shall be made available to the Philippine government and that the benefits shall be shared equitably among the government, the Integrated Protected Areas Fund (IPAF), the local communities or the individual if the resource comes from private property (DAO 96-20, Section 8). The new regulations set a framework for these negotiations. If a bioprospecting undertaking is concluded, the government (i.e., the implementing agency) receives a bioprospecting fee, whereas up-front payments accrue to the resource providers. Annual royalties (i.e., a minimum of two percent of total global gross sales) are shared between the national government (25 percent) and the resource providers (75 percent). Local governments should share the amounts received by the national government, consistent with the provisions of the Local Government Code. For monetary benefits intended for the local community, it should be ensured that the funds received are used solely for biodiversity conservation or environmental protection, including alternative or supplemental livelihood opportunities for community members. Non-monetary benefits may be agreed upon by the resource user and resource providers as addition to the minimum benefits provided.

In the Philippines individuals on the local level do not hold property rights over biological material, all natural resources are owned by the state. This property rights distribution hampers rent capturing by resource providers. Only if the ones, being in charge of using and conserving biological resources and bearing the conservation costs, are included in the negotiations and participate in the benefits through a clear distribution of property rights, they have a real incentive to protect and conserve biodiversity. However, PIC has been a very strong instrument in the Philippines and many interviewed stakeholders from non-governmental organizations (NGOs) stress that this principle has to remain as the heart of the Philippine ABS regulation. The final decision about access is left entirely to the communities and they can negotiate potential benefits. The PIC in the Philippines is controversial debated. In the interviews, the local researchers complained about the expensive PIC obligations. In the only CRA the Philippine researchers had to obtain eight PICs in advance for the first year because they wanted to collect at different sites and many communities were concerned. For foreign users it would be impossible to carry out this activity because of language problems and the lack of knowledge of the local conditions. Identifying the communities that have to give PIC is very difficult. It is obvious that there is a trade-off between strengthening the property rights of the local level and increasing the transaction costs of users. The new Bioprospecting Guidelines maintain the principle and stress the importance of increased resource holder participation. They even specify a benefit-sharing distribution system, but it has to be awaited for if the regulations will effectively be implemented.

Looking from the beginning of the value chain to the end, IPRs also play an important role in the Philippines. The Philippines are a member of the WTO. The national law implementing the minimum standards set by TRIPs is the Intellectual Property Code of the Philippines (IPC), Republic Act No. 8293. The criteria of product patentability are new, inventive, and industrially applicable. This means that the Philippines allow users of genetic resources to obtain strong property rights on the products derived from genetic resources. Plant varieties and animal breeds are excluded from patentability. To fulfill the TRIPS obligation of a *sui generis* system in 2002, the country adopted the Philippine Plant Variety Protection (PVP) law to provide protection over plant varieties. According to the UPOV Convention, the protection criteria are new, distinct, uniform and stable (Benavidez 2004, 167). Therefore, also in the case of plants the Philippine law gives users the opportunity to protect their breeds. Some NGO representatives criticized the patenting of life forms (including microorganisms) and the PVP in the interviews. They reject patenting on life forms for ethical and moral reasons, but also because they think that the Philippines cannot benefit from such a system because it is not sufficiently advanced regarding research and development to make use of it. With the adoption of the IPC and the PVP, the Philippines have complied with the WTO obligations. No disclosure of origin requirement is established, whereas the new Bioprospecting Guidelines stress it as a major control instrument. However, the Guidelines are not based on the existence of an IPR system. For example, joint ownership over IPRs is not determined as a benefit-sharing element.

6.1.5 Information asymmetry

Information asymmetry can be identified as the strongest critical factor in this case. It appears on all identified levels. Firstly, it occurs pre-contractually because providers expect higher benefits than users are willing to pay. According to the interviews, the users in the Philippines complain that NGOs expect unrealistic benefits. However, it appeared that the claim for higher benefits has not diffused into the negotiations. The CRA covers only a royalty rate (five percent) in case of commercialization but no other monetary benefits, and the interviews of the concerned parties document that benefit-sharing was not a considerable problem in the negotiations. The expectations on the two sides were not diverged. However, it has to be kept in mind that the Philippine Marine Science Institute is an equal partner of the Utah University and has self-interest in the negotiations. It was also in their interest to keep the monetary benefits for the government and communities low to being able to conduct the research.

Post-contractual information asymmetries are a more substantial problem. Being aware of the post-contractual information deficiencies on the provider side, the application procedure has been designed in a very risk-averse manner. It is obvious that with the EO 247 the Philippines over-regulated ABS and developed a quite inflexible and limiting ABS regime due to its bad experiences and the limited capacity to control users' behavior. One industry representative said in the interviews that everybody doing research in the Philippines is regarded as a “biopirate”. The system was so restrictive that it discouraged even local researchers to collect biological material for scientific purpose. Instead of facilitating access to their genetic resources and developing effective strategies to prevent misappropriation, the Philippines disrupted any kind of research – commercial and scientific – related to the collection of biological resources.

The new Bioprospecting Guidelines promise to address this problem. Instead of very restrictive rules, compliance and monitoring instruments are established. Monitoring is mainly carried out by the implementing agencies, but can be supported by the Department of Foreign Affairs (DFA) (including embassies and missions) and the Department of Science and Technology (DOST), especially regarding the monitoring of inventions and the commercialization that is undertaken in foreign countries. It is expected that these institutions have greater ability to deal with the prevention of biological resources from entering countries without a bioprospecting contract, to control the compliance of the disclosure requirement of country of origin in patent applications, and to enforce the claims against collectors or commercializing entities. It is hoped that DFA and DOST are able to establish and maintain contacts with users of biological material of the Philippines and create trust between the partners.

The main monitoring instrument is, however, that the bioprospecting guidelines still require the co-operation with a national partner. No bioprospecting activity can be conducted by a foreign user, unless a local collaborator has been engaged to participate. From a development policy perspective, this requirement is very positive, but it needs competent institutions to be successful. Other monitoring instruments are reporting requirements, which include the submission of an annual progress report to the implementing agencies by the user (e.g., on status of the procurement of PIC, progress of collection of samples, benefit-sharing negotiations, progress on payment of benefits or other provisions of the contract). The Guidelines provide several model certificates, which the resource user should use as proof of compliance and submit to DENR, DA or PCSD regional representatives. The certificates attest proper procurement of PIC, delivery of benefit-sharing agreements (i.e., the acceptance by resource providers of the monetary and/or non-monetary benefits provided in the agreement) and collection quota. In order to monitor whether the benefit-sharing agreement can be considered fair and equitable, a model of a checklist of process and content indicators is provided by the Bioprospecting Guidelines. The contracting parties and other stakeholders can use it. Besides, the Philippines seem to rely on the support of the civil society, especially NGOs and Peoples Organizations, and encourage them to support the monitoring activities within the country but also abroad.

The information deficiencies on the user side have only slightly been addressed. Until the new regulation was adopted, users could not be sure that the shared benefits are invested in environmental protection and that they receive exclusive and high-quality material. According to the new regulation, benefits should be used for environmental protection, but with a view to exclusivity no regulation has been formulated. Regarding the quality they have some idea. Since users can carry out self-collection under supervision of Philippine researcher, they have an influence on the material they obtain and of which quality it is.

The on-going loss of biodiversity cannot indicate the willingness of the Philippine government to protect biodiversity. No mechanisms are in place to determine how local communities and individuals can benefit except through the PIC. Besides, since even local researchers have been accused of being biopirates, foreign users are uncertain how to fulfill the Philippine requirements. One researcher in the National Museum who has the mandate to conduct basic taxonomic research complained in the interview that he was accused of biopiracy because he assisted French scientists from the Paris National and History Museum to undertake a biodiversity assessment. They only had obtained PIC for one region (Sulu) where they finally did not go because they had changed plans to undertake the assessment in Palawan. According to the scientists of the National Museum, the Philippine researcher realized too late that the French researchers did not have the appropriate permit and had not contacted the Palawan Council for Sustainable Development.

The interviews with governmental and non-governmental persons reveal that in the Philippines no mechanism exists to guarantee exclusiveness to the users. It is possible that different users collect in the same areas. From an economic point of view, exclusiveness is very important for commercial users. Therefore, users will opt to other countries that provide this security.

6.1.6 Accounting for time lags

Not many contracts have been negotiated. De facto only one commercial agreement has been concluded. This outcome is an essential weak point of the Philippine approach. The low number of concluded contracts reduces the chance of realizing these benefits, which constitute an incentive for conservation. The only CRA has been negotiated between the Department of Agriculture and the University of Utah (principal collector)/ Marine Science Institute of the University of the Philippines. Since it was negotiated before the Wildlife Act has been adopted it follows the EO 247.

The agreement stipulates that the Utah University and the Marine Science Institute both will share non-monetary and monetary benefits. In the short term non-monetary benefits are dominant. The Marine Science Institute has benefited in the short-term through training, exchange, and technology transfer. In the long term, the Philippine government and resource providers should have access to all product discoveries deriving from the collected material, and all used technologies should be made freely available. If a product is developed from the collected material, five percent of the net revenue has to be paid to the DA. How local communities will participate in these royalties depends on the decision of the government. In all documents and publications referring to the collected materials and their improvement, the provider has to be acknowledged and the Philippines have to be disclosed as the country of origin. If a third party obtains IPRs, commercializes a discovery or technology derived from the material, a separate agreement between principal collector/co-collector and the third party has to define the concrete sharing of royalties and other monetary benefits or technology (Liebig et al. 2002, 47). No up-front payments were made. The Philippine government receives only a small yearly bioprospection fee of Philippine Peso (PhP) 10,000 (about US$ 200). The local communities benefit through education and training. It is not clear how they will benefit from monetary benefits, since it is regulated by the national government. So far, no monetary benefits, arising out of this agreement, have been received by the Philippines. The co-operation between local and international collector has created some non-monetary benefits in scientific education, but neither the resource providers nor the environment have benefited.

Compared to the earlier regulation, the new Guidelines deal much more in detail with the issue of fair and equitable benefit-sharing. EO 247 and DAO 96-20 left these terms open for the negotiations between the responsible agency and the collector/ co-collector. New contracts will have more determined obligations, including annual up-front payments and royalties (two percent of total global gross sales of the products). Up-front payments as annual using fees can bridge the time lag at least somewhat and set an incentive to conserve biodiversity.

6.1.7 Good governance in provider countries

The general political situation is not bioprospecting-friendly. Poverty, economic stagnation, corruption, governmental incompetence, and conflicts with insurgents destabilize the political situation and decrease the Philippines' attractiveness as a collection and research place. The World Bank Governance Indicators show a clear picture. All indicators reflect deterioration between 1998 and 2005. For instance, only 17.5 percent of the 213 countries and territories rate worth than the Philippines according to political stability.

Table 13: World Bank Governance Indicators, Philippines (1998, 2005)

Governance Indicator	1998	2005
Voice and accountability	58.9	47.8
Political stability/no violence	39.2	17.5
Government effectiveness	63.2	55.5
Regulatory quality	68.5	52.0
Rule of law	55.3	38.6
Control of corruption	50.5	37.4

Source: Kaufmann / Kraay / Mastruzzi 2006

However, compared to many other countries the Philippines do not lack an access legislation. It is quite the reverse. Due to its pioneer status, EO 247 and DAO 96-20 have become quite popular on the international level. However, the frameworks have been vehemently criticized by national and international users of genetic resources due to its restrictive, overregulating and bureaucratic character. In the interviews, almost all stakeholders welcome the Philippine approach, but they also agree that it is too ambitious and complain about the complex procedures to implement it. The outcomes of the Philippine legislation already indicate vulnerability. Out of 14 CRA and 20 ARA applications[27], only one CRA and one ARA have been approved. Some interested users even withdrew their application.

Recently, the Philippines implemented the second generation of ABS laws and it is hoped that this regulation will provide more efficiency but also transparency. The responsibilities have been transferred to the ministries (DENR and DA) and the interagency committee has been removed. The inability of the committee to process applications is seen as a major weak point of the Philippine system. It has to be awaited if the governmental institutions will be able to cope with the additional burden. Now, all pending ARA applications will not be processed anymore in the EO 247 framework, but enter in a free permit system established by Wildlife Act. This indicates that biodiversity research and access to resources is facilitated. Pending CRAs will be processed under the new Bioprospecting Guidelines. It is foreseen to ensure that the funds are used solely for biodiversity conservation or environmental protection, including alternative or supplemental livelihood opportunities for community members.

In order to increase their reputation and finally convince users to bioprospect in the Philippines, the country has to increase good governance, stabilize the political situation, and keep the promise of the new Bioprospecting Guidelines to streamline and improve the application process.

6.1.8 Administrative complexity

Administrative complexity was probably the main reason for the failure of EO 247. All interview partners confirmed that the application procedure, including the obtaining of the PIC put inappropriate burden on researchers and commercial users. The regulations were complex and restrictive, and adequate human and financial resources were missing to manage the challenge of implementing such a system. Researchers from the Marine Science Institute stressed that it took seven month until the CRA was concluded. When they tried to renew it, many problems came up: unsolved relationship of Wildlife Act and EO 247, no

[27] 6 of the CRA and 3 of the ARA applications were exempt from EO 247 coverage.

decision by the IACBGR because not all members were present when they discussed the application, and the lack of communication between the IACBGR and the applicant. An industry representative also states the problem that there is often no quorum because the members are not paid and they are all volunteers. Especially for the members that come from industry are concerned. In another interview, the researcher from the Marine Science Institute mentioned a second application for a CRA that was submitted in 1998. It is still pending. These researchers who are actually the only ones that undertake legally approved bioprospecting activities state that the procedure is very time-consuming and that not many foreign partners can accept this. Only because the Utah University is a long-term partner for more than 10 years and the Philippine applicant is a former colleague of the foreign partner, the collaboration works out.

The new regulation dissolves the IACBGR, but the competencies and responsibilities are allocated to different agencies depending on the location of the collection or the type of resources. There is no main contact point for users that can facilitate communication. Taking into account that the concerned ministries are already occupied with many tasks, the additional task to process ABS applications can overburden them. An efficient execution would not be possible. In the interviews, the IACBGR has been mainly criticized because it consists of high-level governmental persons who have many responsibilities regarding other issues. The work of the IACBGR is often not their priority and they miss the meetings or do not fulfill their task. For example, in the case of the Marine Science Institute, the applicant did not receive comments on the draft of the CRA from the IACBGR and the process only advanced because the applicant did not give up and contacted several members of the IACBGR. The dissolution of the IACBGR alone cannot solve the problem of high administrative complexity. It depends now on the different agencies how they implement the new ABS provisions and if they provide additional financial and human resources.

According to the guidelines, if necessary the implementing agencies should recommend qualified Philippine scientists as research collaborators to foreign users, but there are doubts that the governmental agencies are familiar with the scientific infrastructure in the country. An independent research institution would probably better informed and more competent in these issues. If this intermediation is inadequate, it can be expected that users will have difficulties in fulfilling this initial condition.

Other factors that increase the administrative complexity are the broad scope and the timeframes. IACBGR also regulated all biological resources, including ex-situ collections although are they were not covered by EO 247 and DAO 96-20. No adequate regulations exist to deal with these resources. However, due to their special nature, they require a specific system. The Wildlife Act has clarified this issue by defining its scope. According to the Guidelines, it applies to bioprospecting of any biological resource found in the Philippines including wildlife, microorganisms, domesticated or propagated species, exotic species, and ex-situ collections of biological resources sourced from the Philippines (Bioprospecting Guidelines 2004, Section 2). Nevertheless, the scope is still very broad and the concerned resources are still very diverse.

Furthermore, it took at least five months to go through the process. However, even this timeframe was never kept. EO 247 set a 60-day requirement to obtain PIC after the research proposal had been submitted to a community. This requirement was removed in the Wildlife Act. However, incentives have to be established to accelerate the process since the regulation does not set maximum timeframes. The general process has also been streamlined, since a decision on the application has to be made fifteen working days after the receipt of complete requirements (Bioprospecting Guidelines, Section 8).

6.1.9 Market structure

Not only because of the global market structure the Philippines' position in the market is quite weak. Ten years of restricting and not facilitating access have decreased the countries reputation as a reliable partner. One interview partner from the industry side stated ironically that the EO 247 is good for conferences and that the Philippines are the first in Asia, but that there are no results, that there is no conservation and no ABS.

It is difficult to estimate the country's position in the market, since only little empirical data about ABS research and development is available. The Philippines have only limited research and development capacity. The interviewed scientists see the Philippines advantage in marine and not plant genetic resources, since many countries in the South Asian region might have the same resources. Before users will become more interested in starting bioprospecting activities in the Philippines, the country has to prove that it is serious about changing the track, and that users' transaction costs will significantly decrease.

The Philippines are a member of ASEAN, which integrates the country in a regional context. Even if the Philippine legislation is already the most advanced in the region it can be expected that the country will also benefit by the adoption of the regional framework agreement. Regional co-operation regarding transboundary movements and dissemination of information will strengthen the countries position. Besides, the Philippines are a member of the group of megadiverse countries. The country can strengthen its position through coalitions.

6.1.10 Conclusions

The Philippines serve as an example for a provider country that pioneered regarding the development of ABS legislation, but has not managed to establish an effective regime. Only two ABS contracts have been concluded and the government, researchers, or the resource holders have received no major benefits, monetary or non-monetary. Forests and biodiversity in the Philippines are still declining, which shows that there is also a lack of other instruments addressing the country's environmental problems.

The old regulation EO 247 could hardly address the critical factors. This can explain why the regulation could not establish an effective ABS regime. The new regulation handles some of the weak points others remain. They promise to streamline and improve the application process. Concrete and realistic expectations for benefits are recommended for the negotiations. Up-front payments that can partly overcome the time lag are more important and play a central role among the benefits in the guidelines. The information deficiencies are better addressed. The former system prevented misappropriation by restrictive regulations, whereas the new Bioprospecting Guidelines develop non-restrictive instruments to monitor and solve the problems arising out of the information deficiencies. The political situation is still the same, but the legal security can improve if the new system is effectively enforced.

Nevertheless, the property rights system is unchanged. The state remains the owner of biological material in the Philippines and PIC is still a strong participation right. However, the new Bioprospecting Guidelines concretize how the benefits have to be shared with the local level. Administrative complexity and high entrance cost of users remain as a main problem. However, they are slightly reduced compared to the initial situation because the intersectoral committee has been abolished. Different ministries are responsible for processing ABS applications, which is confusing for applicants. However, the determined timeframes will definitely tighten the application process.

Table 14: Overview on the Philippines and the critical factors

	Philippines
Property rights	State has property rights over biodiversity Local communities participate through strong PIC requirements Guidelines on benefit-sharing procedure Government receives bioprospecting fee, resource holders receive up-front payments Plant varieties and animal breeds are excluded from patentability, but Plant Variety Protection Law as *sui generis* system
Asymmetric Information	Pre-contractual: providers expect high benefits, but claim has not diffused into the negotiations Post-contractual: substantial problem, partly addressed by new regulation (use of benefits, less over-regulation due to better monitoring mechanism), but exclusivity and quality are not guaranteed
Time lags	Only one commercial contract, but substantial non-monetary benefits for Philippine research institute In future more weight on up-front payments
Good governance	General situation is not very positive New ABS law has promising improvements
Administrative complexity	Costs have been very high Improved through abolishment of ineffective intersectoral committee and introduction of determined timeframes Responsibility is still allocated to different agencies (DENR, DA and PCSD) Academic research is excluded
Market structure	Ten years of over-regulation have decreased the market position ASEAN member/ megadiverse countries

The new Philippine Bioprospecting Guidelines are a big step forward to an effective ABS concept, but any legislative and institutional framework of an ABS regime is only as good as the process through which it is implemented. The Philippines have to prove their willingness to improve the situation, not by only developing this new regulation, but also by implementing it. Without facilitating access and concluding any ABS contracts, no benefits will be realized. At this point, only a presumption can be made and it has to be waited if the Philippines will be able to turn the legislative framework into factual practice.

6.2 Costa Rica[28]

Costa is the second case study that was carried out. The analysis follows the Philippine case. The developed analytic framework, based on the critical factors and the potential measures, is exercised in the country-specific case in order to prove and illustrate its applicability. First of all, the case study methodology is shortly presented. Then, a short introduction to the Costa Rican case is given and the regulatory environment, including the legal and institutional setting, is illustrated. The main part of the analysis is the application of the critical factors to the country-specific case. Taking into account the established analytic framework regarding the effectiveness (cf. chapter 5), it is looked at how the critical factors are shaped and how they are already addressed in Costa Rica. The analysis of the second case study finishes with a short case study conclusion.

6.2.1 Case study methodology

In this study, the case of Costa Rica is evaluated by using the critical factors identified above. The underlying question is whether the specifications of these factors in the Costa Rican case can explain its apparent success and if this success relates with effectiveness. Worldwide Costa Rica's ABS approach is the most advanced, transparent and experienced one, but it is also still changing and improving. The analysis is based on expert interviews, conducted in Costa Rica in November and December 2002. Semi-structured interviews were used as the method of gathering and analyzing qualitative data. Throughout the interviewing process different thematic areas were addressed in line with the identified critical factors. 23 experts were interviewed who represent the variety of stakeholders, including individuals, communities, government, universities, NGOs, scientific institutions and industry involved in the ABS process or having expertise related to the ABS issue. Stakeholders are defined here as persons who are affected by or who have an influence on ABS regulations in Costa Rica. Additionally, secondary literature, as e.g., books, journal articles, and reports is used to complement the information gained from the interviews.

6.2.2 Introduction

The tropical zones of the American continent contain more species than other tropical regions of the world, and many more species than the temperate and cold zones. Costa Rica

[28] The case of Costa Rica has been already analyzed by the author. The results are published in Richerzhagen, C. and Holm-Mueller, K. (2005): The effectiveness of access and benefit-sharing in Costa Rica: implications for national and international regimes, in: Ecological Economics 53, 4, pp. 445-460. This chapter is based on this article.

covers 51.100 km^2 of the world's terrestrial surface, representing only 0.03 percent of the global territory, but it is considered as one of the most diverse regions and identified as a biodiversity hotspot (Myers et al. 2000, 855). According to estimations, four percent of all living species are found there. During the 1970s and 1980s, a series of reports predicted that based on the actual deforestation rate, Costa Rica's productive forests would vanish before the end of the century. The first undertaking to conserve its rich biological heritage was the introduction of protection measures. Since 1970, the country has dedicated 25 percent of the national territory to conservation (Castro-Salazar / Arias-Murillo 1998, 5). The second response was the creation of the technical, institutional, and financial structure for a system of incentives and payments of environmental services. Costa Rica developed a diverse strategy to conserve forest areas and biodiversity with international and national support and bioprospecting played an important part within this strategy. The country managed to address the ongoing declination of forests and biodiversity. Whereas in the 1980s Costa Rica had one of the highest deforestation rates in the world, since 1995 the deforestation rate has fallen dramatically. Before 1986, there was a net loss in annual forest cover. After 1986, a net gain in forest cover of 5.857 hectares per year was recorded during the period 1987-1997 (afforestation minus deforestation). As consequence in 1997, Costa Rica had the same percentage of forest cover as 20 years before (Castro-Salazar / Arias-Murillo 1998, 15).

6.2.3 Regulatory environment: legal and institutional setting

The country's stable socio-political climate has been favorable for those developments. Costa Rica is one of the most stable and robust democracies in Latin America, with a long-standing commitment to economic growth and substantial advancement in social indicators (Gámez et al. 1993, 54).

With the establishment of the Ministry of Natural Resources and Energy and Mines (MINAE) in 1986, Costa Rica's environmental issues entered daily policy. The ministry developed new administrative, financial and institutional procedures. For instance, it took over and decentralized the administration of protected land with the new National System of Conserved Areas (SINAC) and removed perverse incentives, e.g., the Forest Payment Title, a subsidy to promote reforestation. It allowed landowners to make money twice: firstly, by cutting and selling primary forest and secondly, by reforesting the open areas (Miranda / Dieperink / Glasbergen 2002, 5). Furthermore, it designed the National Conservation Strategy for Sustainable Development in Costa Rica, and came up with new innovative financing mechanisms for conservation activities (Gámez et al. 1993, 55).

Even before the adoption of the CBD in 1992, Costa Rica concluded bioprospecting contracts with companies. The country implemented the CBD by the comprehensive Law of Biodiversity in 1998, but many years before it established a quasi ABS regime. In Costa Rica, the concept of ABS is embedded in a comprehensive environmental governance framework, and it seems to work well. The environmental situation has improved due to the expansion of protected areas, the removal of perverse incentives against conservation, and the implementation of conservation measures. Since the late 1990s, Costa Rica's biodiversity conservation policy focuses even more on the sustainable utilization of biodiversity as a way to promote its conservation. In addition to bioprospecting, ecotourism and payment programs for environmental services are established as instruments for internalizing the cost of providing environmental services and mainly biodiversity. Therefore, bioprospecting is part of a strategy and embedded in a bunch of measures striving for biodiversity conservation.

The main institution in Costa Rica dealing with bioprospecting issues is the National Institute for Biodiversity (INBio)[29]. INBio was created as a private, but non-profit institution to coordinate the different activities of universities, private organizations and the government and to become a national center of expertise in the field of biodiversity. The institute's mission is to raise awareness of the value of biodiversity and thereby promote biodiversity conservation and economic development in Costa Rica. INBio's different programs such as the biodiversity inventory, search for sustainable uses, accumulation of information and dissemination of knowledge complement one another and help to document the state of Costa Rica's biodiversity and to identify bioprospecting potential. However, it is not only INBio. The institute is interlinked with Costa Rican universities.

Except for some initial funding, INBio is a self-supporting institution allowed to receive grants and enjoying tax-free status but being responsible for its own funds and personnel. In 2001 the bioprospecting budget represented eleven percent of the total institutional budget having fluctuated between eleven and 17 percent in previous years (Gámez 2003, 8). A co-operation agreement concluded between MINAE and INBio provides the legal framework for all of the institute's inventory and bioprospecting activities. Authorized through single research permits, INBio collects samples for its own inventory and bioprospecting divisions or interested parties. Based on this agreement, INBio bioprospects only within the country's protected wild areas. Monetary benefits are shared with MINAE. The ministry receives as an up-front payment ten percent of the research budget and ex post 50 percent of any further

[29] INBio was visited for this study and interviews with a business development person and INBio's lawyer were conducted. INBio is the most important intermediary (others are marginalized) and plays an outstanding role. Therefore, the analysis focuses on INBIo.

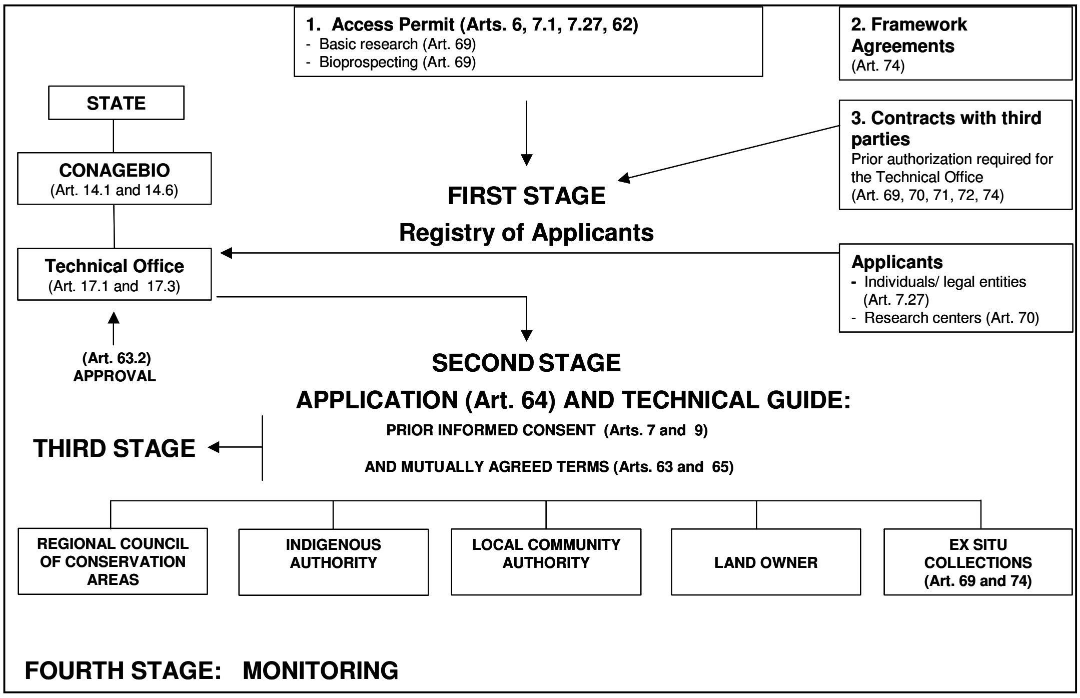
royalties or milestone payments from bioprospecting contracts. The benefits are used to finance the management and the protection of conservation areas (MINAE 1994, Clausulas 12; Sittenfeld / Lovejoy 1999, 95).

Only in 1998, Costa Rica implemented the CBD by the Law of Biodiversity, No. 7788. Before that date, ABS was regulated in the framework of the Law of Wildlife Conservation and corresponding regulations. It is obvious that the experiences with INBio, which attracted worldwide attention, had a decisive influence on the CBD. Nevertheless, Costa Rica introduced with the Biodiversity Law a new ABS approach because it changed INBio's role. Some interview partners who were involved in drafting the Biodiversity Law stated that the drafting process was very fast and intensive. INBio should not know about it before it was published for the first time because INBio was against the formulation of a new law. According to the interviews (including INBio staff) for INBio the situation was better without a law like the Biodiversity Law. According to an interview partner, INBio perceives itself as the most competent institution to deal with biodiversity issues. Therefore, they also prepared an own draft for a law, mainly developed by scientist.

The Biodiversity Law introduces new procedures and institutions. Regulating the use and management of biodiversity, associated knowledge, institutional authorities, the basic requirements and procedure for ABS and IPRs, the new law offers the basic framework for access permits and bioprospecting contracts. It establishes the National Commission for the Management of Biodiversity (CONAGEBIO) as the responsible institution for ABS and defines it functions. CONAGEBIO is an intersectoral coordination body. It consists of ministers or representatives from the ministry of Environment and Energy, Agriculture, Health and Foreign Trade, the Institute for Agricultural and Fishing, the Small Farmers Board, the Indigenous People Board, the National Council of Rectors, the Federation for the Conservation of the environment and the Union of Chambers of Commerce. The implementation process was delayed due to a claim of unconstitutionality concerning the extensive competencies of CONAGEBIO. Therefore, CONAGEBIO operates since 2002. It has permanent staff and its own budget. The national law and especially the ABS part are completed via an ABS by-law (Rules on Access to Biodiversity, Presidential Decree No. 31-514), which was published in December 2003 and defines CONAGEBIO's responsibilities. On the administrative level CONAGEBIO is supported by a Technical Office, which has permanent staff.

The ABS procedure in Costa Rica can be divided in four steps: i) registry of the applicants, ii) application process, iii) approval process, iv) monitoring (cf. Figure 19).

Figure 19: ABS procedure in Costa Rica



Source: Cabrera Medaglia 2004, 106

Only CONAGEBIO and the Technical Office can grant access. PIC is obtained from other entities, e.g., conservation areas, indigenous territories, ex-situ collections, and landowners. In case material is collected on private lands, authorization from state entities is also necessary (Cabrera Medaglia 2004, 107). The permits can cover commercial and non-commercial bioprospecting permits. It is also possible to establish general framework agreements on collection permits with universities and other centers. Usually they are valid for three years and can be renewed. Permits will contain a certificate of origin (Law of Biodiversity No. 7788, Art. 71). In general, the establishment of CONAGEBIO is seen as a very positive development, since it includes all the relevant stakeholders and moves the authority to MINAE. Only one interviewee from the university thinks that CONAGEBIO poses the same problems as IACBGR in the Philippine case.

Until the adoption of the Biodiversity Law, INBio's activities were based on the Law of Wildlife Conservation and the MINAE-INBio agreement that gave the institute much freedom and independency. This has changed through the Biodiversity Law. INBio has concluded more than 20 investigation contracts with many life science companies, international research institutions, and universities in the meantime (cf. Table 16). The agreements have common criteria as depicted in Table 15.

Table 15: Basic criteria of most of INBio's bioprospecting contracts

• Facilitate access to a limited amount of samples from natural resources for a limited period of time (exclusivity terms are limited)
• Significant part of the research is carried out locally and associated research costs are entirely covered by the industrial partner (defined as research budget)
• Up front payments for conservation (a minimum of 10 percent of the research budget is transferred to MINAE for conservation purposes)
• Benefit-sharing mechanisms should be negotiated beforehand and should include among others: - Milestone payments for the discovery and development phases of a potential product, to be shared 50:50 with MINAE - A percentage of royalties on net sales of the final product (covering also derivatives from the original natural scaffold and/or any technology derived thereof), also to be shared 50:50 with MINAE - IPR should include participation of INBio's scientists if applicable (joint patents and publications)
• Technology transfer and capacity building of local scientists should be significant and should include state- of-the-art technologies
• The discovery and development of a product must engage non-destructive uses of natural resources and be consistent with the national legislation regarding access of genetic resources and development thereof

Source: Cabrera Medaglia 2002

At the request of companies, the concrete contractual contents according to royalties are not published. This was criticized by some interviewees, since hiding of the rate does not provide transparency and raises mistrust.

One interesting example is the corporation between the National Biodiversity Institute (INBio), the British Technology Group (BTG) and Ecos La Pacífica that aims at producing a nematicide for tropical crops. The nematicidal activity (DMDP) comes from a tree in the Costa Rican dry tropical forest. It is expected that a product will enter the market soon. BTG has paid a small amount of money to both INBio and Ecos for the licensing of a patent related to the DMDP use (Cabrera Medaglia 2002, 20).

INBio's co-operation with international companies supported its scientific and technological capacity, which is a prerequisite for the realization of such projects. Through funds from the Inter-American Development Bank, small local enterprises, using biological material as production inputs are able to initiate low-cost projects for the local market, requiring relatively simple technologies and limited time of development. Contrary to the projects carried out with large international corporations, these small and simpler projects, while not totally completed yet, are already considered to be successful initiatives, likely to make contributions in terms of profit, employment and more value-added agro-industrial developments (Gámez 2003, 10).

Table 16: Significant commercial and academic agreements in Costa Rica, 1991-2004

Industry or academic partner	Application fields	Research activities in Costa Rica
Cornell University	Chemical Prospecting	1990-1992
Merck & Co	Human health and veterinary	1991-1999
British Technology Group	Agriculture	1992-present
Ecos/ La Pacifica	Agriculture	1993-present
Cornell University and NIH	Human health	1993-1999
Bristol Myers & Squibb	Human health	1994-1998
Givaudan Roure	Fragrances and essences	1995-1998
University of Massachusetts	Insecticidal components	1995-1998
Diversa	Enzymes of industrial applications	1998-2007
Indena	Human health	1996-2004
Phytera Inc.	Human health	1998-2000
Strathclyde University	Human health	1997-2000
Eli Lilly	Human health and agriculture	1999-2000
Akkadix Corporation	Nematocidal proteins	1999-2001
Follajes Ticos	Ornamental applications	2000-
La Gavilana S.A.	Ecological control of pathogens of *Vanilla*	2000-
Laboratorios Lisan S.A.	Production of standardized phytopharmaceuticals	2000-
Bouganvillea S.A.	Production of standardized biopesticide	2000-
Agrobiot S.A.	Ornamental applications	2000-
Guelph University	Agriculture and Conservation purposes	2000-
Florida Ice & Farm	Technical and scientific support	2001-
ChagasSpaceProgram	Chagas disease	2001-
SACRO	Ornamental applications	2002-
CIFLORPAN, Universidad de Panama	Extracts of plants	2003-2005
Havard University	Extracts with potential activity from endophytic fungi	2003-2005

Source: Cabrera Medaglia 2002; INBio 2004

Taking the number of contracts with the estimated royalty percentage as an indicator for expectable benefits contracts - the more contracts, the more research and the higher the possibility of discovering a substance for commercialization - the result turns out relative satisfactory. By receiving an eventual royalty payment of one to five percent for one highly successful drug Costa Rica could generate as much national net income during the life of the patent as a major crop does (Sittenfeld / Gámez 1993, 75).

6.2.4 Assigning property and intellectual property rights

Costa Rica established property rights on all levels of stakeholders, thus allowing rent capture from the commercialization of genetic resources and institutes conservation incentives. By assigning rights and enabling participation in the Costa Rican case, the critical factor of property rights assignment is positively addressed. However, as in the Philippines biodiversity is assigned to the state. This has some implications.

Costa Rica has implemented the sovereignty principle as follows. The Biodiversity Law applies to all components of biodiversity found under the state's sovereignty, as well as to the processes and activities carried out under its jurisdiction or control (Law of Biodiversity No. 7788, Art. 3). Biochemical and genetic properties of components of biodiversity within the Costa Rican territory belong to the public domain, but the state has the responsibility to authorize the exploration, research, bioprospecting and use (Law of Biodiversity No. 7788, Art. 6). In this way, a second property right regime is created in addition to the private property for the tangible biological material, which can be held by the landowner (i.e., individuals, communities, state). This second regime for the genetic and biochemical information of the resources is held by the public domain and executed by the state or the commission (CONAGEBIO).

But even if the state has the authority over biodiversity according to the Biodiversity Law, an important part of the benefits flow back to the National System of Conservation Areas (apart from other benefits, at least ten percent of the research budget, 50 percent of later bonuses), indigenous communities or to the private owner depending on the land property rights. Thus, by establishing a benefit-sharing scheme, which allows those economic agents who decide over the use of the biological resources to participate in the benefits, conservation incentives are instituted.

Until now, bioprospecting has only been undertaken in conservation areas on state property where property rights are clearly defined and assigned. However, in the interviews representatives of indigenous people state that they do not feel that the rights of indigenous people are well represented. The majority of protected areas in Costa Rica especially the areas where bioprospecting takes place are scarcely inhabited. However, twelve of the 24 indigenous territories in Costa Rica are protected areas. In these cases, PIC has been granted by the state and indigenous people have not been included.

In the interviews, it became clear that mainly the government and INBio benefited from the bioprospecting activities. MINAE channeled the benefits directly to the conservation areas. The distribution of the benefits arising out of INBio's contracts is transparent. Between 1991 and 2000, the total amount of US$ 512,148 has been received by MINAE due to the ten percent research budget regulation and US$ 790,649 directly by the conservation areas (Cabrera Medaglia 2002, 25). According to an interview partner, MINAE invested the money in pure conservation activities: the Island Coco, which is absolutely uninhabitated. Compared to revenues gained by selected agricultural and forest products and tourism, this contribution is small. The foreign exchange generated during the same period (1991-2000) by timber was US$ 2,613,000, by bananas US$ 57,051,000, by coffee US$ 32,659,000 and by tourism, one of the most important economic activities of the country, US$ 71,986,000 (Gámez 2003, 3).

Table 17: Contribution to biodiversity conservation in Costa Rica and to universities:

	1993*	1994	1995	1996	1997	1998	1999	2000	Total
MINAE (10%)	110,040	43,400	66,670	51,092	95,196	24,160	38,793	82,797	512,148
Conservation areas	86102	203,135	153,555	192,035	126,243	29,579	0	0	790,649
Costa Rican public universities	460,409	126,006	46,962	31,265	34,694	14,186	7,123	4,083	724,728
Other groups in INBio	228,161	92,830	118,292	172,591	129,008	0	0	0	740,882
Total	**884,712**	**465,371**	**385,479**	**446,983**	**385,141**	**67,925**	**45,916**	**86,880**	**2,768,407**

Source: Cabrera Medaglia 2004, 111

Costa Rica is a member of the WTO and therefore, it is obliged to implement IPR protection in line with the TRIPs agreement. The Patent, Drawings and Utility Model Law No. 6867 was reformed by Law No. 7979 in 2000 to make it compatible with TRIPs. It includes microorganism, biological processes, genes, genetic sequences as long as the patentability requirements are met. A draft on plant breeders' rights has been formulated in accordance with UPOV 1991 (Cabrera Medaglia 2004, 116).

By its very wide scope the Biodiversity Law takes up Costa Rica's TRIPs obligations in the area of biodiversity. Apart from the issues directly connected with biodiversity conservation, it addresses IPR issues very explicitly, especially the scope of application. Before granting some kind of IPR for biodiversity components, the National Seed Office and Registers of Intellectual and Industrial Property have to consult the technical office of CONAGEBIO and provide a certificate of origin and prior informed consent in order to ensure exceptions of patentability (i.e., DNA sequences, plants and animals, not genetic modified microorganisms, etc.). The objection of the technical office forecloses the registration of patent or another IPR (Law of Biodiversity No. 7788, Art. 80). With the exception of the IPR law of the Andean Community (Andean Community Decision 486, Art. 26h) neither international nor other national IPR laws require such a certificate. Thus, the control and prevention mechanism only takes effect in Costa Rica and not in important locations as the EU or the US.

According to the contractual commitments, Costa Rica and INBio as providers usually do not participate in a patent because they are not regarded as inventors of the final product. If INBio contributes to the invention, a joint patent is possible, but this has not yet been the case so far. Only through PIC and benefit-sharing, the contributions of the country and the biodiversity institute are considered and acknowledged.

ABS is more or less accepted in Costa Rica and it is regarded as the implementation of international obligations. Nevertheless, there exist environmental, farmer and indigenous groups objecting the concept. Representatives of these groups have been interviewed. Indigenous and farmer groups are mainly concerned because they do not see the rights of indigenous people and farmers well represented. Environmental groups, which reject patents of life, consider INBio as a “legal biopirate” or an “international company” selling Costa Rica’s biodiversity to international companies. INBio is strongly supported by the government. This was underlined by many interviewees. The minister of environment was INBio’s lawyer some time ago and therefore, the strong relationship between INBio and the government is obvious. Most of the groups do not try to prevent bioprospecting but to increase their influence and realize their ideas through the participation in CONAGEBIO or as observers and consultants during the negotiations, as for example, the debates on the drafted by-law for ABS.

The new by-law will guarantee the participation of the local level by establishing clear regulation on access application and benefit-sharing. Since bioprospecting has only taken place in state property, there are no experiences with negotiations and benefit-sharing with private landowners. However, it can be expected if this is the case, in future ABS will still work out.

6.2.5 Information asymmetry

Pre-contractual problems of asymmetric information have not evidently emerged. INBio has gained a lot of experience and has approached the negotiations realistically. According to INBio, MINAE never participated in the negotiations due to lack of capacity and interests. Therefore, INBio independently negotiated the contracts. MINAE only signed the agreement later.

Post-contractual problems on both sides have been recognized and addressed by Costa Rica. The country tried to protect itself against the misappropriation. Interested parties do not collect bioprospecting material themselves; they receive it directly from INBio or a few other intermediaries (e.g., the Organization of Tropical Studies). Since INBio almost process all bioprospecting activities, the use of Costa Rica’s resources is easier to control. According to

INBio's staff, the bioprospecting contracts are concluded for a certain amount of samples from specified areas. INBio keeps an identical sample in its inventory and delivers coded material. If the contractual partners are interested in more of the collected material, they have to return to INBio. By this way, INBio keeps important information about the material and controls its export. As already indicated the Biodiversity Law also regulates the patenting process for bio-products in Costa Rica. The provision of a PIC certificate is an obligation within the patent application process. Thus, the legal origin of the biological material that is used for the patent is guaranteed. However, this does not hinder patenting with illegal material outside Costa Rica though. The only asset Costa Rica has in this respect is the interest of companies to continue the co-operation with INBio.

On the user side, Costa Rica undertook measures to address the problem of asymmetric information regarding the use of the benefits and exclusivity. The utilization of the benefits has been quite transparent so far. MINAE and INBio have published the amounts of benefits they received and disclosed how they used it. This was the procedure under the old system. Even if the new approach is much more complex and many other stakeholders are involved, it can be expected to be more transparent. INBio guarantees users temporary exclusivity that varies between 6 months to 2 years. However, so far INBio does not offer a guarantee regarding the quality of the material. Users are not involved in the collection process and have to trust INBio that they provide the material they promise. Nevertheless, this lack of information has not reduced companies' interest to collaborate with INBio. By working successfully and reliably in this field for more than ten years, INBio gained experiences and developed procedures, pioneering and resulting in long-lasting partnerships with industry and research institutions. Signaling reliability helped INBio to stand out from the other providers and to overcome the problem arising out of the asymmetric distribution of information.

6.2.6 Accounting for time lags

Time lags can be addressed by adequate payment schemes. The bioprospecting contracts, which INBio has negotiated, include regulations for milestone payments and royalties. However, apart from minor up-front payments, Costa Rica or INBio have not received payments so far. In the years 1991 to 2000, the total contributions of bioprospecting activities to biodiversity conservation and education add up to US$ 2,768,407 (cf. Table 17). For a ten-year period, the monetary contributions, raised out of direct payments, payments for specific samples and the coverage of research budgets, are relative small. Due to the long and insecure development, until now, no product has reached the market and no royalties have been paid. However, there are some products under development, especially related to herbal areas (cf. Table 18; Cabrera Medaglia 2002, 19).

Table 18: Outputs generated since 1992 as a result of the ABS agreements with INBio

Project	Initiated	Output
Merck & Co.	1992	27 patents
BTG/ECOS	1992	DMDP on its way to commercialization
NCI	1999	Secondary screening for anti- cancer compounds
Givaudan Roure	1995	-
INDENA	1996	Two compounds with significant anti-bacterial activity
Diversa	1998	Two potential products at initial stages / Publication underway
Phytera Inc.	1998	-
Eli Lilly & Co.	1999	-
Akkadix	1999	52 bacterial strains with nematocidal activity
CR-USA	1999	One compound with significant anti-malarial activity
LISAN	2000	Two phytopharmaceuticals in the process

Source: Cabrera Medaglia 2002

Consequently, the substantial part of benefits in form of future royalties and milestone payments is still waited for. Around 50 percent of the total revenues of bioprospecting activities went directly to the conservation areas; research groups within INBio and national public universities have received the rest. Until now, non-monetary benefits dominate the ABS process, playing a major role for sustainable development. Costa Rica and INBio benefited in different ways. The transfer of important technology has improved the infrastructure within INBio and public universities and enables the institute to do research and develop own products or at least more processed, value-added samples. The biodiversity inventory has been expanded by the collected material and financed by bio-prospecting partners. Scientists and technicians could build up scientific capacity in relation to state-of-the-art technologies, joint research and received acknowledgement in publications. INBio and Costa Rica benefit through development of negotiation expertise and spill-over effects on other economic activities like ecotourism and the improvement of local legislation according to conservation issues (Cabrera Medaglia 2002, 26).

In monetary terms, time lags remain a problem, even if milestone payments are planned. These payments are relatively small. The main benefits accruing to the country and especially INBio and the government without any delay are non-monetary benefits, especially benefits that positively influence the research capacity. This fact is acceptable for Costa Rica as management of biodiversity is placed in the hands of the state, the dominant land-owner of collection sites, and INBio was the only institution involved. In future, this picture may change since more actors are involved. It shows that even in a relatively successful case payments would rarely be able to change the decision of local agents because during the time lag only non-monetary benefits are received.

6.2.7 Good governance in provider countries

Good governance is one explaining factor for the high number of bioprospecting contracts with Costa Rica. Costa Rica offers a stable democratic and political system. One interviewee called it as a comparative advantage that is not related to biodiversity. It is obvious that the World Bank Governance Indicators are much better than the Philippines'. For instance, 70.3 percent of the 213 countries and territories rate worth than Costa Rica according to political stability. However, all indicators trend downwards in the 1998-2005 comparison, but it is still on a very high level.

Table 19: World Bank Governance Indicators, Costa Rica (1998, 2005)

Governance Indicator	1998	2005
Voice and accountability	87.0	76.3
Political stability/no violence	84.0	70.3
Government effectiveness	72.7	64.1
Regulatory quality	80.8	68.8
Rule of law	76.0	65.7
Control of corruption	76.0	66.5

Source: Kaufmann / Kraay / Mastruzzi 2006

Beside the political stability, not too often found in biodiversity-rich countries, it is the clear cut legislation concerning INBio that seems to be highly valued by companies. INBio was quite independent and flexible. It was only bound by the agreement with MINAE. This situation will change, since MINAE's position will be stronger. However, the comprehensive Biodiversity Law and the developed by-law for ABS will even more ensure the legal framework for ABS. Other intermediaries have been also active in Costa Rica, but their activities very not regulated. Especially their work is framed by the new regulations. Some interview partners underline that companies can find diverse resources in many neighboring countries where resources are cheaper and ABS is unregulated. However, they come to Costa Rica because it has a system of parks, an adequate documentation system and the country provides safety.

According to INBio, there is a relatively high interest of international companies or research institutions to bioprospect in Costa Rica (together with INBio) and the country is attractive for bioprospecting. Costa Rica and INBio have concluded many more contracts than other countries. Legal security provided in the country and by the biodiversity institute is an important reason for companies to choose this research location and partner (Cabrera

Medaglia 2002, 37). The legal security guarantees that the Costa Rican partner fulfills contractual commitments. The application procedure carried out by INBio is quite transparent. INBio is not the only intermediary in Costa Rica who bioprospects and assists interested companies and researchers. Private persons as well as other organizations try to work in this field, but not on the same scale as INBio does. These intermediaries do not have an agreement with MINAE, so their activities take place in a grey area. No significant number of contracts has been concluded with those intermediaries, supporting the argument that missing legal security deters companies from undertaking bioprospecting activities.

In future, it has to be waited if CONAGEBIO can offer the same security as INBio did. One interviewee from the industry side has doubts and states that CONAGEBIO cannot provide the same service and particularly confidentiality.

6.2.8 Administrative complexity

INBio was founded with international support and with the objective to support the country's responsibilities in the area of biodiversity inventory, search for sustainable uses and accumulation of information and dissemination of knowledge. The biodiversity institute is the national center of expertise for bioprospecting. This leads to short timeframes in the negotiations of contracts and thus lowers the transaction costs for companies. According to INBio's staff, within one year a bioprospecting contract can be concluded with INBio; in other countries this process takes much longer. The experiences seem to prove that a specialized probably private (whether non-profit or a profit) organization is in a better position to fulfill this function in an efficient manner access than governmental institutions, especially related to the process of applying for access. The Biodiversity Institute is not part of the complex governmental administration, but operates as a consultant. The condition of not being a profit organization prevents INBio from abusing its standing out position related to bioprospecting. INBio has even a business development officer who is responsible for the co-operation with bioprospecting partners. Therefore, users find a competent contact person at the institute. By forming an independent institution with expertise in the decisive fields and embedded in a stable political system, Costa Rica succeeds in getting a leading position in bioprospecting.

The expected changes in processing by the creation of CONAGEBIO as the new governmental National Focal Point related to biodiversity policy and management is differently evaluated. In the interviews, the demand side appears to be very content with the existing regulations. Although, the Biodiversity Law is advertised by some experts as the most ambitious and elaborate national law of its kind, bioprospectors and intermediaries assume that the new regulation will complicate the application and execution process and that the competitive advantage of Costa Rica in the bioprospecting market will vanish. One Costa Rican researcher who is involved in bioprospecting complained that Costa Rica follows the Philippines. Under the new by-law, INBio can still work as an intermediary, but CONAGEBIO also participates in and supervises the negotiations with the bioprospectors and approve the MAT and PIC. The composition of CONAGEBIO representing the major concerned stakeholders can lead to longer negotiations and decision-making processes due to differences in opinions. Besides, one interviewee mentions that the members are also very busy and may not attend meetings, just as in the Philippine case. The transaction costs on both the provider and the user side are expected to increase, which will restrict the efficiency of ABS. Even if the interview partners support the new system they underlined that it will be a more complex process.

It seems that the construction of one independent agency was one of the assets of Costa Rica. The resulting short decision-processes were especially interesting for the demand side. The new processes will presumably be more time-consuming, integrating the interests of different stakeholders that formerly remained outside the process. However, even if the transaction costs will increase due to the increased participation of the stakeholders Costa Rica will benefit. The participation will also be a requirement if bioprospecting will not only take place on state property but also on private and community property.

6.2.9 Market structure

In principle, the bargaining position of Costa Rica is relatively weak due to the oligopsonistic competition. Despite the ongoing loss of biodiversity, the total supply of diverse genetic material still satisfies the demand. It is still possible to obtain samples even if the total number of species decreases. In many countries the access is not regulated and free to obtain. Therefore, the degree of competition among buyers is much lower than on the supplier side. The diverse biological resources within the mesoamerican biological corridor from Mexico to Colombia are similar and an interested company is able to substitute one country for another. In fact, INBio and Costa Rica succeeded in attracting many interested parties, more than any other country within the mesoamerican biological corridor even though there was unregulated access in competing countries. This success can be ascribed to the scientific capacity of INBio, the National System of Conserved Areas and other institutions (e.g., the Organization of Tropical Studies), which is a result of a long-time research by international biodiversity scientists in the country and the transfer of technology, knowledge and human capacity. As transaction costs are much lower in Costa Rica than in other countries, firms have a great interest in bioprospecting in Costa Rica and INBio's bargaining position is considerably improved.

Since 2002, a group of megadiverse countries has been established with Costa Rica as one of its members. It can be expected that such a coalition will strengthen the market position of supplier countries. However, the bargaining position is still weakened by the existence of ex-situ collections. Within Costa Rica the Biodiversity Law applies and bioprospecting samples, existing in-situ or ex-situ, can only be obtained through an access permit. Nevertheless, the access to ex-situ collections in other countries and the access to material stored pre-CBD adoption are not regulated and companies still can recourse to these collections. This selection is limited though, and the expectations of finding promising genetic material within these collections is not as high as from samples, obtained from in-situ sites or ex-situ collections, created after the adoption of the CBD. Hence, industry continues to have a high interest in bioprospecting contracts (Wynberg / A Laird 2005)

6.2.10 Conclusions

Costa Rica is an example for a relatively successful strategy of ABS. The number of contracts with companies in the life science industry is high, and there are considerable non-monetary benefits accruing to Costa Rica. However, up to now there are only scientific, academic, industrial benefits and little conservation benefits. The country’s popularity accruing from the bioprospecting contracts affects other economic activities including nature-oriented tourism. INBio developed itself to be an outstanding research institution with high scientific and technological capacity in Central America. The national university also benefits from the work of the institution. Successful partnerships with local enterprises in the agro-industrial area developed through Costa Rica’s bioprospecting program, have created jobs and have also benefited the local level through the development of new products for the local market.

The ecological data on Costa Rica also shows a favorable development. The monetary benefits are small though. This is one important indicator for the fact that the ecological progress in Costa Rica is not only and perhaps not even mainly due to the commercialization of biodiversity associated with bioprospecting. In Costa Rica ABS is only part of a comprehensive strategy. Nevertheless, there are reasons to take Costa Rica as a model country for designing ABS procedures. Many of the critical factors analyzed here are handled in an outstanding way. With the introduction of one single authority in the bioprospecting process Costa Rica lowered transaction costs (in contract preparation and enforcement) for demanding companies thus greatly improving its bargaining position. The bioprospecting procedure alleviates the country’s informational deficiencies about the use of the biological material and thus its own enforcement costs.

INBio as the agent being responsible for the management of biodiversity in the country is also in charge of the bioprospecting process. In this respect, incentives are set correctly.

Table 20: Overview on Costa Rica and the critical factors

	Costa Rica
Property rights	Tangible material is subject of private property right; intangible is subject of state property Until now, bioprospecting only on state property IPR application process requires certificate of origin
Asymmetric Information	No pre-contractual problems Post-contractual problems on both sides have been recognized and addressed: users cannot collect, exclusivity and quality guaranteed, benefits flow to protection areas
Time lags	Bioprospecting contracts include regulations for milestone payments and royalties Apart from minor up-front payments, no payments have been received by Costa Rica or INBio so far (many patents, product expected soon)
Good governance	Stable democratic and political system favors bioprospecting INBio, ABS framework and experience provide security
Administrative complexity	INBio is a very efficient, non-governmental institution Complexity will increase with the intersectoral committee
Market structure	High reputation and low transaction costs improve market position Member of the group of the megadiverse countries

It has to be acknowledged though that this happened in a very favorable environment. Good governance and political stability greatly helped INBio to win its good reputation for bioprospecting. Costa Rica is a small and not too densely populated country. Property rights over the biological resources are defined and assigned. This all helped in designing an efficient institutional setting. Nevertheless, there are problems not yet solved. Payments come late and they are insecure. The efficient decision process goes together with little influence of other stakeholders. Until now, INBio did not manage to gain acceptance among the stakeholders, which formally have not participated in the bargaining-process before. However, as a non-profit- and non-governmental organization INBio should be in the position to integrate all the stakeholders' views; not only through CONAGEBIO but also in its own processes.

In conclusion, it seems that by the establishment of an intermediate organization as INBio, providing technical and scientific capacity and assisting partners in bioprospecting activities, countries can greatly enhance their chances to participate in the benefits of bioprospecting.

This may help to change the attitude towards the sustainable use of natural resources and thus have a positive impact on the ecological situation. It should not be hoped though that with future and insecure payments ABS alone can hinder deforestation processes. A comprehensive strategy is the minimum requirement to make any progress in this field.

6.3 Ethiopia[30]

Ethiopia was chosen as the third case study. Ethiopia is a very special case, since the country appears a very strong actor on the international level, but according to national implementation, it falls behind many other countries and can provide only limited empirical data. The analysis in this study follows the other two case studies. The developed analytic framework, based on the critical factors and the potential measures, is exercised in the country-specific case in order to prove and illustrate its applicability. First of all, the case study methodology is shortly presented. Then, a short introduction to the Ethiopian case is given and the regulatory environment, including the legal and institutional setting, is illustrated. The focus of the introduction is wild coffee genetic resources since the author participated in a project dealing with the specific case of wild coffee genetic resources in Ethiopia. Genetic resources of wild coffee are a very interesting example because wild coffee is a crop, but it as similar characteristics as wild plant genetic resources used in pharmaceutical research. Therefore, this case study is considered to be very useful for the analysis.

The main part of the analysis is the application of the critical factors to the country-specific case. Taking into account the established analytic framework regarding the effectiveness (cf. chapter 5) it is looked at how the critical factors are shaped and how they are already addressed in Ethiopia. Since Ethiopia has only recently adopted a regulation, the analysis is limited because of the lack of data. However, some very interesting results can be concluded, which are summarized at the end of this subchapter.

6.3.1 Case study methodology

The expert interviews in Ethiopia were carried out in co-operation with the Center for Development Research within the project "Conservation and use of wild populations of

[30] The main ideas and findings regarding the conservation of montane forests in Ethiopia are based on the paper Richerzhagen, C., Virchow, D. (2007): Sustainable Utilization of Crop Genetic Diversity through Property Rights Mechanisms? The Case of Coffee Genetic Resources in Ethiopia, in: International Journal of Biotechnology 9 (1), 60–86.

Coffea arabica in the montane rainforests of Ethiopia". This explains why the focus of this study is the use of coffee genetic resources. Other crop genetic resources are also very relevant and threatened in Ethiopia, but this project chooses coffee as an example. It is a product of high commercial value. In this case study the regulative framework for all genetic resources is investigated but coffee receives special attention. Whereas the emphasis of the other two case studies is on wild plant genetic resources, wild coffee is an example for crop genetic resources that is not domesticated but that is available in the wild.

Like Costa Rica and the Philippines, Ethiopia is a country with high biodiversity and suffers from a high loss of forests, harboring this diversity. Compared to the other case studies its high diversity is especially made up of crop genetic diversity. When the case study was conducted (October 2003), Ethiopia had not implemented any ABS regulation, but was strongly involved in the international negotiations within the CBD. In February 2006 the proclamation "A Proclamation to provide Access to Genetic Resources and Community Knowledge and Community Rights" (Proclamation No. 482/2006) has been adopted and its implementation is on the way. Based on the legal document, the relevant provisions and implications are included in the analysis. However, until now with a view to genetic resources Ethiopia has been an open access country. A considerable amount of biological material, which originally is from Ethiopia, has been used in research, development, and commercialization abroad, but benefits have not been shared with the country.

Ethiopia has started to develop a legislative framework to address these problems for a considerable time and finally adopted a document, which implements the ABS provisions of the CBD. Therefore, the Ethiopian case is excellently suited for a closer look. The case of Ethiopia is also evaluated by using the critical factors identified above, and it is analyzed how these factors or their interdependency will affect the current situation and the introduction of a potential ABS regime in Ethiopia. Even if Ethiopia has only recently implemented the ABS regulation and no experiences with the implementation of ABS are available, the analysis of the critical factors can be applied. Based on the past situation and the experiences gained there, and the analysis of the adopted proclamation that indicates the way Ethiopia has chosen to implement the ABS concept, problems can be highlighted and valuable conclusions can be drawn.

The data are based on expert interviews, conducted in Ethiopia in October 2003. Semi-structured interviews were used as the method of gathering and analyzing qualitative data. Throughout the interviewing process, different thematic areas, in line with the identified critical factors, were addressed. Since ABS has not played a role in Ethiopia so far, only a limited number of experts could be identified. Fifteen experts were interviewed. They represent the variety of stakeholders involved in the ABS process or having expertise related to the ABS issue (cf. list in the appendix). Additionally, secondary literature, as e.g., books, journal articles, reports is used to complement the information gained from the interviews.

6.3.2 Introduction

Ethiopia possesses considerable biodiversity and natural resources, as well as many endemic species due to its geographical characteristics as range of altitude, rainfall pattern and soil variability. Complex topography and environmental heterogeneity offers suitable environments for a wide range of life-forms. Vegetation types in Ethiopia are highly diverse ranging from afro-alpine to desert vegetation. It has a large number of plant species: over 7,000 species from which about twelve percent are probably endemic (IBCR 2007). Only a limited number of studies have been conducted to assess Ethiopia's diversity, which allows estimating its value.

Ethiopia is one of the major Vavilovian centers of origin and crop diversity in the world. Famous examples are coffee and teff, the major stable food for Ethiopians. For instance, wild coffee varieties derived from the wild populations of *Coffea Arabica* with large potential future value still exist in Ethiopia's montane forests. These forests are situated in the south and south-western parts of the country (Kumilachew 2001, 115-122). These genetic resources have not only a potential option value, but they have direct use values. Wherever accessible, coffee is harvested directly from these naturally regenerating and unmanaged wild coffee trees. This forest coffee system contributes about six percent to the total coffee production in Ethiopia (Demel Teketay 1999). Furthermore, there are wild coffee trees in inaccessible forest areas, which are not utilized at all.

Besides this in-situ existence of coffee genetic resources, landraces of coffee exist in the other coffee farming systems of Ethiopia, the semi-forest coffee and home garden coffee system (Tadesse Woldemariam / Demel Teketay 2001, 131-141). In addition to the in-situ and on-farm management, coffee genetic resources have been collected and conserved ex-situ in field genebanks in Ethiopia as well as in various other countries (FAO 1998). Breeders are the users of wild coffee. Coffee breeding is taking place at the national level mainly in other countries than Ethiopia (e.g., Columbia, Kenya) and in international research institutes (e.g., CIRAD). Interestingly to note that, although the coffee processing and marketing is world-wide mainly in the hand of the private sector, the breeding research is done mainly in the public sector (Richerzhagen / Virchow 2007, 69). Realizing this unique situation that in a country of origin the genetic resources are still existing in in-situ, on-farm as well as in ex-situ conservation facilities, it has to be noted that this situation is threatened and – without determined commitment right now – the valuable coffee genetic resources may be lost in-situ as well as on-farm in one or two decades.

The threat of extinction for the plant genetic resources is based on the fact that the remaining natural montane rain forests of Ethiopia, the habitat of wild plants, are under constant pressure due to land use conflicts in forests and forest fringes. One hundres years ago, the natural forest covered more than 40 percent of the country's highland area. These days it has decreased to less than three percent (Gebre Markos Selassie / Deribe Gurmu 2001). Ethiopia's forests are threatened by demand for forest products on the one hand and by the conversion of forest areas into agricultural land or settlement on the other hand. The former is determined by the demand for fuel wood (95 percent of the whole demand for forest products), construction poles (four percent) and industrial wood (one percent). Underlying force is the population growth and the increase in energy demand and in construction activities. Because the demand is higher than the supply, uncontrolled wood harvesting is one of the critical results. The gap between the supply and the demand is increasing significantly to the disadvantage of the remaining forest, due to only minor reforestation programs (Berhanu Mengesha / Million Bekele 2001, 97–114). It seems that this gap will increase, if in future still only little attention is given to the investment in forestry.

The conversion into agricultural or settlement land is the second major reason for the plight of Ethiopia's rain forests and thereby threatening the extinction of the wild populations of plants and their genetic resources. The rapid rates of clearing to open up new agricultural and settlement land is driven partly by the need for compensation of land lost through degradation, but above all because of the necessity to accommodate the rapidly increasing population and their need for new agricultural land. The concentration of population in the Ethiopian highlands is threatening the remaining forest areas. Seventy percent of Ethiopia's population is living in the highlands, which occupy only 40 percent of the total area of the country (Gebre Markos Selassie / Deribe Gurmu 2001). Besides internal population growth, migration to forest areas is generated by various external pressures as for instance, poverty, lack of employment opportunities and droughts on the northern highlands leading to governmental planned resettlement schemes in the southwest rain forests (Tadesse Woldemariam et al. 2001, 237-248; Yonas 2001; Reusing 1998; Alemneh Dejene 1990). The resettlement schemes are, however, not a sustainable answer to the famines in the northern part of Ethiopia, because it can already be predicted that the migration will carry on, continuing to threaten the destruction of the rain forests and the survival of the wild plant genetic resources in the montane rain forests of Ethiopia (Yonas 2001). Beside this intersectoral aspect of migration, the movement of existing people within the forests determined by unsustainable shifting cultivation or by pressures to move exerted by forestry staff or by settlement policies is another reason for the deforestation process.

In addition, the rain forest areas are attracting the interests of investors due to their high ecological potential for growing coffee and tea. Hence, forest areas are in the process of being either thinned or cleared for coffee, tea or rubber tree plantations, having a negative impact on habitats of the wild genetic resources (Kumilachew 2001, 115 – 122).

According to Demel Teketay (2002), deforestation of the montane rain forest takes place at a pace of up to 200,000 ha p.a. At present, only 2.3 million ha of montane rain forest exist, of which 0.7 million ha is slightly disturbed and 1.6 million ha highly disturbed by human activities. Based on the deforestation rate of the 1990s, it can be expected that in less than 15 years the whole montane rain forest of Ethiopia, including all wild plant genetic resources, will have disappeared. Today about five percent of Ethiopia's territory is officially protected, but even these areas suffer from poaching and illegal logging.

The little efforts by the government to allocate necessary financial resources for forestry conservation indicate the marginal governmental commitment to forest and wild coffee conservation. Between 1992 and 1999, only 0.1 percent of all investment projects in Ethiopia were related to forestry and just 0.04 percent of all financial resources were allocated to forest conservation and development (Berhanu Mengesha / Million Bekele 2001, 97 – 114).

With US$ 160 Gross National Income (GNI) per capita in 2005 Ethiopia is one of the poorest countries in the world (GNI: Philippines US$ 1,300 and Costa Rica US$ 4,590 in 2005) (World Bank 2006b; World Bank 2006c; World Bank 2006a). Ethiopa is ranked 170 out of 177 countries in the UNDP Human Development Index in 2004. 80.7 percent of the population live on less than US$ 2 a day and 42 percent of the population is undernourished (UNDP 2004, 142). In the last thirty years, Ethiopia has suffered from wars, food shortages, political instability and famines, which decreased the situation extremely. This situation also put high pressure on Ethiopia's environment.

To sum up, Ethiopia's montane rain forests are declining at an alarming rate, and with the forest, wild genetic resources and especially the endemic wild populations of *Coffea arabica* are in the risk of being extinct. For all genetic resources with commercial potential it still holds true what Tewolde called out 16 years ago: "Arabica coffee has the bizarre distinction of being commercially one of the most important and, at the same time, in terms of genetic conservation, one of the most neglected crops in the world." (Egziabher Tewolde Berhan Gebre 1990, 65-72).

6.3.3 Regulatory environment: legal and institutional setting

The Institute of Biodiversity Conservation (IBC) is the leading agency for biodiversity management and ABS issues in Ethiopia. The IBC establishment proclamation authorizes IBC to grant permission for the collection of biological resources (Proclamation No. 120/1998). Until 2005, IBC was called Institute of Biodiversity Conservation and Research (IBCR) and its mandate was also to conduct research. This mandate was abolished; anyhow conservation based research is still an issue.

Other organizations that are involved in biodiversity issues are the Environmental Protection Authority (EPA) and the Ethiopian Wildlife Conservation Organization (EWCO). EPA advises both organizations, represents Ethiopia in international conferences and develops the legal frameworks for environmental protection. EWCO is responsible for the implementation of CITES (Yifru 2003, 108).

Ethiopia is a member of the CBD, but the country has not developed and implemented a law that specifically implements the Convention. In 1998 the country adopted a non-binding National Policy on Biodiversity Conservation. For a long time the only existing law that broadly addresses access to and use of biological resources has been the Forest Conservation, Development and Utilization Proclamation of 1994. This law generally aims to ensure the participation of the local communities in forest conservation activities and benefits arising out of the utilization of forests (Yifru 2003, 112). On the international level, Ethiopia was strongly involved in the development of an African Model Law on ABS. The Ethiopian Institute for Sustainable Development (ISD) and EPA prepared the draft for the law that was adopted later. Although Ethiopia was strongly involved in the development of the African Model law, it has only recently implemented an ABS regulation.

Since 1998, a national committee, led by the IBC and EPA, have started to develop a draft proclamation on access to genetic resources. The draft has been discussed in various workshops and between stakeholders. The involvement of local communities has been very limited. The draft proclamation “Community Knowledge and Access to Biological Resources Proclamation” was finally adopted as proclamation in February 2006. In the interviews EPA’s representative, being responsible for the development of the proclamation, reasoned the delay with the urgency of other problems and advantage of a defensive position. The civil war stopped Ethiopia’s development process and generated problems, which required many resources. Developing an ABS regime fell back among the priorities. Another reason is that Ethiopia has no patent system that can be applied to life forms. Since patented genetic resources that originate from Ethiopia can still be used in Ethiopia, ignoring the foreign patents, the problem was not considered as being very urgent. According to EPA, Ethiopia decided to concentrate its resources to fight on the international level, for example, by developing the Model Law and by standing up for its position in the international negotiations.

The Proclamation No. 482/2006 “Access to Genetic Resources and Community Knowledge, and Community Rights” has the objective “to ensure that the country and its communities obtain fair and equitable share from the benefits arising out of the use of genetic resources so as to promote the conservation and sustainable utilization of the country’s biodiversity resources” (Article 3). The law follows the ABS sections of the African model law in many parts and addresses in- and ex-situ collected genetic resources in Ethiopia. It does not apply to the customary use and exchange of genetic resources by and among Ethiopian communities as well as to the trade of biological resources used for direct consumption (Proclamation No. 482/2006, Article 4).

According to IBC staff, until the Proclamation was adopted the IBC used MTAs according to the FAO Code of Conduct to transfer material for public and postgraduate research. The Addis Ababa University has also developed guidelines and Standard MTAs to transfer material for research purposes.

In the interview with a person from the National Herbarium it was mentioned that in the past two important ABS agreements have been concluded. The first is on teff. Teff is an indigenous crop to Ethiopia and is the major staple food of Ethiopia. A Dutch company improves teff varieties, grows them and produces gluten-free flour, which is a suitable ingredient in gluten-free diets and sports foods. The company has agreed a memorandum of understanding with the Ethiopian Institute for Agricultural Research (EIAR, former Ethiopian Agricultural Research Organization EARO) on benefit-sharing, which offers Ethiopia joint ownership on teff varieties developed by the company (Feyissa 2006, 9). As compensation € 10 will be paid to Ethiopia for every hectare of teff sewn outside of Ethiopia. The company will also deposit five percent of net profits in a fund, which it will use to support Ethiopian farmers, for instance, by promoting a commercial approach to teff cultivation. Until a profit is made on teff, the company will deposit € 20,000 annually in that fund. Ethiopia now wants to revise these agreements because they were concluded before the Proclamation came into force. A committee has been appointed in Ethiopia to study this issue. Negotiations with the Ethiopian government on how to share the profits are progressing slowly, but the company proceeds with its applications for IPRs for growing the teff crop as well as for the production of all products containing teff or teff-flour. The company has been criticized by several NGOs regarding these applications. It won the Captain Hook Award for biopiracy in 2004, which is an award a NGO gives to companies, individuals or institute that they consider as biopirates (Coalition Against Biopiracy 2007).

Besides the teff agreement, another ABS agreement has been just signed in 2006. The Ethiopian government and Vernique Biotech, a British-based start-up company, have agreed on a contract to commercialize vernonia oil. Vernonia is a weed growing in eastern Ethiopia, which was almost extinct. Its seeds yield oil, which might be a living source of epoxy compounds. These are currently produced entirely from petrochemicals. Until now epoxy sales amount to US$ 15 billion per year and provide a great market for its potential substitute. In exchange for access, the company agreed to pay a mix of license fees, royalties and a share of profits to the Ethiopian government over the next ten years. Since vernonia can only grow close to the equator, Verique decided to cultivate it in Ethiopia. Cultivation started in 2004 with 200 ha but the company intends to expand the area to thousands of hectares. Therefore, many local farmers will be paid to cultivate vernonia in an area, which is not well suited to produce crops (Cookson 2006).

Ethiopia and the African model law

Many African countries regard the CBD and TRIPs as contradictory agreements related to their understanding of property rights. They argue that the CBD recognize sovereignty rights of states over their biological resources, whereas TRIPs confers monopoly rights through IPRs without recognizing technologies, innovations and practices of local communities and their collective ownership of common goods (Ekpere 2000, 1). In their opinion TRIPs cannot protect and reward valuable indigenous knowledge. Nevertheless, many African countries are members of the WTO and therefore obliged to implement the TRIPs agreement. In order to fill the gap and to provide these countries a *sui generis* system for protecting plant varieties, a chapter on breeders' rights was included in the model law. It was hoped that such a model law could reconcile the conflicting approaches arising out of the CBD and TRIPs (Zerbe 2003, 13). Furthermore, the African countries intended to widen the scope of the model law to agricultural development, indigenous knowledge systems, conservation and sustainable use of biological resources, community rights, equitable sharing of the benefits and national sovereignty consistent with the provisions of the CBD (Zerbe 2003, 16).

The African Model Legislation on the Protection of the Rights of Local Communities, Farmers, Breeders and the Regulation of Access to Biological Resource was approved at the conference of the Organization of African Unity (OAU)[31] in Lusaka, Zambia in July 2001. A draft of the model law had been developed by the Ethiopian EPA, the Third World Network and the ISD in Ethiopia. It was discussed and finally adopted as a draft model law in Addis

[31] The OAU is an antecessor organization of the African Union (AU). It was established in 2001 and consists of fifty-three African states.

Ababa in 1998. In the same year the 68th Ordinary Session of the Council of Ministers of the OAU recommended that governments of member states should adopt the draft model legislation. Until 2001, the law was further developed and redrafted and should from then on assist Union members to formulate their national legislation.

The objectives of the model law reflect its broad scope. It aims at conservation, evaluation, and sustainable use of biological resources including agricultural genetic resources, knowledge and technology against the background of food security. The model law applies not only to in-situ genetic resources, but also to ex-situ collections, derivatives from biological resources. It recognizes and aims to protect the rights of local communities over their biological resources, knowledge, and technology. The main features are the provision of a system of access to resources and knowledge, the promotion of a mechanism of a fair and equitable benefit-sharing and the recognition and protection of community, farmers' and plant breeders' rights as explained in the following:

- System of access to biological resources. The system is in line with the CBD, including PIC, MAT, benefit-sharing. Patents over life forms and biological processes are not recognized;
- Community rights. The model law defines community rights as rights that entitle communities sovereign rights over their resources, innovations, practices, knowledge and technologies and benefits arising out of their use;
- Farmers' rights. The model law recognizes farmers' contribution to the conservation, development and sustainable use of genetic resources and regards the recognition of farmers' rights as a necessary incentive to continue these achievements. In the model law farmers' rights are defined as the rights to participate in benefit-sharing, save, use, exchange and sell farm-saved seed as well as use protected varieties to develop farmers' varieties and save, use, multiply and process these new developed varieties;
- Breeders' rights. The model law recognizes breeders' efforts and investments for the development of new varieties of plants. Plant breeders' rights include the exclusive rights to sell or license material of a new developed variety if the variety is clearly distinguishable, stable and homogenous. Despite the recognition of these rights, the model law emphasizes the rights of farmers to save, exchange, and use seed material in order to produce seeds for a second sowings.

Although the ambitions were great, the realization of the initial intends to overcome the problems have failed due implementation problems. Until now, the model law has not been widely adopted across Africa. Only few countries have taken steps to establish legal frameworks for its implementation due to financial, institutional and political problems (Zerbe 2003, 22). It seems that the model law can only be implemented if capacities are available and certain frameworks are already established. The model law has been criticized by WIPO and UPOV mainly regarding its rejection of patents over life forms and biological processes and its provisions on farmers' and breeders' rights (Egziabher Tewolde Berhan Gebre 2002).

6.3.4 Assigning property and intellectual property rights

According to the Ethiopian constitution, land belongs to the state and citizens obtain only use rights (Constitution of Ethiopia, Article 40.3). Tenure is insecure. The absence of integrated land-use policies and regulations contributes significantly to the loss of the forest resources and biodiversity as well as the expansion of agriculture into forests. The government regularly redistributes land. Without secure forestland tenure, long-term investment in forestry by farmers will be hindered (Melesse Damtie 2001). Without legal instruments, it is difficult to prosecute the alleged offenders and impose adequate penalties. In the interviews, it became clear that the government of Ethiopia does not intend to legalize private property rights in land in near future. Analogical private IPRs on biological resources are not accepted. Ethiopia is not a member of the WTO. It has an observer status and is seeking membership, but until now the country is not bound by the TRIPs agreement. In the interviews at EPA, it was obvious that some people being involved in ABS policy-making strongly offend patents on life forms and consider CBD and TRIPs as contradictory. In fact, Ethiopia has even played a major role in uniting Africa to come up with a position against patenting on life forms (Yifru 2003, 116). So far, Ethiopia has excluded all life forms (i.e., plants, animals, and microorganisms) from patentability. However, if Ethiopia becomes a member of the WTO the country must change this perception.

The discussed ABS regulations in Ethiopia consider national characteristics and the African model law. According to the Proclamation, the ownership of the genetic resources is vested in the state and the peoples of Ethiopia (Proclamation No. 482/2006, Article 5.1). However, the state has the authority to decide on the use of Ethiopian genetic resources. PIC has to be granted by the national competent authority, which is IBC. In line with the African model law, the Ethiopian proclamation recognizes and protects community rights. Local communities have the right to use and exchange genetic resources and share from the benefits but their PIC is not obtained if their genetic resources are subject to an ABS agreement. The rights over the knowledge of communities are stronger protected (Proclamation No. 482/2006, Article 6-10).

The Proclamation stipulates that the benefits should be shared among the state and the communities. Communities should receive 50 percent of the benefits in form of money, which should be used to the common advantage of the concerned local communities (Proclamation No. 482/2006, Article 9). However, the government is responsible for the distribution. Communities will depend on the mechanism the government will develop. Such a mechanism is still lacking. Due to the absence of land use policy, not much can be expected. In some the interviews doubts were mentioned if Ethiopia's government would be able to realize this aim.

6.3.5 Information asymmetry

In Ethiopia pre-contractual problems arising from information deficiencies regarding the expected benefits cannot be observed. Much more relevant are post-contractual problems on the provider side. They are attempted to be regulated with the new Proclamation. The information problems on the user side regarding exclusivity, use of the shared benefits and the quality are not addressed at all. Many interview partners stress that Ethiopia has very little capacity to monitor the flow of genetic material with Ethiopian origin. Until now, Ethiopia, supported by international NGOs, used the strength of public relation to disclose cases of inappropriate behavior. Many interviewees underlined that Ethiopia depends on the support of user countries, as for example Germany. Nevertheless, as long as Ethiopia had not implemented the CBD provision on ABS, none of the activities, even if they are not in line with the CBD, is illegal.

In future, Ethiopia intends to monitor ABS activities in the country through the creation of joint research projects and the participation of Ethiopians in collection and research. Besides, the Proclamation calls on the local communities and the regional bodies to control the use of genetic resources (Proclamation No. 482/2006, Article 28). Especially NGOs' representatives mention that the public awareness is quite low and that it will take time to integrate local communities in the process.

Foreigners' application for access to genetic resources is only successful if they present a supporting document of the competent authority that has been issued with regard to the CBD in their home countries (e.g., the Ministry for Environment in Germany) and if they agree to be accompanied by the personnel of IBC or of another designated institution. However, users of genetic resources can do even more than only comply with these obligations. Establishing research or even developments units in the country will certainly facilitate monitoring and build trust between Ethiopia and users. Users are urged to deliver regularly progress reports on their work and a sample copy of the material with IBC (Proclamation No. 482/2006, Article 17).

Furthermore, in the interviews it was underlined that export controls to monitor the flow of genetic material, leaving Ethiopia, play an important role. The Proclamation also adopted this instrument. Customs officers, quarantine control institutions and mail service institutions should inspect material that is taken out of Ethiopia and ask for an export permit (Proclamation No. 482/2006, Article 30/31/32). One interviewee from the university states that some genetic material has left Ethiopia through diplomats that enjoy certain privileges at the customs. However, until now it seems that Ethiopia does not have the human capacity to control exports. According to the interviewees, the training of the customs officer will be a big challenge.

The penalties that can affect collectors for the unapproved use of genetic resources are relatively high. Any person who is engaged in access activities without securing access permits from the competent authority can be punished depending on the circumstances and the type of genetic material with prison (between three months and twelve years) or with a fine (between US$ 600 and US$ 6000) (Proclamation No. 482/2006, Article 35).

National research has been exempted from the ABS regulations. IBC can grant researchers access permits, which are not issued based on the access procedure. Here, Ethiopia has addressed an issue that is heavily debated on the national level, and has simplified the access for national researcher.

Ethiopia rejects the patenting of life forms and hopes therefore to prevent the misappropriation of genetic material, which originated in Ethiopia. User measures as the disclosure of origin in patent application are not applicable in this case. It is expected that eventually Ethiopia will become a member of the WTO. In this case, the Ethiopian government has to review this rejection due to its non-compliance with the TRIPs agreement.

6.3.6 Accounting for time lags

Ethiopia's experience with ABS on the national level is very limited and time lags have not played a major role because until recently, no ABS agreement has been concluded and no adequate payment schemes, which can address the time lag, have been developed. In the interviews, it was often stressed that Ethiopia has already lost much of its genetic resources because it has been an open access country so far. However, this will change in future. The first ABS agreement on teff that was concluded before the Proclamation was adopted already indicated this change. The company pays a fee of € 10 to Ethiopia for every hectare of teff sewn outside of Ethiopia. Besides, there is a five percent royalty rate, which is at the upper end of the supposed “world market rates” (one to five percent) and which flows into a fund. Furthermore, an up-front payment in form of deposit of € 20,000 is made. Nevertheless, it is not clear how the local will benefits. Even if community rights are recognized and monetary benefits will be shared, there are doubts that this mechanism will set incentives for conservation on the local level and bridge the time lag.

However, Ethiopia strongly focuses on non-monetary benefits. Non-monetary benefits are independent of the development of a product as up-front payments. In the interviews with IBC, it became clear that Ethiopia intends that research on the genetic resources collected in Ethiopia should be done in Ethiopia, and in a manner that facilitates the participation of relevant agents in the country as local organizations and academic institution, which are designated by IBC. Only if it is impossible it is allowed to carry out the research activities abroad. Ethiopia’s research infrastructure is quite poor. Unlike Costa Rica, the country cannot look back on enormous scientific capacity because of a long-time research by international scientists and the transfer of technology, knowledge and human capacity. Probably only few companies and researcher will find appropriate initial conditions and incentives to invest in research and development in Ethiopia. Unfortunately, IBC puts less importance on research (with the exception of conservation-based research) but more on policy and conservation activities.

6.3.7 Good governance in provider countries

The general political situation in Ethiopia can be described as relatively unstable. In the last ten years, Ethiopia has undertaken many efforts to advance democratization and decentralization. However, these processes were slowed down due to the border war with Eritrea from 1998 to 2000. Just in May 2005, democratic reforms led to heavy participation in the elections. However, the results were contested and civil unrest ensued (Lemma Teigist 2006). The World Bank’s Government Indicators 1996-2005 approve these results.

Table 21: World Bank Governance Indicators, Ethiopia (1998, 2005)

Governance Indicator	1998	2005
Voice and accountability	28.0	19.3
Political stability/no violence	18.9	8.0
Government effectiveness	51.7	15.8
Regulatory quality	36.0	13.9
Rule of law	53.8	28.0
Control of corruption	53.9	25.1

Source: Kaufmann / Kraay / Mastruzzi 2006

The indicator for political stability amounts to eight percents, i.e., only eight percent of the other 213 countries and territories in the world rank worse and 92 percent rank better than Ethiopia.

The unstable political situation is reflected in Ethiopia's environmental policy. One can state a lack of political will to protect and develop the forest. According to Berhanu and Million, there is neither a Federal Government policy on forest conservation nor clear forest policy in general (Berhanu Mengesha / Million Bekele 2001). It can also be stated that the Ethiopian government has shown a gross negligence in the protection and development of forest resources (Melesse Damtie 2001). The government of Ethiopia admits that it cannot effectively conserve and develop forest resources in the country. On the contrary, the communities, the NGOs, the private sector and professional associations are called upon by the government to be actively involved in the conservation of Ethiopia's forest (Mengistu Hulluka 2001). Even worse, the government encourages "investors" to open up land for food production, tea and coffee plantations and logging without conducting an environmental impact assessment beforehand (Yonas 2001).

Even if Ethiopia was strongly involved in the development of the African model law, the country was not able to develop and implement own biodiversity policies and legislations. Just recently, the ABS regulation has been implemented. However, the responsibility for access but not benefit-sharing had been allocated to the IBC. Benefit-sharing has remained as an unclear issue. The legislation, which has been in place until now to determine the responsibility and work of IBC, has not sufficiently and efficiently implemented the obligations of the CBD. Due to the lack of regulations, the good governance appears to be weak in order to attract users of genetic resources. Moreover, the existence of different responsible institutions seems to be confusing. In the teff case, EIAR (former EARO) negotiated the memorandum of understanding.

6.3.8 Administrative complexity

Due to the lack of empirical data it is difficult to estimate the level of administrative complexity. However, in the teff case users regard the negotiations as a unnecessary time-consuming process. Too many institutions are still involved in the ABS process. By defining one competent authority, as for example IBC, to be responsible for all ABS activities in Ethiopia, the country can decrease the administrative complexity, which appears as a problem in many countries when implementing ABS regulations. The split-up of the responsibilities among different institutions has to be avoided. Comparable to INBio, IBC can lower the transaction costs for companies if it manages to reduce bureaucracy. The accumulation of biodiversity activities, as well as the separation from governmental procedure can lead to short timeframes for the negotiations of contracts, and help Ethiopia to become an interesting source of genetic resources for users. In the interviews, it became clear that most interview partners think that it is impossible to establish an intersectoral committee as in Costa Rica. However, many issues are not regulated in the Proclamation. For example, the application procedure is still unclear as well as the obtaining of PIC.

6.3.9 Market structure

Ethiopia's initial bargaining position has been very weak due to market structure and the general political and institutional environment, but also due to the lack of a clear-cut legislation that can increase users' interest. Until now, only few agreements have been concluded with the private sector for commercial purposes. Much more scientific research agreements have been concluded. However, Ethiopia and IBC have the potential to improve the situation. Once other critical factors are addressed, Ethiopia can strengthen its position in the market. Nevertheless, the initial condition is to effectively implement the newly formulated ABS legislation. In many interviews, especially with staff from IBC, it was mentioned that Ethiopia is a weak country regarding the negotiations, but also regarding the monitoring. Besides, Ethiopia has no private sector (e.g., breeding institutions and seed enterprises) using genetic resources. This also weakens the country's position (Feyissa 2006, 13).

The advancement of the implementation of the African model law in many African countries and the stronger co-operation of these countries can increase the bargaining position of Ethiopia. Besides, in the international negotiation process Ethiopia represents the African countries and strongly stands up for the implementation of an international regime, but on the national level things look different. After establishing a clear-cut legislation, Ethiopia can use its strength on the international level to improve its position.

Like in the other case studies the access to ex-situ collections in other countries and the access to material stored pre-CBD adoption are not regulated, and companies still can recourse to these collections. A lot of material with Ethiopian origin has already left the country before a legislation will finally come into place. This was underlined by many interviews. In this case Ethiopia depends on regulations on the international level that can address the problem.

6.3.10 Conclusions

It is obvious that the Ethiopian forest and genetic resources should be preserved. Therefore, strategies have to be implemented aiming at this goal. The final implementation of the ABS regulations could work and contribute to their conservation if the critical factors can be addressed and specific institutional arrangements exist that ensure the performance of the necessary tasks. Even if the proclamation has been adopted, detailed rules are not existent, as e.g., how the benefit-sharing is going to be implemented. The absence of implementing measures is problematic and can be the main reason why it might be difficult to enforce provisions of the legislation. Nevertheless, the guidelines pave the way for a better approach compared to the one that was carried out until now. They include many important issues and integrate experience that was already made in other countries, as for example, the regulations regarding national research. Based on these guidelines, IBC has the potential to evolve to an adequate ABS institution if it receives support for capacity development. With such an institution, chances are given to establish ABS as a conservation concept in Ethiopia. This will require time and sufficient financial resources and capacity development.

Table 22: Overview on Ethiopia and the critical factors

	Ethiopia
Property rights	No private property rights system, but communities are strengthened Benefits are to be shared between government and communities (50:50), but no distribution mechanisms No IPRs on biological resources
Asymmetric Information	No pre-contractual, but post-contractual problems ABS regulation only addresses post-contractual problems on the provider side (e.g., export control, joint research, document from competent authority in user countries)
Time lags	Country strongly focuses on non-monetary benefits Participation in research and development
Good governance	General unstable situation Just recently, the country has adopted an ABS regulation despite the country's efforts regarding the African Model Law
Administrative complexity	IBC is an excellent institution and is suitable to be the institution responsible for ABS Too many institutions involved
Market structure	No experiences: weak market position African Model provides opportunities to strengthen African countries as a coalition

The most critical factor in the Ethiopian system are the property rights. Due to the lack of adequate property rights and appropriate land-use policies, it is unlikely that an ABS regime can address the problem and effectively contribute to the conservation of biodiversity in Ethiopia. The other critical factors are also hardly affected. Even if Ethiopia considers them in the new Proclamation, the country lacks the capacity to effectively implement the provisions. Ethiopia needs support from other African countries, but also from industrialized countries to set up an efficient system. To ensure legal security the responsibilities have to be clearly defined and the number of interfering institutions has to be reduced. The new proclamation and concentration of responsibility to IBC is a step in the right direction. IBC has the potential to work as a reliable partner for interested companies. The institute is the center of biodiversity activities in Ethiopia, and has experiences and capacities to increase users' interest in bioprospecting in Ethiopia. With the proclamation on ABS, Ethiopia has gained a good instrument that can strengthen the role of IBC, but it needs more to advance Ethiopia with regard to ABS and biodiversity conservation. The institute needs political and financial support to fulfill its task and to fully implement the Proclamation.

ABS needs to be integrated in a broader conservation program, which is politically supported. Policy and institutional deficiencies hold back these developments. The national government of Ethiopia is embarking on a decentralization of political power. The responsibilities to establish, manage, and utilize forests and most of the protected areas have been passed on to regional governments who struggle with low technical and management capacity to execute the new responsibilities (Leykun Abunie 2000). The decentralization process was carried out so quickly that the regions were not at all prepared for the new tasks, mainly without adequate financial and human resources.

6.4 EU and Germany

The EU, with a special focus on Germany, serves as an example for a group of user countries. The analysis of the EU and Germany complements the study. Whereas the other three case studies represent provider countries, the analysis of the EU focuses on the user side that has been neglected so far. However, in an international regime the user dimension is the second pillar beside the provider dimension. The analysis follows up the previous investigations of the three case studies. The developed analytic framework, based on the critical factors and the potential measures, is exercised in the EU context with a special focus on Germany in order to prove and illustrate its applicability. First of all, the case study methodology is presented. Then, a short introduction to the role of the EU and Germany is given. The main part of the analysis is the application of the critical factors to the EU case. Taking into account the established analytic framework regarding the effectiveness (cf. chapter 5) it is looked at how the critical factors are shaped and how they are already addressed in the EU and through its regulatory framework. The analysis of the EU case study finishes with a short case study conclusion.

6.4.1 Case study methodology

When discussing ABS issues and using the terms of user and provider countries, the main criteria of distinction are the amount of biodiversity in the country and the occurrence and development of biotechnological, pharmaceutical and agricultural industry. Due to the unequal distribution of resources and research and development capacities in the world, biodiversity-rich developing countries are classified as provider countries and most of the industrialized countries as user countries. However, the distinction and the generalization cannot be held in all cases. For example, Australia is an important provider genetic resources, whereas Brasilia has a highly developed biotechnology and agri-industry sector (Barber / Johnston / Tobin 2003, 18). User countries are characterized as countries that have a high demand for genetic resources and capacity to use them in research, development and commercialization disregarding if they also provide biodiversity. Users are those agents that import or use genetic resources for commercial or scientific purpose. User countries reflect the competent legal and political authorities under which jurisdiction the users of genetic resources act and operate (Barber / Johnston / Tobin 2003, 18). User measures are understood as a package of legal, administrative and policy measures designed to promote compliance by users of genetic resources and traditional knowledge with obligations regarding prior informed consent, mutually agreed terms, and benefit-sharing. These measures can be applied by either the private or public sector and may be mandatory or voluntary (CBD 2002, 17).

In the following chapters, different user or user country measures, with regard to the analysis in chapter 5.2.2 and their implementation in the EU, are investigated based on literature and activity review. It is analyzed if the introduction of these measures can fulfill the requirements, which are derived from the identified critical factors. As already indicated, there is a wide range of user measures that promise to support the objectives of the CBD and that can be applied in the private and in the public sector. The introduction of such measures requires different degrees of intervention in the existing situation on part of the governments of user and provider countries as well as on part of the providers and users themselves. In the following, selected user measures are evaluated with regard to their feasibility, efficiency, interrelationships and their potential to address the critical factors.

On the one hand, the considered measures are corporate and institutional policies and codes of conduct, the initiation of voluntary certification schemes (mostly applied in the private sector), as well as the establishment of a Clearing House Mechanism. On the other hand, the measures are National Focal Points, the monitoring of IPRs applications, certificates of origin, and the implementation of conflict resolution, arbitration and redress mechanisms, which are exclusively applied in the public sector. The list of user measures considered here is not exhaustive, but it contains user measures which are intensely discussed in the international arena and which in the author’s view promise the most success concerning implementation and targeting.

6.4.2 Introduction

The EU is an important community of user countries of genetic resources in research and product development and possesses substantial commercial research and development capacity. European life sciences industry constitutes an important sector of the European economy (EU Commission 2003, 6). In 1993 the Community joined the CBD as a member and is committed to the implementation of its provisions, including ABS. Responding to developing countries' requests, the EU supported in the fourth COP to the CBD (in

Bratislava, 1998) the launching of a negotiation process on the question of ABS to explore options for access to genetic resources and benefit-sharing on mutually agreed terms. This process led to the adoption of the Bonn Guidelines on ABS, a set of detailed, voluntary provisions, which should help to implement the ABS provisions of the CBD (EU Commission 2003, 7). Some member states, as for example Norway and Germany, have been active in addressing provider countries concerns and request by financing ABS governance research projects and establishing and supporting the introduction of user measures.

The German user survey revealed that German users generally support user measures, which are currently being discussed at the international level, as e.g., the governmental support of ABS projects, certification systems, certificates of origin, disclosure of country of origin, codes of conduct, international standardized ABS contracts, and central information offices (focal points). German users consider instruments in form of services, which have less impact on their activities, as more useful than measures regulating their handling of genetic resources. A central information point in Germany, which actively informs about access possibilities and conditions in provider countries and assists in approaching the latter, is considered the most useful instrument (Holm-Mueller / Richerzhagen / Taeuber 2005, 50-53).

6.4.3 Property rights and intellectual property rights

Disclosure of origin has been identified as a strong instrument to balance the property rights distribution between user and provider country. In some countries, both user and provider countries, the concept has already been implemented as a stand-alone disclosure requirement. This means that non-compliance does not affect the patentability or enforceability of a patent. Besides, the consequences of non-compliance lie outside the ambit of patent law. Denmark and Norway have followed the approach. The non-compliance of the disclosure requirements does not affect the handling of a patent or the validity of a patent. Belgium has recently introduced a formal requirement for disclosure of geographical origin. Theoretically, failure to comply with this requirement could result in the patent application not being processed. However, the Belgian patent office does not check compliance, as it is not a searching authority, and so this would be an unlikely occurrence. For patents that have been granted, wrongful disclosure would not affect their validity, but could result in a fine. Switzerland has proposed similar legislation. Under their draft legislation, non-disclosure would lead to rejection of a patent application and wrongful disclosure would be an offence to be prosecuted ex officio, the applicant being liable to a fine. The provider countries have stronger regulations. In the Andean Community, Brazil, Costa Rica, and India the failure to disclose geographical origin and/or PIC will result in rejection of the patent application or its subsequent nullification (Chatham House 2006, 2-3).

The European Community (EC) Directive 98/44/EC on the legal protection of biotechnological inventions specifically considers ABS. The Directive encourages patent applications to include information on the geographical origin of biological material, but it is non-binding of voluntary nature (Directive 98/44/EC, Recital 27). This provision supports compliance with national legislation in the source country of biological material and with contractual arrangements governing the acquisition and use of that material. It is without prejudice to the processing of patent applications or the validity of rights arising from granted patents (Straus 2001, 161).

Furthermore, in the European patent law a regulation already exists that is not aiming at the disclosure of origin of genetic resources as an instrument to monitor compliance with the CBD, but rather as an instrument to enable the reproduction of the invention. The EC Directive 98/44/EC states that where an invention involves the use of or concerns biological material, which is not available to the public and which cannot be described in a patent application in such a manner as to enable the invention to be reproduced by a person skilled in the art, the description shall be considered inadequate for the purpose of patent law, unless the application as filed contains such relevant information as is available to the applicant on the characteristics of the biological material deposited (Directive 98/44/EC, Article 13(1)b). In this case the disclosure of origin serves the only purpose to enable persons to reproduce the invention and would only be applied in few cases (EU Commission 2003, 17).

6.4.4 Information asymmetries

Post-contractual information asymmetries on the provider side (due to the lack of monitoring capacity) can be addressed by certain user measures, which the EU has already partly implemented and developed. They are corporate and institutional policies and codes of conduct, voluntary certification schemes, National Focal Points and the CHM, and the promotion of co-operation and standardized contracts.

I. Corporate and institutional policies and codes of conduct

In the EU some stakeholders' initiatives exist in order to develop and implement policies and codes of conduct, which comply with the CBD and national ABS legislation in provider countries. Scientific research institutions and networks of ex-situ collections in the EU have developed institutional policies and codes of conduct on ABS to facilitate the acquisition and exchange of genetic resources in accordance with applicable national and international law. Important initiatives have been taken by European botanic gardens, microbial culture collections and germplasm collections (EU Commission 2003, 10).

The "Principles on access to genetic resources and benefit-sharing for participating institutions" developed under the auspices of the Royal Botanic Gardens, Kew and involving 28 botanic gardens from 21 countries is an important example, as well as the International Plant Exchange Network (IPEN). IPEN is an exchange system for botanic gardens according to the CBD and has been developed by the Verband Botanischer Garten (an association of botanic gardens in German speaking countries) on behalf of the Federal Ministry of Environment, Nature Conservation and Nuclear Safety. Botanic gardens that wish to join the network must sign and abide by a Code of Conduct that sets out gardens' responsibilities for acquisition, maintenance and supply of living plant material and associated benefit-sharing. The botanical gardens themselves impose the control of admission, conservation, and dissemination of genetic resources. The objective of this initiative is to promote the conservation and sustainable use of biodiversity, to comprehensibly document living plant material in order to secure the rights of the countries of origin in accordance with the CBD, and to strengthen the mutual trust with the countries of origin so that the access to genetic resources and its use are guaranteed for the future (Holm-Mueller / Richerzhagen / Taeuber 2005, 24).

The project "Micro-organisms Sustainable Use and Access Regulation International Code of Conduct (MOSAICC)", which is financed by the EU and has been developed by the Belgian Co-ordinated Collections of Micro-organisms (BCCM) conjointly with 16 international organizations, is another example. MOSAICC is a code of conduct developed to facilitate access to microbial resources and to help partners in developing practical agreements when transferring microbial resources. MOSAICC provides a system based on the identification of the in-situ origin of microbial resources via PIC and the monitored transfer of the resources and material transfer agreements defined by provider and user. It is already frequently used by institutions using microbial resources (BCCM 2007).

Some European pharmaceutical and biotechnology companies have developed corporate policies on ABS. Other smaller sectors, including horticulture and botanical medicines, do not seem to have developed comprehensive corporate or sector-based policies on ABS (EC 2002, 34).

II. Voluntary certification schemes

The gaining of reputation of bioprospecting companies would be the simplest measure to establish confidence between partners and overcome the problem of asymmetric information. On the user side, some large pharmaceutical companies (e.g., Merck) have already improved their image by concluding ABS agreements in compliance with the CBD. But even if the market for genetic resources is dominated by a few companies, a large number of small biotech firms still exist in there and there is a growing tendency of large, established pharmaceutical, agricultural and other life science companies cooperating with these smaller, start-up biotechnology research companies (Hill 1999). These small start-up research companies are new in the market and lack the time to gain reputation. The participation in a certification system can improve the user's reputation and provide the basis for provider countries to feel more confident about their potential partners. However, in reality they are not sufficiently applied.

The EC Eco-Management and Audit Scheme (EMAS) offers an interesting example that should be considered for the development of voluntary certification schemes for organizations complying with the CBD, Bonn Guidelines and national ABS regulations. Nevertheless, so far it does not receive much attention. EMAS is a voluntary scheme for organizations and was established for the evaluation and improvement of the environmental performance of organizations, and the provision of relevant information to the public and other interested parties. It is open to any organization in the public and in the private sector in the EU (Regulation (EC) No 761/2001, Art. 1/3,1). The participation in EMAS requires the conduction of an environmental review considering all environmental aspects of the organization's activities, products and services, the establishment of an effective environmental management system, the carrying out of an environmental audit, and the provision of an environmental statement (Regulation (EC) No 761/2001, Art. 3, 2). The direct and indirect environmental aspects that have to be considered include, e.g., emissions to air, the use of natural resources and raw materials, and effects on biodiversity (Regulation (EC) No 761/2001, Annex VI).

The European Commission has developed guidance on the identification of the environmental impacts and on the assessment of their significance that can be used by companies and research institution to identify significant direct and indirect impacts of their activities on the conservation and sustainable use of genetic resources (EU Commission 2001a).

The application of EMAS in the ABS process seems to be appropriate. The principles formulated in the CBD and in the Bonn Guidelines could be incorporated in organizations' environmental policies and environmental management systems established under EMAS and could then be reflected in their environmental statement. The independent environmental verifiers accredited under EMAS would control the reliability, credibility and correctness of the data and information in the environmental statement. EMAS is based on the international standard ISO 14001 as its basic management system and goes even beyond in relation to public transparency, credibility and environmental performance (EU Commission 2003, 23). The application of EMAS could support the setting up of an international certification system for genetic resources, as it is discussed in the CBD, with useful information and experiences. A modified EMAS could be implemented in other user countries.

III. National Focal Points and the Clearing House Mechanism

National Focal Points in user countries as well as CHMs increase transparency and trust especially when information deficiencies may compromise the relationships between provider and users.

The EC-CHM is an important portal and database regarding biodiversity issues. However, it is rarely known and not frequently used by users. In September 2005, the EC has launched the EC ABS Portal (EC 2007). It provides information on European policy and legislative measures related to ABS as well as links to web pages of international organizations that are active in this field. The Bonn Guidelines can be found in different European languages. As a network platform it shares details of contact points in all the Member States of the European Union and links to information on ABS in the Member States. This portal is a significant improvement of the European information policy. However, the utilization of such a portal requires the readiness of stakeholders to provide informational documents as well as publicity among those. Until now, this portal is also rarely used.

Most member states of the EU have designated national CBD and/or ABS focal points. The EC-CHM provides access to some but incomplete information on policies, legislation, funding opportunities, databases, sources of expertise, etc. held by European Community institutions. It publicizes links to other European institutions and organizations (i.e., governmental, private and NGOs) keeping useful information. It also links to web sites of global organizations such as the CBD Secretariat’s web site and CHMs of EU member states (e.g., Belgium, France, Germany). National CHMs play a very important role to inform users on biodiversity-related issues and ABS in their own language. Recently, Germany has launched a new ABS portal in addition to its CHM (BfN 2007). The portal provides essential information on ABS for German citizens and especially users.

IV. Promotion of co-operation and standardized contracts

Governments of user countries can support the development and execution of projects aiming at the promotion of co-operation between users and providers and the development of standardized material transfer agreements. Governmental institutions monitor these projects and can ensure that users comply with the CBD. Providers will be more confident about their partners if the ABS negotiations take place in the framework of such a project and facilitate access. By participating in such projects users can gain reputation and constitute a positive example (Holm-Mueller / Richerzhagen / Taeuber 2005, 25).

The Federal German Ministry for Education and Research (BMBF) finances the project Process-oriented development of a model for equitable benefit-sharing for the use of biological resources in the Amazon Lowlands of Ecuador (ProBenefit). The main participants in the project are German institutions (Institute of Biodiversity, University of Göttingen), the Association of German Engineers, and a German company, one of the leading manufacturers of phytomedicines worldwide. The objectives of ProBenefit are to develop a model agreement on equitable benefit-sharing in Ecuador's Amazon region, to explore the potential for using medicinal plants and develop possibilities for sustainable use of these plants. ProBenefit started in June 2003 and has a planned term of about 5 years. Until now, only an agreement with the indigenous organization Federación de Organizaciones de la Nacionalidad Kichwa del Napo (FONAKIN) has been reached. This organization supports the negotiation process with concerned indigenous communities. No ABS agreement has been signed so far (ProBenefit 2007).

6.4.5 Accounting for time lags

Technology transfer is the most relevant non-monetary benefit. It can address the time lags between the bioprospecting activities and the development of a marketable product.

The EU has the potential and the possibilities to transfer technology to provider countries. However, no data are available to draw conclusions about the actual implementation. In the EU no policy measure exists addressing especially technology transfer and ABS. Technology transfer is supported through general rules of competition, partnership agreements, and framework programs for research and development. In the EU technology transfer is very diverse and carried out on member state level. In Germany several hundred institutions in different sectors (government-based international co-operation sector, science sector, governmental sector, private sector, and non-governmental sector) are actively dealing with aspects of biodiversity technology transfer (Paulsch et al. 2004, 4). In the EU no legislative and policy measure exists that specifically addresses research and technology transfer under the CBD. The EU Declaration ratifying the Biodiversity Convention highlights technology transfer and access to biotechnology in accordance with CBD Article 16 and in compliance with IPRs (EC 2002, 8).

The Decision No 1513/2002/EC of the European Parliament and the Council of 27 June 2002 concerning the Sixth Framework Programme of the European Community for research, technological development and demonstration activities sets up rules with regard to international scientific co-operation, technology and knowledge transfer and human resources. It stresses the importance of the consideration of developing countries' interests (EU Parliament and Council 2002). These proposed rules do not, however, incorporate provisions on ABS in the context of the CBD (EC 2002, 14).

The Partnership Agreement between the Members of the African, Caribbean and Pacific (ACP) States and the European Community and its Member States (Cotonou Agreement) could also enable technology transfer under ABS partnerships between EU institutions and countries that provide genetic resources. A Compendium on Co-operation Strategies is part of the agreement and provides strategies and guidelines for scientific, technical and research co-operation. Especially the section Scientific, Technological and Research Co-operation of the Compendium stresses the importance of the strategies with regard to the implementation of research and development projects and programs established by the ACP States, the establishment and promotion of activities aimed at the consolidation of appropriate indigenous technology, and the acquisition and adaptation of relevant foreign technology promotion of scientific and technological co-operation between ACP States themselves, between ACP States and other developing countries, and between ACP States and the European Community and its Member States (EU Commission 2001b, 35-36). Additionally, the Compendium states that ACP/EC collaboration shall continue to stimulate partnerships between all sectors of society, both users and generators of knowledge. It stresses that co-operation should support the efforts of the ACP states to create and develop technology and research (EU Commission 2001b, 36).

6.4.6 Good governance in provider countries

So far, good governance has only been discussed in the providing countries. Through development and foreign policies user countries can support measures aiming at stabilizing general political security, but also support the development and implementation of biodiversity and ABS laws. Nevertheless, it is difficult or even impossible for the EU to ensure that the regulations are actually enforced. Therefore, the influence of the EU and its possibilities to positively contribute to this critical factor are very limited.

6.4.7 Administrative Complexity

The EU cannot directly influence problems related to administrative complexity, except through the support within development co-operation. However, National Focal Points and CHMs have a positive effect on the administrative complexity in provider countries. By implementing certain user measures, the EU can assume some responsibility in the process and lessen the burden of the provider countries. For example, the National Focal Points of an EU member state could inform potential users about the ABS regulation in provider countries. Besides, they issue some kind of document to the user, which they can use as a proof of registration as required in the Ethiopian Proclamation. Besides, National Focal Points and CHMs in user countries can support the exchange of information and experiences in ABS issues. They also can establish contacts to National Focal Points and authorities in provider countries and therefore facilitate the establishment of contacts among the users. By informing users, which are often insufficiently informed regarding ABS, about their obligations the National Focal Points relieve the provider countries.

The German user survey revealed that German users of genetic resources are poorly informed about the international legal framework of access to and use of genetic resources, and not familiar with CBD terms. Many users, regardless of the size of their company or institution, do not know the Convention and the meaning of the terms “Access and benefit-sharing”, “National Focal Point/National Competent Authority”, “Clearing House Mechanism”. However, users are aware of this situation. More than half of the users who know of the CBD consider themselves not sufficiently informed. The lack of knowledge and information is differently distributed among the sectors. Public institutions (i.e., ex-situ collections, universities, and other research institutions) are more familiar with the terms and feel better informed than private institutions and companies. The main channels through which users obtain information are secondary sources: the internet, associations and scientific journals. National authorities in Germany or in the countries of origin are of minor significance as source of information (Holm-Mueller / Richerzhagen / Taeuber 2005, 59).

Through the initial work of the focal points through CHM or other media in user countries, the competent authorities in provider countries that are often overburdened with the complex ABS issues can be relieved.

6.4.8 Market Structure

The transfer of technology from the EU to provider countries, which has been explained in chapter 6.4.5, will certainly increase their position in the market both among other providers but also towards users. Through technological improvement, provider countries are enabled to use the country's biodiversity for research and development or even for commercialization. If it is possible to establish and technically equip research facilities in provider countries, they are able to offer more processed and higher valued genetic material in the market instead of raw genetic material. Positive effects on economic development can be expected. Furthermore, technology transfer related to biodiversity conservation and environmental protection has a positive influence on the environmental situation in the provider country.

6.4.9 Conclusions

The EU is taken as an example for an important community of user countries of genetic resources in research and product development. The life sciences industry constitutes an important sector of the European economy and has a considerable demand for genetic resources.

User measures can take effect where providers' influence and capacities are very limited. They can benefit users and providers and have the potential to advance the international governance of ABS. On the policy level, some European user measures are already implemented or being intensely discussed and designed. They can serve as an example for the introduction of user measures in other user countries even if they are still in the development stage. The EU's user measures address the factors, which have been defined as critical for an effective international ABS regime that aims at conservation, access, and benefit-sharing. Scientific research institutions and networks of ex-situ collections in the EU have developed institutional policies and codes of conduct on ABS to facilitate the acquisition and exchange of genetic resources. They increase user transparency and facilitate users' acquisition activities. There is probably less need of other compliance procedures. By transferring important technologies, the EU member states can bridge the time lags between provision and compensation and strengthen the bargaining position of provider countries. Voluntary certification schemes like EMAS and the monitoring of the use of genetic resources in research and development and IPRs applications help to verify the transparency of the ABS process and the compliance with the CBD obligations. Furthermore, they remove information deficiencies on the part of providers and users. The creation of a National Focal Point is important as an official contact for applicants and for information dissemination. The same applies to the CHM. Moreover, the Clearing House Mechanism supports scientific and technical co-operation through the provision of an information management and exchange system. Conflict solution and redress can be reached through the traditional, already existing systems.

Table 23: Overview on the EU (Germany) and the critical factors

	EU - Germany
Property rights	Encouragement: disclosure of origin in order to comply with the CBD, but also to enable reproduction of the invention
Asymmetric Information	Few examples of corporate and institutional policies and codes of conduct (e.g., botanical gardens, microbial collections) Application of voluntary certification schemes not sufficient National Focal Points and the European CHM Promotion of co-operation and standardized contracts (e.g., ProBenefit)
Time lags	Technology transfer is carried out, but not sufficient to solve problem
Good governance	Only support through development co-operation
Administrative complexity	National Focal Points can release provider countries by informing and preparing users
Market structure	Technology transfer can enable provider countries to offer value-added products (increased market position)

The EU's activities regarding the disclosure of origin can be seen as very limited, since they rely on a unilateral and voluntary system. Here, a multilateral system with a self-standing disclosure requirement in patent application is preferable. Within such a system, providers of genetic resources who have granted access to their resources would have the opportunity to observe the utilization and commercialization of the provided genetic material outside of their territory. The establishment of such a multilateral system, attached to the TRIPs Agreement, the PCT or the Patent Law Treaty (PLT) seems to be impossible because of the difficult negotiations in the WTO or WIPO. Therefore, policy-makers should support the development of a binding disclosure requirement in patent applications in the EU - probably as a formal condition for patentability. It can improve the situation and pave the way for a multilateral solution.

When looking at the EU as an example, it has to be considered that in the international negotiations about ABS the EU has always appeared as an ABS supportive party of the CBD responding to developing countries requests. Therefore, the EU's activities regarding the establishment of user measures are not surprising. However, the EU case allows drawing important conclusions, which can be applied to other user countries. The analysis of the user measures shows that many actual and potential measures do not require the development of new national or international laws and regulations or the development of new and complex institutions. This plays an important role for their feasibility. Rather it can be concluded that user measures can be implemented by the adjustment and modification of existing systems in the area of voluntary certification, monitoring of IPRs, and certificates of origin. The implementation of user measures in user countries should provide effective and feasible measures regarding the ABS objectives of the CBD and not hindering the utilization and the trade of genetic resources. Therefore, these measures have to be designed in such a way to avoid the creation of time-consuming and bureaucratic regimes aligned with high transaction costs.

Even if user countries outside of the EU do not have the same institutional and legislative environment as EU member states, they should consider the European measures experiences when designing and implementing user measures within their territory. User measures play a significant role in an international ABS regime to support the compliance with the obligations and responsibilities arising out of the ratification of the CBD. Only then a fair and equitable benefit-sharing can be realized.

7 Conclusions

Since 1992, ABS has been promoted as a promising concept to halt the on-going loss of biodiversity. However, the success has failed to appear so far. Biodiversity is still declining, ABS has only been implemented in about 20 countries, and only a few successful cases have been reported. Researchers and industry relying on wild genetic resources complain that access has been restricted and provider countries complain that no shared benefits have been channeled to the resource countries and holders and that their genetic material is still used without approval. Therefore, it is legitimate to raise the question how has the ABS regime to be designed to reach effectiveness.

To answer this question the study establishes an analytic framework to measure the effectiveness of the ABS concept on the national and regional level. The effectiveness is the capability of the ABS regime i) to set incentives for the sustainable use and the conservation of biodiversity, ii) to facilitate access to plant genetic material and iii) to enhance a fair and equitable benefit-sharing, which also implies the prevention of the misappropriation and unapproved use of genetic resources. Six critical factors determine the level of effectiveness and the realization of these objectives. They are property rights, asymmetric information, time lags, good governance, administrative complexity, and market structure.

User and provider countries have different options to develop and implement measures that have the potential to address the critical factors and thereby to improve ABS governance and form an international regime. The measures can be differentiated by the party that is mainly responsible for its implementation. User measures are implemented by users and provider measures by providers, but most measures depend on the commitment of both sides or are interlinked. The respective provider measures are the assigment of property rights, compensation schemes, institutional strengthening, coalitions, screening, and signaling. The respective user measures are monitoring of IPR applications, documentation of gene flow, certification schemes, corporate and institutional policies, National Focal Points and Clearing House Mechanisms, projects and model contracts, technology transfer, and conflict resolution. In the following, the main results of the study regarding the relationship between the critical factors and the provider and user measures are illustrated.

7.1 ABS and the critical factors

The ABS concept is still suffering from the high expectations providers and environmentalists had when it was developed and integrated into the CBD. In the beginning of the 1990s, genetic resources were considered as green gold that has high economic value due to its genetic potential. It was hoped that if the share of the benefits arising out of the utilization of genetic resources flows back to provider countries, it will facilitate access to genetic resources and set incentives for conservation and make destructive activities less economical. However, it can be observed even without the deeper insights of the case studies that these anticipations have not turned into reality. Not many contracts have been concluded during the last fourteen years and the concluded contracts have not generated sufficient incentives to stop the on-going loss of biodiversity. This is the point of departure of this study. The question arises whether the ABS is a silver bullet that can effectively contribute to the reaching of its promises that are i) facilitated access to the genetic resources, ii) conservation of biodiversity and iii) the fair and equitable benefit-sharing. The latter implies the prevention of the misappropriation and unapproved use of genetic resources. Only if the three elements are positively affected by the critical factors the approach is effective.

In general, it can be concluded that despite its overall disappointing experiences ABS is a useful concept that can contribute to the three goals. The CBD and ABS have improved the situation. Before, biodiversity was considered as common heritage and treated as an open access resource. The tangible resource as well as its intangible components have suffered from exploitation. The ABS concept in the CBD can accomplish two important things. Firstly, it allocates the responsibility for acting to the provider countries. Through the principle of self-sovereignty, provider countries are not only responsible, they also receive the autonomy of decision. Secondly, it internalizes a part of the total economic value of biodiversity: the commercial value of genetic resources and its contribution to research and development. Other values are not considered. Users of genetic resources have to share the benefits they gain from the use. Therefore, it is clear that ABS alone is never sufficient to provide an incentive for biodiversity conservation. It has to be embedded in a comprehensive strategy that internalizes other values beside the commercial value. Moreover, ABS does not only take effect in one dimension. Besides its impact on access, conservation and benefit-sharing, ABS can have large-scale impacts on provider countries' economic and social situation. It has the potential to alleviate poverty and support economic development. For example, if ABS attracts foreign direct investment, drives the establishment of new industries and supports the improvement of the research potential it can assist countries in their development goals. Therefore, ABS needs to be seen in a much broader sense of sustainable development and cannot be reduced to only environmental objectives. For example, Costa Rica is the case that shows that ABS has supported the country's will and capability to establish and advance a research institution.

The CBD and the ABS concept raised awareness about biodiversity and provided environmentalists and policy-makers with economic arguments to conserve the biological diversity. As the Stern report, which caused a stir, showed economic arguments are much better perceived than any other by the decision-makers and the population.

Having the limitations of internalization in mind, the theory suggests that the approach is still very promising within this defined scope. However, the reality shows different results but the reasons for this divergence have not been analyzed in the relevant literature. This study provides a new analytical framework to measure the effectiveness by six determinants, (property rights, asymmetric information, time lags, political and legal security, administrative complexity, and market structure). The ABS concept itself is very sophisticated and it is a long way from theory to practice. The analysis shows that due to the interlinkages of the determinants and the possible instruments and measures providers and users have to address the shape of the critical factors. The ABS concept is very complex. There is no "perfect" or "optimal" specification of the critical factors. However, some rules of performance can be formulated that the critical factors should follow. It always depends on how specific critical factors and undertaken measures can jointly take effect. Therefore, it is necessary to consider both sides. Even if a critical factor indicates a poor performance of a country when the right provider or user measures are in place, the result can be satisfying. However, based on the analysis some striking statements can be made regarding the specification of the critical factors.

Property rights including intellectual property rights, and especially their strength and how they are distributed among the stakeholders (providers and users), are the most relevant critical factor in the ABS concept. Property rights impact all three elements of ABS effectiveness: conservation, access and benefit-sharing. If property rights are not allocated, resource holders cannot grant access and benefit-sharing does not take place. Property rights enable property owners to market the resources. Only if the agents responsible for conserving biodiversity have adequate property rights over the biological resources, they can grant access, and they are in the position to receive benefits that in the next step establish incentives for biodiversity conservation. If the property rights situation in a country is not sufficient, a national trust fund can guarantee a fair and equitable benefit-sharing.

Intellectual property rights take effect on the other end and provide users with strong rights after a product has been developed. The balanced distribution of property and intellectual property rights is essential. Property rights or intellectual property rights must be placed at those levels that are most effective at maintaining and investing in the concerned asset, and adequate compensation payments must occur real-time to make other destructive uses less profitable. The approval of intellectual property rights has to ensure that such rights are only granted if material has been obtained legally. The disclosure of the origin when users of genetic resources apply for a patent is an appropriate instrument. Certificates of origin issued by provider countries can be used as the relevant document to prove that the material was legally obtained.

Asymmetric information is the second important critical factor. In the form of pre-contractual and post-contractual problems, it impacts all three elements of effectiveness. Information deficiencies are reciprocal. They occur on both sides, on the user and provider side. Providers have information deficiencies regarding the expected benefits genetic resources will deliver and the factual utilization of the material once users have them. Providers cannot estimate the value of the expected benefits and ask for unrealistic benefits. As a consequence, no contracts are concluded. To address the problem more economic studies on the commercial value of genetic resources have to be undertaken and more contracts have to be published. Model contracts and projects and economic assessments can put the negotiations on a solid basis.

Providers cannot observe the use of the provided material. Worried about the unapproved use, provider countries over-regulate and stop trading genetic resources. To confirm their eligibility users can signal their willingness to comply. Besides, providers can screen users with specifically designed contracts.

Users lack information regarding exclusivity, quality and the utilization of the received benefits and react with a country substitution if the deficiencies are too obvious. Users can also screen providers to ensure the provision of better quality. This is especially relevant when the role of intermediaries grows. All scenarios can lead to a situation in which access, conservation and benefit-sharing does not take place. Adequate conflict resolution mechanism enable trust building among users and providers, since providers can rely on support if their rights are compromised.

Time lags strongly impact the effectiveness elements of conservation and benefit-sharing. If the timeframes between the collection and the flow of benefits is too large, no incentives for conservation are stipulated. Adequate compensation schemes or fund solutions can address the problems. Up-front payments need to be included. However, many companies, especially small ones, are not able to make payments in advance. Therefore, a fund solution would be adequate. Users of genetic resources have to make some advance payments into this fund and from then on all the payments can be channeled through the biodiversity trust fund managed by representatives of all stakeholders. This group can even decide on the distribution among the provider. In this case, the payments are uncoupled from the national property right distribution.

The next two critical factors are highly relevant from a transaction cost perspective as asymmetric information. **Good governance** plays an important role for the transaction costs that arise in the access phase of ABS. The general transaction environment is important, especially if users collect the material themselves. Costa Rica is a good example for a developing country that offers high legal and political security. Furthermore, it is also important whether the provider country has already implemented a clear ABS regulation. Otherwise, users react with country substitution. The strengthening of institutions and political systems as well as the support of the formulation of laws facilitate the development of good governance.

Administrative complexity is another aspect of governance and mainly impacts the access phase. It can heavily increase users' transaction costs. Competent, multifunctional institutions in provider countries are required to design and allocate rights, manage conservation areas, coordinate activities, negotiate ABS contracts, control compliance and sanction misappropriation regarding the use of genetic resources. Many developing countries lack such institutions. Institutional strengthening in provider countries and streamlining of ABS policies and procedures is therefore very important. The introduction of documentation systems, as e.g., certificates of origin, can support such processes.

Finally, the **market structure** also impacts the access objective of ABS. To reach a fair and equitable benefit-sharing, the negotiations on ABS have also to be fair and undertaken by equal partners. Due to the market conditions provider countries are in a weaker position. However, although the industry argues that genetic resources have become less important recent data indicate that, for example, in Germany users expect to constantly use genetic resources or even expand the use. However, the existence of ex-situ collections, providing material that was collected before the CBD was adopted, is an alternative for users and weakens the bargaining position of providers. Coalitions, as e.g., the group of megadiverse countries, are an option to strengthen the position of providers in the market. The same applies to the use of model contracts and model projects on ABS (e.g., ProBenefit).

It is obvious that the analyzed provider measures can address the critical factors. Most of them are very target-oriented and address only one critical factor. Four out of the six measures (assigning property rights, coalitions, screening and signaling) have only a one-dimensional impact, and one other measure (compensation schemes) has a strong impact on one critical factor, which is time lags, but weaker effects on property rights and asymmetric information. Therefore, a variety of provider measures is necessary if different critical factors cause problems for the ABS effectiveness.

Table 24: Critical factors and provider measures

	Assigning property rights	Compensation schemes	Institutional strengthening	Coalitions	Screening/ Signaling
Property rights					
Asymmetric information					
Time lags					
Good governance					
Admin. complexity					
Market structure					

Strong effect weak effect no effect

Users have a comprehensive set of measures that have the potential to address all critical factors. However, as in the case of the provider measures the instruments can only tackle one or two critical factors. Only the measure "projects and model contracts" promise to be broader instruments since it impacts up to four critical factors.

Table 25: Critical factors and user measures

	Monitoring IPR applications	Documentation gene flow	Certification schemes/ institutional policies/	Focal points/ CHM	Projects/ model contracts	Technology transfer	Conflict resolution
Property rights							
Asymmetric information							
Time lags							
Good governance							
Admin. complexity							
Market structure							

Strong effect weak effect no effect

The user measures have been not only analyzed with a view to their potential to address the critical factors. Other criteria that have to be regarded are if they are feasible and practicable. In the international discussions, the feasibility of user measures is persistently questioned by users. The analysis shows that all measures are feasible. Some are already implemented and applied, as for example, the coalition of group of megadiverse countries on the provider side or the different CHMs on the user side. Some measures are still under discussion or in the development as it is in the case of certificates of origin. However, the analysis makes clear that most of the instruments are not fully effective yet. They need adjustment or have to be applied and used in a better and broader way. Measures that are based on voluntary initiatives and agreements, e.g., institutional policies, projects and model contracts, certification system, can be implemented easier and faster. Measures that require changes in the legal system (e.g., disclosure of origin) are subject to long and taxing political and legislative processes.

7.2 Case studies

The three provider country case studies have proved to be excellent examples of how developing countries deal with the challenge to implement an international concept that aims to protect a formerly open access resource. From many points of view, the case studies differ much and can show the range of aspects that have to be regarded when analyzing the effectiveness of ABS. Costa Rica and the Philippines are pioneers regarding the implementation of the ABS concept. However, they walked on different paths. The Philippines already developed a regulation in 1995, but since then only one commercial agreement has been concluded, whereas Costa Rica has negotiated and concluded contracts on bioprospecting even before the CBD has been in place. The comprehensive legislative frameworks were only adopted in 1998 and in the end of 2003. However, this has not impeded the country to establish a research institute, namely INBio, which successfully conducted more than twenty research projects on bioprospecting. Ethiopia is a late-comer regarding the development and implementation of ABS laws as well as the conclusion of contracts. Only in 2006, an ABS Proclamation has been adopted. However, few bioprospecting contracts have been concluded and Ethiopia is on the way to apply the ABS concept. In environmental terms, Costa Rica was able to improve the situation and slow down deforestation. In the Philippines and Ethiopia the situation is worse. Nevertheless, this positive development cannot only be traced back to the implementation of ABS. The inclusion of ABS in a comprehensive environmental and forest protection strategy and the diversification of applied instruments to protect the forests and internalize environmental costs can rather explain the success.

Based on the case studies this study analyses the strengths and weaknesses of current ABS regimes in provider countries and user countries with a view to the critical factors. On the one hand, in the three provider countries the shape of the critical factors is analyzed in a country-specific context and it is investigated whether they are already addressed and/or gaps are still existent. On the other hand, in the group of user countries potential user measures are identified and analyzed with regard to their feasibility, efficiency, and their potential to address the critical factors.

The **property rights** systems in the three provider countries differ. Especially Ethiopia's approach is very different from Costa Rica's and the Philippines'. In the latter two, the state has the property rights and authority over biodiversity as allocated by the CBD. In the Philippines these rights apply to all forms of biodiversity, whereas in Costa Rica only the intangible material is subject of state property and the tangible material is subject of private property rights. However, in the Philippines the role of the private level is acknowledged and local communities participate through strong PIC requirements, which are already exercised, since the government recognizes the right of private land property. It is regulated that the government receives the bioprospecting fee, and that resource holders receive the up-front payments. In Costa Rica, private landowner and communities can also participate through PIC. However, so far bioprospecting has only taken place on state property and only the government and INBio as an intermediary have received benefits. Therefore, in Costa Rica the experiences are fractional and only partial useful. In Ethiopia biodiversity but also land is under state property. Communities have the right to control access and participate through PIC and benefit-sharing. However, until now this has only rarely been implemented.

Intellectual property rights are a strong counterpart of property rights over wild genetic resources and they are treated differently in the countries. Ethiopia is not a member of the WTO and does not have to comply with TRIPs. All biological resources are exempted from patentability. Both countries the Philippines and Costa Rica are members of the WTO and comply with TRIPs. In the Philippines plant varieties and animal breeds are also excluded from patentability, but the country has adopted a Plant Variety Protection Law as *sui generis*, which strengthen users of genetic resources. In Costar Rica providers are strengthened, since IPR application processes require the submission of a certificate of origin.

User countries have only limited possibilities to impact the critical factor of property rights, since national property rights systems are fully under the control of the national states. User countries can only positively contribute through user measures that address intellectual property rights. Most of the intellectual property rights are granted in user countries, since the majority of products are sold there. On example is the EC Directive on the legal protection of biotechnological inventions, which specifically encourages patent applications to include information on the geographical origin of biological material. However, it is non-binding and has voluntary nature.

In the Philippines both pre-contractual and post-contractual problems are relevant due to **asymmetric information**. Pre-contractual problems are due to the benefits providers expect. Philippine providers expect high benefits. These unreasonable expectations paralyze the negotiations. Post-contractual problems arise on the user side regarding the use of the benefits, exclusivity, and quality. The problem is partly addressed by the new regulation. The use of benefits is defined and less over-regulation occurs due to better monitoring mechanisms. However, exclusivity and quality regarding the provided material are not guaranteed for the users. In Costa Rica pre-contractual problems do not occur, but post-contractual problems on both sides have been recognized and addressed. Users cannot collect themselves, but exclusivity and quality are guaranteed. The received benefits flow to protection areas. In Ethiopia all mentioned post-contractual problems appear and the ABS regulation only addresses post-contractual problems on the provider side through, e.g., increased export control, joint research, and the requirement of a document from competent authority in user countries.

In order to address asymmetric information user countries can signal that they are willing to comply and screen providers, especially intermediaries. In the EU only few examples of corporate and institutional policies and codes of conduct are known. Mainly botanical gardens and microbial collections introduce such policies. Most EU member states have established National Focal Points and CHMs to increase transparency and inform providers and users on existing procedures and activities. The promotion of co-operation and standardized contracts, as e.g., the ProBenefit project are useful examples how user countries can contribute to the mitigation of information deficiencies in the market.

All three provider countries have difficulties with the **time lags** between collection of genetic resources and marketing of a product, and focus more on non-monetary benefits and diversified compensation schemes to address this problem. In the Philippines only one commercial contract has been concluded. However, this contract provided substantial non-monetary benefits for a Philippine research institute. In future, the country will put more weight on up-front payments. In Costa Rica all bioprospecting contracts include regulations for milestone payments and royalties. However, apart from minor up-front payments, Costa Rica and INBio have received no payments so far. Even though, many patents have come out from the INBio-Merck agreement. Ethiopia strongly focuses on non-monetary benefits, e.g., the participation in research and development. Monetary benefits are subordinate. Here it becomes clear that in Ethiopia ABS is considered more as an instrument that strengthens the local research capacities than setting incentives for conservation. User countries in the EU can address the problem by providing monetary contributions for a fund that allows payments that are independent of the commercialization of a product. Another option to bridge the gap and enable providers to offer value-added genetic resources is increased technology transfer.

In Ethiopia and the Philippines **good governance** is much weaker than in Costa Rica, since the general situation not very positive, especially regarding political stability. However, in the Philippines it is hoped that the situation slightly improves due to the revised ABS regulation. In Ethiopia only recently an ABS regulation has been adopted despite the countries efforts regarding the African Model Law. In Costa Rica the picture is different. The country has a stable democratic and political system that favors bioprospecting. Besides, INBio, the ABS framework and the country's experience indicate security and attract users. User countries have only limited influence on the governance of provider countries. Through development co-operation they can support the strengthening of institutions, actors and political processes.

Administrative complexity plays a significant role in the Philippines and is less important in Costa Rica and Ethiopia. There, the access and negotiation cost have been very high for the users and hindered the conclusion of ABS contracts. Especially the existence of the ineffective intersectoral committee, representing the relevant stakeholders, and the long and costly application process has been a problem. The situation will improve through the abolishment of the ineffective intersectoral committee, determined timeframes, and the exclusion of academic research. The committee is substituted by governmental agencies. However, the responsibility is still allocated to different agencies, which makes coordination difficult. In Costa Rica INBio has been the leading agency for bioprospecting, including the application process. INBio, being a non-governmental institution, has worked very efficiently. Due to the regulative changes, administrative complexity will increase with the new intersectoral committee, which is very similar to the one that was dissolved in the Philippines. Ethiopia has mandated the governmental research institute IBC to overview and manage bioprospecting. Before, many institutions were involved in bioprospecting. Since its work concentrates on biodiversity just like INBio, it appears to be very appropriate to handle bioprospecting. It is, just like INBio, excluded from political processes. Therefore, it is expected that the institute will work efficiently.

User countries as the EU can mitigate the burden of the provider countries by informing, e.g., German users on the conditions and regulations in provider countries. National Focal Points can inform and prepare users and release provider countries.

In general, provider countries have a weak position due to the **market structure**. This applies also to the three provider countries case studies. Additionally, ten years of over-regulation have even more decreased the market position of the Philippines. The country is an ASEAN member. Being a member of such a regional coalition can strengthen its position. Beside, the country is also a member of the group of the megadiverse countries. Just as well as Costa Rica. In contrast to the Philippines, Costa Rica was able to improve its market position. The country and INBio have gained a high reputation because they have been reliable partners for bioprospecting and caused low transaction costs to users. Ethiopia's weak position has only slightly, since the ABS regulation has been implemented. Due to the small number of co-operation projects, Ethiopia did not have a chance to increase its reputation and attractiveness by proving reliability and service. The African Model provides Ethiopia and other African countries opportunities to strengthen African countries as a coalition. The EU can support provider countries through technology transfer. This can enable provider countries to offer value-added products and increase their market position.

7.3 Recommendations

What can we learn from this analysis? What are feasible steps that should be taken by the international community and policy-makers to improve the concept and make it work? The analysis of the effectiveness and the perspectives of the ABS concept allow deriving recommendations to improve the ABS concept.

Policy-makers need to initiate studies and analyze the critical factors in their countries and derive particular measures that address them in an adequate way. The analytic framework of this study can support these investigations and can be applied to other countries faced with the implementation of the ABS concept. All these countries, both user and provider countries, need to investigate their own regulative and institutional frameworks and assess the shape of the critical factors: property rights, asymmetric information, time lags, good governance, administrative complexity, and market structure. This information is needed to feed the international negotiations and advance them, but also to streamline the concept domestically. Only having in mind the critical factors an effective implementation is possible.

However, although it has to be tested in deep research, it is obvious that the findings and results derived here are not only limited to the investigated case studies. They have a general and global dimension across the different countries. ABS can only work in an international context. Too much time has passed already in which users and providers are more and more estranged instead of cooperating and creating an effective ABS framework. Only both providers and users can implement the concept and address the critical factors. Therefore, it is necessary to have a comprehensive international regime. The negotiations on an international regime need to be strengthened and successfully put to an end. However, it has to be shaped in a way that it addresses the critical factors.

Not all of the analyzed measures in this study that can be introduced to address the critical factors are negotiatable on the international level, since providers or users do not agree. The measures under discussion are certain user measures, but there is no reason for not including also provider measures so that the international regime is more balanced and users have a higher incentive to agree to some users measures. Furthermore, the interplay of user and provider measures is important. Only an international regime can lay the foundation of an effective interplay. The international regime has to provide the framework and different options. Since the users and providers and the ABS activities are very heterogeneous, an international regime needs to be flexible. It can be expected that only very few mandatory measures will be included in the regime because users will try to prevent the adoption of many commitments. To be effective the regime has not to build on mandatory measures. The analysis shows that a range of measures is necessary to address the critical factors. Therefore, these certain measures need to be implemented jointly with the international regime on a voluntary basis. These provide the flexibility needed.

Some possible approaches have been introduced and explicitly analyzed by this study. They show the point of departure. Some of them are already in place but do not function well. For provider countries it is important to assign property rights. Property rights are the heart of the whole concept. Institutions have to be strengthened and good governance has to be maintained or developed to create a good ABS environment and signal this to the users. Capacity development is very important. Jointly with the national governments, the international community should support capacity development activities. If providers can build up research capacity and increase vertical integration their position in the market will be stronger and as well as their participation in economic benefits. Through the provision of valued added products based on genetic resources, ABS can deliver some of its promises. Provider countries need to strengthen their position in the market and make coalitions work. So far, it seems that the group of the megadiverse countries is too heterogeneous and indecisive. When ABS contracts are concluded, providers have to make sure to accomplish adequate payments schemes, which lead to an apparent fair and equitable benefit-sharing. To remove this burden from the providers and overcome the time lag a biodiversity trust fund is an appropriate instrument. The analysis of this study strongly supports the establishment of such a fund, which allows providers to benefit directly of the use of their genetic resources and sets a strong incentive for conservation.

On the user side, it can be expected that certificates and probably disclosure will be the only mandatory measure in an international regime. It is the only measure that is seriously discussed on the international level. The results of this study fully support this political development. However, it has to be kept in mind that these measures alone cannot solve the problems related to ABS. Other voluntary user measures are very important and need to be implemented and improved. Many measures exist to address the asymmetric information and build up trust among the parties. One possibility is a certification scheme to certify “good” users. However, if the establishment of such a complex system is too expensive, corporate and institutional policies need to be implemented by the user institutions and the user countries need to establish the National Focal Points and CHMs. They play a very important role. Some of them are already in place, but they are too passive and do not assume the responsibility they should. Besides, single and sectoral examples as projects and model contracts are not sufficiently used. They need to be broadly applied. Often the public sector is more active than the private sector. The initiative from the microbial collections should be applied by the pharmaceutical sector for instance.

Often in the international debate the question is raised whether the bilateral ABS concept is adequate to reach the goals conservation, access and benefit-sharing and some voices propose a multilateral system as the ITPGRFA. Compared to the bilateral system a multilateral system causes much lower transaction costs in form of search and information costs, bargaining costs and enforcement and monitoring costs. However, the shared benefits will be lower and not directly linked to the genetic resources of a certain country.

Even if this argument has been put forward, no serious study has been undertaken to analyze the options of a multilateral regime under the CBD. In the negotiations there are doubts that the states (both provider and user countries) will agree to move from the bilateral benefit-sharing to a multilateral one. Provider countries fear to loose their sovereignty and user countries worry about even more complicated access. Definitely, more research is needed to analyze this question.

ABS provides an instrument that can monetarize the commercial value of genetic resources, but due to the complexity of the problem and the involvement of actors the effective implementation of the concept is difficult. ABS alone cannot stop the on-going loss of biodiversity. Therefore, the international community has to agree and advance other approaches to protect biodiversity.

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CMS (Convention on the Conservation of Migratory Species of Wild Animals), 1979

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Constitution of Ethiopia, 1994

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Law of Wildlife Conservation, No.7317 (Costa Rica), 1992

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National Policy on Biodiversity Conservation (Ethiopia), 1998

NIPAS (National Integrated Protected Areas System Law), 1992

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PCT (Patent Cooperation Treaty), 1970

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Protection of Plant Variety and Farmers' Rights Act (India), 2001

PVP (Philippine Plant Variety Protection) Law, 2002

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Treaty of Rome, 1957

TRIPs (Agreement on Trade-Related Aspects of Intellectual Property Rights), 1994

UPOV Convention (International Convention for the Protection of New Varieties of Plants), 1978

UPOV Convention (International Convention for the Protection of New Varieties of Plants), 1991

WHC (World Heritage Convention), 1972

Wildlife Resources Conservation and Protection Act (Republic Act No. 9147) (Philippines), 2001

9 Appendix

Table A1: Interview partner, Philippines

Date	Name	Institution
02/04/2002	Elpidio Peria	Searice, NGO
05/04/2002	Patrick T. “Sonny” Batungbacal	Tambuyog, Research Officer
05/04/2002	Fabian Dayrit	Ateneo University
05/04/2002	Jose Padilla	WWF
08/04/2002	Dr. Lourdes Cruz	Marine Science Center (MSI)
09/04/2002	Althea O. “Teng” Lota	Protected Area Wildlife Bureau (PAWB)
09/04/2002	Noel Saguil	MSI
10/04/2002	Dr. Amelia Guevarra	Vice Chancellor UP Diliman
10/04/2002	Dr. Elisio Ponce	Bureau of Agricultural Research, Director
11/04/2002	Paz “Babs” Benavidez II	Private Lawyer
12/04/2002	Rodolfo Caberoy	Philippine National Museum (PNM)
12/04/2002	Dr. Domingo A. Madulid	Philippine National Museum (PNM)
12/04/2002	Rina Rosales	REECS, Consultant
13/04/2002	Jose Maria “Joey” Ochave	UNILAB
13/04/2002	Rene Salazar	Consultant, SEARICE
15/04/2002	Porfirio “Perry” Aliño	MSI
15/04/2002	Francis Gomez	Altermed/Pascual Lab.
16/04/2002	Dr. Giselle P. Concepion	Marine Science Institute, UP Diliman
16/04/2002	Analiza Albano Vitug	Bureau for Fisheries and Aquatic Resources (BFAR)
17/04/2002	Ms. Teresita (TS) Borromeo	UP Los Banos, Department of Agronomy
24/04/2002	Dr. med. Eliseo T. Balaynal	Deputy Director General of PITAHC
24/04/2002	Rene / Alesna, Edwyn B. Ledesma	Bureau for Fisheries and Aquatic Resources (BFAR)
25/04/2002	Gemiliano A. Aliqui	Philippine Council for Health Research and Development (PCHRD), Executive Director
25/04/2002	Dr. Julie Barcelona	Philippine National Museum (PNM), Researcher and curator of ferns, Botany Division
25/04/2002	Marivene Manuel	Philippine National Museum (PNM), Zoology Division
25/04/2002	Virgilio S. Palpal-Latoc	Philippine National Museum (PNM)
29/04/2002	Dr. Saturnina C. Halos	Bureau of Agricultural Research, Senior Project Development Adviser

Table A2: Interview partner Costa Rica

Date	Name	Institution
14/11/2002	Edgar Fürst	UNA
15/11/2002	Grethel Aguilar Rojas	IUCN
15/11/2002	Isaak Rojas	Friends of the Earth
21/11/2002	Marta Liliana Jimenez	MINAE
25/11/2002	Miriam Miranda	CINPE
27/11/2002	Jaime Echevarria	Consultant
29/11/2002	Carlos Hernández	Mesa Nacional Campesina
02/12/2002	Patricia Madrigal Cordero	SoLiDar, Coopperativa Autogestionaria de Servicios Profesionales para Solidaridad Social R.L.
02/12/2002	Vivienne Solis Rivera	SoLiDar, Coopperativa Autogestionaria de Servicios Profesionales para Solidaridad Social R.L.
03/12/2002	Jorge Polimeni	MINAE
04/12/2002	Jorge A. Cabrera Medaglia	INBio Attorney. Co-president of the Panel of Experts on Access and Benefit-Sharing of the CBD, Professor of Environmental Law, University of Costa Rica
04/12/2002	Luisa Eugenia Castillo	Instituto Regional des Estudios en Sustancias Toxicas (IRET), UNA, Ciencias del Medio Ambiente
05/12/2002	Eugenia Wo Ching	Cedarena (Centro de Derecho Ambiental y de los Recursos Naturales)
05/12/2002	Marco V. Zamora Castro	FES
09/12/2002	Silvia Rodriguez Cervantes	UNA
10/12/2002	Isabell Macdonald	FECON
12/12/2002	Ester Cama	IXAUACAA
13/12/2002	Ana Sylvia Huertas	Business Development Officer, INBio
16/12/2002	Donald Rojas	Mesa Idigenas
17/12/2002	Francisco E. Campos Rivers	Organización para Estudios Tropicales (OET/OTS Organization for Tropical Studies)
17/12/2002	Javier Guevarra Sequeira	Oficina Atencíon al Usario, SINAC, MINAE, Ventania Unica
19/12/2002	Carlos Manuel Rodriguez	MINAE
19/12/2002	Ana Sittelfeld	UCR, former head of the department for bioprospecting at INBio

Table A3: Interview partner Ethiopia

Date	Name	Institution
7/10/2003	Demel Teketay	Ethiopian Agricultural Research Organization
8/10/2003	Mesfin Bayou	Institute of Biodiversity Conservation (IBC)
9/10/2003	Haileselassie Yibrah	Institute of Biodiversity Conservation (IBC)
10/10/2003	Sue Edwards	National Herbarium, Addis Ababa University / Institute for Sustainable Development (ISD)
13/10/2003	Martin Neumann	GTZ
14/10/2003	Imiru Tamirat	Consultant
14/10/2003	Dessalegn Mesfin	Environmental Protection Authority (EPA)
16/10/2003	Tewolde Berhan Gebre Egziabher	Director General, Environmental Protection Authority (EPA)
16/10/2003	Regassa Feyissa	Ethio Organic Seed Action
17/10/2003	Yonas Yohannes	Institute for Sustainable Development
20/10/2003	Getachew Mengistie	Ethiopian Intellectual Property Office (EIPO)
22/10/2003	Girma Balch	Institute of Biodiversity (IBC)
20/10/2003	Zemedie Asfaw	Biology Department Addis Ababa University
23/10/2003	Mehdin Zewdu	Conservation and Sustainable Use of Medical Plants Project (CSMPP)
24/10/2003	Taye Bekele	Institute of Biodiversity (IBC)

A. Guiding Questions Philippines

1. **The bilateral and multilateral access and benefit sharing approach have a positive effect on the conservation and sustainable use of genetic resources**
   a. Is ABS a successful strategy for the conservation and sustainable use of plant genetic resources?
   b. Is the multilateral or the bilateral approach more promising?
2. **Assigned property rights are prerequisite for a successful ABS regime.**
   a. Who owns the property rights for genetic resources in the Philippines?
   b. Who owns the property rights for genetic resources when they have left the country?
   c. Who gets intellectual property rights if a product or process is derived from the collected genetic resources? Is this correct?
   d. Suggestions for improvement according to the assignment of property rights for genetic resources?
3. **Bilateral contracts result in a win-win situation**
4. **Monetary and non-monetary benefits can arise out of ABS agreements**
   a. Which kind of benefits are perceived and received in the Philippines?
   b. - up-front payments or royalties?
   c. Who gets the benefits?
   d. Which benefits are of more importance (non-monetary, monetary)?
   e. Do these benefits have an positive effect on the conservation of biodiversity?
   f. Are there other benefits not being concerned with biodiversity?
   g. What benefits receive the user of genetic resources from a Philippine stakeholder's view?
   h. What are the costs of the bilateral contracts for the provider and the user?
5. **Application process is bureaucratic, time-consuming, causes high transaction costs and is one of the main reasons for missing interested firms**
   a. Which stakeholders are involved in the application process?
   b. What are stakeholders' experiences with ABS application process?
   c. How do stakeholders evaluate the application process (time)?
   d. Suggestions for improvement for the Philippine and the international ABS regulation?
6. **Diverging views and interests of the stakeholders result in inefficient ABS**

a. Who are the stakeholders being involved in ABS?

b. What are the views and interests of the different stakeholders?

7. Over-regulation is a consequence of asymmetric information

a. What are the concerns of the resource provider in the ABS process?

b. How do providers try to obviate these concerns?

8. Legal and institutional insecurity result in a "country-substitution"

a. How do the Philippine stakeholders assess the international acceptance (resource users' acceptance) of the national ABS regulations?

- Will the benefits really be used for biodiversity measures?

b. How do they evaluate the ABS regulations in other countries (better, worse examples)?

9. International control and sanction mechanisms are necessary for efficient ABS regulations

a. Which are the control and sanction mechanisms for ABS?

b. Are the control and sanction mechanisms efficient?

Detailed questions about the bilateral approach (CBD)

EO 247, IACBGR, PIC, BS, CRA, ARA

Wildlife Act

Detailed questions about the multilateral approach (ITPGRFA)

ITPGRFA, Trust Fund, Annex list (crops not in the list?), Farmer's rights

PVP bill

B. Guiding Questions Costa Rica

1. **The bilateral benefit sharing approach has a positive effect on the conservation and sustainable use of genetic resources**

   a. Is bilateral ABS a successful strategy for the conservation and sustainable use of genetic resources/biodiversity?

   b. How important is this strategy compared to other strategies? Which other strategies does Costa Rica have to promote the conservation and sustainable use of biodiversity?

   c. What are the major threats of biodiversity in Costa Rica? Do they differ from those in other countries?

2. **Assigned property rights are prerequisite for a successful ABS regime.**

   a. Who owns the property rights for biodiversity (genetic resources) in Costa Rica?

      - Bioprospecting on private land (negotiations, royalties)? Has a private landowner the same status as for example INBio?
      - PIC: how is the course of the procedure, who controls?

   b. Who owns the property rights for genetic resources when they have left the country?

   c. Who gets intellectual property rights if a product or process is derived from the collected genetic resources? Is this correct?

   d. Suggestions for improvement according to the assignment of property rights for genetic resources?

3. **Bilateral contracts result in a win-win situation**

   a. Do you think that bilateral contracts result in a win-win situation?

4. **Monetary and non-monetary benefits can arise out of ABS agreements**

   a. Which kind of benefits are perceived and received in Costa Rica?

      - Up-front payments or royalties?
      - Before bioprospecting: 10% of INBio's research budget, salary, technology; after bioprospecting: ?% to INBio => 50% to MINAE
      - Which royalties can be justified (1-5% of net profit)?
      - Are 50% for MINAE enough?

   b. Who gets the benefits?

   c. Which benefits are of more importance (non-monetary, monetary)?

   d. Do these benefits have a positive effect on the conservation of biodiversity?

   e. Are there other benefits not being concerned with biodiversity (national economy)?

f. What benefits receive the user of genetic resources from a Costa Rica stakeholder's view?

5. **According to Biodiversity Law the state is responsible for the ABS, but it transferred the responsibility to an independent institute (INBio)**

a. What is the role of the National Commission for the Management of Biodiversity? Focus point for applicants? Is it efficient, are the representatives paid (Philippine experiences)?

b. Is INBio only responsible for National Parks? Is bioprospecting possible without INBio?

c. Who is responsible for other areas outside of protected areas?

d. Has in such areas any bioprospecting taken place? Before and after the adoption of the Biodiversity Law?

e. Suggestions for improvement for the Philippine and the international ABS regulation?

6. **The privatization of the application process is a major advantage of the Costa Rican ABS system**

a. Can a private organization/institute better fulfil the function of negotiating, leading through the application process (instead of state or private landowner)? Why?

7. **The composition of INBio (inventory, information management/distribution) is a decisive factor for a successful institution**

a. How import is the concentration of biodiversity management within INBio?

b. Is INBio self supporting?

8. **Legal and institutional security attracts bioprospectors (multinational companies) and hinder a "country-substitution"**

a. How long did the negotiations last? Who was included?

b. What are the costs of the bilateral contracts for the provider and the user?

c. How many contracts have been concluded [academic (other regulation?), commercial/national, international]?

d. How do you judge the new Biodiversity Law?

e. How do the Costa Rican stakeholders assess the international acceptance (resource users' acceptance) of the national ABS regulations?

f. Will the benefits really used for biodiversity measures? Are they a contribution to biodiversity conservation?

g. How do they evaluate the ABS regulations in other countries (better, worse examples)?

9. **Asymmetric Information about benefits, costs, quality, exclusivity can hinder the signing of contracts**

a. How is the problem of asymmetric information tackled?

- Provider's knowledge: foregone costs/conserving costs, quality of areas, exclusivity, use of benefits?

- User's knowledge: expected benefits, development?

b. How are the royalties determined (costs/benefits/different)?

10. International control and sanction mechanisms are necessary for efficient ABS regulations

a. Which are the control and sanction mechanisms for ABS (national/international)?

b. Are the control and sanction mechanisms efficient?

Detailed questions

Contact persons?

C. Guiding Questions Ethiopia

1. **The bilateral benefit sharing approach has a positive effect on the conservation and sustainable use of genetic resources**

   a. Is bilateral ABS a successful strategy for the conservation and sustainable use of genetic resources/biodiversity?

   b. How important is this strategy compared to other strategies? Which other strategies does Ethiopia have to promote the conservation and sustainable use of biodiversity?

   g. What are the major threats of biodiversity in Ethiopia? Do they differ from those in other countries?

2. **Assigned property rights are prerequisite for a successful ABS regime.**

   a. Who owns the property rights for biodiversity (genetic resources) in Ethiopia? Do you think property rights system will change/should change?

      - Bioprospecting on land used by farmers (negotiations, royalties)?
      - PIC: how is the course of the procedure, who controls?

   b. Who owns the property rights for genetic resources when they have left the country?

   c. Who gets intellectual property rights if a product or process is derived from the collected genetic resources? Is this correct?

   d. Suggestions for improvement according to the assignment of property rights for genetic resources?

3. **Bilateral contracts result in a win-win situation**

   a. Do you think that bilateral contracts result in a win-win situation?

4. **Monetary and non-monetary benefits can arise out of ABS agreements**

   a. Which kind of benefits can be perceived and received in Ethiopia?

      - Up-front payments or royalties?
      - Which royalties can be justified (1-5% of net profit)?

   b. Who gets the benefits?

   c. Which benefits are of more importance (non-monetary, monetary)?

   d. Do these benefits have a positive effect on the conservation of biodiversity?

   e. Are there other benefits not being concerned with biodiversity (national economy)?

5. **IBRC is responsible for bioprospecting in Ethiopia**

   a. What is the role of the IBCR?

   b. Is only IBCR responsible? Is bioprospecting possible without IBCR?

   c. Has bioprospecting taken place?

d. Suggestions for improvement for the international ABS regulation? Other countries?

6. IBCR is in a similar position has INBio in Costa Rica

a. Can an external organization/institute better fulfil the function of negotiating, leading through the application process than a ministerial department (instead of the state)? Why?

7. The composition of IBCR (biodiversity science) is a decisive factor for a successful institution

a. How import is the concentration of biodiversity management within IBCR?

8. Legal and institutional security attracts bioprospectors (multinational companies) and hinder a "country-substitution"

a. How long did the negotiations last? Who was included?

b. What are the costs of the bilateral contracts for the provider and the user?

c. How many contracts have been concluded [academic (other regulation?), commercial/national, international]?

d. How do you judge the Proclamation draft?

e. How do the Ethiopian stakeholders assess the international acceptance (resource users' acceptance) of the national ABS regulations?

f. Will the benefits really used for biodiversity measures? Are they a contribution to biodiversity conservation?

g. How do they evaluate the ABS regulations in other countries (better, worse examples)?

9. Asymmetric Information about benefits, costs, quality, exclusivity can hinder the signing of contracts

a. How is the problem of asymmetric information tackled?

- Provider's knowledge: foregone costs/conserving costs, quality of areas, exclusivity, use of benefits?
- User's knowledge: expected benefits, development?

b. How are the royalties determined (costs/benefits/different)?

10. International control and sanction mechanisms are necessary for efficient ABS regulations

a. Which are the control and sanction mechanisms for ABS (national/international)?

b. Are the control and sanction mechanisms efficient?

Detailed questions

Contact persons?