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Contract Standardisation as an Instrument for Access and Benefit-Sharing under the Convention on Biological Diversity

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A Governance Analysis of Transactions with Genetic Resources

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Abstract

Access to genetic resources and the fair and equitable sharing of benefits arising of their utilisation (short: ABS) is a central issue in the Convention on Biological Diversity. ABS is intended as mechanism to create economic incentives for biodiversity conservation. However, its implementation is not satisfyingly achieved yet. Transaction costs for creating agreements between users and providers of genetic resources are often referred to as impediment. During the consultations for an international regime for ABS contract standardisation in the form of voluntary "menus of model contract clauses" has been suggested as counter measure. To map the potential and design options of such an instrument research was demanded by the international community.

The focus of analysis in this work is on users of genetic resources, since they form the demand side in the market. In a first step problems occurring in the creation of ABS agreements are identified and analysed with a new institutional economics theory framework. Based thereupon, chances and limitations of the suggested instrument are assessed. Then, a governance-theory concept with transaction cost economics and strategic management is developed and tested. It defines similarity of transactions with genetic resources with regard to the choice of governance forms and creates the ground for design recommendations for a model-clause instrument. A mix of methods including exploratory and standardised data collection and the corresponding evaluation techniques are applied. Literature review and exploratory interviews and group discussions served to choose appropriate theories, narrow down the set of variables, and operationalise the theory for quantitative analyses. To verify the developed theories correlations between transaction variables and transaction-cost proxies (problem analysis) respectively governance elements (governance analysis) are tested.

The problem analysis shows that transaction costs can be an impediment for the creation of ABS agreements. Factors inducing transaction costs (transaction cost factors) can be distinguished in three categories: (1) the nature of the transaction subject and the utilisation intention (e.g. uncertainty and complexity of the provider contribution), (2) the institutional transaction environment in the provider country (including property rights systems, information management about ABS, and the organisation of access negotiations), and (3) user characteristics, such as access to legal and management capacities.

Menus of model contract clauses can substitute users and providers' lack of capacities for formulating agreements in contractual form. Complementary guidelines would be required to support the translation of individual cases content-wise for each relevant contract element. Several transaction cost factors cannot be tackled by a voluntary model-clause instrument, among others search of market information, information about the value of resources, and several aspects of the provider countries' transaction environment. It can therefore be stated that the effects of a voluntary instrument like model clauses are limited. However, particularly for small companies and small-scale research it could make a substantial difference, since lack of legal capacities is most prevalent in these user groups.

The governance analysis provides a basis for the development of menus of model clauses and complementary guidelines. Contract elements with relevant governance functions, such as monetary and non-monetary compensation, conflict resolution mechanisms, contract duration and contracting approach, and design options for each element are identified empirically and functional differences explained theoretically. Transaction attributes, user, provider, as well as demand characteristics assumingly determining governance choice are identified and characterised for transactions with genetic resources. The operationalisation of governance forms and explanatory variables for quantitative analyses in this research field is a major contribution to the literature, which previously was limited to qualitative surveys and case studies.

The results of hypotheses tests in the framework of the governance analysis indicate that several explanatory variables are relevant as predicted. Variation of provider contribution and synergy effects of non-monetary benefit-sharing are significantly associated with several governance elements. This supports a triangulation of theories as suggested. Several classical transaction-cost hypotheses are not supported, though. In the framework of future research the theory could be further developed and the operationalisation of certain variables refined.

Homogeneity of cases within certain user-industries, e.g. pharmacy is not confirmed. A differentiation of contract standardisation in accordance with user sectors is therefore not recommended. Instead, an instrument is suggested that provides a menu of model clauses for each functional contract element reflecting the different governance options, e.g. different types of monetary compensation varying in attributes of flexibility and opportunism-control. Contracting parties would characterise their case according to the transaction variables identified as relevant and therewith receive recommendations for adapted contract clauses for each functional contract element.

Kurzfassung

Zugang zu genetischen Ressourcen und die gerechte und ausgewogene Aufteilung der aus der Nutzung entstehenden Vorteile (kurz: Zugang und Vorteilsausgleich oder ABS) ist ein zentrales Thema in der Konvention über die Biologische Vielfalt. Zugang und Vorteilsausgleich soll ökonomische Anreize zum Erhalt der Biodiversität schaffen. Die Umsetzung in der Praxis ist bisher jedoch noch nicht zufriedenstellend erreicht. Transaktionskosten für die Gestaltung von Vereinbarungen zwischen Nutzern und Bereitstellern von genetischen Ressourcen werden häufig als wesentlicher Hinderungsgrund genannt. Im Rahmen der Konsultationen für ein internationales ABS-Regime wurde Vertragsstandardisierung in Form von freiwilligen Modellklauseln für ABS-Verträge als Gegenmaßnahme vorgeschlagen. Um das Potential und Ausgestaltungsmöglichkeiten eines solchen Instruments zu eruieren, hat die internationale Gemeinschaft Forschung zu dem Thema gefordert.

Der Fokus der Analyse in dieser Arbeit liegt auf den Nutzern genetischer Ressourcen, da diese die Nachfrageseite des Marktes bilden. Im ersten Schritt werden Probleme der Gestaltung von ABS-Vereinbarungen identifiziert und anhand von Theorien der Neuen Institutionenökonomik analysiert. Darauf basierend können die Chancen und Grenzen des Instruments beurteilt werden. Anschließend wird ein Governance-Theorie Konzept, basierende auf Transaktionskostenökonomik und Strategischem Management, entwickelt und getestet. Dieses Theoriekonzept definiert Ähnlichkeit von Transaktionen mit genetischen Ressourcen mit Hinblick auf die Wahl vertraglicher Steuerungsmechanismen und bietet die Grundlage für Empfehlungen zu einem Modellklausel-Instrument.

Es wird ein Methodenmix mit explorativer und standardisierter Datenerhebung und entsprechenden Auswertungsmethoden angewendet. Leitfadengestützte, explorative Einzelinterviews und Gruppendiskussionen dienen dazu relevante Theorien auszuwählen, die Variablensets einzugrenzen und für eine Operationalisierung der Theorie für quantitative Analysen. Zur Überprüfung der entwickelten Theorien werden schließlich Korrelationen zwischen Transaktionsvariablen und Transaktionskosten (Problemanalyse) bzw. Governance-Formen (Governance-Analyse) getestet.

Die Problemanalyse hat gezeigt, dass Transaktionskosten einen Hinderungsgrund für das Erzielen von ABS-Vereinbarungen darstellen können. Transaktionskosten-Faktoren können in drei Kategorien unterschieden werden: (1) Die Natur des Transaktionsobjektes und der Nutzungsweise (z. B. Unsicherheitscharakteristika und die Komplexität des Beitrags durch den Bereitsteller), (2) die Transaktionsumwelt im Bereitsteller-Land (einschließlich Eigentumsrechtssystem, Informationsmanagement für ABS sowie die Organisation des Zugangsprozesses), und (3) Eigenschaften des Nutzers, wie z.B. Zugang zu juristischem Knowhow und Managementkapazitäten eine Rolle.

Eine Auswahl von Modelklauseln für ABS-Verträge kann fehlendes juristisches Knowhow von Nutzern sowie Bereitstellern für die Formulierung einer Vereinbarung in Vertragsform

substituieren. Weitergehende Guidelines, eine Art Gebrauchsanweisung zur Auswahl geeigneter Klauseln, ist für die Übersetzung der individuellen Eigenschaften eines Falles in geeignete Inhalte für sämtliche relevanten Vertragselemente notwendig. Mehrere Transaktionskostenfaktoren können überdies nicht durch Modellklausel-Instrument beeinflusst werden, unter anderem die Suche nach Marktinformationen sowie Informationsbeschaffung über den Wert von Ressourcen und einige Aspekte der Transaktionsumwelt in Bereitsteller-Ländern. Es kann also konstatiert werden, dass die Effekte des Instruments auf die Umsetzung von ABS eher begrenzt wären. Insbesondere für kleine Unternehmen und Forschungsprojekte mit sehr begrenztem Budget, könnte jedoch eine erhebliche Erleichterung geschaffen werden, da für solche Nutzer juristisches Knowhow am ehesten ein begrenzender Faktor ist.

Die Governance-Analyse liefert eine Grundlage für die Entwicklung von Modellklauseln und ergänzenden Guidelines. Vertragselemente mit Steuerungsfunktionen, wie monetäre und nicht-monetäre Kompensation, Konfliktlösungsmechanismen, Vertragsdauer und Art der Vertragsschließung, sowie die Ausgestaltungsformen dieser Vertragselemente in der Praxis wurden identifiziert und die unterschiedlichen Wirkungsweisen mit Hilfe der Theorie aufgezeigt. Transaktionsattribute, Eigenschaften von Nutzern und Bereitstellern sowie Nachfrageheterogenität, die in Transaktionen mit genetischen Ressourcen angenommener weise die Wahl der Governance-Form determinieren, wurden identifiziert und verschiedene Ausprägungsmöglichkeiten definiert. Die Operationalisierung sowohl von Governance-Formen als auch erklärenden Variablen für quantitative Analysen in diesem Forschungsfeld ist ein wesentlicher Beitrag dieser Arbeit zur Literatur. Diese war zuvor begrenzt auf qualitative Befragungen und Fallstudien.

Ergebnisse der Hypothesentests im Rahmen der Governance-Analyse bestätigen die Relevanz eines Großteils der erklärenden Variablen. Die Variation des Transaktionsgegenstandes (Beitrag des Bereitstellers) und Synergieeffekte von nicht-monetärem Vorteilsausgleich sind signifikant korreliert mit mehreren Governance-Elementen. Dies spricht, wie vorgeschlagen, für eine Triangulation der Theorien. Mehrere klassische Transaktionskosten-Hypothesen wurden hingegen nicht bestätigt. Im Rahmen zukünftiger Forschung kann die Theorie und die Operationalisierung der Variablen weiterentwickelt werden.

Homogenität der Fälle innerhalb bestimmter Nutzerindustrien, z.B. Pharmazie, wurde nicht bestätigt. Die Differenzierung eines Instrumentes entsprechend Nutzersektoren wird daher nicht empfohlen. Stattdessen wird ein Instrument vorgeschlagen, das für jedes wichtige Vertragselement eine Auswahl an Modellklauseln mit unterschiedlichen Steuerungsmechanismen beinhaltet, z.B. Klauseln für unterschiedliche Formen monetärer Kompensation, die sich hinsichtlich der Eigenschaften Flexibilität und Opportunismus-Kontrolle unterscheiden. Die Vertragsparteien würden ihren Fall hinsichtlich der als relevant identifizierten Transaktionsvariablen charakterisieren und so für jedes Vertragselement Empfehlungen für die Auswahl der passenden Modellklauseln erhalten.

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Abbreviations

ABS	Access and benefit-sharing
ATCC	American Type Culture Collection
BCCM	Belgian Coordinated Collections of Microorganisms
BDP	Federal Association of German Plant Breeders
BfN	German Federal Agency for Nature Conservation
CBD	Convention on Biological Diversity
CIGAR	Consultative Group on International Agricultural Research
CIOPORA	International community of breeders of asexually reproduced ornamental and fruit varieties.
FAO	International Food and Agriculture Organisation
GR	Genetic Resources
IPR	Intellectual property rights
ISF	International Seed Federation
ITPGR(FA)	International Treaty on Plant Genetic Resources (for Food and Agriculture)
LOC	Letter of Collection
MAT	Mutually Agreed Terms
MGR	Microbial Genetic Resources
MOSAICC	Micro-organisms Sustainable Use and Access Regulation International Code of Conduct
MOU	Memorandum of Understanding
MTA	Material Transfer Agreement
NCI	National Cancer Institut (USA)
NIH	US National Institute of Health
PGR(FA)	Plant Genetic Resources (for Food and Agriculture)
PIC	Prior informed consent
PPR	Plant Protection Right
R&D	Research and Development
SLA	Simple Letter Agreement
sMTA	Standard material transfer agreement
UBMTA	Uniform Biological Material Transfer Agreement
UNU	United Nations University
UPOV	International Union for the Protection of New Varieties of Plants
WIPO	World Intellectual Property Organisation

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1 Introduction

1.1 Problem statement

Access to and the utilisation of genetic resources and the fair and equitable sharing of benefits arising thereof (short: Access and Benefit-sharing, or ABS) is a central issue in the Convention on Biological Diversity (CBD) (CBD 1992, Art. 1). ABS was intended as an instrument to overcome market failure for genetic resources. Member countries agreed to mutually recognise the national sovereignty for regulating access to and use of genetic resources, and thereby set the cornerstones for an improved property rights system. The aim was to strengthen economic valorisation of genetic resources and thereby create incentives for biodiversity conservation (OECD 2003: 7). In contrast, before the CBD was enacted biological diversity and hence genetic resources were understood as a "heritage of mankind", with free access for all and available without restrictions (FAO 1983, Art. 5).

It is widely agreed that over 15 years after the adoption of the convention, ABS is not working in a satisfactory way. Fewer agreements between users and providers of genetic resources have been concluded than expected; as a result less benefit-sharing is happening than was originally hoped. A concretisation of the ABS provisions to improve implementation is a major target in the further development of the convention. At the Johannesburg Summit, United Nation member countries officially adopted a resolution that an international regime on access and benefit-sharing should be implemented under the umbrella of the CBD. The timeframe for negotiations on the ABS regime ended with the 10th Conference of the Parties to the CBD (COP 10) in Japan in October 2010.

In the consultations legal uncertainty and transaction costs for reaching and implementing ABS-agreements were issued by government representatives, user representatives and "external" ABS experts (CBD 2001: 15; CARRIZOSA, 2004; GEHL SAMPATH 2005; HOLM-MUELLER ET AL. 2005; OECD 2003: 26; RICHERZHAGEN 2007: 105).

Incremental transaction costs for acquiring genetic resources are viewed as an impediment to their demand, since users' (companies and researchers) time and financial resources are scare (cf. OECD 2003: 26). In particular, researchers from academic institutions and small companies with limited access to financial and human resources for lengthy and legally-demanding ABS procedures are assumed to be concerned.

Moreover, genetic resources under the scope of ABS regulations compete with resources available without such obligations, for instance resources that were put into ex-situ collections (e.g. private or public gene banks) before the CBD came into effect. Some users substitute natural product research with other types of research methods, e.g. combinatorial chemistry. And finally, though illegal, users can try to access in-situ material without concluding ABS agreements. This might happen with or without the awareness of existing regulations (HOLM-MUELLER ET AL. 2005; KATE AND LAIRD 1999). Under the aspects of substitutability and cost sensitivity, transaction costs can be assumed to play a significant role with regard to concluding ABS agreements.

A promising option to reduce transaction costs and to increase legal certainty is standardisation that simplifies transaction procedures. In a previous user survey, standardisation scored well among a range of suggested measures to improve ABS implementation (HOLM-MUELLER ET AL. 2005). Several authors recommend applying standardisation in various forms, mostly with the argument of transaction costs reduction and improvement of legal certainty (cf. YOUNG 2004; BARBER ET AL. 203; UGALDE 2003; VISSER ET AL. 2000). Contract standardisation, which is in the focus of this research, has not been the subject of in-depth research in the literature so far.

In the beginning of 2007 the German Federal Agency for Nature Conservation (BfN) initiated a research project for an investigation of new instruments for an international regime on access and benefit-sharing. The focus of the project was on measures to support the creation of ABS agreements by reducing transaction costs and improving legal certainty for users and providers. Under consideration of previous research and recent developments within the CBD negotiations, a problem analysis on the level of bilateral ABS agreements and a governance analysis of contracts for transactions with genetic resources were defined as the main fields of investigation. Based on the results of this project, recommendations for a potential contract-standardisation instrument were to be developed. The present dissertation was written based on this research project.

1.2 A closer look at the research subject

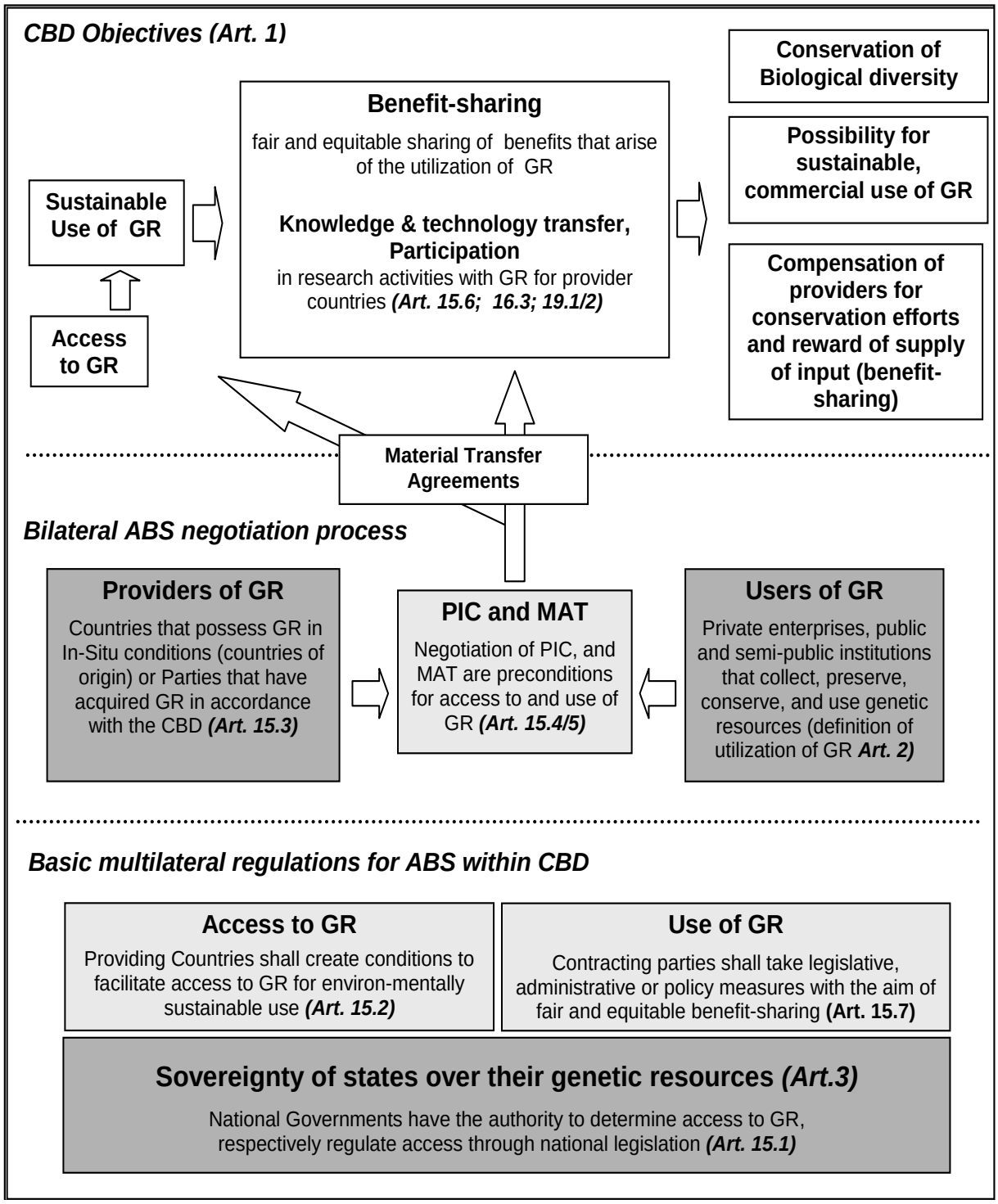
The research subject is access and benefit-sharing, or more precisely transactions with genetic resources. ABS has several dimensions, however, which are important for the development of this work.

The political dimension of access and benefit-sharing

Access and benefit-sharing was developed as multinational institutional framework for using the value of genetic resources in research and in the commercial sector for achieving the objectives of the Convention on Biological Diversity, which are

- Environment conservation => biodiversity conservation for ecological reasons, e.g. ecosystem functions;
- Distributive justice and development => transfer of financial and technological resources, know-how to developing countries, internalisation/compensation for positive global externalities of biodiversity existence/conservation; distribution of property rights for genetic material and traditional knowledge (cf. OECD 2003: 8; YOUNG 2004: 286); and
- Trade and commercial policy, intellectual property rights issues => access to genetic resources for (commercial) utilisation.

The convention builds the institutional frame for ABS with several pillars. Article three is the basis, as it affirms and secures the sovereignty of the countries over their genetic resources (CBD 1992: Art. 3). Moreover, article three states that it is the responsibility of CBD member countries "to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction" (CBD 1992: Art. 3). Article 15 contains more "concrete" provisions related to access and to benefit-sharing (CBD 1992: Art. 15). Figure 1 summarises the most important matters of the ABS articles and illustrates the linkages between the regulations and the three objectives stated in Art. 1 of the convention.



Source: Authors' illustration, based on CBD, 1992

Figure 1: Access and benefit-sharing provisions in the Convention on Biological Diversity

The scope of the ABS provisions is limited to the utilisation of genetic resources (as a part of the biological diversity) (CBD 1992, Art. 1 and Art. 15). In this context, genetic resources are defined as "genetic material of actual or potential value" and genetic material covers "any material of plant, animal, microbial or other origin containing functional units of heredity" (CBD 1992: Art. 2). The utilisation of biological resources as raw biological material is therefore originally not covered by the convention text on ABS. However, if biological resources are also used for their genetic information, for example to produce offspring, the utilisation would fall under the scope of ABS (cf. Latorre 2005: pp. 38). According to TEN KATE AND LAIRD (1999) "it is widely accepted that the scope of Article 15 [of the CBD] is confined on the use of genetic resources for their genetic purpose" (pp. 17). National ABS regulations and bilateral contracts demonstrate however, that the interpretation of scope has been heterogeneous in reality so far.

The CBD articles are legally binding international law. Hence, they are binding for countries, but not directly for private entities such as companies and research institutions that want to use genetic resources. By ratification the member countries commit themselves to implement the CBD provisions on national level and translate ABS into domestic law, administrative regulations and policy measures (CBD Art. 15.7). So far, the convention leaves plenty of room for countries to individually define national ABS systems including the distribution of property rights over genetic resources and the authority to negotiate Prior Informed Consent (PIC), Mutually Agreed Terms (MAT) and benefit-sharing. Since the member countries have different interests and capacities the national systems are very different.

The convention text provides corner stones for ABS systems, but the practical implications for exchange between users and providers result from the national ABS-systems. Hence, the institutional transaction framework is to a great extend determined by the domestic ABS institutions in the respective provider country. However, the CBD is an evolving convention and ABS is constantly under further development. Concretisation of the provisions is one major goal of the negotiations for an international ABS regime.

The stakeholder dimension of access and benefit-sharing

Users are private companies as well as public or semi-public research institutions acquiring genetic resources for utilisation in basic research, applied research, and research and development for marketable (intermediary) products. In the past 15 years a hand-full of empirical studies have been conducted aiming at identifying sectors or groups of users and potential users to describe and analyse the demand side in the market for genetic resources (cf. FRISON AND DEDEURWAERDERE 2006; HOLM-MÜLLER ET AL. 2005; TEN KATE AND LAIRD 2000; LAIRD AND WYNBERG 2005). Figure 2 compiles the main groups of users or areas of utilisation for genetic resources.

Healthcare	**Body care**
- Pharmaceutical industry - Botanical medicine	- Cosmetics, fragrances - natural personal care products
Agriculture	**Biotechnology,** others
- Plant breeding (crops, ornamentals, fruit, vegetables, other econ. plants) - Spice and medicinal plants - Plant protection - Animal breeding	- Food - Energy - Environmental remediation - Material - etc.
Public research institutions and Ex-situ collections	
- Researchers at Universities and other institutions (pharmaceutical biology, chemistry, taxonomy, materials, etc.) - Botanical gardens, Zoos, Herbariums, Museums - Gene banks, microorganism collections	

Source: Authors' own illustration, based on Holm-Müller et al. 2005: 18.

Figure 2: Users of genetic resources

The ABS provisions under the CBD are directed at entities supplying genetic resources in particular transactions, whereby the provider can take various forms. In the convention text a **provider** is defined as a "country providing genetic resources". This encompasses "genetic resources collected from in-situ sources, including populations of wild and domesticated species, or taken from ex-situ sources, which may or may not have originated in that country" (CBD Art. 2). In practice, genetic resources are held by a multitude of different types of entities.

A specific genetic resource may have one country or region of origin, but several source countries, because genetic information spreads over time naturally or by human impact. In reality, intermediaries play an important role in the trade with genetic resources. They can roughly be divided in two groups: commercial intermediaries (broker companies) and non-commercial intermediaries (botanic gardens, public gene banks, etc.) (cf. DROSS 2005: 126).

We can distinguish providers with respect to their legal nature and their relation to genetic resources, for example, how they acquired the material. Another relevant factor is the country in which a providing entity is located. As elaborated, member countries to the CBD are required to develop domestic systems to regulate access and to define benefit-sharing requirements for genetic resources falling under their territory. The implementation on country level varies significantly.

CARRIZOSA analysed national ABS systems and identified several criteria in which these vary. 1: The concept of ownership as applied for genetic resources in the territory of the provider country[1]. 2: The scope of regimes including the types of resources, activities and actors. 3: The design of access procedures. 4: In some countries ABS systems have different regulations for access requests depending on whether the access is for commercial or non-commercial purposes. 5: Regulations regarding the specification on compensation mechanisms. 6: Enforcement and monitoring mechanisms to be included in ABS agreements (2004: p. 17-19).

[1] See also OECD 2003: 27-28

Contract standardisation for access and benefit-sharing agreements

Standardisation of ABS has been suggested for consideration in the framework of an international regime repeatedly during the official debates in the last ten years. The Panel of Experts recommended so-called standard Material Transfer Agreements (sMTAs) as a measure to reduce transaction costs in developing mutually agreed terms (CBD 2001: 15). This approach is also mentioned in the Bonn Guidelines (CBD 2002: 12). Based on submissions by member countries the CBD Secretariat prepared an analysis of GAPs in 2006. SMTAs were therein referred to as measures to overcome problems in bilateral ABS negotiations, such as unbalanced bargaining power resulting from asymmetries in information, knowledge, negotiation skills and capacity (CBD 2006: 2 and pp. 11).

As a result of the consultations with stakeholder groups, the EU adapted their proposal in the submissions for ABS WG 5 and 6 in the year 2007. Instead of obligatory standard contracts like the sMTA, they suggested sectorally adapted, voluntary "menus of model clauses for potential inclusion in Material Transfer Agreements" (CBD 2007a: 49).

The following rationales for this approach were given:

- The reduction of transaction costs as the general contract conditions are standardised;
- A higher legal certainty because standard options have already been tested on their workability;
- Balancing negotiation power and protection of the weaker party by limiting the choices and hence constraining the use of power in MTA negotiations: and
- Simplifying the information exchange through utilising electronic networks, which is possible by standardising information in transactions (ibid. pp. 49).

Several member countries stated interest in this idea. It was noted in the report that further research on the applicability and feasibility of such an instrument should be done, especially regarding the heterogeneity of the different sectors engaging in genetic resources' transactions (ibid.).

The proposal was included in the official negotiation agenda for an international regime at the Conference of the Parties (COP9) in Bonn, 2008. The Final COP report refers to "menus of model clauses for potential inclusion in MTAs" as a component to be further elaborated with the aim of incorporation in the international regime (CBD 2008: 115-117).

1.3 Status of the literature

The level of analysis for ABS in this research is the transaction, which is in many cases a long-term project or research collaboration between parties from different countries. In the framework of the transaction genetic resources, and possibly related information and/or services, are transferred from a provider to a user. Two questions related to this user-provider relation are in the focus of interest in this research: (1) problems occurring in initiating and implementing transactions, and (2) how do transactions differ with regard to contractual solutions for governing the exchange-relation. Answers to these two questions shall lead to arguments for and against contract standardisation for ABS and to design options for such an instrument.

This research is the first on contract standardisation for ABS agreements; nevertheless, it can build on a range of different types of publications on related aspects of ABS or transactions with genetic resources. Publications providing the basis to this research shall be presented in the following. The focus, type of contribution and the limitation of the relevant topical literature is summarised briefly. The relevant findings, however, are taken up in the respective theory chapters of the thesis.

After the CBD was adopted, the community called for research on various access and benefit-sharing issues. Today several studies on bioprospecting[2] agreements exist. TEN KATE AND LAIRD (1999) carried out the most comprehensive cross-sectional survey on demand for access to and the commercial value of genetic resources 1999. Their study included various fields of utilisation. The authors describe transaction relations and types of benefits arising from the utilisation. The study gives also a good overview on technical and financial aspects of the utilisation process in different branches.

[2] Bioprospecting refers to the process of looking for potentially valuable genetic resources and biochemical compounds in nature (REID ET AL. 1993)

Several shorter papers and research reports have been published since ten KATE AND LAIRD'S book, some by the same authors. These publications were mostly aimed at keeping the ABS community, and especially decision makers, informed about trends in different user sectors. With such background information the development of ABS measures should be supported (cf. LAIRD AND WYNBERG 2005; LAIRD ET AL. 2006). Publications of this strand create a broad and, at the same time, deep insight into different fields of utilisation, which is of particular value for the governance analysis in this research. Also, they give a good overview on benefit-sharing practice. However, the information is derived from the description and comparison of findings from a range of (supposedly) similar interviews and the evaluation and interpretation is based on "expert knowledge". Causalities on transaction characteristics and governance are drawn without any explicit theory framework. A specification of the methods applied for evaluation of primary and secondary data is also lacking.

Besides cross-sectional surveys, there exist a range of publications basing on in-depth case-studies on bioprospecting agreements. Stakeholders, main elements of the agreement (particularly benefit-sharing) and sometimes framework conditions are described. Some authors generalise and draw tendencies from the comparison of several case studies under certain aspects (cf. CBD 2008). Again, the set-up of case-studies and the interpretation is based on expert knowledge, and not motivated by a (explicit) theory framework.

An exception in this branch of the topical literature is GEHL SAMPATH (2005). She uses transaction cost economics and economic theory of contracting to investigate market imperfections for bioprospection in the area of pharmaceutical R&D and biomedicine. The focus is on property rights issues. She analyses the utilisation process and ABS agreements as background information to discuss and develop recommendations for property rights systems that minimize transaction costs while balancing interests of different stakeholder groups (commercial interests of users, compliance with property rights for access and traditional knowledge, as well as biodiversity conservation). GEHL SAMPATH applies an "interdisciplinary law and economics methodology", whereby theoretical considerations are substantiated by examples of ABS agreements. The information stems mostly from the literature and partly from personal communication with stakeholders of bioprospecting collaborations.

A further exception are MULHOLLAND AND WILMAN (2003) who investigate the question as to whether (monetary) incentive structures in bioprospecting agreements can be optimised in a way to induce an economically optimal level of provider effort for biodiversity conservation. The authors develop a dynamic economic model based on assumptions of (formal) contract theory (principal-agent theory) to predict provider efforts. With this model at hand compensation structures in existing bioprospecting contracts are analysed. The focus and method of the paper differs from the present research. However, some assumptions on market imperfections, as well as findings on transaction and governance characteristics inherent in their model, shall be considered in the theory framework in this study.

Another strand of literature deals with the analysis and comparison of national ABS systems. By discussing empirical experiences of the different systems RICHERZHAGEN (2007) defines "success factors" and recommendations for policy making derived, mostly on the national level in provider countries. The author employs new institutional economics to develop the framework of analysis, and compare three domestic ABS systems to derive and test the critical factors. CARRIZOSA ET AL. (2004) as well as LEWIS-LETTINGTON AND WANYIKI (2006) are two further examples of publications based on comprehensive provider country-case studies. Here findings are generated without an explicit theory framework, though. However, all three studies provide valuable starting points for developing the theory framework for problem identification and analysis in this research.

A few cross-sectional user studies investigate institutional insufficiencies in provider countries as sources for implementation problems for ABS agreements (FRISON AND DEDEURWAERDERE 2006; HOLM-MUELLER ET AL. 2005; LATORRE 2005).

In a paper on economic issues of ABS, the OECD (2003) discusses theoretical reasons for market failure for genetic resources. As critical issues are identified: (1) property rights regimes for genetic resources (the national system is are the most relevant in this research), (2) uncertainty and imperfect information regarding the timing and quantity of returns on bioprospection, and hence the value of genetic resources in the intended utilisation, (3) transaction costs for acquiring genetic resources, as well as the (4) bargaining context including unbalanced power, e.g. due to the market form, and information asymmetries regarding the subject of transaction as well as knowledge of the market, access to lawyers, etc. (p. 22-27). In an additional comparison of case studies the range of characteristics for

several governance elements in ABS agreements are described, such as monetary and non-monetary benefit-sharing and the timing of when contracts are concluded. References to the previously developed theory framework are weak, though. The aim of the project and the role of each stakeholder in the project were identified as factors influencing the choice of benefit-sharing mechanisms among others. Many other "explanatory" factors of potential relevance are not considered in the comparison.

The issue of standardisation has been taken up by several authors working on potential instruments for enhancing the implementation of ABS. Work by VISSER ET AL. (2000) indicates that transactional costs borne in individually negotiated transactions with genetic resources can be very high and significantly reduced by applying standardisation of transaction procedures and benefit-sharing obligations. BARBER ET AL. (2003) refer to standardisation in the context of the certificate of origin discussion. They recommend a standardised "gene flow documentation" to simplify the recognition of the existence of PIC, to increase legal certainty, to reduce transaction costs, to facilitate tracking of genetic resources, to increase the trade in genetic resources, and support more flexible ABS rules and procedures (UNITED NATIONS UNIVERSITY 2003: 38). UGALDE (2007) suggests documentation standards for genetic resource transfer and standards for benefit-sharing obligations for genetic resources as elements of an international ABS regime (p. 36). DROSS AND WOLFF recommend procedural standards for ABS to keep down the transaction costs for a certificate of legal provenance for genetic resources acquired from in-situ sources (2005: pp.134). All these publications are based on the considerations of legal experts. An analysis based on economic theory regarding the applicability and feasibility of respective suggestions is lacking, even though transaction costs are mentioned as arguments in almost all publications.

1.4 Objectives of the research

This research has two overall objectives: it aims at bringing forward the debate on contract standardisation as an ABS instrument, and it shall contribute to the literature on transaction costs and governance-choice for transactions with genetic resources. To achieve these goals the following set of research questions affiliated with two aspects of transactions with genetic resources are defined and shall be answer in the framework of the present dissertation:

Problem analysis

1. What types of transaction costs characterise ABS agreements?
2. Do transaction costs impede the creation of ABS agreements?
3. Can a voluntary "model-clause instrument" tackle the identified problems and support the creation of ABS agreements?

Governance analysis

4. How can governance forms for transactions with genetic resources under the scope of the CBD be characterised and distinguished?
5. What factors determine the choice of governance forms in the case of transactions with genetic resources (relevant transaction characteristics)?
6. How can a "model-clause instrument" be designed taking into account theory-based findings on interrelations between governance forms and transaction characteristics?
7. Is the sectoral approach a feasible concept to characterise cases with respect to adapted model-clauses?

The transaction process, including its stages and activities, has to be specified. Types of transaction costs arising in each stage and the sources, as well as determining factors shall be identified. New institutional economic theories shall be consulted to guide exploratory research on these questions. Based on the theory and the findings hypotheses on interrelations of transaction costs and transaction characteristics shall be developed, and tested with the author's empirical data. The findings of the problem analysis are discussed with regard to the features of a model-clause instrument for ABS agreements, and conclusions on the chances and limitations of the measure will be deduced.

An in-depth discussion of current problems is a prerequisite to evaluate the general chances and limitations of an instrument based on contract standardisation for enhancing the implementation of ABS. Tackling the problem subject creates therewith a justification for further research on design aspects of the model-clause instrument.

According to theory, standardisation is only suitable for circumstances where similar economic interaction is carried out repeatedly (cf. KESTING AND SMOLINSKI 2007). What constitutes similarity with respect to contract standardisation for transactions with genetic resources, however, has not yet been defined. On the basis of economic theories, i.e. the governance approach of transaction cost economics and elements of strategic management theory, a framework for a governance analysis shall be developed. Ways to characterise and distinguish contractual solutions for ABS agreements and factors contributing to the variation of contractual solutions shall be identified for this framework.

In a subsequent step, with the help of literature and findings from exploratory research, transaction variables and the governance variables shall be operationalized in form of standardised, "closed" questions. Sets of theory-based hypotheses about interrelations of governance elements and transaction variables shall be specified and tested with the author's empirical data. The development of the governance-hypotheses framework and the operationalisation of the variables for this type of analysis are a major contribution to the literature, moreover, a foundation of a possible design-concept for a model-clause instrument.

In the political debate, a sectoral differentiation of ABS instruments was suggested. It is assumed that transactions differ in accordance with sector affiliation, since the way of utilisation (the R&D methods) vary. With the help of the previously developed and tested theory the sectoral approach to contract-standardisation for ABS transactions shall be revised.

1.5 Research approach and structure of this work

This research focuses on individually negotiated agreements for transactions with genetic resources between users (companies and research institutes) and entities in source countries acting as officially appointed providers. Intermediary providers, such as international culture collections or gene-banks, are of less relevance, since they usually apply highly standardised procedures. Moreover, they are the holders of genetic resources (not owners) and do not represent a specific provider country as the official access authority. Since intermediaries do not possess the same property rights over the resource, the motivation and behaviour of such entities can be assumed to diverge from that of an initial resource owner.

In the problem analysis, transaction cost economics and property rights theory as well as principal-agent theory are employed to guide the exploratory investigation, and to interpret its results. The results are then condensed into a set of hypotheses on associations between transaction costs and transaction characteristics.

The standardisation theory is used as the starting point for developing a similarity concept for transactions with genetic resources. Governance theories interrelating contractual forms with characteristics of the transaction, the user, and the provider serve to specify the governance-theory framework. A triangulation of theories from new institutional economics and strategic management has been suggested in the literature and tested in empirical studies before, but not in the field of transactions with genetic resources. It is appropriate to test the synthesis of both theories in this context, since user and demand-characteristics are not considered to be explanatory variables in transaction cost economics, but indicated in the literature to vary significantly among bioprospecting projects.

A mix of methods including literature review, exploratory and standardised data collection and the corresponding evaluation techniques is applied for both research questions. Literature and the exploratory research serve to choose appropriate theories and narrow down the set of variables for closer investigation. Moreover, they provide information required for the operationalisation of the variables for quantitative analyses. The quantitative methods are aimed at testing the developed theory and therewith provide more profound findings for answering the research questions and indicate issues for further investigation.

The dissertation is structured in nine chapters. The introduction (chapter 1) provides the background and problem statement for this research and introduces the research subject "access and benefit-sharing for genetic resources". A short overview on the relevant literature is given and the research goals and the contribution of this dissertation are stated. The introduction chapter concludes with an overview on the research approach and an outline of the structure.

The chapter on methods (chapter 2) elaborates the empirical approach. The three main methods: literature review, exploratory investigations, and a standardised online survey for user companies are specified. Chapter 3 provides the theoretical framework to the problem analysis and the governance analysis. The concepts of the theories and their contribution to the exploratory research are elaborated.

In chapter 4 the results of the exploratory research are presented including the evaluation of existing model agreements, standard contracts and guidelines as well as the interviews and focus groups. Based on findings in chapter 3 and 4, variables for quantitative analyses are operationalised and hypotheses-frameworks for the research questions are specified in chapter 5.

Chapter 6 presents the results of the standardised-online survey for user companies. The evaluation is structured in four main parts. First, a one-dimensional evaluation of the survey-questions including characteristics of bioprospecting projects and governance forms employed therein is given. Subsequently, bivariate evaluations are presented to test the hypotheses on factors inducing transaction cost (here also called transaction cost factors), governance determinants and finally sectoral homogeneity of transactions with genetic resources.

In chapter 7 the results of the problem analysis are discussed. Findings on the transaction process and transaction costs are summarised, transaction cost factors are evaluated and conclusions as to how a model-clause instrument could tackle the identified problems are drawn.

The results of the governance analysis are discussed in chapter 8. This includes a discussion of the theory framework with the contributions and limitations of this work to the theory. The results are evaluated with respect to design options for a model-clause instrument, which makes the contribution of the governance analysis to the debate on ABS-instruments. Finally, limitations of the methodological approach are discussed.

The study closes with an outlook on suggestions for future research that evolved from this work. A short reflection is also provided on the findings of this work with respect to the outcomes of COP 10 in Nagoya in October 2010.

2 Methods and empirical approach

This dissertation is composed of two main thematic parts, each with a different focus, but linked through the same research subject and overall research question. One part investigates mainly implementation problems for ABS in bilateral transaction agreements, while the other deals with governance forms and governance decisions for transactions with genetic resources. For both parts, a mix of methods for data generation is applied including literature review, exploratory data collection as well as a cross-sectional, standardised online survey, and corresponding data analysis. For reason of synergy, questions on both research issues were covered in the same survey. To some extent, the same evaluation methods were used. To avoid repetition, a comprehensive description of methods is given in this chapter.

The overall research design is displayed in Table 1. The methods applied in the different steps are evaluated more in depth in the following sections.

Table 1: Research design of the present dissertation

Phase	Goal / Content	Methods / working steps
Exploration	Developing the overall research question	Analysis of official documents on ABS Attendance of ABS WG5 & COP 9 to follow up developments in ABS-negotiations (observation of negotiations and discussions with negotiators & stakeholders) Review of the topical literature for standardisation ideas for ABS
Structuring	Specification of subquestions to approach overall research question Choice of theories for further investigation on subquestions Defining methods for empirical investigations	Study of literature in the area of standardisation (theory and application, but no relevant application in the field of transactions with genetic resources) Study of empirical transaction cost- and governance-literature => broadening from initially only transaction cost economics to other strands of NIE-theory & further theories
Specification of the analytical framework (I)	Developing theory frameworks as guidelines for exploratory empirical research Adaptation of theory frameworks & operationalization of governance theory (specification of variables & hypothesis) for data collection with standardised questionnaire and quantitative data analysis	In-depth study of the topical ABS literature with respect to (a) implementation problems on the transaction level, and (b) governance forms, and governance choice factors Attendance of ABS WG6 Individual exploratory interviews with users Analysis of existing model & standard contracts, guidelines for ABS agreements Group discussions with different user groups
Specification (II) *Empirical research*	Conduction of standardized, cross sectional user survey Testing the theory framework	Data collection (definition of population, identifying multiplicators, choice of survey-tool, creating questionnaire, carrying out survey) Data evaluation (evaluating quality if data, choice of method, data evaluation) Evaluation of results with respect to the theory
Specification (III) Interpretation	Answering research questions Defining contribution to the literature Policy recommendations	Interpretation of the results with respect to research questions Defining contribution & limitation of research

Source: Author.

2.1 Literature analysis and review of existing model agreements and guidelines

The topical literature dealing with access and benefit-sharing on the transaction level was screened for information on initiation and implementation problems and governance related issues, as well as for theoretic models developed by other authors to approach these questions. Relevant information was noted, and supplemented by an in-depth review of governance theory and its application in fields other than genetic resources. Based thereupon the author's empirical findings from an exploratory pre-survey were discussed and complemented to develop refined theory frameworks on both research questions.

The identification and examination of existing model and standard agreements as well as guidelines for the creation of ABS contracts is the first step towards learning how contractual forms for transactions with genetic resources can be characterised and operationalised for this research; it supplements other types of literature used to generate a theory framework for the governance analysis. The existing instruments are examined regarding contractual elements and design of these elements (how are contract-clauses designed). Moreover, in some cases information about the developers' considerations regarding linkages between the utilization of genetic resources and the design of the instrument are given.

To extract information the models of legal contracts and guidelines, which are formulated in the style of legal documents, are analysed with a set of questions at hand that were developed on the basis of preexisting understanding of governance theory. In some cases additional personal communication with the institutions that developed or implemented the instruments was carried out.

2.2 Exploratory empirical research: interviews and group discussions

The first step of empirical research was qualitative and exploratory. Qualitative methods are recommended for the exploration of new and complex research fields with limited previous knowledge, if the logic and interrelation of phenomena are the main goals and shall lead to the specification of hypotheses for new research questions (cf. BORTZ AND DÖRING 2009: 308f.; LAMNEK 2005: 242f.; SCHÖNHAGEN AND WAGNER 2007: 7).

Representatives of industry associations were interviewed and information from "side events" during ABS Working Group 5, 6 and 7 as well as COP 9 were gathered. In side events stakeholders presented cases of ABS agreements and industry associations or research representatives gave background information about the utilisation of genetic resources, and their organisations' perceptions about useful ABS regulations and instruments.

A series of problem-oriented interviews with individual users, companies (pharmacy, biotech, and plant breeding) and researchers from public or semi-public research institutes was conducted. Additionally, three group discussions with four to eight participants were held.

The specific advantage of focus group as a method is that the communication tool is close to reality; hence, participants' statements can be assessed authentically. In the discussion, participants can be inspired by each other's contributions and therefore more and different kinds of information might be generated (cf. BORTZ AND DÖRING 2009: 319; SCHÖNHAGEN AND WAGNER 2007: 9).

2.2.1 Object of investigation of the exploratory pre-survey

The subject matter of the exploratory interviews and group discussions are users' experiences and practice with the initiation and implementation of projects including access to genetic resources, or the procurement thereof, as well as related rights, information and services. The aim was to evaluate whether a common practice exists within a particular research group, and to substantiate the theory concepts for both thematic research questions. Additionally, participants were asked to assess how feasible and applicable contract-standardisation for ABS agreements is from their point of view.

2.2.2 Defining the research group for the exploratory pre-survey

The construction of samples for interviews as well as for group discussions was determined by several factors: the target groups that were chosen, contacts that could be established (partly with assistance of intermediaries, such as the German Research Foundation and industry associations), as well as addressees' willingness to participate and for the focus groups the ability to communicate in German.

As elaborated in chapter 1, genetic resources serve as an input for various uses and purposes in a multitude of fields. Since the literature (cf. TEN KATE AND LAIRD 2000) indicates that ABS works differently in different industry sectors, and differently in the commercial versus the public research sector several user groups should be considered in this study. However, the scope of the exploratory inquiry had to be narrowed down. Three important groups of users were selected as research groups, namely researchers from public or semi-public institutions (Group A); second, pharmaceutical and industrial biotechnology companies (Group B) and third, plant breeding companies in the fields of agricultural crops (Group C1) and horticulture (Group C2). The target group "researchers from public or semi-public institutions" is of particular interest for this study, because stakeholders and representatives of this group call for simplified ABS procedures for basic research. However, so far no workable concept for distinguishing between basic and applied research with respect to ABS implications exists. Pharmacy and biotech were selected as a research group due to their economic relevance and because previous studies indicate that companies from these branches have entered into comprehensive ABS agreements with provider countries. Plant Breeders have a specific role in the debate on an international ABS regime, because they are partly concerned with the ABS system of the ITPGRFA and have therewith experiences with the standardised procedures of ABS for resources from the Multilateral System. Several large plant breeding companies and sector associations are requesting the extension of the scope of the sMTA to all genetic resources used within plant breeding.

To recruit participants for the exploratory interviews, a contact network with intermediary institutions (industry associations[3] and the German Research Foundation) was established. They helped to identify potential participants and provided contact details. E-mails with a

[3]Bund Deutscher Pflanzenzüchter (BDP), Deutsche Industrievereiningung Biotechnologie (DIB), Verband forschender Arzneimittelhersteller (VfI)

short description of the project and the request to agree to an interview were sent out. Addressees that did not respond within a certain timeframe were called and asked for the reasons and invited a second time. More details about the survey are summarised in Table 2.

Table 2: Details of survey "exploratory interviews with users of genetic resources"

Target Group	Number of participants	Type of interview	Period
Researchers from public or semi-public research institutes (varying disciplines)	5	Telephone interviews + one email	April and May 2008
Pharmaceutical companies and Biotech companies	4	Face-to-face	January to March 2008
Plant breeding companies (crops, seed industry), and representative of German Plant Breeders Association (BDP)	5 + 1	Telephone interview + face-to-face with BDP' representative	December 2008 and January 2009
Representative of International Community of Asexually Reproduced ornamental and fruit plant varieties (CIOPORA)	1	Face-to-face	May 2008

Source: Author.

A similar recruitment procedure as for the individual interviews was applied to invite users for the focus groups. In the pharmaceutical and Biotech group some participants participated in of both surveys. Details of the survey are listed in Table 3.

Table 3: Details of survey "focus groups"

Target Group	Number of participants	Location and Duration	Period
Researchers from public or semi-public research institutes (varying disciplines)	7	4 hours (with coffee break), Institute for Food and Resource Economics, University of Bonn, Bonn	7th of July 2008
Pharmaceutical companies and Biotech companies	4	3 1/2 hours (with coffee break), Gustav-Stresemann-Institute, Bonn	12th of September 2008
Breeding companies in the field of Asexually Reproduced ornamental and fruit plant varieties	4	1 ½ hours, International Trade Fair for Plants, Technology, Floristry and Sales Promotion, Essen	29th of January 2009

Source: Author.

2.2.3 Survey instruments in the non-standardised exploratory pre-survey

The qualitative interviews were conducted as semi-structured expert interviews. The interviews were guided by a set of open questions, which are based on theoretical and practical considerations, as well as findings from the topical literature and from stakeholder contributions in the political debate.

Each interviewee received an e-mail with the guiding questions beforehand. Interviews with representatives of pharmaceutical and biotech companies were conducted face-to-face; the interviews with participants from the two other groups were carried out by telephone due to long traveling-distances. The duration of telephone interviews varied between 45 minutes and 1½ hours; face-to-face interviews were longer varying from 1½ to 3 hours. In both cases clarification of remaining questions was accomplished by e-mail.

The arrangement of the group discussions varied according to the participants' previous level of knowledge regarding ABS in general and practical experiences as well as time restrictions. In both respects the conditions for the group discussions with researchers from public and semi-public institutions (Group A) and pharmaceutical as well as biotech companies (Group B) were very positive. The majority of participants had extensive experiences with the procurement of genetic resources and the negotiation of ABS agreements. Moreover, several participants were following and engaged in the political debate on ABS. The conditions for the group discussion with horticultural plant breeders (Group C1) were less optimal.

To guide the focus groups for key group A and B the participants were informed beforehand in an e-mail about the main discussion. For exemplification an overview of core elements of existing model contracts on contractual elements of ABS model-agreements (findings from the analysis of existing instruments) was enclosed. The meeting was opened with a short presentation of the research project and an outline of the topics and objectives for the discussion. During the course of the meeting one person of the organisation team took notes which allowed the course of discussion and the statements made by the different participants to be reconstructed afterwards (cf. BORTZ AND DÖRING 2009: 319-320). The discussion was not recorded to guarantee an open atmosphere in which all participants could speak without restraint.

2.2.4 Evaluation of the exploratory pre-surveys

The interview protocols were distributed after the meeting and participants were given the opportunity to correct any misunderstandings and respond to remaining questions. Following the method of qualitative content analysis (cf. MAYRING 1995 referred to in LAMNEK 2005) the first information was reassembled and the protocolled contributions restructured with the help of guiding research questions. The results were then analysed and discussed in an interpretative manner.

2.3 Standardised online survey for user companies

As a continuation of the exploratory empirical research an international, anonymous, standardised online survey for users of genetic resources was conducted. Subject matters were users' experiences and assessments related to the procurement of genetic resources in general and the characterisation of a specific ABS project. The case-specific part was mostly dedicated to the governance analysis.

The target group of this survey was limited to the private sector, but including many different fields of utilisation of genetic resources: pharmacy, biomedicine, biotechnology in other fields than pharmacy and plant breeding, plant breeding (seed and horticulture), biocontrol agents, cosmetics and care.

2.3.1 Development of the questionnaire

A standardised questionnaire with a total number of 51 questions[4] was developed, based on the theory, which was specified with the help of the topical literature and the findings from the exploratory pre-survey. The vast majority of questions are coded as closed questions meaning that the respondent is requested to select from a given set of answering options. Depending on the subject matter of the variable the answering options are coded as (a) dichotomous (yes / no; option one or two), (b) nominal scale (selection out of more than two options but without logical ranking), or (c) ordinal scale (ranking, but not necessarily same distance between options). This approach was applied with the aim of generating standardised data for quantitative statistical analysis.

[4] Not all questions are evaluated in the framework of this dissertation.

The questionnaire is composed of three thematic parts. Part one consists of questions dealing with the users' sector affiliation, the general approach to procurement of genetic resources as well as companies' experiences and strategies to keep transaction costs low. Moreover, participants were asked to assess the relevance of a set of institutional factors in provider countries and characteristics to differentiate supply/demand aspects of genetic resources with relevance for the choice of a provider country. Part 1 of the questionnaire could be answered by all companies using genetic resources irrespective of the source of the resources (ex-situ or in-situ, national authority or commercial intermediary).

Questions in the second part of the survey were used to gain information about the practice of governance solutions for ABS agreements. Following the overall bottom-up approach in this research, the source of information should be the users' experience and practice in real transactions with genetic resources. The focus of interest is on cases in which resources are obtained from their source country and negotiations with authorised entities have taken place. Since due to confidentiality reasons, no access to contract documents in detail was possible, the following approach was applied: based on governance theories and the analysis of existing model and standard agreements as well as exploratory surveys relevant elements of contracts, overall governance forms, and factors supposedly determining which governance form is the most efficient were identified. These create the variables of the developed theory frameworks for the problem and the governance-analysis. All variables were then operationalised in a way that allowed them to be surveyed in a standardised online questionnaire. In the end, the surveyed questions characterised each bioprospecting case on a very detailed level, whereby anonymity of the respondent remains.

A filter between part one and two of the questionnaire limited the sample in the second part to companies experienced in negotiations with authorised entities in countries where the genetic resources occur in-situ (even if intermediaries have been involved for support). Guidelines (Table 4) explained how the respondent should identify an adequate project and use it as a reference to answer questions in the case-specific part. Hence, each participant characterised in detail one particular project. The questions were formulated in a way to ensure that as much information as possible was revealed in order to be able to distinguish between cases, but aspects known to be sensitive (e.g. amount of monetary benefit-sharing, the concrete source country) which might have deterred participants were left out.

Table 4: The guidelines for the case specific part of the online survey

In this part of the survey, we request that you recall a specific case of procuring genetic resources. **Please select a case for which the following factors apply (as closely as possible):**
- The genetic resources were acquired directly from their country of origin, whereas officially authorised actors from the provider country were involved in the negotiations (even when intermediaries are or were involved for support)
- The provider country in not a European Union member state and not the USA
- The main features of the agreement have been legally defined at the time of the survey.
- The agreement has at this point not been revoked and there is also no foreseeable revoking of the agreement.
- It is chronologically the last case you can remember well and the last case for which you have the most possible knowledge.
Note: In following sections, the case that you have selected will be referred to as the project.

Source: Author.

In the third part of the questionnaire company data were surveyed including the size (number of employees, turnover) etc. Moreover, the companies indirect capabilities, such as the level of experiences with complex projects, e.g. with partners from developing countries, were requested.

2.3.2 Reliability and validity of the online questionnaire

Several researcher colleagues cross-checked the questionnaire. Moreover, a pre-test with two company representatives was conducted. To create a common understanding of important terms such as genetic resources, provider countries, ex-situ, and intermediaries a set of definitions was given on the introductory side (see Table 5), as well as some principle guidelines regarding how to answer questions and how to deal with questions that cannot be answered.

Table 5: Selected definitions included in the guidelines to the online survey

Genetic Resources: Encompasses in this survey the usage of genetic information of plants, animals, Microorganisms (all creatures except humans) - as starting point in developing active compounds for intermediary or end products - for identification (and modification) of genes for breeding purposes - as Elements of vaccines - for the development of inactive compounds in products - as instruments in the research and/or production process
Ex-Situ: the genetic resource is stored outside its natural habitat for preservation purposes or to make it available for research.
Provider country: In this survey, this is the simplified term for the country in which the genetic resource can be found in its natural habitat.
Intermediaries: Institutions (such as gene banks, botanical gardens, research institutes) as well as commercial enterprises that mediate between the authorities and local/indigenous groups in the provider country on one hand and the enterprises interested in access on the other.

Source: Author.

In an online survey a specific challenge to respect the trade-off between maximising the response rate for vital questions and minimising the dropout rate. A number of questions required for the most important evaluations were selected and modified as compulsory questions; the respondent has to answer questions of this type to proceed to the next "page" in the questionnaire. Other questions were configured in a way they could be skipped. In multi-item questions it was possible to skip single items as well. This approach has an effect on the data: the sample size varies between questions. But instead of sorting out cases with "missing" values for certain questions, each question was evaluated with the respective sample size. The reason is that data on this topic is very scarce and hence valuable.

2.3.3 Recruitment of participants for the online survey

The recruitment of survey participants was a challenge in many respects. The subject matter of the survey is very specific, and the population is identifiable only to a limited extent. There exists no official or unofficial database listing (all) companies that use or have been using genetic resources. Not even stakeholder associations have full knowledge as to which of their member companies belong to the target group. Second, the topic is highly political and many companies are reluctant to provide data. Third, even if a company uses genetic resources, it is difficult to identify and reach the responsible contact person.

A mix of non-probability sampling methods was applied. Existing literature about ABS and bioprospecting cases was screened for company names and contact persons; the same was applied to participation lists of ABS WG meetings. Moreover, the internet was searched for scientific conferences in the field of natural products research and companies; contact persons were noted if available. Different sources were searched for industry associations in relevant fields. In total about 38 associations were contacted via e-mail and/or telephone. They were informed about the research project and invited to distribute the survey invitation to member companies or to provide the contact details of companies potentially belonging to the target group. About eleven associations actively supported the survey. The number of contacts per association varied greatly, as some selected only companies supposedly belonging to the target group, while others distributed the invitation to all member companies. Following a hint from an expert publishing in the fields of Intellectual Property Rights (IPRs) and genetic resources, the survey invitation was even placed in different "linked-in groups", an internet platform for professional networking. After a period of time, if there was no response to the initial invitation, a reminder was sent. Companies for which a telephone number and a contact person were available were called.

As distribution channels were used for which the number of invitation recipients is unknown, an exact number of addresses cannot be reported. The number of known addressees is about 600. However, it has to be noted that assumingly not only companies actually using genetic resources (target group) received the invitation. Additionally, in many cases, someone who was not the responsible contact person might have received the e-mail. Therefore, it does not appear useful to calculate a response rate. The sampling details are summarised in Table 6.

Table 6: Technical details of the online survey

Tool	EFS survey, online survey in German and English http://www.globalpark.de/efs-uebersicht/efs-survey.html
Period	November and December 2009
Approximate number of addressees	About 600
Number of questionnaires evaluated for Part 1 of the survey	Up to 77
Number of questionnaires evaluated for Part 2 of the survey	Up to 41

Source: Author.

A number of incidents during the course of the survey are worth reporting. Several addressees answered that they are not users of genetic resources. Although a pre-test was conducted, some company representatives indicated that they had problems with the definition of the term "utilisation of genetic resources"; some said the questionnaire was too long, others had difficulties to abstract their reference project in order to be able to answer the questions using the standard answering options.

2.3.4 Evaluation methods

The survey data was evaluated with the statistics program SPSS. The methods include one-dimensional, descriptive evaluations such as frequency counts, cumulated frequencies and Median (appropriate measure for mean value for data with ordinal scales). Due to the limited sample size and data quality (non-normally distributed[5] and data scaling[6]), bivariate evaluation methods were chosen to analyse patterns in the data, and to evaluate previously defined hypotheses about correlations between governance variables and transaction characteristics. Table 7 gives an overview on which measure was applied for what type of combination.

[5] All variables were tested for normal distribution with the Kolmogorov-Smirnoff test. Almost none is normally distributed, though, which has to be considered for the choice of measures and tests in further evaluations.

[6] None of the variables has a metric scale.

Table 7: Statistical measures applied in the evaluation of the online company survey

	Dichotomous	**Nominal**	**Ordinal**
Dichotomous	Fisher's exact test	Contingency-Coefficient	Mann-Whitney U test
Nominal	X	(not applied)	Kruskal Wallis-test
Ordinal	X	X	Kendall's Tau

Source: Author.

Fisher's exact test

Fisher's exact test is a nonparametrical significance test for bivariate evaluations of dichotomous variables. It tests for independency in contingency tables; the null-hypothesis that the "relative proportions of one variable are independent of the second variable" (McDonald 2009: 70). The test is applied instead of the chi-square test, for small samples and if data sets are sparsely distributed, such that one or more cells have an expected frequency of five or less (cf. Boslaugh and Watters 2008: 196; McDonald 2009: 70).

The probability value is calculated based on the hypergeometric distribution:

$$P = \frac{r_1!r_2!c_1!c_2!}{n!a!b!c!d!}$$

The following example of a contingency table shall exemplify the way of calculating p

a=7, b=2, c=5, d=6
r1=9, r2=11,
c1=12, c2=8
n=20

7	2	9 (r1)
5	6	11 (r2)
12 (c1)	8 (c2)	20 (n)

$$P = \frac{9!11!12!8!}{20!7!2!5!6} = 0.196 \quad \text{(2-Tail)}$$

he p-value is calculated in the same way for more extreme contingency tables with the same sum of rows and columns as the original table. The probability values are then added up. If the summoned p-value is lower than .05 the null hypothesis can be rejected, otherwise the association between the two variables is not considered significant (cf. BOSLAUGH AND WATTERS 2008: 196).

Contingency coefficient

The contingency coefficient is applied in bivariate evaluations, if one variable is nominal and the other dichotomous (2 x k or k x 2 -tables). The calculation of the coefficient is based on chi-square value

$$C = \sqrt{\frac{x^2}{x^2+n}} \in [0,1[$$

n is the sample size

The coefficient can take values between one (perfect correlation) and zero (no correlation). However, the value one is never achieved (cf. CLEFF 2008: 90-91; BROSIUS 1998:411).

For information on the calculation of chi-square and formulas please see CLEFF 2008: 82-87 or BROSIUS 1998: 404-405).

Kendall's tau

For bivariate combinations of ordinal scaled variables Kendall's tau, a non-parametric rank correlation coefficient is applied (cf. CLEFF 2008: 80). It measures the strength of association, and indicates the direction of association. It is carried out on the ranks of data evaluating the similarity between two sets of ranks[7] to a same set of objects[8].

First, for both sets all values are put in order and asserted a rank (the values of variable x: 2, 5, 7, 2, 3, 3 become ranks R(y): 1, 3, 4, 1, 2, 2). In the second step, the rank-values of one set (in this example variable x) are re-ordered ascending (anker-set (R(x): 1, 2, 2, 3, 4) and the rank-values of the second set are reordered in accordance with the first set (does not necessarily result in a monotone ascending order for second set). Then, all existing combinations of rank-pairs of variable y are compared (R(y1)-R(y2) … R(y3)-R(y4)). It is counted, how often the rank for the second observation of the pair has a higher (nonconcordant) and how often a lower (concordant) rank compared to the first observation of the pair. Now the number of concordant pairs is put in relation to nonconcordant pairs, to measure the so-called symmetric difference between the two sets.

The Kendall's coefficient of correlation is obtained by normalizing the symmetric difference so that it will take values between −1 and +1. The sign indicates the direction of association and 0 indicates absence of association. -1 reflects the "largest possible distance" between the two variables and +1 the "smallest possible distance". The correlation coefficient is modified for data sets with ties[9] and different types of cross-tables. Tau-b and Tau-c both correct for ties. Tau-b is suitable for square tables and Ta-c for rectangular tables (cf. ABDI 2007: 1-3; CLEFF 2008: 118-124; BROSIUS 2007: 416-417).

The "tau test" is used to evaluate whether the results can be generalised to the population. It is a non-parametric hypothesis test and therefore is robust against non-normally distribution. Tau is interpreted as "the difference between the probability for these objects to be in the same order […] and the probability of these objects being in a different order […]." (ABDI 2007: 2-3, and see also CLEFF 2008: 118-124; BROSIUS 2007: 416-417; NELSEN 2001).

[7] The two sets of ranks are the values for the two variables which are tested for correlation.

[8] The set of objects is the cases of the sample included in the evaluation.

[9] The term "ties" means that several observations of one set have the same value and therefore the same rank.

The Formula for calculating Kendall's tau:

$$\tau = \frac{P - I}{\frac{1}{2} n * (n - 1)} = \quad \in [-1,+1]$$

Mann-Whitney U test and Kruskal-Wallis test

In bivariate evaluations with one dichotomous and one ordinal scaled variable the nonparametric Mann-Whitney U test can be applied. It tests whether two independent samples[10] originate from the same distribution. The test is based on the comparison of ranked answering values for both groups (samples). First, the values of both groups are subsumed in one group and sorted in ascending order. Each value is assigned a rank in accordance to its position. If two values have the same rank, an average rank is calculated and adapted for these values. For both groups the sum of ranks is calculated and divided by the size of each group. Based on the sum of ranks the U-value is calculated, which in turn is used to conduct the significance test. In a first step it is calculated how often a value of the first group is higher than a value of the second group and vice versa. The lower of both values is represented in the Mann-Whitney-U value, which is calculated as following: for each value of the second group the number of values with a lower rank in the first group is counted and added up. Hence, each value of the first group is counted several times. Based upon these two measures (sum of ranks and Mann-Whitney-U value) the significance for the null-hypothesis is calculated. Is the asymptotic significance smaller or equal to 5% the null-hypothesis is to be rejected (cf. BROSIUS 2007: 740 and 758-760; BÜHL 2005: 318-320). In this study, the Mann-Whitney test it is applied to test the null-hypothesis that users answering differently on the dichotomous question (one sample: yes, and the other: no) do not give significantly different answers on the second, ordinal scaled variable.

The Kruskal-Wallis test is applied in a similar way, but it compares not only the distribution of two but n samples. In this study it is used for combined evaluations of nominal with ordinal scaled variables. The categories of the nominal variable represent the different samples. Again, the test is based on a comparison of ranking value (cf. BROSIUS 2007: 741 and 764-766; BÜHL 2005: 330-332).

[10] Dependent samples would mean that the data is collected from the sample at two different points in time.

3 Theory

New institutional economics builds on the assumption that in many contexts the paradigm of a perfect market[11] is not consistent with reality. The implication is that adequate institutions are useful to support economic interaction. Contract standardisation is such an institutional instrument, and it has been raised in the debate on an international ABS regime for reducing transaction costs and increasing legal certainty for transactions with genetic resources.

An in-depth analysis of problems on the level of user-provider relations in ABS negotiations has been lacking so far. Therefore, it is hard to assess how far such an instrument, in particular in form of menus of voluntary model-clauses, is actually feasible for the stated goal. Moreover, the applicability of contract standardisation is generally limited, and requires a certain level of homogeneity or similarity of the "object of standardisation". The question is what constitutes similarity requirements in the case of ABS with respect to contract standardisation?

This chapter provides the theoretical foundation to both main research questions: the problem analysis and the governance analysis. Since the main concepts of new institutional economics and particularly transaction cost economics are employed for both research questions, the chapter is not strictly separated in a theory chapter for each research question. The structure of the chapter does not follow the order in which evaluations of the various surveys are presented in the following chapters either; it is build up in a way to give a consistent overview on the different theories reflecting also their interrelations.

Standardisation theory led the way to transaction cost-economics and management strategies as a tool for the governance analysis. Therefore, the contribution of the standardisation theory is highlighted first (3.1). Subsequently, the basic assumptions and terms of new institutional economics shall be provided (3.2). Transaction cost economics is presented including a specification of the terms transaction and transaction costs in the context of the study (3.3.1). Transaction attributes and other factors considered relevant for transaction costs and variation of governance forms are elaborated (3.3.2), as well as governance forms and functional elements of governance arrangements (3.3.3).

[11] Among others the paradigm of the perfect market assumes homogeneous goods, perfect information, and zero transaction costs (FRITSCH ET AL. 2003: p. 27).

Subsequently, the interrelation of transaction characteristics and governance forms is framed as a foundation to the governance analysis (3.3.4). Finally, the contribution of three main new institutional economics theories - transaction cost economics, property rights theory and agency theory - to the problem analysis is elaborated.

3.1 Contribution of standardisation theory

Standardisation can be understood as a form of regulation, comparable to markets and organisations, including the creation and propagation of rules for economic interaction (BRUNSSON AND JACOBSSON 2002: 4-11). Standardisation is often implemented to supplement and support other institutions, such as markets or hierarchies. Various forms can be found, for instance, product or production standards, a set of common definitions of terms relevant in the context of certain transactions, a contract standardisation, or routines for the procedure of decision making and action taking. The purpose and the mode of operation depend on the subject of standardisation.

It should be noted that in spite of the many positive features associated with standardisation, negative aspects and problems have been identified as well. Developing and distributing standards causes costs. Not always the most appropriate, but the standard favoured by the most powerful negotiation party prevails. Moreover, standards can impede innovations and the on-going discussions and research on the matter of efficiency and feasibility of the implemented system (KESTING AND SMOLINSKI 2007: 427; MÜHLENKAMP 1999: 23; SFG INSTITUTIONENANALYSE FH DARMSTADT 2003: 20). Such potential drawbacks should be considered when defining the degree of standardisation for an ABS instrument.

A special form of standardisation relevant for this study is the negotiation routine. KESTING AND SMOLINSKI (2007) define negotiations by two dimensions: (1) the problem-solving dimension, which tackles the substance of negotiation, and (2) the communication dimension, which is related to the parties involving in the negotiation (p. 422). Routines are defined as “a person’s ability to substitute deliberate planning and decision making with replication”, whereby replication is understood as “the application of former solutions to current problems [...] in a well-founded manner”. This substitution can be gradual and limited to certain aspects (ibid. 421).

The authors state that negotiation routines may "[…] to improve the efficiency of the result" (ibid. 426). Routines substitute deliberate planning, if solutions found in former problem-solving processes can be adopted (ibid. 426). Lessons learned from former negotiations can help to avoid mistakes, and using routines allows for economising scarce capacities.

The predefinition of negotiation procedures and the limitation of possible outcomes can also reduce the problem of asymmetric information and unbalanced negotiation power. Planning reliability can be increased this way, and negotiation time reduced. Legal certainty is improved and costs for control of contract enforcement on both sides are lowered (SFG INSTITUTIONENANALYSE FH DARMSTADT 2003: 19; KLEINALTENKAMP 1993: 97).

A contract standardisation for ABS, or more concrete the model-clause instrument under discussion, is comparable to a negotiation routine. Such an instrument shall be based on stakeholders' practice of contracting. Users and providers would contribute with their experiences to formalise the contents of main contractual elements in model clauses; they develop the routine in a participative manner.

As elaborated before, negotiation routines cannot be applied for random transactions. The two dimensions identified by KESTING AND SMOLINSKI (2007) are criteria for the applicability. The better the criteria similarity of the problem and stability of the transaction context are fulfilled the better knowledge can be transferred from one problem to another.

Transferring the concept of KESTING AND SMOLINSKIS to this research comprises the definition of "problem similarity" for transactions with genetic resources and related rights and services. This shall be done with the help of governance theories. In KESTING AND SMOLINSKIS' model "context stability" is understood as the similarity of transaction parties an actor faces in varying relations. With respect to ABS this can be understood as the similarity of strategies, needs and requirements of different providers of genetic resources[12]. An additional dimension of the "transaction context" is the transaction environment including the institutions in place in a provider country, such as legal, administrative and policy measures for access and use of genetic resources.

[12] Providers' strategies refer here mostly to the assessment of elements of ABS, for instance the importance of benefit-sharing measures, the assessment of the value of genetic resources, etc.

The model-clause approach stipulates voluntary application and sets of model clauses rather than one or several fully standardised contracts. Hence, the providers' sovereignty to decide on access requirements is not affected by this instrument. The instrument would suggest benefit-sharing types but no amounts, and the provider obviously participates in the process of selecting and substantiating the model clauses. The instrument leaves room for heterogeneity of providers' strategies and variation between domestic ABS institutions meaning that full context stability is not assumed or required.

In the next step, theories should be identified that can be employed for a specification of context stability and problem similarity in the context of transactions with genetic resources. The governance approach of transaction cost economics and strategic management were found to deal with explaining variation of efficiency of governance forms (contracts and contractual elements) by highlighting a whole range of characteristics distinguishing transactions.

3.2 New institutional economics – an overview and definitions

Theories under the umbrella of new institutional economics provide a framework for explaining how alternative institutions[13] influence the economic process and how institutions evolve (cf. RICHTER AND FURUBOTN 2003: 50; MARTIENSEN 2000: 6). New institutional economics is concerned principally with the "formal rules (constitutions, laws, property rights)" creating the environment of economic interaction and with governance structures for "managing" economic interaction (WILLIAMSON 2000: 596-598).

The term new institutional economics was established by O.E. WILLIAMSON (1975:1) (cf. see RICHTER AND FURUBOTN 2003: 39 referring to WILLIAMSON 1975). The addition "new" demarks new institutional economics from institutional theories, which attempt to explain institutions while maintaining the assumptions of neoclassical economics (MARTIENSEN 2000: 7). This relatively new theory field in economics is often referred to as an advancement of neoclassical theory in the sense that new assumptions are integrated into the analytical framework making it more realistic (RICHTER UND FURUBOTN 2003: 3). The perspective or the unit of analysis also differs from neoclassic economic theories. Neoclassical theory works

[13] The term "institution" in the context of this research is defined in one of the following sections.

with marginal analysis, wherein the economic actor is described through a production or utility function. New institutional economics, in contrast, works on the basis of discrete structural analysis of governance solutions (WILLIAMSON 2000: 600).

Three main elements of the new institutional economics are property rights theory, principal agent theory (formal contract theory) and transaction cost economics (cf. RICHTER AND FURUBOTN 2003: 40-42). Property rights theory deals with aspects of the institutional environment, whereas transaction cost economics and principal agent theory are mostly applied for analysis on the level of governance structures. Transaction cost economics deals with ex-post analysis of contracts/governance structures, while agency theory traditionally is applied for analysis of ex ante incentive alignment (ibid. 599).

All three theories are based on the assumption that human behaviour is characterised by bounded rationality (imperfect information is rational) and individual utility maximisation, also called opportunism (cf. PICOT ET AL. 2002: 70; WILLIAMSON 1998: 30ff). WILLIAMSON 2000 complements the attribute of conscious foresight (p. 601). These and additional relevant terms shall be defined in the following sections. It should be noted, however, that for most of the terms several definitions exist. Interpretations diverge, for example, depending on the research contexts. Here definitions are chosen with respect to transactions with genetic resources under the framework of the CBD.

Transaction

According to RICHTER & FURUBOTN (2003), a transaction is a "technical mechanism" for the "transfer of a good or a service across a technically separable barrier" as well as the "transfer of property rights" (p. 592). In this study a transaction refers to the transfer of rights to access and use genetic resources, and related information and rights (e.g. exclusivity rights) from a certain provider to a certain recipient (user). The transaction could also include services related to the resources, such as collecting samples, preparing samples and material evaluations. In return, the provider receives some kind of reward or compensation, so called benefit-sharing, which can be monetary and/or non-monetary, for example, know-how transfer, technology transfer or support of inventorisation and taxonomisation of biodiversity[14]. The exchange relation constitutes what in political terms is called "access to genetic resources and sharing of benefits arising from the utilisation thereof".

Institution(s)

OSTROM defines "institutions [...] as the sets of working rules that are used to determine who is eligible to make decisions in some arena, what actions are allowed or constrained, what aggregation rules will be used, what procedures must be followed, what information must or must not be provided, and what payoffs will be assigned to individuals dependent on their actions. All rules contain prescriptions that forbid, permit, or require some action or outcome." (1997: 51). RICHTER AND FURUBOTN (2003) characterise institutions as systems with "rules that are connected to each other in a formal or informal manner that include a provision for their execution" serving to govern the conduct of individuals. Examples of institutions are contracts, markets, companies, and states (p. 7).

[14] The Bonn Guidelines list a range of monetary and non-monetary benefit-sharing measures (Bonn Guidelines, Appendix II Paragraph 1 and 2), and case study based literature shows that a variety of measures is applied in practice (cp. GEHL SAMPATH 2005; SECRETARIAT OF THE CBD 2008).

MARTIENSEN (2000) discusses several definitions and summarises in conclusion the following key characteristics of institutions. Institutions are "rules in social behaviour, which

- prohibit, demand or allow certain behavioural patterns in recurring situations,
- evolve through processes of the "invisible hand" or through public or private contracts, and
- are either incentive compatible or compliance is enforced through external authorities" (MARTIENSEN 2000: 16) [15].

This definition encompasses institutional arrangements (contracts) as well as the institutional environment. The latter contains basic rules governing individual conduct, whereas institutional arrangements are explicit negotiation directives decided upon by contracting partners which serve to mediate the economic relationship (cf. SCHIRM 2004: 59).

This research refers to several types of institutions related to genetic resources and access and benefit-sharing:

(1) Contracts, or more general governance solutions adopted between users and the providers of genetic resources (institutional arrangements);

(2) National ABS regimes in provider countries including administrative, legislative and policy measures. These institutions constitute a part of the transaction environment for genetic resources (institutional environment); and

(3) Implementation instruments for ABS that are under consideration for inclusion in an international ABS regime. Such instruments would also be part of the transaction environment for genetic resources (institutional environment).

[15] For more definitions and a critical discussion thereof see MARTIENSEN 2000: 12-26.

Institutional transaction environment

New institutional economics asserts that for the economic process the institutional environment is important. WILLIAMSON (1991) describes the institutional environment as a set of parameters (i.e. political, social, and legal) that leads to a shift in the comparative costs of governance (p. 287). As the transaction environment can encompass a source of uncertainty (cf. RICHMAN AND MACHER 2006: 42; SUTCLIFFE 1998: 2ff.), it can be assumed to be a determinant of transaction costs.

In the case of transactions with genetic resources subject to CBD provisions on ABS, the institutional environment is a complex issue. What varies among ABS cases is the institutional transaction environment in provider countries. It is composed of several elements, such as the property-rights distribution for genetic resources, and the administrative requirements for access to genetic resources (cf. CARRIZOSA 2004: 14-25).

Governance

Williamson defines governance as "[...] an effort to craft *order*, thereby to mitigate *conflict* and realize *mutual gains."* (WILLIAMSON 2000: 599). In this research governance is used as synonym for the institutional (contractual) arrangement developed and established between a user and a provider to manage transactions with genetic resources, related services and rights.

Transaction costs

MARTIENSEN (200) defines transaction costs as "welfare loss that would be avoidable, if the right institution was chosen" (p. 117). RICHTER AND FURUBOTN (2003) define transaction costs as "resources to create and run an institution (or organisation) and to ensure compliance with its rules" (p. 12). PICOT ET AL. (2003) focus the term on the governance of transactions: transaction costs are "all sacrifices and drawbacks that transacting parties have to bear to realize the exchange, including initiating costs, costs to reach agreement, execution, control and adaptation" (p. 68). WILLIAMSON (1990) uses the term friction-costs in this context to describe misunderstandings and conflicts between transaction partners leading to impediments and breakdowns (p. 325). In this research it is assumed that appropriate institutions or institutional measures can reduce but not necessarily completely obviate transaction costs.

Bounded rationality

The acquisition of information in a transaction process causes efforts and is therefore not costless. Transaction parties remain partially uninformed if the costs for gathering information exceed the (expected) benefits incremental information would create. Asymmetric information or generally incomplete information can thus be rational. The amount of information costs depends to a great extent on the information characteristics of the subject of the transaction, which in this research are genetic resources, related information, rights and services (PICOT ET AL. 2002: 54; RÖSCH 2007: 129f.).

Bounded rationality is acknowledged in the ABS literature as characteristic for user-provider relations. Often neither the provider nor the recipient of genetic material can with reasonable effort foresee at the contracting stage what the utilisation outcomes of the genetic resource – in other words, the benefits – will be (GEHL SAMPATH 2005: 65; CARRIZOSA 2004: 73).

Opportunism

Opportunism is also circumscribed as "behavioural uncertainty". Parties engaging in economic interactions face uncertainty induced by the possibility of a counterparts' opportunistic behaviour. It is assumed that each party might try to make transactions work to their own advantage, particularly under the presence of asymmetric distribution of knowledge. According to WILLIAMSON, the ex-ante choice of the "right" form of governance to prevent opportunism "[...] is central to the transaction cost economics exercise" (WILLIAMSON 1996b: 152 and 1998: 30ff.). The suspicion or apprehension of opportunistic behaviour is sufficient to raise transaction costs, as the other party will take actions to protect himself against such behaviour (KERSTEN 2004: 58ff.). This holds particularly, if it is difficult and costly to determine the trustworthiness of the transaction partner ex ante (WANG 2002: 161ff.). However, the assumption of opportunism in transaction cost economics has evoked a lot of criticism from researchers of other disciplines, e.g. structural sociologists and behavioural researchers. They argue that embeddedness and trust can alleviate the hazard of opportunism. Reputation is also discussed as a factor that can prevent opportunism (MEULEMAN ET AL. 2006: 4, referring to MAYER ET AL. 1995; ZAHEER AND VENKATRAMAN 1995; HILL 1990; PARKHE 1993).

In the case of genetic resources, asymmetric information fostering opportunistic behaviour can occur before contracting, e.g. when providers misrepresent the value of their supply, when users are dishonest with their intentions for the product, and ex ante in monitoring relationships (cf. GEHL SAMPATH 2005: 65; RICHERZHAGEN 2007: 118ff.).

Conscious foresight

Conscious foresight is the third attribute of human behaviour underlying the analysis of new institutional economics. It captures the actors' ability of looking ahead and anticipating potential hazards. Insights achieved thereby can be considered in decisions on governance structures (WILLIAMSON 2000: 601, and 2003: 922-923).

3.3 The concept of transaction cost economics

Transaction cost economics is developed in two main fields. The measurement part deals with identifying, measuring and explaining transaction costs. The governance part uses the transaction cost minimising argument to explain the variation of governance forms for transactions. The core message is the discriminating alignment hypothesis that "transactions, which differ in their attributes, are aligned with governance structures, which vary in their cost and competence, so as to effect a (mainly) transaction cost economizing result" (Williamson 2003: 926). This means that the transaction characteristics determine how relevant each governance property is for reaching organisational efficiency.

The link between the two approaches is that transaction characteristics are assumed to explain the depended variable in both analyses: the level of transaction costs on the one hand and the choice of a governance form on the other hand. Moreover, governance forms as such are viewed as sources of transaction costs: efforts for initiation, implementation and enforcement differ among governance forms. Therefore, it is necessary for both research questions to elaborate the concepts of transaction and transaction costs, transaction characteristics and governance forms.

3.3.1 Specification of transaction and transaction costs for access and benefit-sharing

Although transaction costs have been mentioned as a major impediment for the successful conclusion of agreements between users and providers (cf. OECD 2003: 26), a comprehensive definition of the term for the research subject "transactions with genetic resources and related rights and services" does not exist yet. It shall be substantiated in the following based on the general definitions provided in chapter 3.2.

The "creation and running of an institution" RICHTER AND FURUBOTN (2003) define as transaction costs, refers in this research to the "bilateral" governance arrangement for a transaction (or a set of transactions) with genetic resources and related services, rights and information. The interest is on efforts related to the initiation, conclusion and implementation of this "bilateral" governance arrangement, whereby the focus is on the user entity. Transaction costs borne by the provider are not investigated explicitly.

The aspect of "friction costs" WILLIAMSON (1990) uses in his definition shall be of specific relevance in the analyses. The international debate on the CBD level reveals that there are highly divergent views on the very basic provisions for ABS (what resources should be covered, what is an appropriate basis for fair benefit-sharing…). This indicates that in negotiations for concluding bilateral contracts communication problems and misunderstandings are likely to be significant.

In the literature three types of transaction costs are distinguished: (1) market, (2) firm, and (3) political/governmental transaction costs. Political transaction costs are "the costs of establishment, maintenance and modification of the formal and informal political order of a system" and the "operating costs of a state" (RICHTER AND FURUBOTN 2003: 63-65). For the problem analysis on the transaction level these transaction costs are not relevant. When discussing the pros and cons of a standardisation-based ABS instrument in a larger context, they must be taken into account of course.

In different phases of economic interaction, different types of transaction costs arise. WILLIAMSON distinguishes between ex ante and ex post transaction costs (1990: 22ff.), while other authors identify three phases. The latter approach shall be adopted in this research as well, since it better fits the often complex procedure of concluding an ABS agreement. For market transaction costs this would be: (1) Search and information, (2) Bargaining, and (3) Monitoring and enforcement (RICHTER AND FURUBOTN 2003: 59-61).

Some activities are typical for just one phase. Deciding, planning, arranging, and negotiating are activities that might take place in any of the three phases, however.

Types or indicators of transaction costs user entities might have to bear in the chain of concluding an agreement could be the following:

- Labour (working time of employees)
- Travel expenses that arise because site visits, meetings, participation in conferences are required
- Costs for arranging meetings
- Hiring external consultants (for example, lawyers)
- Costs of internal coordination, preparation of decisions in negotiations
- Opportunity costs of the time invested in "managing" the transaction (ibid.)

VISSER ET AL. (2000) is the only study that was found in the literature that defines transaction cost types and monetises them for transactions with genetic resources. The authors compare transaction costs of bilateral agreements with those of several options of a standardised multilateral exchange-system[16]. The scope of the study is, however, limited to the exchange of "by breeding unchanged" genetic material between users (breeders) and gene banks (national gene banks and CGIAR gene banks). The data stems from informed guesses and expert knowledge of the team of authors.

[16] At the time of the study of VISSER et al. (2000), it had not yet been established what form the future multilateral system would take. For this reason the study worked with four options: from exclusively bilateral to unrestricted multilateral access to all PGRFA collections. (cp. Ibid.: 7).

The following cost components are considered:

- Negotiation costs (costs for lawyers),
- Costs that are connected to accessing the resource ("pre-distribution tracking costs")
- Costs following access to the resource for monitoring and enforcement of the contract ("post-distribution tracking costs").

3.3.2 Transaction characteristics and further transaction cost factors

As mentioned before, new institutional economics theories shall be supplemented with aspects of strategic management[17] for the identification of factors determining transaction costs and governance choice. Both theories deal with the nature of economic relationships on the contracting level. Complementarity of the two theories for governance analysis has been suggested in the literature (cf. ERLEI 1999: 69; MASTEN and SAUSSIER 2000: 224[18]; SHAN 1990: 129-131). However, while new institutional economics has been used in the analysis of bioprospection and ABS agreements in the past, strategic management, to the best of my knowledge, has not been considered in this area. In this work a framework of contract theories from the institutional economics side and strategic management aspects is used for identifying determinants for governance choice and transaction cost determinants.

OLIVER WILLIAMSON identified three major transaction attributes: asset specificity, frequency, and uncertainty (WILLIAMSON 2002; WILLIAMSON 1979: 239) as determinants for transaction costs and governance efficiency.

[17] Strategic management is a branch of business administration. It consists of many branches with different focuses. The overall subjects are development, planning and implementation of goals and the organisational concept of organisations. The objects of analyses are strategies, structures and systems. The resource-based view, which will be consulted in this work, is one of the branches of strategic management (cf. GRANT AND NIPPA 2006, NAG ET AL. 2007; Ritson 2008).

[18] "The structure of contractual agreements may vary with, among other things, the objectives of the contracting parties, underlying production relations, and the nature and size of informational and strategic impediments to contract formation and enforcement. As a consequence, theory provides no unifying structure for the specification and testing of contract design hypotheses." (MASTEN and SAUSSIER 2000: 224).

Other researchers supplemented the theory with additional explanatory factors, partly from the principal-agent theory. MILGROM AND ROBERTS (1992 and 1995) found that transaction complexity and performance duration are further relevant transaction attributes (referred to in Altman und Johnson 2004: 3).[19]

A further variable to be included is the transaction environment, here the variation of national ABS systems, since it is referred to as source of uncertainty in the literature and transaction costs in the public debate.

Access to specific complementary assets or rights for creating competitive advantages is considered relevant for governance choice in strategic management. It shall be included in the governance analysis for transactions with genetic resources as well as variation of indirect capabilities or capacities of the user entity.

These characteristics distinguishing ABS-cases are elaborated more in depth in the following.

Asset Specificity

WILLIAMSON defines asset specificity as: "[The] degree to which an asset can be redeployed to alternative uses and by alternative users without sacrifice of productive value" (cf. WILLIAMSON 1996a: 59; see also cf. PICOT ET AL. 2002: pp. 70).

Relation specific investments can take the form of:

- **Physical assets**, e.g. specific machinery, laboratory equipment, hard- or software etc. required to execute the activity subject to the transaction
- **Human assets**, e.g. learning by doing or specific training of employees for activities related to the transaction project
- **Site specificity,** e.g. choice of location to economise on transport costs, share inventory or easy information exchange, proximity to resources that are subject to the transaction

19 MILGROM AND ROBERTS (1992 and 1995) found also that difficulties of measuring performance and connectedness are relevant transaction attributes (referred to in Altman und Johnson 2004: 3). Grant adds measurability of the value created by the transaction and interdependency with other transactions (2006: 209-210).

- **Dedicated assets**, which Williamson defines as "discrete investments in general purpose plant that are made at the behest of a particular customer"
- **Brand name** capital (presumably not relevant in the context of this research)
- **Temporal specificity**, which refers to the risk of losses due to hold-ups in the further utilisation of the transaction subject, if the provider does not deliver in time, quantity, and/ or quality (WILLIAMSON 1991: 281 and 1998: 36).

Relationship-specific investments require governance safeguards for economic rents, because the investor cannot exit the relation (transaction) without loss due to the "specificity" of his investments, if disturbances require adaptation. Since the other party is aware of this, the "investors' position" in renegotiations would be weakened. The other party might take advantage of this and act in an opportunistic manner or at least hold up processes and therewith cause loss of economic rents (cf. ibid.; ALTMAN, KLEIN & JOHNSON 2007: 3; DYER 1997: 536).

SAMPATH states that opportunistic behaviour, legal uncertainty and insufficient enforcement measures for contracts can cause problems in bioprospecting projects if relation-specific investments are or will be made (2005: 65). She found that particularly temporal asset specificity is a critical factor in bioprospecting R&D projects in the field of pharmacy and botanical medicine. At certain stages in pharmaceutical research the reliable supply of raw material (quantity, quality and schedule) is crucial; the process is vulnerable for hold-ups and investments made in the course of R&D are at risk. Similar problems can arise if intellectual property rights over traditional knowledge are issued at a late stage of R&D process (ibid: 95-98).

Asset specificity is in the theory and in empirical studies most often treated as an exogenous variable (see argumentation above). However, specific investments can very well be viewed as part of the governance structure, hence a decision variable (MASTEN AND SAUSSIER 2000: 231).

Primary Uncertainty

Primary uncertainty can be defined as the degree to which adjustments of exchange terms during a transaction are necessary and how predictable these adjustments are ex ante (cf. PICOT ET ALL 2002: 70). In other words, to what extent can the implementation of the transaction (including rent sharing) be structured ex ante? Sources for primary uncertainty are various; in general, we can say that the more complex and dynamic the activities underlying the project are, the more difficult ex ante anticipation will be (GRANT 2006: 420). How far this applies to a certain transaction depends on the characteristics of the transaction object and the intended use of the transaction object.

The topical literature indicates that many sources of primary uncertainty can be attributed to transactions with genetic resources or the utilisation of genetic resources (GEHL SAMPATH 2005: 65-66).

The technological process of utilisation can be uncertain in the sense that unforeseeable investments might become necessary (technological uncertainty). Moreover, due to the nature of the R&D process, marketable or in general commercial valuable outcomes might be predictable only to a limited extent. Often, neither the provider nor the recipient of genetic material can foresee at the contracting stage what the outcomes of the investigation with the resource – in other words, the benefits – will be (scientific uncertainty and commercial uncertainty) (CARRIZOSA 2004: 73; Dedeurwaerdere 2005: 474; GEHL SAMPATH 2005: 65; OECD 2003: 24-25). The economic rents from marketing a product/intermediate product based on genetic resources can also be uncertain due to volume uncertainty resulting from volatile or new markets or products (market or demand uncertainty) (SHELANSKI 1995: 339).

The performance duration can be interpreted as the duration of the delivery from the provider, or what makes more sense in the case of genetic resources: the utilisation duration. How long it takes until the user knows, whether and what amount of commercial benefits will arise from the utilisation influences all four other types of primary uncertainty.

Uncertainty needs to be examined in connection with relation-specific investments; without, transaction cost economics does not predict that primary uncertainty influences efficiency of different governance forms (cf. RICHMAN AND MACHER 2006: 7; SHELANSKI 1995: 339).

Frequency of Economic Interaction

Different governance forms for transactions require different levels of effort for their initial implementation. The costs accruing for each additional transaction vary. A reduction in costs for the individual transaction might outweigh higher implementation efforts if a certain number of transactions are reached (PICOT ET AL. 2002: 71). Therefore, if transactions are frequent, parties respond by investing in governance structures (high initiation costs) that increase reliability and are cost effective per transaction (low costs of individual transaction). GEHL SAMPATH stresses this aspect in her analysis of bioprospecting cases (2005: 69).

Heterogeneity of demand

Strategic management suggests "access to relevant complementary assets" as a strategic determinant for the choice of governance forms. Exclusive access to rare resources and/or related information might be a strategically relevant complementary asset (OECD 2003: 20).

Cost reduction in input allocation and outsourcing of labour intensive working-steps in the utilisation procedure are further strategically motivated factors of choosing a certain governance arrangement. These factors differentiate demand for genetic resources, related services and rights. They are not directly linked to the transaction cost minimisation goal but rather indicate a plurality of logics of governance choice (cf. DEDEURWAERDERE 2005: 475).

The nature of demand and the complexity of the provider contribution can be assumed to influence both, the governance arrangement and the transaction costs.

The transaction environment

It is assumed that the transaction environment with its economic, institutional, and cultural aspects influences the efforts required to initiate and negotiate an exchange with genetic resources as well as the governance form adopted for the executive phase of the transaction (cf. WILLIAMSON 1990: p. 25ff). Butter stresses in particular the relevance of cultural and ethical factors as a source of environmental uncertainty, since they might influence the risk of opportunistic behavior and evoke communication problems. They require additional information gathering and/or consultancy (BUTTER 2007: 7). In the governance approach of transaction cost economics, the transaction environment is often considered static and therefore not included as potential explanatory variable in empirical analysis. For bioprospection, however, the transaction environment can be assumed to be non-static and highly relevant, because users acquire resources from all over the world, from sources with highly different transaction environments. In the topical literature the relevance of this aspect for bioprospection is mentioned by several authors (cf. GEHL SAMPATH 2005; HOLM-MUELLER ET AL. 2005; OECD 2003; RICHERZHAGEN 2007).

Relevant institutional factors are the availability of information regarding the responsible authorities (National Competent Authorities), and procedural routines among entities within the provider country. A higher level of experience and the application of efficient routines were named as assets of a provider country (OECD 2008: 68). The lack of familiarity of the responsible government authorities with the market, legal factors and the scientific and technological process in the fields of utilisation for genetic resources, on the other hand, are criticised as drawbacks and impediments in negotiations (LAIRD AND WYNBERG 2005: 33).

MARTHUR ET AL. (2004) identified relevant institutional factors in provider countries among others from company statements on ABS strategies. The company Diversa chooses provider countries collaboration by (among others) the legal framework (simple, complete, including standardised procedures for exporting samples, Intellectual Property Rights protection…), and the political will of the country (training of officials on bioprospecting issues). Appropriate scientific capabilities (skills, equipment, and infrastructure) and unique and protected habitats are further selection criteria (p. 13).

Indirect capacities

Indirect capabilities or capacities[20] are competences in interacting with, for example, economic suppliers and alliance partners (ARAUJO ET AL. 2003; LOASBY 1998). In the theory "resource based view" (KASCH AND DOWLING 2008: 1766), which belongs under the umbrella of strategic management, companies or more generally economically active entities are viewed as pools of resources and skills or capabilities (GRANT 2006: 176). Indirect capacities are assumed to increase with experience in cooperating (KALE ET AL. 2002; SIMONIN 1997), because experience builds up routines, which protect tacit knowledge or tacit information and reduce uncertainty in communication with transaction partners (GULATI 1999: 413; KATILA AND MANG 2003). Hence, the level of experience is assumed to influence relative costs of different governance forms. Empirical studies show that a high level of indirect capabilities increases the likelihood of a company to engage in complex governance structures, since the costs of implementing complex governance structures are relatively lower compared to companies lacking such capacities (GULATI 1999: 413; KATILA AND MANG 2003).

Since this research focuses on the procurement of genetic resources from source countries and under compliance with the respective domestic regulations, the aspect of indirect capacities seems highly relevant for transaction costs and the choice of governance forms. Genetic resources are used in many different fields and presumably by companies of different sizes and researchers with different levels of experience in executing long-term complex projects, particularly with partners in developing or newly industrialising countries. It can be assumed that users with different levels of indirect capacities apply different transacting strategies and face different levels of transaction costs.

[20] The terms "capacities" and "capabilities" are here used as synonyms.

3.3.3 The concept of governance forms

Principal-agent theory, relational contract theory, and WILLIAMSON'S governance approach of *transaction cost economics (TCE)* can be attributed to the governance branch of new institutional economics (RICHTER AND FURUBOTN 2003: 171-172). However, the assumptions about the governance choice differ to some extent among these theories.

Principal-agent theory considers only formal contracts as a governance form. The main purposes of contract design are risk transfer and incentive alignment as means to overcome problems of asymmetric information (MASTEN AND SAUSSIER 2000: 216 and 228). It is assumed that contracts specify the parties' obligations for every contingency on the basis of the information available at the time the agreement is carried out (ibid. p. 220).

The *theory of relational contracts* views governance forms as relations rather than as discrete transactions (WILLIAMSON 1991 referring to MCNEIl 1974). In contrast to classical contracts personal relations between the parties are important. Friction is accepted as a normal part of the relation, and the contract contains mechanisms for cooperative conflict resolution. Relational contract types are suggested for governing economic interaction in "imperfect markets", in which the stipulation of all eventualities in a contract is very costly (RICHTER AND FURUBOTN 2003: 168-170). Relational contract elements can be assumed to play an important role in transactions with genetic resources, since the market for genetic resources is characterised by market imperfections and the utilisation by uncertainty.

Some authors view relational contracts as intermediary governance forms and consistent with transaction cost economics (MASTEN AND SAUSSIER 2000: 226). This shall be assumed in this research as well.

Williamson's *governance approach of transaction cost economics* provides an analytical framework to interrelate transaction attributes and human behavioural factors with coordination (governance) forms for transactions. Governance choices are thought to be made against the background of economizing transaction costs.[21] Production costs are considered, but are not in the focus of analysis in the governance approach of transaction cost economics (Williamson 1985).

Transaction cost economics recognizes that incomplete contracts can be rational, for example, if due to uncertainty not all contingencies can be anticipated or if measurability and verifiability of contract fulfillment through third parties (e.g. courts) is limited and hence external enforcement restricted (RICHTER and FURUBOTN 2003: 269). It is important to note that this understanding of information deficiencies diverges from asymmetrical information in principal-agent theory. In transaction cost economics the role of contracts to align incentives for agents to reach certain effort levels is acknowledged (MASTEN and SAUSSIER 2000: 225). However, contracts are first and foremost understood as "devices for structuring ex post adjustments and for constraining wasteful (rent-dissipating) efforts to influence the distribution of gains from trade, including, especially ex post bargaining and "hold-up" activities in transactions supported by relationship-specific investments. [Moreover, contracts shall prevent from] [...] ex ante sorting and search in contexts where additional information serves merely to redistribute rather than expand the available surplus [...]" (ibid. 216 and 225).

Transaction cost economics has been criticised for insufficiently capturing strategic considerations (BELLO ET AL. 1997: 118-119; SHAN 1990). Companies using genetic resources can be assumed to aim for long-term goals (profitability). *Strategic management theories* treat the governance mode as a strategic variable to pursue long-term profitability by improving the competitive position (ibid. 130).[22] The resource-based view focuses on creating or acquiring strategically relevant and unique resources to reach such goals, in particular the improvement

[21] What the governance approach of transaction cost economics does is defined varyingly in the literature; the message, however, is somewhat the same. PICOT ET AL. describe transaction cost economics as a measure to analyse the performance relationships between transactors, and the optimisation of these (PICOT ET AL. 2002: 79 and 85). SHELANSKI AND KLEIN see the aim of transaction cost economics as "explaining […] contracting arrangements observed in practice" by using efficiency arguments (SHELANSKI AND KLEIN 1995: 341). According to MASTEN "[…] transaction cost economics offers […] a set of normative rules for choosing among alternative governance arrangements" (MASTEN 1993: 119).

[22] Competitiveness as long-term strategic goals for public research institutions is not merely related to financial profitability but to scientific recognition and visibility, e.g. through publications.

of the competitive position. Companies might strive for strategic alliances or cooperation to acquire strategically relevant genetic resources and related rights, and information.

The concept of "indirect capabilities" in the resource-based view reflects the heterogeneity of the human capital resources in companies. Indirect capabilities are assumed to influence the relative costs of engaging in complex relations and therefore the choice of engaging in such governance forms to acquire strategically relevant resources (KASH and DOWLING 2008: 1767).

Competing governance forms

Theory and empirical studies distinguish between market transactions (competition) and the hierarchical organisation of economic activities. Between these two generic governance forms exist many intermediaries.

Characteristics of the market transaction are a homogeneous, standardised "subject matter of transaction" (ex-ante information is easy to obtain) and perfect competition. As a result, transaction parties are not dependent on each other. They can switch partners without economic loss (cf. RICHTER AND FURUBOTN 2003: 196). Hierarchical coordination, on the other hand, means that economic activities are integrated and governed under a corporate headquarters (cf. ibid. p. 197).

In general, a simple, complete formal contract would be applied for the market transaction. The more the transaction type shifts to the integrated end, the more informal mechanisms are applied. Intermediary governance forms are governed by so-called hybrid contracts[23] (DA SILVA AND SAES 2007: 450-451). The relational contract, which has many characteristics of internal governance, is a special type of hybrid contract. WILLIAMSON defines evenly unified, internal governance as relational contracting (1995: 253).

In the literature on bioprospecting, a vast variety of design options for governance elements (referred to as ABS-agreements or bioprospecting contracts) are described. SAMPATH identified three general types of contractual relationships in her research, which is specific to the pharmaceutical sector: (1) long-term multilateral contracts between different actors (she

23 Hybrid means that the contract is subject to negotiations between the transacting parties.

calls it research collaboration), (2) a sequence of bilateral contracts (private research collaboration), and (3) the acquisition of material via commercial intermediaries or public culture collections, gene banks or botanical gardens (spot market transaction) (2005: 26ff.). The latter type of transaction is, however, not the focus of interest in this research. A look at case studies in other publications indicates that highly integrative governance measures, such as technology transfer and training of the provider as well as joint IPRs, are applied compensation mechanisms as well as market based monetary benefit sharing, such as fixed prices for amounts of biological material (cf. TEN KATE AND LAIRD 1999; GEHL SAMPATH 2005).

A comprehensive theory-based framework for the empirical comparison of governance forms from a broader sample including other application fields is lacking so far. One goal of this research is therefore the characterisation of governance forms for transactions with genetic resources in a way that they can be investigated and compared empirically and interrelated with transaction characteristics.

WILLIAMSON developed a concept to distinguish "competing" governance forms by their properties regarding costs and competencies:

1: Incentive intensity: Markets provide incentives for competition; if the transaction partner performs insufficiently, the other party can switch to a different provider. Hierarchy lacks this kind of incentive (WILLIAMSON 1998: 37). It is assumed that the effort level contributed by an actor has less of an immediate effect on the compensation within an organisation compared to a classical market transaction. In hierarchical governance, incentives (e.g. wage increases or bonus payments) have the intention of safeguarding cooperative behaviour (WILLIAMSON 1991: 275).

2: Administrative controls: Incentive intensity and administrative control measures are instruments to safeguard actors' behaviour in the transaction relationship. At higher levels of integration more forms of administrative controls and sanctions are available, but bureaucratic costs rise at the same time. Depending on the requirements regarding other governance characteristics (e.g. adaptability), incentive intensity and administrative control measures are to a certain extent substitutes (ibid. p. 280).

3: Adaptation: Adaptation: Presumably, problems in transaction relationships arise if the adaptation to new circumstances is required. Mechanisms for adaptation are therefore a central challenge of an organisation. Different governance forms support different kinds of "changes", since they have different properties of adaptation (WILLIAMSON 1991: 278; 1996a: 26; 2003: 924-925).

The kind of adaptation required depends on the type of disturbance. WILLIAMSON (1991) differentiates disturbances regarding (1) the requirement for coordinated adaptation and (2) with respect to consequentiality (p. 278-280).

Adaptability to changes in demand or supply - where prices are good indicators (uncoordinated adaptation) - is higher at lower integration levels. A coordinated response is superior for adaptation to more complex disturbances, for instance if several levels of R&D and/or the production chain are involved and a wider range of information and information exchange is required.

Coordinated response can be carried out under both hybrid and integrated governance, but there are significant differences. In hybrid modes autonomous ownership theoretically elicits stronger incentives, which encourages adaptation to less complex disturbances. Contractual safeguards and administrative mechanisms in relation to bilateral-dependency support adaptation to complex disturbances. The problem of hybrid modes in long-term relationships is the subsequent gap-filling and adaptation due to incompleteness of contracts. This opens opportunities for costly and time-consuming ex post bargaining over the distribution of economic rents (causing poor adaptation of the transaction until resolved) and inefficient propositions ex ante. Therefore, with increasing consequentiality of complex disturbances, integration is favoured over hybrid forms to achieve transaction cost minimising adaptation (ibid.).

4: Applicable Contract law: WILLIAMSON distinguishes between three main types of contract law regimes: classical contract law, neoclassical contract law and transaction-specific relational mechanisms (for bilateral governance and unified governance). For market transactions classical contract law is applicable, meaning that dispute settlement is external with legal mechanisms relying on courts. In intermediary governance types contracts remain incomplete due to uncertainty. This is why external contract law (courts) is inefficient and neoclassical contract law (third party assistance, arbitration) or relational, transaction-specific, mechanisms that are increasingly administrative are frequently applied (1991: 271-272; 1995: 236ff).

The more complex and long-term relations become, the more frequently special adaptive dispute settlement measures are employed (WILLIAMSON 1991: 271-273; 1998: 46). At the same time, the more relational a contract, the weaker the legal commitment becomes. The importance of conventions and internal enforcement thereby rises.

Relational, implicit contract law might provide insufficient safeguards to bilateral governance if transactions are exposed to highly consequential disturbances and the risk of opportunism rises. In such cases integration would be the governance form of last resort. Stakeholders should work out disputes themselves or appeal to the hierarchy for a decision. The results presumably would rely on instrumental reasoning and mutual accommodation.

To sustain a cooperative and constructive atmosphere between transacting parties, avoiding dispute resolution through courts can be vital (1995: 238 and 244). Arbitration is a type of dispute resolution that envisages a continuation of the relationship, which distinguishes it from most other types of external contract law. Another rationale for applying forbearance is that the transfer of in-depth knowledge regarding circumstances and the efficiency of different options to external courts might be quite prohibitive (1991: 275-276).

Williamson defines each generic mode of governance by a syndrome of the attributes elaborated previously (see Table 8).

Table 8: Attributes that define three viable modes of governance

Governance Structures	Governance Attributes		
	Incentive Intensity	Administrative control	Contract law regime
Spot market	++	0	++
Hybrid	+	+	+
Hierarchy	0	++	0

Source: Williamson 1991: 281 and 2003: 925-926 (++ = much; + = some; 0 = little)

From governance properties a concept of functional units - here called "**governance elements**" - shall be derived and tested in this research, with discrete observable characteristics incorporating WILLIAMSONS' governance attributes. The choice to operate on the level of governance elements rather than complete contract or agreement types results from a lack of information. The variety of contractual forms is "virtually unlimited" and the literature does not provide empirically tested, discrete contract types for transactions with genetic resources. Another reason is that the latest suggestion for an ABS-instrument actually envisages "menus of model clauses" rather than "complete" model contracts.

Three main observable governance elements have been defined basing on Williamson's "properties" concept:

(i) **Compensation or pricing structure**

(ii) Stipulated or implicit dispute **resolution mechanisms**

(iii) **Duration of contracts** (short versus long-term)

P**ricing/compensation mechanisms** generally vary concerning the time period and means of determining the final compensation as well as what it responds to, e.g. the market price, negotiations, or the future outcome of economic activity based on the transaction object. In bioprospecting contracts, a combination of different monetary benefit-sharing measures is often utilised, e.g. per sample payments and royalties. Risk-sharing (the user's investments) and incentives for ensuring that material deliveries fulfil quality and quantity requirements in a longer run are mentioned as determinants for non-monetary benefit-sharing in ABS agreements (cf. OECD 2003: 29-30; MULHOLLAND AND WILMAN 2003: 427- 431).

Of particular interest in the case of ABS is **non-monetary benefit-sharing**, which can be affiliated with the governance category pricing-mechanism as well. Non-monetary benefit-sharing measures can also be viewed as relation-specific investments with a purpose beyond compensation. Capacity building, joint intellectual property rights (IPRs) or joint publications can strengthen mutual trust and create dependency for the provider as well. Non-monetary benefit-sharing could therefore be viewed as an integrative, hierarchical governance mechanism for the creation of interest harmonisation and to prevent opportunism.

Observable characteristics of **dispute resolution mechanisms** found in the theory are (a) the stipulation of external contract enforcement through courts, (b) the stipulation of arbitration, (c) the stipulation of proceedings for internal dispute resolution including measures of trust-building and mutual information. In the case of transactions with genetic resources, a well-defined legal regime, which is a precondition for (exclusively) external enforcement, is however, lacking (cf. Dedeurwaerdere 2005: 477; OECD 2003). Also, full hierarchical control and enforcement is not achievable in the case of bioprospecting projects, since full integration of the "provision of genetic resources" by a user entity is not possible.

Contract duration can vary continuously. For ABS agreements it might cover the timeframe of the actual exchange between the transacting parties, or the timeframe of utilisation.

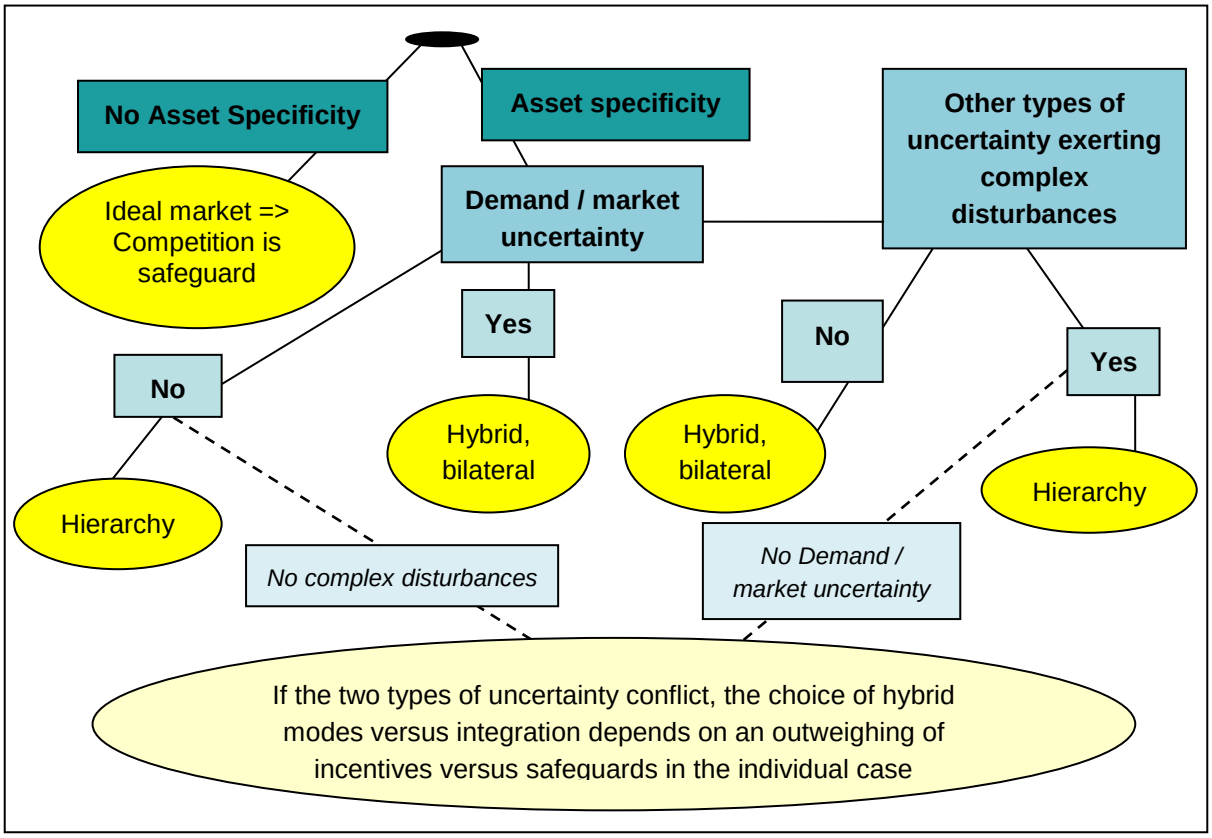
The concretisation and operationalisation of the governance elements for transactions with genetic resources shall be carried out with the help of a literature review and several exploratory research steps, such as the study of existing model-agreements, guidelines and standard contracts for ABS agreements, as well as exploratory stakeholder interviews and group discussions with users. The adapted theory framework is presented in chapter 5.3.

3.3.4 Interlinking transaction characteristics and governance

In this section the fundamental hypotheses on the connections between overall governance forms and the typical transaction characteristics are sketched. Based on these findings, sets of hypotheses shall be specified for transactions with genetic resources in chapter 5.3. These will be tested with data from a cross-sectional survey in chapter 6.

According to WILLIAMSON (2003), the very basic regularity of aligning governance forms with transaction attributes is that with increasing bilateral dependency (e.g. due to asset specificity by both parties) and "complex" disturbances (we deal with ex-ante uncertainty, in other words the possibility that certain disturbances occur), coordinated response and safeguards against opportunistic behaviour gain importance. Due to bounded rationality, uncertainty leads to incomplete contracts. However, under the presence of asset specificity uncertainty induces a move from spot market to hybrid solutions or integration. Whether autonomy should remain or unified governance is superior depends on the level of asset specificity and consequentiality of disturbances (p. 926). Transaction relations "for which the requisite adaptations to disturbances are neither predominantly autonomous nor bilateral but require a mixture of each, are candidates to be organised under the hybrid mode" (WILLIAMSON 1991: 283).

The differentiation of disturbances (uncertainty) is vital. In the literature market and demand uncertainty refers to rather "simple" disturbances, detected easily through price shifts and not requiring a coordinated response. Technological uncertainty raises the risk of opportunism. If the investments or other types of adjustments in the process have to be coordinated among several transaction parties, coordinated response becomes important. Figure 3 indicates that several types of uncertainty have to be considered simultaneously. If a transaction is characterised by types of uncertainty pointing towards opposing governance solutions, the decider has to evaluate the trade-offs in the individual case.

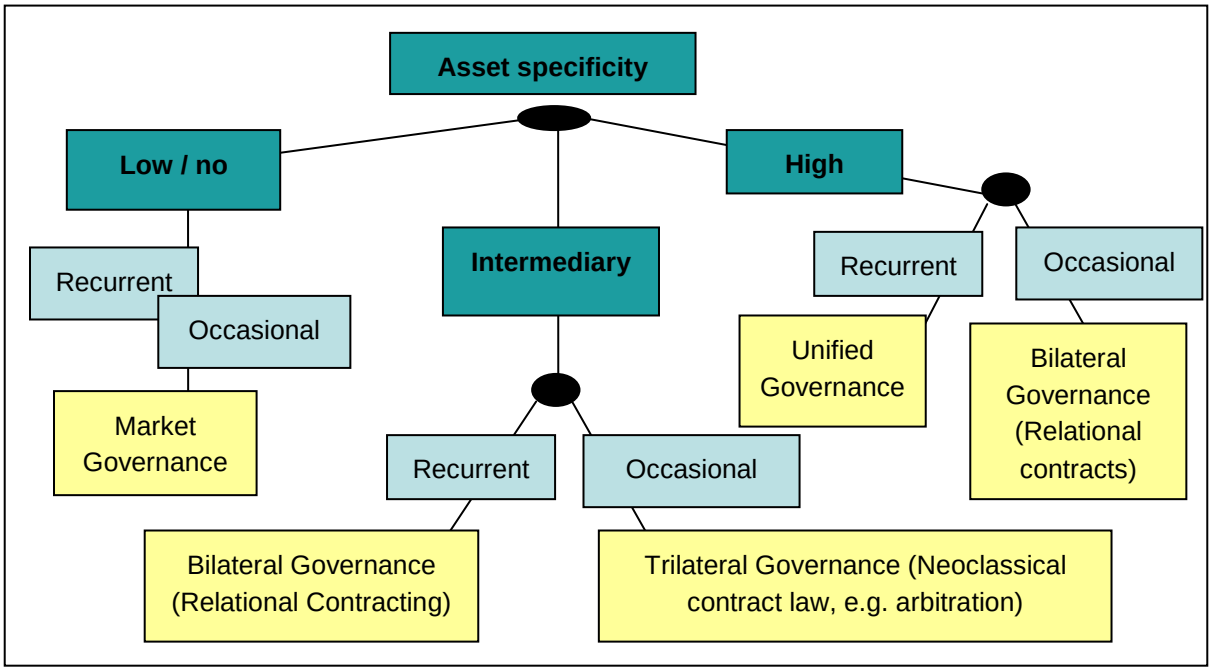


Source: Author based on WILLIAMSON 1991: 282-285; 1998: pp. 38; 1995: 116-117; RICHMAN AND MACHER 2006).

Figure 3: Decision tree interrelating asset specificity and uncertainty with governance modes

Hierarchical coordination becomes more advantageous as idiosyncrasies (due to asset specificity) increase. The choice between relational contracting and vertical integration is then a matter of weighing the relevance of coordinated adaptation against incentive intensity. The different types of uncertainty that characterise economic interaction are the determining factors.

The influence of frequency on the advantageousness of governance forms is also interrelated with asset specificity. If asset specificity is high and coordinated response to disturbances is important, the transaction frequency adds to the advantageousness of integrated governance forms (WILLIAMSON 1995: 259).



Source Author's: based on Williamson 1995: 246-253 and Williamson 1998: pp. 38.

Figure 4: Decision tree interrelating transaction attributes with governance modes

Figure 4 shows that for transactions without asset specificity it does not matter whether the transaction is recurrent or occasional. In both cases market governance is most efficient. If intermediary or high levels of asset specificity are at hand, frequency matters. Here we find a differentiation between trilateral (dispute resolution with third party assistance), bilateral (see above) and hierarchical governance forms.

The influence of strategic aspects on governance forms is manifold. If companies seek exclusive access to resources and/or information for competition reasons, the supplier makes specific investments by granting exclusivity. If additionally the outcome of the utilisation is uncertain, governance structures have to include relational monitoring and enforcement mechanisms and participatory compensation mechanisms.

Cost factors could be a strategic motivation for outsourcing of the preparation of samples and initial material evaluation, for example. Specific investments might be required in the context of outsourcing, such as training or laboratory facilities to enable the provider to carry out a specific service. Governance forms are presumably adopted to provide safeguards for these strategically motivated investments. Since the user can be assumed to have an interest in sustaining the relationship, relational rather than classical dispute resolution mechanisms shall be established.

Another strategic aspect affecting governance decisions in ABS agreements is noted by CARRIZOSA (2004). Setting up cooperative projects with local counterparts to acquire access to genetic resources is a common strategy to expedite the access process (local entities are familiar with local customs and bureaucracy) and to bring legitimacy and transparency to the project (p. 17-19).

3.4 Contribution of the new institutional economics theories to the problem analysis

In the following subchapters the contribution of (1) transaction cost economics, (2) property rights theory, and (3) the principal-agent theory to the analysis of problems occurring in the implementation of ABS-agreements will be discussed. The theories shall guide exploratory interviews and group discussions for identifying transaction cost sources, types and determinants. Based thereupon a framework of hypotheses on transaction costs and transaction characteristics is specified in chapter 5.4 and tested with data from the online company survey in chapter 6.2.

3.4.1 The contribution of transaction cost economics

The measurement of absolute transaction costs and the comparison of different cases are hardly found in the literature. Previous studies and exploratory interviews indicate that such data could hardly be collected for transactions with genetic resources under the scope of the CBD. However, what is relevant and identifiable in this research are types of costs and the users' individual assessments of transaction costs as impediments to the implementation of ABS agreements. Moreover, sources of transaction costs are of interest and are identifiable.

Transaction cost economics postulates that the transfer of resources, goods, rights or information can be carried out at low (without significant) transaction costs, given that the market is "perfect". The theory further suggests a set of "external factors" and transaction characteristics that in reality violate the assumption of a perfect market. These factors induce certain problems of economic interaction requiring governance beyond standard forms and therefore transaction costs can be significant. In the following sections three parts of new institutional economics are elaborated with the aim of identifying such external factors and transaction characteristics.

3.4.2 The contribution of property rights theory to the problem analysis

It was previously indicated that in transaction cost economics the institutional environment is thought to be a relevant factor for transaction costs. It is stipulated in the relevant literature (cf. GEHL SAMPATH 2005: 78-79; OECD 2003; RICHERZHAGEN 2007) that the organisation of property rights for genetic resources in provider countries is an essential part of the institutional environment.

For the problem analysis, property rights theory shall be employed to specify characteristics of institutional frameworks in provider countries that may influence transaction costs in the implementation of ABS agreements.

The basis of the property rights theory is the specification and allocation of property rights for scarce resources. Property in this context has many definitions; for this research we consider physical (biological resources) and intangible entities (genetic information) as property. Rights concerning property are (1) the right to use and control the property, (2) the right to

benefit from the property and the obligation to bear losses, (3) the right to transfer or sell the property, and (4) to exclude others from the property. The different rights can be owned by one person or jointly by a group of persons (cf. LIPPERT 2005: 17; MARTIENSEN 2000: 224-225; PICOT ET AL. 2002: 55).[24]

The CBD states that their member countries have the sovereign rights over genetic resources in their territory and that they shall implement national systems to execute these rights. Depending on the system of goals and pre-existing institutions, countries come to diverging conclusions on how to allocate property rights for genetic resources. CARRIZOSA (2004) analysed national ABS systems in provider countries with regard to this question. Relevant factors he identified are the ownership-system for genetic resources, access procedures, and regulations for Prior Informed Consent (PIC).

Natural resources can be privately or communally owned or state property. In the first case, private or communal landowners do not need the state's approval to market biological, biochemical, or genetic resources. Regimes applying the latter approach require bioprospectors to obtain a permit from the state and to negotiate access with the individual or collective owner or holder of the land or ex-situ collection where the biological or genetic resource is found (ibid. p. 14).

[24] Property rights theory postulates that in a world with transaction costs, the structure of property rights influences the decisions of economic actors in a distinctive and predictable way. This means that property rights determine resource allocation (MARTIENSEN 2000: 113). Political or administrative decision makers can use property rights allocation as an institutional element to pursue certain goals, for example, to attract users by facilitating access through well-defined and transparent property rights for genetic resources. On the transactional level, contracting parties can use the specification of property rights as incentive measures to foster certain behaviour, for example, to reduce behavioural uncertainty (cf. ibid. p. 9). Both aspects of property rights are relevant for this research. For the problem analysis, however, property rights systems as part of the transaction environment are of the most interest. Property rights alignment as a governance element in transaction relations are taken up in chapter 6.

In the topical literature property rights theory is also employed in the discussion of incentive-alignments for biodiversity conservation (GEHL SAMPATH 2005: pp. 102-123; OECD 2003: 22-23; RICHERZHAGEN 2007: 109-110, SWANSON AND GÖSCHL 2000). This, however, is not the focus of this research. Issues of the property rights system on the provider country level are investigated as a potential source of transaction costs.

Access procedures differ among others in terms of timeframe. CARRIZOSA sees differences in the negotiation of PIC and benefit-sharing agreements as main reasons. The requirement for PIC is an essential part of establishing the national sovereignty of member countries over their genetic resources. However, national systems vary regarding from whom and how often PIC has to be obtained before access is granted. In some cases only actual providers have to be consulted in others additionally state authorities have to be involved in benefit-sharing negotiations. It also varies whether PIC has to be obtained from local communities. Involvement of state authorities and local communities supposedly impede negotiations and lead to higher transaction costs (2004: 22-25).

Similar to CARRIZOSA (2004), RICHERZHAGEN (2007) identified the property rights assignment and administrative complexity of access procedures for genetic resources as relevant success factors for provider countries aiming to implement the CBD goals, what includes the successful implementation of ABS agreements. Moreover, she supplemented "good governance" as a further critical factor of the institutional environment in provider countries. Good governance comprises political stability, control of corruption, rule of law, and accountability (p. 113 referring to KAUFMANN ET AL. 2006: 4), factors of the property rights system that determine enforceability.

3.4.3 The contribution of principal-agent theory to the problem analysis

At the core of the principal-agent theory is asymmetric information between parties in an economic relationship. In the worst case scenario, asymmetric information might omit market transactions (adverse selection) (cf. RICHTER UND FURUBOTN 2003: 175f.). Signalling and control are suggested as counter measures (cf. ERLEI ET AL. 1999: 157f.) against principal-agent problems, but they induce costs and welfare loss due to inefficient resource allocation. These costs are called agency costs (PICOT ET AL. 2002: 87). The principal-agent theory contributes to the problem analysis by supplementing the theoretical framework with the aspects of asymmetric information and agency costs.

Information asymmetries between user and provider of genetic resources are conceivable in both directions and ex ante (before the conclusion of an agreement) as well as ex post (during the course of a transaction and afterwards, when compensation is due, since this might be

carried out over a longer timeframe). The user and provider might face problems observing and assessing the efforts and actions (hidden action) taken during the project by the respective other party. Parties might also have relevant information and fail to share it with the other (hidden information). Opportunistic behaviour in one of the two described ways is referred to as the "moral hazard" problem (cf. RICHTER UND FURUBOTN 2003: 173f.).

User entities usually have more information about their interest in the genetic resources, the costs of the utilisation process (for example research and development or investments) and the availability of substitutes for the providers' service. Supposedly they can also better predict the commercial outcomes of the utilisation. Providers on the other hand might have private information on the quality of samples or the biodiversity in a specific area. Moreover, users cannot without costs safeguard providers' compliance with exclusivity agreements (cf. OECD 2003, GEHL SAMPATH 2005: 65-67; MULHOLLAND AND WILMAN 2003: 419, 432f; RICHERZHAGEN 2007: 118-119; REID ET AL. 1993: 38).

4 Empirical results I – exploratory analyses

This dissertation is founded on three main empirical analyses: (1) an evaluation of existing guidelines, model- and standard-contracts for transactions with genetic resources, (2) exploratory interviews and group discussions with users of genetic resources, and (3) a quantitative, standardised online survey for user companies. The first two steps are exploratory. The findings shall feed into the discussion of both research questions, but are also aimed at substantiating findings from the literature and theory for operationalising and specifying the theory concepts for quantitative analyses.

Evaluations of the exploratory research are presented in this chapter.

4.1 Existing guidelines, standard and model contracts for ABS agreements

Various institutions have already developed contract-standardisation based instruments for transactions with genetic resources and related services, mostly for supporting a certain group in implementing the CBD provisions on ABS. The range of measures spans the Bonn Guidelines, a set of non-binding and rather general guidelines for elements of Material Transfer Agreements (CBD 2002), to fully-fledge standardised contracts. An example for the latter type of instrument is the standardised Material Transfer Agreement (sMTA) of the International Treaty ABS-regime (FAO 2006). Besides these multilaterally developed instruments initiatives on different stakeholder levels have evolved.

A set of instruments shall be evaluated as a starting point for identifying relevant contract elements and different design options. The different solutions are compared regarding contents and with respect to the level of standardisation.

Nine guidelines, model- and standard-contracts were analysed:

- CBD Bonn Guidelines
- IISD ABS-management tool
- ITPGRFAs standard Material Transfer Agreement (sMTA)
- Australian Governments ABS Model MTA
- Biotechnology Industrial Organisation (BIO) Model-MTA for transactions with genetic resources
- Science commons model
- Micro-organisms Sustainable Use and Access Regulation International Code of Conduct (MOSAICC) and Model Agreement
- US National Cancer Institutes' Letter of Collection (LOC) & Memorandum of Understanding (MOU)

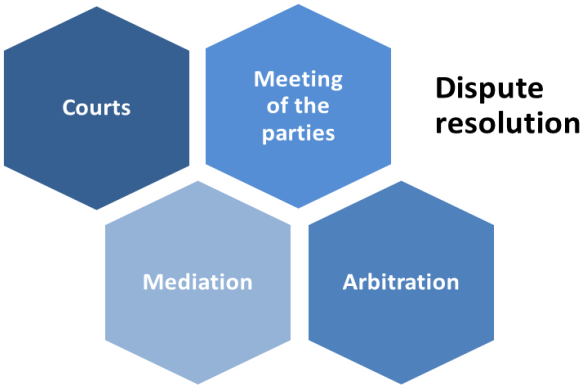
4.1.1 Guidelines for ABS agreements

The *Bonn Guidelines* were developed by the Ad Hoc Open-ended Working Group on ABS and adopted 2002 at the sixth Conference of the parties to the CBD. They shall give guidance to providers and users, among others by providing recommendations for elements to be included in Material Transfer Agreements (MTAs) for transactions with genetic resources under the scope of the CBD. The Bonn Guidelines also give an overview of forms of monetary and non-monetary benefit-sharing (CBD 2002: Appendix II, pp. 17-20).

The Swiss "*ABS management tool*" was developed by ABS-experts under the direction of the International Institute for Sustainable Development (IISD). Like the Bonn Guidelines it is a voluntary instrument, which users and providers can use as guidelines in the negotiation and implementation of ABS-project. It is more detailed and gives more concrete suggestions for the design of contract elements agreements compared to the Bonne Guidelines, though.

Both guidelines suggest similar elements or issues to be regulated in ABS contracts; the full list is displayed in Table A 1. The functional units of contracts defined in the theory chapter could be identified in both guidelines: the duration of the agreement, the enforcement and dispute resolution measures, and the compensation or pricing mechanisms.

Enforcement of the contract / dispute resolution arrangements



The Bonn Guidelines do not go into details regarding suggestions for contract enforcement and dispute resolution mechanisms applicable in ABS-relations. The management tool on the other hand names four dispute resolution mechanisms with different contract laws. The stipulation of courts means that contracts are enforced externally. Arbitration, which means third party assisted conflict resolution is an intermediary form, while meeting of the parties and mediation are clearly on the administrative controls' side.

Compensation (benefit-sharing)

The suggestions for monetary benefit-sharing are quite similar in both guidelines (Table 9). The management tool gives some more practical examples, though.

Table 9: Suggestions for monetary benefit-sharing for genetic resources in the Bonn Guidelines and in the IISD ABS management tool

CBD Bonn Guidelines	IISD ABS management tool
Access fees/fee per sample collected or otherwise acquired	Compensation per sample, Collecting fee (by collector, by source), Handling fee
Up-front payments	Fixed fee (one-time, recurring, staged (different fees for different periods)
Milestone payments	
Payment of royalties	Revenue sharing/royalty (% of revenue from testing activities, - of revenues of middleman from supply activities, - of net sales of covered products)
License fees in case of commercialization	Offset or deductions from amounts owed

Source: Authors', based on CBD 2002: 18-19 AND IISD and STATE SECRETARIAT FOR ECONOMIC AFFAIRS 2007: 26.

The Management tool suggests considering the following issues for designing the royalty structure in an ABS agreement:

(a) relative contribution of partners to invention and development;

(b) information provided with samples;

(c) novelty or rarity of sample organisms;

(d) degree of derivation of the final product from the genetic resources supplied; and

(e) likely market share of the final product (IISD and STATE SECRETARIAT FOR ECONOMIC AFFAIRS 2007: 39).

Some measures the Bonn Guidelines assign with monetary benefit-sharing (supposedly because they imply monetary efforts from the user) are in this research categorised as non-monetary benefit-sharing measures. The reason is that in the governance analysis benefit-sharing is understood as pricing mechanism with purposes to steer in the first line the providers' behaviour. If the user pays money into a trust fund, which is used to finance biodiversity conservation, education or infrastructure (see Table 10) the provider does not receive direct financial benefits, even if the user compensates with money.

Table 10: Suggestions for non-monetary benefit-sharing for genetic resources in the Bonn Guidelines and in the IISD ABS management tool

CBD Bonn Guidelines	IISD ABS management tool
- Fees to be paid to trust funds supporting conservation & sustainable use - Access to scientific information relevant to conservation and sustainable use of biological diversity	- Fund conservation programs - Trust Fund
Joint ownership of relevant IPRs	
- Research funding - Collaboration, cooperation and contribution to … … scientific research and development programs, particularly biotechnological research activities, where possible in the provider country. … in education & training - Participation in product development - Sharing of research and development results	- Fund and/or educate source's own drug development and research efforts - Fund and facilitate education programs and other expertise
- Transfer of knowledge and technology - Capacity building for receiving knowledge & technology transfer - Admittance to ex situ facilities of genetic resources & databases	- Technology-transfer initiatives - Provide equipment
	Fund cultural programs
Institutional capacity building	- Fund infrastructure projects - Funds or personnel for services

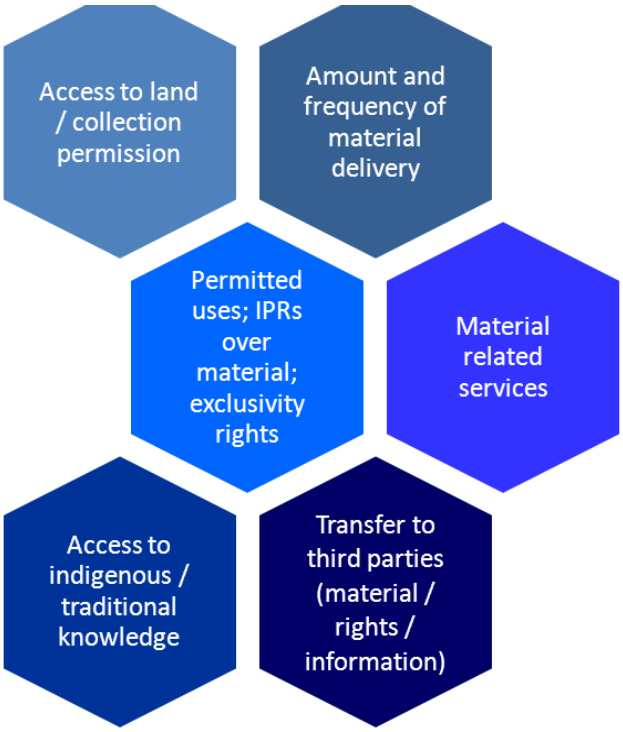
Source: Author, based on CBD 2002: 19 and IISD AND STATE SECRETARIAT FOR ECONOMIC AFFAIRS 2007: 26.

None of the guidelines gives concrete suggestions on the duration of a contract for ABS agreements.

The Management tool states that contracts should be adapted to the individual case; it refers to a paper by the World Intellectual Property Organisation (WIPO)[25] in which five different contract types are mentioned for transaction with genetic resources. They are thought to be applied in different stages of a transaction (the initiation phase versus the implementation phase) and for different types interaction or relation between user and provider (material transfer versus research cooperation). Also specific contracts for handling tacit information are recommended (IISD AND STATE SECRETARIAT FOR ECONOMIC AFFAIRS 2007: 20).

The Management tool also provides suggestions for the concretisation of the subject matter of transaction including the specification of demand, respectively the providers' contribution. This includes also the frequency of transaction. In the governance analysis these factors are explanatory variables (governance-choice determinants).

Both instruments state that the contract should be adapted to the individual case. We can understand that this means the contract should be adapted to the specifics of the subject matter of transaction, and the nature or special needs of the transacting parties. However, neither of the guidelines explicitly demonstrates how to interrelate the design options of contract elements with the case-characteristics. Let alone explaining why certain options are appropriate under certain conditions. It is left to the user of the guidelines to consider which of the suggested options fit for the individual case.



Source: IISD and State Secretariat for Economic Affairs 2007: 24-29, and CBD 2002: 17-20

Figure 5: Types of provider contribution in ABS agreements differentiated in the IISD ABS management-tool and in the CBD Bonn Guidelines for ABS

25 (WIPO), WIPO/GRTKF/IC/7/9 July 2004. "Genetic Resources: Draft Intellectual Property Guidelines for Access and Equitable Benefit-sharing," prepared by the WIPO Secretariat.

4.1.2 Standard and model agreements for transactions with genetic resources

The following instruments go beyond guidelines in terms of the standardisation-level. However, except for the plant treaties' sMTA, all measures are model contracts and voluntary rather than obligatory standard-contracts. Table 11 displays the responsible institution and institutional level, the target group, and the stated intentions for the seven measures.

The instruments are designed by different types of institutions for **different target groups**. However, the simplification of compliance with ABS requirements and the reduction of transaction costs are key **intentions** in all cases. Some instruments (1, 3, 4, 5) are designed by interest organisations specifically for their members (Pharmacy, Biotech, academic research); other instruments are developed by provider (2) or intermediary entities (6). The Australian model contracts were developed and established by the government of Australia in its function as a provider country. Australia **implements therewith its national biodiversity strategy**, which includes the attraction of foreign R&D and to support national research by reducing transaction costs and increasing legal certainty. The MOSAICC model contract has inter alia the aim of contributing to the **implementation of ABS** for Microorganism Collections (as intermediaries).

Table 12 subsumes further characteristics of the instruments, such as the object of transaction for which they are thought to be used, the type of transaction, and the praxis of benefit-sharing suggested in the model.

Table 11: Main characteristics of existing standardisation measures for ABS contracts

	Responsible Institution	Target group	Stated Intentions
1: sMTA in the ITPGRFA	Multilateral level Governing Body of the ITPGRFA	Commercial & non-commercial users, though restricted to research, breeding, training for food & agriculture	Simplifying access to and exchange of genetic resources for food and agriculture (supporting food security & quality), lowering transaction costs
2: Australian Model MTA	Australian Government, Department of the Environment, Water, Heritage and the Arts	Developed by gov-ernment institution in its function as a provider of genetic resources. Guidance tool in ABS negotiations with commercial users.	Meeting CBD obligations for ABS; Minimising transaction costs; Encouraging R&D; Avoiding decision-making delays; Facilitating flexible access arrangements for lengthy or even unlimited periods
3: BIO Model MTA	US Biotech Industry Association BIO	Members of BIO, mainly biotech-companies for bioprospecting activities	Educating & supporting bioprospecting activities "[…] providing a useful "roadmap" for a BIO company […] in bioprospecting activities."
4: LOC and MOU	US National Cancer Institute (NCI)	Cancer fighting and prevention research, commercial and non-commercial utilisation	Providing a legal mechanism and fundamental framework for international cooperation; Balancing interests; Transcending national barriers, clearly defined common understanding of transactions
5: Science commons	Science commons Researchers Initiative	Target group: not-for profit researchers from all scientific fields utilising genetic resources. For profit entities are affected indirectly when involved in genetic resource transactions with the target group.	Lowering transaction costs, simplifying negotiations for material transfers between institutions (academia & for-profit) Providing infrastructure for web-based transactions Avoiding impediments Improving accessibility and exchange of data, material, and metadata on genetic resource utilisation in research
6: MOSAICC MTA	Belgian Coordinated Collections of Microorganisms	Ex-situ collections for microbial genetic resources (intermediaries who obtain microbial genetic resources to extend their collections)	Facilitating access; Helping collections to make appropriate agreements; Increasing uniformity in MTA contents & defining a minimum set of information; Electronic handling of digitalised MTAs (fast, cost-effective, reliable management of MGRs

Sources: FAO 2006: 10-11; AUSTRALIAN GOVERNMENT, DEPARTMENT OF ENVIRONMENT AND HERITAGE 2005a and 2005b: both 3 and 26; AUSTRALIAN GOVERNMENT, DEPARTMENT OF ENVIRONMENT AND HERITAGE 2004: 9; BIO Model MTA: 1 and 8; NATIONAL CANCER INSTITUTE 1988b: 1; ROSENTHAL 1997: 4; WILBANKS, J. AND J. BOYLE 2006; personal communication with PHILIP DESMETH (April 2008); BCCM 2000: II.2-II.4, 1.8

Table 12: Main characteristics of standardisation initiatives for ABS contracts continued

	Object of transaction	Kind of transaction	Understanding of Benefit-sharing
sMTA of ITPGRFA	Plant genetic resources held in ex-situ collections	Spot market, limited complexity	Monetary benefit-sharing is triggered only in cases where restrictive IPRs are applied to R&D outcome; flows into a multilateral fund, distribution through projects which are chosen according to multilaterally agreed priorities
Australian Model MTA	Biological resources including GRs, organisms and parts of organisms, populations, &any other biotic components […] with actual or potential use	Rather complex transactions; it is deemed most useful for procurement of in-situ resources	Threshold recommendations for monetary benefit-sharing; distinguished by sector and gross revenue of the product concerned (0 to 5%). Recommendation to adjust amount and form of benefits depending on: market conditions, characteristics of the specific access agreement, Circumstances of contracting parties.
BIO Model MTA	Physical samples of "regulated genetic resources" (under CBD); in situ or ex situ; materials that contain functional units of heredity	Bioprospecting agreements involving collecting activities and procurement from ex-situ collections	Benefits shall be defined depending on inter alia: - needs of the providers (including indigenous or local communities), - the commercial value of the transferred physical samples, - the intended use of the samples, - Likelihood of using the samples to create a commercially viable product
LOC & MOU	Plants, micro-organisms, and marine macro-organisms	LOC: acquisition of GRs from region-specific collectors; MOU: research collaborations between with source country institutions	Contain clauses about appropriate compensation (e.g. royalties); Base for defining monetary benefit-sharing: contribution of both parties, and relationship between the originally isolated product and the marketed drug
Science commons	All kinds of biological materials	Material & information, not for complex research collaborations	Does not contain benefit-sharing suggestions
MOSAICC MTA	Microorganism genetic resources (MGRs)	Checklist for complex transactions; Model MTA is applicable to simple, more routine transactions	Payment of royalties should depend on the successful commercial utilisation; partly dedication to technical & scientific cooperation programs; Recommendation: negotiate preliminary agreement on monetary benefit-sharing before starting R&D that could lead to commercialization

Sources: ibid.

As Table 12 shows the measures are partly designed for different **types of resources.** The model contracts established by the Australian Government, the US National Cancer Institutes, the US National Health Institutes, and Science Commons are thought to be applied for transactions with a whole range of materials, all covered by the term genetic resources. The ITPGRFAs standard Material transfer agreement was developed for transactions with specific plant genetic resources for food and agriculture (PGRFA), Annex I resources. In the meantime several intermediary institutions use it also for non-Annex-I resources, but still only for PGRFA. The MOSAICC Model-MTA is restricted to specific types of genetic resources, microorganisms.

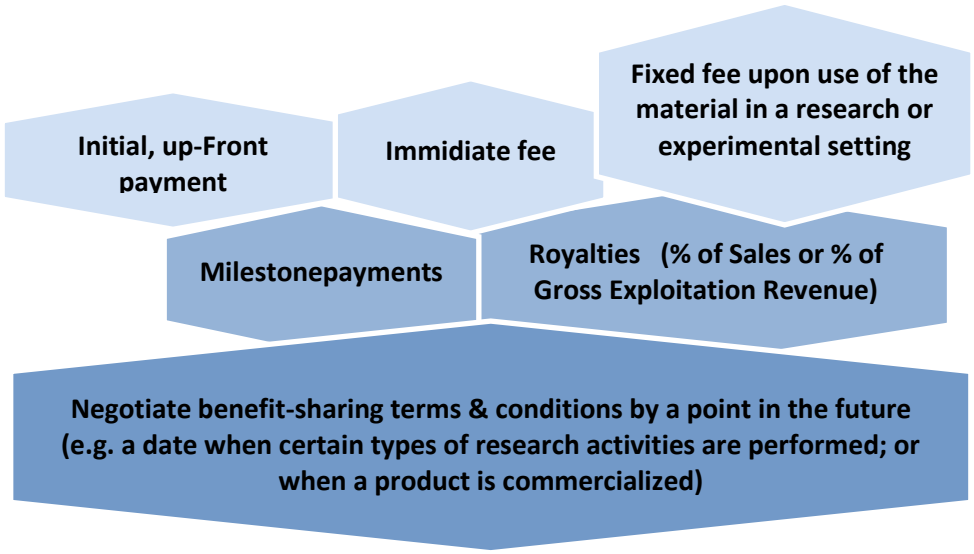
The instruments can also be differentiated by the level of **complexity of the exchange-relation** they are thought to be applied for. The treaties' sMTA and the Australian instrument provide comprehensive contracts. However, while the treaties' sMTA is a standard contract, the Australian sMTA is actually a model contract which shall be adjusted for individual ABS-projects. The different levels of standardisation supposedly reflect the different level of complexity of transactions the instruments were designed to cover. The Australian sMTA is thought to be used for complex transactions, involving access to in-situ material, own sampling activities, maybe in the framework of research cooperation projects. The ITPGRs' sMTA, in contrary, is mainly applied to spot market transactions. It is not designed to govern complex relations between entities in provider countries and users, but for accessing and inserting material in international ex-situ collections.

The National Cancer Institute provides different model contracts for transactions with different intensity of cooperation between user and provider. MOSAICC also has developed two instruments: a model Material Transfer Agreement for "simple" transactions and a MTA-checklist for customised, more complex transactions.

Benefit-sharing is a core element in all models, except those that are developed only for transactions within the academic environment. Monetary benefit-sharing is concretised to numeric provisions only in the plant treaties' sMTA. The Australian model-contract provides quantitative recommendations for monetary benefit-sharing (AUSTRALIAN GOVERNMENT, DEPARTMENT OF ENVIRONMENT AND HERITAGE 2005a and 2005b: 28). The other measures name possible types and give reference points for the definition of royalties, mostly the economic value of the genetic resource in the R&D process.

The providers' assessment of the resources value is reflected in terms like "circumstances of both parties shall be considered when benefit-sharing is appointed". Costs of conservation and opportunity costs of the provision are not reflected in the models.

The range of monetary benefit-sharing measures that could be identified from the model-agreements (see Figure 6) is similar to the Bonn Guidelines and the Swiss ABS management tool (see Table 9). The suggestion of postponing benefit-sharing negotiations until a certain step in the utilisation process respectively commercialisation is accomplished (BIO Model MTA and in the MOSAICC instrument) was not found in either of the guidelines, though.



Source: Author, based on FAO 2006: Art. 6.7 and Annex 2; Australian Government, Department of Environment and Heritage 2005a and 2005b: Art. 3.1.1 and Schedule 3; BIO Model MTA: Art. 5; National Cancer Institute 1988b: Art. 12; BCCM 2000: I.8 and II.4.

Figure 6: Monetary benefit-sharing measures suggested in model and standard contracts for ABS

Non-monetary benefit-sharing measures are elaborated more detailed in the Australian sMTA and in the MOSAICC instrument. The only instrument without explicit references to capacity building or information-transfer is the BIO model MTA. All measures that were found are listed in Table 13. Again, the suggestions overlap to a great extent with the guidelines.

Table 13: Non-monetary benefit-sharing suggested in model & standard contracts for ABS

Non-monetary benefit-sharing measures suggested in model agreements
Taxonomic duplicate of each Sample taken
Biological Information of the Samples taken
Making non-confidential information about R&D with the genetic resources available
Access Party provides research funding to local research institution
Access Party enters into a **joint venture** with a local research institution, and with a local Company or research institution for screening or developing commercial products containing the Sample
Collaboration for contributing scientific research and development
Training, Capacity building for e.g. taxonomy and general microbiology
Technical and scientific co-operation
Technology transfer
Exchange of information and publication policy
Transfer of test results for material
Establishment of conservation facilities in the country of origin, or development of agreements between on the one hand countries of origin having no conservation facilities yet and on the other hand foreign microbial genetic resources centers
Transfer of knowledge that is relevant to the conservation and sustainable use of biological diversity

Source: Author, based on FAO 2006: Art. 6.3, 6.9 Australian Government, Department of Environment and Heritage 2005a and 2005b: both Art. 3.1.2-3.1.3 and Schedule 4; National Cancer Institute 1988b: Art. 5.b; BCCM 2000: II.3.

Except for the ITPGRFA sMTA all systems differentiate requirements in ABS procedures for commercial and non-commercial utilisation of genetic resources. As a general rule the requirements are higher for commercial access purposes.

Not all instruments provide recommendations or standards regarding the **duration of contracts**. The BIO Model MTA suggests using a contract term of ten years (BIO Model-MTA, Article 7, p. 10). The wording in the standard contract of the ITPGRFA Multilateral system is that "This Agreement shall remain in force so long as the Treaty remains in force" (Article 9, Duration of Agreement, p. 7). We interpret this as a contract without termination. The Letter of Collection and the Memorandum of Understanding (both by US NCI) suggest initial contract duration of five years and thereafter renewal based on mutual agreement (LOC, p. 5; MOC, p. 5). However, both documents contain an article on benefit-sharing which notes that the duration of R&D in Pharmacy may require 10-15 years until eventually a drug can be marketed (LOC, Art. 9, p. 3; MOU, Art. 12, p. 4). The Australian Model Agreement does not contain a standard on contract duration.

The Australian Model MTA contains a clause on **dispute resolution,** which requires the contract partners to employ legal proceedings only as measure of last resort that means if bilateral negotiations failed. The BIO Model-MTA contains placeholder paragraph for dispute settlement procedures and a commentary explaining that appropriate mechanisms depend on the Transferor(s) (provider), and, if the agreement is about to govern bioprospecting activities international arbitration is recommended being included in the repertoire (BIO Model-MTA, Article 7.8, p. 10-11). The MOU contains no explicit clause on dispute resolution; however, the agreement includes several items that manifest close collaboration. The closing paragraph contains the wording "[…] this MOU will lay the basis for a mutually successful cooperation […]" (MOU, p. 5). The other model agreements do not contain stipulations on which measures should or could be applied for dispute settlement at all.

4.2 Exploratory interviews and group discussions

The results of the interviews and group discussions are presented in this chapter. The set of guiding questions respectively the subjects proposed for group discussions are introduced beforehand. Some questions are relevant for both research questions, others are more directed to just one, but provide with relevant background knowledge for both. Therefore, the evaluation is presented in one piece.

Guiding questions:

1 *What are acquisition strategies and demand criteria for genetic resources?*

2 *How is the transaction process structured?*

3 *How are utilisation / demand characterised?*

4 *What kind of problems (transaction costs) are experienced in the process of negotiating and implementing agreements for the procurement of genetic resources, and at what stages of the process do they occur?*

5 *The praxis of benefit-sharing*

6 *Handling of Intellectual Property Rights (IPRs) resulting from the utilisation of genetic resources and related information*

7 *Exclusivity rights in connection with access to genetic resources and related information*

8 *Types of agreements / governance forms for transactions with genetic resources*

9 *Acceptance of contract-standardisation, particularly model clauses, as instrument to facilitate ABS implementation*

The findings derived on the guiding-question are evaluated separately for all three research groups. The information is then condensed in chapter 5 in form of an operationalisation of variables for a standardised questionnaire and the specification of hypotheses on the two overall research questions.

4.2.1 Acquisition strategies and demand criteria for genetic resources

Access to genetic resources can be sought from various sources. Supposedly the governance form and transaction costs vary with the source of acquisition. For material accessions from international ex-situ collections standard procedures and contracts are applied. No direct negotiations between the source country and the recipient are required. The focus of interest in this research is, however, on projects with acquisition of material from the source country, with involvement of officially authorised entities. It is in this kind of transactions ABS has the chance to be actually implemented, since benefits of different kinds shall flow back to the source country and can create conservation-incentives. At the same time transaction costs seem to be most problematic in these types of transactions.

Sourcing strategies were discussed to receive a clearer picture about the relevance of transactions with source country actors and the motivation to engage in these obviously more complex types of transactions.

Researchers from public institutions

Researchers from various disciplines were included in this research group; hence, the variety of sources for genetic resources is large. Acquisition of genetic resources from source countries or access to genetic resources in specific natural habitats plays an important role for several survey participants in this group. Researchers are thus often confronted with the challenge of dealing with ABS regulations in source countries. Besides this, material exchange among researchers as well as acquisition from international ex-situ collections is common praxis.

Of particular interest with regard to a distinction between commercial and non-commercial research with genetic resources, is the common praxis of joint R&D-projects between public research institutes and industry. In research fields with a high degree of applicability (e.g. pharmaceutical biotechnology) it is common practice that universities and industry acquire genetic resources together, as one user entity.

Pharmacy and industrial biotechnology

Users from pharmacy and industrial biotechnology procure genetic resources from international ex-situ collections, like the American Type Culture Collection (ATCC) or the Belgian Coordinated Collections of Microorganisms (BCCM). Biotech companies reported that acquisition from or with the assistance of commercial intermediaries (small broker companies) is common praxis as well. In that case spot-market transactions take place, and simple, classical contracts are used. The "transaction object" in such transactions is usually not adapted specifically to the companies demand (e.g. processing and information). However, in both fields of utilisation cooperation projects with local research institutions or smaller research based companies in provider countries occur as sourcing strategies as well. It seems, however, that the companies rather apply one out these two options to access genetic resources directly in source countries.

Especially in the pharmaceutical sector transactions with genetic resources directly from the source-country go far beyond the mere acquisition of raw material. Companies outsource certain steps in the utilisation process, such as the collection of samples, the characterisation of samples and the processing of raw material or isolation of extracts. Even first sample-evaluations can be part of the "provider contribution". Information regarding the usability of resources can be subject to transaction relations as well.

Reasons for outsourcing are lower labour costs in provider-countries and the locals' better knowledge of the vegetation. In some cases the provider entity also takes care of administrative access requirements. Local actors may have a better knowledge about specific procedures and cultural specifics in dealing with authorities. This specialisation advantage of a local partner is a strategic factor which the user employs for the overall success of the project.

The cooperation with local research institutes or research-based companies also serves as strategy to safeguard stable, long-term supply with natural resources (if required) and as door opener to new markets in the provider country.

For the selection of a specific provider country for bioprospecting projects four main factors were identified in this research group:

(1) Rich biodiversity, which has a high chance of delivering material that fits the research focus. However, companies pursuit heterogeneous strategies. Some prefer regions with undiscovered biodiversity, to higher the possibility of finding new leads. Others go for areas where they know plants that are used in traditional medicines can be found. Based on the traditional knowledge they focus on specific material and by this avoid investing in projects without high risk of hitting any useful material.

(2) The institutional framework in provider countries, meaning are a general political and legal stability, was named as further factor for the selection of a source. In accordance with property rights theory, companies stated that transaction costs can get excessive, if the system to enforce property rights is insufficient.

(3) The provider countries' attitude towards bioprospection is also a relevant institutional aspect. Does the country support bioprospection, is flexible regarding ABS arrangements to meet the companies' specific needs, and has a similar understanding of fair benefit-sharing, are these plus points in the search of a partner country.

(4) Scientific infrastructure and expertise is the third identified factor of a source-country selection in this research group. A certain level of scientific equipment and professionalism is required (see also in the literature cf. TEN KATE and LAIRD 2000: 251).

A similar research focusing was named as relevant factor for good cooperation and therewith the selection of a local partner. Also, the providers' willingness to learn and his flexibility to adaptation in the course of the project are relevant. If research interests match and the provider entity has an intrinsic motivation to learn, interest harmonisation would come by itself.

Plant breeding companies

Interview partners from this group reported about several ways for acquiring genetic material for plant breeding: commercial plant varieties, which are the result of a breeding process, can simply be purchased on the market and used for further breeding under the "breeders' exemption. Breeders might also exchange "material under development" among each other using bilateral licensing agreements, and companies have their own collections of material from former breeding programs. "Raw" genetic material is acquired from gene banks or botanical gardens, as well as via individual expeditions and collecting activities.

Materials that are acquired from gene banks or botanical gardens are usually (even before the sMTA of the ITPGRFA was in place) transferred under standard MTAs, without extensive efforts for administrative requirements. Improved varieties which are commercialised and available on the market can be used for further breeding purposes without additional requirements. In the case of material under development or raw material among breeders, informal conventions on licensing terms are applied (at least in some areas). Source countries of genetic material that was used to develop the commercial material are not involved in these transactions. However, there still exist plant breeders that acquire material directly from provider countries, sometimes with the support of intermediaries (private persons or companies). Own collection activities organised and conducted by breeding companies were also reported by participants of the exploratory survey, but in relation to other procurement strategies less common.

4.2.2 Structure of transactions with genetic resources

This question is relevant to identify all steps and transaction costs composing a transaction with genetic resources in the sense of the research.

Users from public research institutions

The three transaction phases described in Chapter 3.2 (1: search & information, 2: bargaining, 3: Monitoring and enforcement) were identified in projects described by interview partners from public research institutions. Search, information and bargaining are not necessarily separated by chronological order, though. The reason is that some instruments for research granting require that country, and/or local partners are named already in the research proposal. Decisions on a source country, potentially a local research partner, and at least preliminary negotiations on the terms of ABS take therefore not necessarily place one after the other.

Pharmacy and Biotechnology

Cases described by users of this group proceed more or less in three phases (1) initiation of the project including information search, first contact and communication with potential partners (providers). The following phase (2) includes the bargaining process and contract drafting. It finishes with concluding a contract. The third phase (3) is the implementation of the bioprospecting project. If the agreement includes more than just access to resources in a specific habitat or previously inventoried resources, the third phase can be further separated in an adjustment phase, with adjustments of processing of samples (drying, extraction, cleaning) by the provider (often supported and guided through the user, though), and finally a delivery phase.

4.2.3 How is utilisation characterised?

The term "utilisation" of genetic resources has several dimensions that supposedly are reflected in the transaction relation:

- The intention of utilisation: Is the intended outcome commercially valuable or not; can the access seeking party foresee whether research with non-commercial intentions might yield commercially applicable results in the future?
- Uncertainty involved in the technical process of utilisation
- Timeframes of the technical process of R&D, which is also an uncertainty factor

Users from public research institutions

The applicability and the dedication of research to some kind of "economically useful" outcome are of increasing relevance in public research institutions, particularly if external funding is to be acquired and/or universities urge researchers to apply for patents whenever possible. This of course has implications for ABS negotiations between researchers and potential providers of genetic resources. Researchers are bound by their institutional grant regulations when defining their position on the issue of "utilisation intention". For a considerable part of research taking place at public institutions, utilisation permits limited to publications are not sufficient, even if the researcher himself has no commercial intention. We can distinguish three main utilisation types found in ABS agreements involving researchers from public institutions: 1. publications; 2. Patents and other IPRs; 3. Licensing/sale of IPRs or products commercialised by start-up companies that are spin offs from public research institutes. However, starting point for research projects in the public sector is the scientific relevance of a question and the motivation to create knowledge.

Since numerous research disciplines are represented, the technical process of utilisation including uncertainty aspects and timeframes vary as well.

Pharmacy and industrial biotechnology

Industrial biotechnology and pharmacy are covered in one research group in the exploratory research for practical reasons. First of all biotechnology covers a multitude of techniques and methods which are applied in many different fields such as medicine and pharmacy (healthcare (red) biotechnology)[26], agriculture and renewable resources (green biotechnology)[27], and biotechnology in industrial production processes and environment protection (white biotechnology)[28]. There exist (particularly big, multinational) companies that are engaged in R&D with genetic resources in several fields of biotech and in conventional pharmaceutical R&D, hence, genetic resources are used in many different ways in this research group. All utilisation is characterised by commercial interest, though.

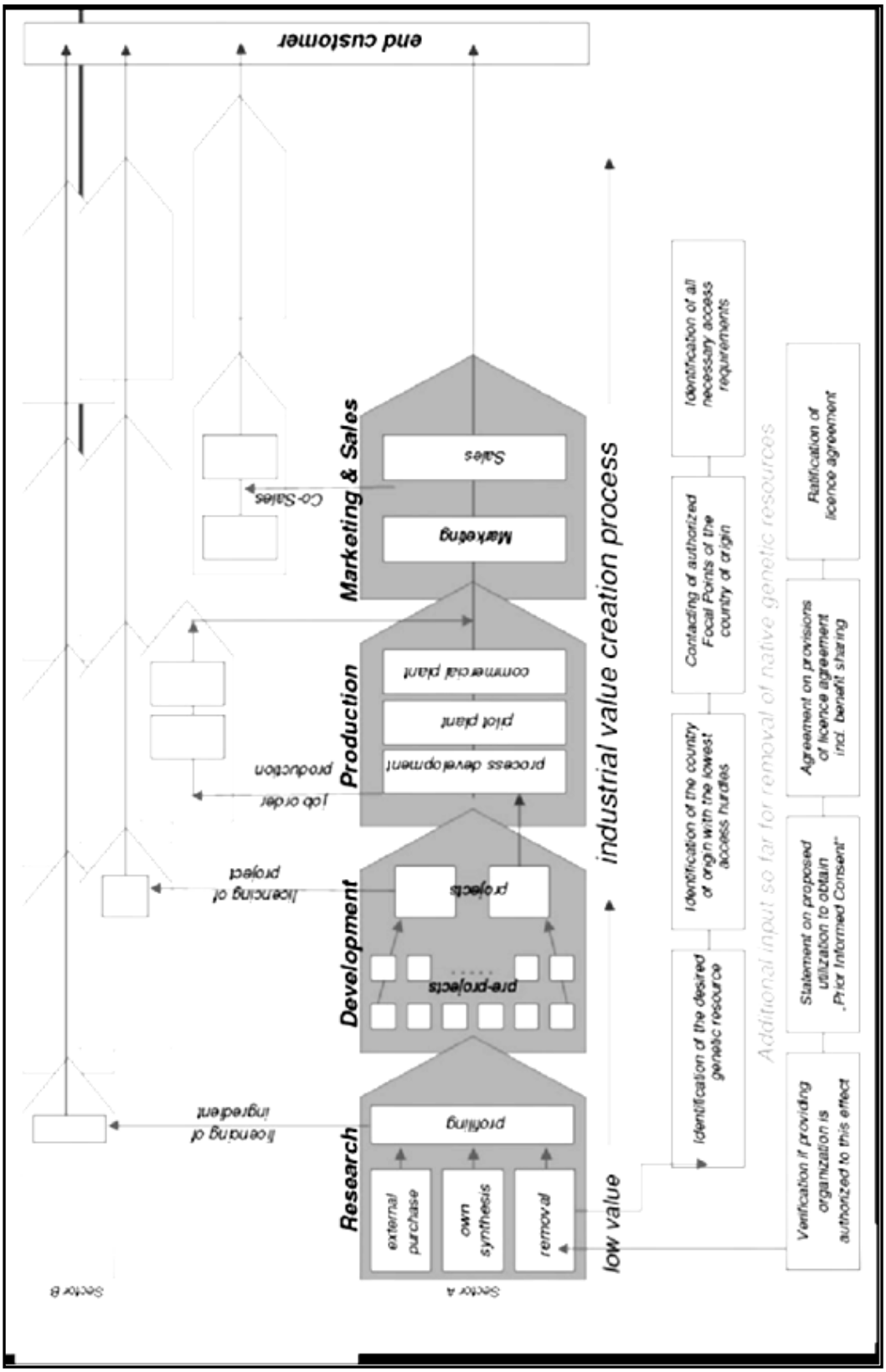
One way of differentiating utilisation is along the process stage of R&D, in which the resources are inserted. Another option (referred to in model agreements, see foregoing chapter) is the differentiation of relation between resource and product: is the genetic resource used as model for the design of a product (active leads are used as patterns for synthesised molecules), as a tool in a process (biocatalysts in an industrial production process), or in the production as active component of a drug (only to name some possibilities). The closeness between the genetic resource (as input) and the intended utilisation product varies as well as the technical process of utilisation along these categories. However, due to individuality of methods, overcuttings and multiple uses of resources within the company it seems very hard to conclude from the utilisation sector to primary uncertainty or the duration of the R&D process.

Participants explained that the technical part of the utilisation-chain can roughly be divided into three stages: 1st Stage: Efficiency analysis, 2nd Stage: Potential evaluation and 3rd Stage: Project development (in Pharmacy: clinical trials).

[26] "Healthcare biotechnology refers to a medicinal or diagnostic product or a vaccine that consists of, or has been produced in, living organisms and may be manufactured via recombinant technology (recombinant DNA is a form of DNA that does not exist naturally. It is created by combining DNA sequences that would not normally occur together)." (http://www.europabio.org/Healthcare/HC_FAQgeneral.htm#6)

[27] Agricultural Biotech covers technologies used to breed improved crops in a more targeted and efficient way, e.g. genetic modification (recombinant DNA or r-DNA technology), Marker Assisted Breeding (increases the effectiveness of conventional breeding). http://www.europabio.org/green_biotech/index.htm

[28] Industrial or white biotechnology uses enzymes and micro-organisms to make biobased products in sectors such as chemicals, food and feed, detergents, paper and pulp, textiles and bioenergy (such as biofuels or biogas). http://www.europabio.org/Industrial_biotech/IB_about.htm



Source: DEUTSCHE INDUSTRIEVEREINIGUNG BIOTECHNOLOGIE (2008).

Figure 7: The chain of utilising genetic resources in the biotechnology industry

The different steps are often not executed by one single company. A company might outsource certain activities, or buy, respectively sell intermediate products. Figure 7 shows the complexity of an utilisation-chain that might be typical in this industry sector. However, as elaborated above the way of utilising genetic resources varies among the many different fields in industrial biotechnology and pharmacy. The activities within the chain lead to various intermediate products with different values. Therefore, the willingness to invest in acquisition costs, as well as options for benefit-sharing varies.

Transaction cost economics suggests characterising economic activity with respect to uncertainty. Some users reported that in pharmaceutical research with natural resources high uncertainty regarding the research process exists. Companies also confirmed the aspect of uncertainty regarding consumer demand for products based on research with genetic resources, as well as unplanned, additional investments were necessary during the course of a bioprospecting project. However, as reason they named not fast technological change but insufficient agreements during the contract negotiations.

Asset specificity is another transaction characteristic governance theory assumes to determine governance choice and transaction costs. One survey-participant stated that several years after initiation of a project his company could find partners in the provider country with a higher scientific expertise. Nevertheless they keep the initial partner, among others because of relation specific investments in form of knowledge-transfer and investments in the partners' equipment, which were made for the partner to be able to process samples as required by the user.

Another user reported about a project in which training for the provider was conducted, technology was transferred and a common database-system implemented, such that data on screening results could easily be transferred between user and provider. These relation specific investments were made to "help" the provider adapt its activities/process in accordance to the users' specific demand.

Adaptations of the users' existing facilities (labs or plants) can be necessary as well, but according to the participants' reports in a less extensive way than in the provider countries.

It can be noted that several kinds of investments can be required in the framework of bioprospecting projects. Regarding the level of specificity assessments were heterogeneous. Obviously investments in human resources, training, and capacity building on the provider country are highly specific, first because they are bound to employees of the provider entity and therefore cannot be reused by the user in case the relation is cancelled, and second because they are adapted to the needs of a specific project.

Investments in machines and technology in the provider country are specific to a certain extent: often they could theoretically be reused in other projects, but high freight costs limit this option. This could be called site specificity of the project. Temporal specify was not indicated as characteristic of bioprospecting projects in this user-group.

Plant breeding companies

In this group genetic resources are used to foster innovation in the breeding process and to develop marketable products. Access to wild material is mainly used for search and integration of diseases-tolerances, and adaptability to extreme habitats, for example, drought resistance, daylight- and temperature-requirements. These characteristics shall be transferred to commercial varieties.

The technical procedure of breeding can be distinguished in classical breeding methods (e.g. selection breeding) and marker-supported methods (application of biotechnology). This distinction is important as it implicates different duration and costs of the research process as well as applicable intellectual property rights. Classical breeding results at the utmost in a new plant variety, which (in Europe) can only be subject to a plant protection right. This type of intellectual property right includes the breeders' exemption, which means that the improved material can be used for further breeding by other breeders without restriction. Biotechnology assisted breeding on the other hand typically yields results that can be protected with patents implying significant restrictions for further use (cf. HERRLINGER ET AL. 2003).

Timeframes for developing new varieties with vegetative propagated ornamental plants vary between 3 to 10 years depending on the growth and reproduction cycle of the individual plant and on the degree of innovation strived after. Accordingly the costs vary.

One crucial difference between the seed industry for agricultural crops and the horticulture strand of plant breeding is that in the latter cooperation between the private and the public sector is much more seldom. Public engagement in research for breeding of vegetative propagated ornamental plants is less intensive and developed than for agriculture and food plants (e.g. Consultative Group on International Agricultural Research (CIGAR), plant breeding at universities). The exception is fruit; here public involvement in breeding research is also high.

The chain of breeding, propagating and marketing of vegetative reproduced horticultural plants is seldom carried out by one single company. Often steps of this process (e.g. propagation) are carried out in typical provider countries, not necessarily the country/countries genetic resources used in the process were acquired from, though.

4.2.4 Users' experiences with problems in ABS agreements

Users from public research institutions

The problems reported by users from public research institutes are summarised in tables three and four. They could be divided in (1) problems affiliated with competencies and resources of the user and (2) problems associated with institutional factors on the provider side.

"Provider-centred problems" are mostly shortcomings of provider countries institutional system for managing ABS including the transparency of regulations and laws, legal and scientific capacities of individuals involved in negotiations, and lack of mutual understanding regarding benefit/sharing (see Table 14).

Table 14: Provider-centred problems; researchers from public institutions

Negotiation with Providers - Lack of competent contact person - Lack of expertise on provider side to assess access requests (often complex research approaches) - Unclear hierarchy of responsibility regarding ABS issues on provider side - Unclear regulations about other groups, e.g. indigenous people, that have to be consulted (PIC) - Providers lack knowledge of legal situation	**Benefit-sharing** - Mistrust of users - Fear of exploitation - Exorbitant claims for benefit-sharing **National ABS Laws** - Lack of transparency - Legal systems / procedural requirements vary among different provider countries - Intransparent distribution of benefits increases risk of corruption accusations for user

Source: Author.

User centred-issues relate to a general lack of information on the CBD and ABS. Since natural science researchers are not management or legal experts they also have limited capacities for negotiations and contracting, and the legal departments of universities often don't have the required specific knowledge.

One interview partner reported about a bigger research project in which an external consultant company was hired to take care of communication and negotiations with the provider. In many other cases the possibility to fall back on external experts is not given due to financial constraints. Anyhow, even if several transactional steps like communication, negotiation, and contract drafting are outsourced to consultants, the user has to bear the transaction costs. In the above referred case these costs accounted for almost 10 % of the research funding.

There is also a lack of information at legal departments at research institutions about ABS, which can make it difficult for researchers to integrate the MAT and PIC obligations into the planning of research projects, and to carry out the required steps in the provider country.

Of special interest, and we assume these are typical problems for this group, are issues centred on the integration of ABS principles in research planning (see shaded box in Table 15). This has much to do with the researchers' intermediary position. They are the party engaged in direct interaction with providers, but their institution (e.g. the university) and external financing bodies decide on research policies, the distribution of research grants and in fact often are the contracting authorities in ABS agreements. This means the researchers often are the ones initiating ABS agreements, but have a limited say in negotiations.

In the academic research sector opportunity costs of projects with genetic resources procurement from source-countries are an important issue. The success of fund-raising efforts for research projects is uncertain and the process is very long-terminated and time-consuming. Often several researchers are dedicated fully to one project. Negotiation problems with providers can hold-up the fundraising process significantly, and therewith add to the opportunity costs. If a project start is massively delayed or even cancelled due to no agreement is reached with the provider, a whole research group can be forced to lay down their work (at least for a certain time). The opportunity costs can be significant, and can be considered as transaction cost element.

Users from the group public research suggested the implementation of a superordinate entity (e.g. at the CBD level, with representatives of providers and users) to check best practise initiatives like codes of conduct, guidelines, etc. for ABS regarding their consistency with general ABS provisions in the CBD. Such an entity could also provide Guidelines for Memorandums of Understanding (MOUs). MOUs seem to be a useful tool to communicate complex research projects to providers of genetic resources. From the researchers' perspective, the clear communication of what they intend to do with the genetic resources is extremely important. Misunderstandings and mistrust are perceived as sources of impediments in research projects or even the breakdown of cooperation between users and providers.

Table 15: User-centred problems in ABS; researchers from public institutions

General lack of information and awareness of researchers, responsibles at research institutions and granting institutions regarding

- Concernment by ABS regulations
- Actual political and legal situation
- limited capacity to achieve & process information on ABS regulations (legal issues are not core competence of natural scientists)
- very limited legal competences regarding ABS of research institutions

Specific case related problems (characteristics of the provider and the utilisation)

- Identification of appropriate procedure
- Finding the authorised partner in provider country to negotiate ABS
- Identify other groups that have to get involved according to national ABS laws
- Adapted communication (language, complexity of research intention)
- Definition of fair benefit-sharing offer (what is the value of access or a specific resource?)
- Adequate formulation of agreement in contract (legal know-how)

Integration of ABS in research project planning (internal coordination)

- Anticipation of research process regarding relevant issues for ABS contract (uncertainty)
- Consideration of policies of research institution when defining the utilisation intention and other MTA elements (e.g. benefit-sharing and IPRs)
- Researchers' communication of ABS towards university, granting institutions and industry partners regarding integrating benefit-sharing in project planning
- Bridging finance for the initialisation and negotiation time before project beginning
- Back-up plan to safeguard the research project (risk that ABS negotiations fail)

Source: Author.

Pharmacy and industrial biotechnology

Interview partners reported about labour costs and travelling expenses as typical transaction costs in the project initiation phase. Information search includes research about potentially interesting biodiversity rich areas, checking the framework conditions in the country of interest including legal framework for ABS, political stability, and the research policy. Potential research partners are of high relevance as well. They are selected by research area and know-how. Through publications, patent applications information about research methods and technological possibilities are acquired. In this phase personal contacts are to be established.

Apart from information search this phase includes internal coordination. Within the company the project coordination has to be established, which also generates labor costs. These are company transaction costs.

The initiation phase can be very transaction-cost intensive. One company reported about a project, in which approximately two to four full-time employees worked five weeks in the initiation phase to get the project started. Another interview partner assumes an initiation phase of approximately two years or even longer.

For contract drafting several departments within a company can be involved including law, financials, and the patent department. It is important to note that especially in larger companies the management level deals with contractual details while the researchers implement the project practically. This requires good internal communication, which was described as resource-intensive by several survey participants. One participant stated that internal coordination in some cases requires more efforts than negotiations with the provider.

Internal communications and communication with the provider in the contract negotiation phase causes labor costs. In smaller companies without a capable law- (and management) department external consultants are hired to support the negotiations. Sometimes also interpreters are required. In one case estimated transaction costs equal three to four weeks of a fulltime employee from the business-development department for drafting the contract, and one week of a lawyer to specify the legal form.

The duration of the negotiation phase varies depending (among others) on how fast a satisfying compromise can be found.

The very important adjustment phase in the project is usually characterised by high communication efforts. Weak points in the projects, which could hinder a smooth implementation in the delivery phase, have to be identified and modified. Transaction costs occur in form of labour, material costs and travelling costs, as well as capacity building through the user. In one case an interviewee reported that a half time employee is constantly working only with communication during the complete adjustment phase.

Users stated that in the delivery phase (implementation) less transaction costs occur. Communication has to take place, in case amounts have to be adapted or quality controls are carried out. Quality controls, however, are not seen as a tool to prevent moral hazard as principal-agent theory suggests, but rather as an instrument to "help" the provider reaching the required standards. In case the standards can't be reached the user would not simply change partner, but rather take additional measures to support the provider to improve performance.

From a comparison of statements by different interview partners it occurs that larger companies with a good international network and experiences regarding information search, and complex contracting have much easier to initiate bioprospection projects compared to companies without access to such resources. The latter reported about severe problems for identifying adequate contacts in provider countries, and to understand the structure of responsibilities. It seems that transaction costs are influenced to some extent by the users' previously established network and capacities.

Companies that have been active in natural product research since many years established over the time strategies to keep transaction costs low. One strategy is to involve intermediaries in source countries, may it be research institutions or broker companies.

Another strategy, especially for large multinational companies with high influence and power, is to directly address high level actors in ministries of the provider country (rather the department of commerce than that for nature conservation).

Intermediaries are involved to support or take over dealing with administrative access requirements. Intermediaries with local knowledge have easier to understand the rules of the game in their country involving language, culture, business practices, and they might face a higher level of trust from the authorities. Some user companies also seek to delegate a part of

the legal uncertainty and image risk by involving an intermediary. In a contract it is specified that the intermediary retains the genetic resources and transfers them to the company only in accordance with national access legislation. Another strategy is to choose, if possible, a provider country that has un-bureaucratic and transparent access requirements in place.

A main reason why many companies previously engaged in natural products research ceased engagement in this branch are new technologies allowing the substitution of genetic resources as input for R&D. The majority of survey participants affiliated with this user group did not see transaction costs as a main impediment for engaging in ABS agreements or as reason for ceasing natural product research. Some participants explained that in relation to other cost components accruing in the chain of R&D, transaction costs for acquiring genetic resources were assessed as rather low. However, participants stated that high bureaucratic hurdles are seen as potential impediments for the future demand of genetic resources.

A problem of a rather general nature stated by survey participants from this group is that ABS is a strongly politicised issue and the expectations for benefit-sharing are excessive (from their perspective). This leads to a difficult atmosphere in negotiations between users and providers. Related with this is the public perception of bioprospecting activities. Image risks resulting from engaging with providers of genetic resources are seen as a significant threat to companies conducting natural product research. Users see themselves as potential victims of biopirating accusations. The greatest risk is seen if concerned minorities, for instance a local groups or indigenous peoples that have some kind of property rights over resources, do not feel or are assumed not to be well represented by their government.

Plant breeding companies

With one exception the interview partners did not report severe problems or impediments in genetic resources' acquisitions. One breeding company reported the failure of an ABS project within which the provision of certain land species of a crop was demanded in exchange for an exchange of scientific staff and breeding cooperation. The project failed, because the providing entity was insecure regarding the national access regulations and finally (two years after the request was posed by the company) decided not to grant access.

In other cases personal contacts and trust established during long-term relationships with entities in the provider country eased concluding agreements on material exchange.

One participant reported about regular collection expeditions in different countries in cooperation with a German gene bank and a gene bank in the target country. This is an example for how companies establish cooperation with public (research) entities in source countries to delegate dealing with administrative access procedure.

A significant impediment to demand of raw material from Ex-Situ collections is that such material is often described and evaluated only at a very low level. For most plant breeders the costs for pre-breeding are too high and in relation the commercial expectations to low. Therefor "wild" material from ex-situ collections is often not included in the breeding programs though it potentially has interesting characteristics.

4.2.5 The praxis of benefit-sharing

In the exploratory survey the users' understanding of benefit-sharing and its application in praxis were issued. What motivates the choice of measures was discussed.

Users from public research institutions

Among the survey participants of this group we found a consensus of willingness to share the benefits of research with genetic resources and related information. However, former user studies indicated that far from all researchers are aware of the CBD, and ABS, and its application in praxis (HOLM-MÜLLER ET. AL. 2005).

Different forms of benefit-sharing (monetary and non-monetary) were identified in this survey-group. Capacity building and technology transfers (the latter in larger, well-staffed and financially well-equipped projects) are buzzwords in projects with the involvement of public institutions. Often a participatory approach is a requirement for public research funding. However, not all institutions and granting bodies necessarily connect this requirement with ABS according to the CBD.

Results-oriented payments are possible, e.g. linked to patent disposal or licensing. Some users reported that upfront payments are also performed, for instance as payment in return for sample provisions or in terms of infrastructure investments (car that becomes the provider's property after a cooperation project ends).

Pharmacy and industrial biotechnology

The group discussion showed a controversial understanding of the benefit-sharing concept among the company representatives, although, all participants had experiences with transactions with genetic resources under the CBD scope. Confusion persists regarding which actors should be beneficiaries in order to comply with the CBD. Should benefit-sharing always include transfers dedicated to a governmental entity in the provider country, even if the transaction takes place without governmental participation?

Users from industrial biotechnology reported that genetic resources acquired via market transactions from commercial intermediaries or ex-situ culture collections are not subject to what they understand under term of benefit-sharing. They pay a fee per acquisition/sample. In both procurement strategies (commercial intermediary and ex-situ conservation institution) users usually do not have direct contact with governmental entities of the "source country" to negotiate ABS requirements.

Users stated that in agreements with source-countries the terms of benefit-sharing are individual from case to case and a matter of negotiation between the parties. Complex models are applied in projects with a higher level of collaboration in R&D with entities in provider countries. However, the companies' capacities for conducting technology transfer or know-how transfer vary and depend on the size and fields of activity. Also the specific needs of providers were referred to as factor for varying measures: what is appropriate differs on a case-by-case basis (short and medium-term technology transfer and capacity building versus long-term, insecure success profit-sharing). Views regarding royalties as compensation mechanism differed among the interviewees; however, they are included in some ABS agreements.

As reference points for equitable benefit-sharing, the participants of the group discussion indicated the overall effort required in the process of R&D for developing a commercial product, as well as the relationship between the genetic resources as input factors and the product (as a measure for the contribution of the resource). Both criteria vary among utilisation cases in the survey group. Nevertheless, in the group discussion users agreed that rough categories could be defined.

The overall tendency in the discussion was that pharmaceutical and biotech companies are willing share benefits. However, they criticised unsolved contradictions with common practice for economic transactions in their sectors. Some users argued that ABS was thought of as a measure to implement a market system for genetic resources. Accordingly, the principles of business in international private law should be applied, and payments should relate to the supplier and the recipient of the good or the service. A system that obliges companies to share benefits with governmental entities, even if these do not actively contribute to the transaction, contradicts the business principle.[29]

Plant breeding companies

The overall view on benefit-sharing in the agricultural plant breeding sector communicated by associations and large companies is that the system of free access to and exchange of improved varieties and information is a major act of benefit-sharing as such. However, plant breeders interviewed in the frame of the exploratory survey reported about various additional forms of bilateral benefit-sharing: bilateral exchange of raw material or material under development, exchanges and training of scientific staff, financing of expeditions in which source country gene banks participated, cooperation in evaluating material, and collaboration in scientific publications.

The breeders stated that usually the contribution of a single genetic resource to the development of a new marketable variety is extremely small. However, this varies among plant types, as does the breeding effort required to develop a new variety.

The general feeling about benefit-sharing among breeders from ornamental horticulture was that they should not at all be subject to any additional ABS regime or benefit-sharing obligations. They reason that breeders by the nature of their business conduct benefit-sharing:

- By creating biodiversity (new varieties) and preserve existing biodiversity (varieties which are threatened with extinction);
- In the sense that improved varieties can be used by every other breeder for further breeding (International Union for the Protection of New Varieties of Plants, short: UPOV), even if they are protected with plant protection rights;

[29] This reflects some companies' argumentation line, not the authors' understanding of ABS.

- An essential part of the value chain of this industry is located in typical provider countries (societies benefit directly from the creation of jobs and income); and they are carried out by other stakeholders than the breeding company.

The sector representatives recommended to consider that breeding companies are likely to transfer monetary benefit-sharing obligations to subsequent stakeholders of the value chain (propagators, growers), because the breeders have the smallest margin level.

4.2.6 Intellectual property rights

The right to apply intellectual property rights (IPRs) based on the utilisation of genetic resources can be viewed as an element of access and utilisation rights users "purchase" from providers. However, IPRs are also used as benefit-sharing component, in form of joint IPRs or by stipulating the commercialisation of IPRs resulting from the utilisation as trigger for monetary benefit-sharing.

Users from public research institutions

IPRs have an increasing relevance in the public research sector. They serve as tool for public research entities to generate commercial benefits and prestige.

Some researchers reported about joint IPRs as part of ABS arrangement. In other fields than research with genetic resources this form of benefit-sharing is common praxis, particularly in collaborations with industry partners. Hence, generally spoken the survey participants of this group think of joint IPRs as a good form of benefit-sharing, if the provider contributes to research beyond the mere provision of raw material.

A strong self-interest of provider entities to ease negotiations and simplify administrative procedures was mentioned as positive side effect of joint IPRs. They might also serve for demonstrating fairness and therewith increase trust. On the other hand, it was mentioned that joint patents can create problems at the stage of commercialisation (e.g. licensing to subsequent users). All patent holders would have to agree on the terms (both the price and with whom to conduct business).

Legal requirements of joint patents were not discussed in this group.

Pharmacy and industrial biotechnology

The survey participants from this group are familiar with the principle of joint patents. However, in the context of ABS they see problems for applying this concept. The patent law requires that all patent holders actually contribute to the invention. It is the view of the companies that merely the provision of genetic material does not fulfils this requirement.

One participant described a case in which a joint patent would be applicable: If a provider contributes by with traditional knowledge about certain healing powers of a plant, and based on this knowledge the company extracts an active component from a plant and develops a drug. In this case benefit-sharing could - in accordance with the provider countries national ABS regulations - include joint IPRs similar to allowance directives like the German Employee`s Invention Law (Arbeitnehmererfindungsgesetz).

Regarding IPRs for genetic resources transferred under an ABS agreement no common practice was identified in this user group. The tendency seems, if resources are acquired via commercial intermediaries, more rights are transferred to the user (whether in accordance with the respective national law of the source country or not we cannot say). If contracts are concluded with authorised public provider entities in source countries, more rights remain with the provider.

Plant breeding companies

Under European regulations, plant breeders can apply for plant protection rights (PPR) for a new variety. Such an IPR is applicable for traditional breeding techniques (selection breeding, crossing, cloning). PPRs are granted if a plant variety fulfils certain criteria (HERRLINGER ET AL. 2003: 246). The process of achieving such a right is lengthy and costly and a breeder will only engage in it if the new variety has sufficient commercial potential. Only selected plant breeding products on the market are protected by a PPR. Despite this, plant varieties under protection can be purchased and used for further breeding activities by any plant breeder without explicit consent of the holder of the PPR (Breeders Exemption in German law30 in accordance with the UPOV convention).

[30] http://transpatent.com/gesetze/sortschg

Since the 1980s biotechnology has been applied as new technique in plant breeding, one example being marker-assisted selection. Since the European Biopatenting Directive (1998), products from biotechnological plant breeding can be protected with Biopatents if they fulfil the patenting criteria (they are novel, non-obvious, and useful). Plants or parts of plants can be part of so-called Biopatents, if they are part of the invention, for instance a certain technique to locate, extract and transfer a gene of a certain plant (cf. HERRLINGER ET AL. 2003: 251ff.). Biopatents provide a stronger, more exclusive protection right compared with PPRs.

4.2.7 Exclusivity rights for access to and utilisation of genetic resources

As elaborated in the theory chapter, the resource based-view assumes that exclusivity agreements for certain inputs can be understood as strategy to achieve competitive advantages. In the interviews and group discussions we elaborated how commonly exclusivity rights are applied, in what form and how this relates to other elements of ABS agreements.

Users from public research institutions

This group was found divided on exclusivity rights for genetic resources and related information. Most participants argued for an open access approach, which would exclude exclusivity rights. However, some researchers stated that exclusivity rights, even if limited in duration and to specific fields of research, are an important instrument to safeguard research investments. Exclusivity seems to be of relevance only in certain research disciplines, such with a high level of applicability, e.g. in pharmaceutical biotechnology.

If exclusive access increases planning certainty for researchers, it might trigger higher investments for the respective research project and therewith enhance the chance of commercial valuable benefits. Positive side effects for providers are possible.

Participants found that potential model clauses on exclusivity should, be limited to certain forms of utilisation or research questions and with a limited timeframe. An option could be the expiration of the exclusivity right for access/utilisation granted by the provider, if the user does not manage to apply for a patent within the defined timeframe. If the user does not succeed within an agreed timeframe, the provider can reconsider engagement with other users or renegotiation and renewal of the arrangement with the first user.

Pharmacy and Industrial Biotechnology

In this research group, two forms of exclusivity related to genetic resources are applied: exclusivity of access and exclusivity of a certain utilisation form. Companies apply both instruments to achieve competitive advantages in the sense of a head start to conduct certain research steps exclusively, for instance efficiency analyses.

Access exclusivity increases incentives for users to invest in broad trials of the resource, which increases the likelihood of commercial success. The companies state that the level of exclusivity a matter of negotiation between user and provider. Users' willingness to pay (or demand) for exclusivity depends on several criteria, among others anticipation of success, uniqueness of the resources, and the level of information available on the resources. It would be comparably low for random samples.

4.2.8 Types of agreements for transactions with genetic resources

In the interviews and focus groups with two research groups, other aspects of governance than benefit-sharing were discussed: the duration of contracts and dispute settlement mechanisms.

Users from public research institutions

During the discussion it appeared that most researchers favour long timeframes for access and the right to utilise genetic resources, publish results and apply for IPRs. This is, because timeframes for research are often very long; of course this varies among disciplines. Short- and medium term (e.g. three years) contracts have the risk that when prolongation becomes necessary renegotiation requires high efforts and might fail. They see this problem particularly in countries with a general unstable political climate or if ABS policies are under revision.

Pharmacy and industrial biotechnology

Company representatives stressed that a concretisation of mutual obligations in contractual form is important for legal certainty for both parties. However, only some companies conclude a full-fledged contract before the first material transfer is carried out. One participant reported that specifications on prices and amounts of plant extracts, investments to be made during the course of the project and success-based monetary benefit-sharing are specified in the initial contract. Amendments during the project are envisaged only to a limited extend. After the initiation phase a dynamic, cooperative work between user and provider is envisaged to pursuit the stated "common" goals.

Other companies use the approach of phasing contracts. At each major step in the project new contract documents are drafted, respectively existing contracts are renegotiated and amended, or the transaction relation is cancelled. Financial details would not be negotiated before the company has found a commercially promising lead in the samples provided under the initial Material Transfer Agreement.

A potential reason for the heterogeneity of contracting approaches in similar fields of utilisation is the variation of internal decision procedure in companies and different demand patterns, especially outsourcing strategies.

The discussion participants elaborated that the duration of the final contract should cover the actual cooperative work, but also the terms of potential patents. They agreed that the praxis was very heterogeneous and individual from case to case.

In this research group we could discuss enforcement mechanisms applied in bioprospectning projects. It is important to note that although the written contracts comes in several cases close to a complete contract, communication, trust-building and interest harmonisation were referred to as the most important enforcement mechanisms in long-term research collaborations. The contracts are rather seen as catalogue of mutual agreements and goals. In case these cannot be reached, problem analysis shall be carried out and options for adaptation discussed. Quality controls are therefore not seen as measures to circumvent moral hazard.

4.2.9 Assessment of the "model-clause idea" by users of genetic resources

Users from public research institutions

Users from this group are not trained lawyers and they only have limited access to legal assistance. Using their working capacities in lengthy administrative procedures and contract negotiations is therefore inefficient. Not all projects provide enough funding to employ external consultants. Accordingly, users from academics tend to assess measures that can simplify administrative procedures as an enhancement. Participants from this group stated they would very much appreciate a central contact for support in administrative and legal issues on ABS. Saving time, particularly reducing lead times for research activities is an important issue in this group since researchers and financing are often bound by certain projects with fixed time constraints. However, the discussion and interviews showed that utilisation of genetic resources in the academic sector is extremely heterogeneous. This would need to be reflected in the development of model clauses.

Pharmacy and industrial biotechnology

In this survey group model clauses for ABS contracts were viewed more controversially. The overall attitude was one of scepticism. The concept and the goals of the instrument, as introduced in the debate on an international ABS regime by the EU, are still unclear to survey participants (although these individuals try to stay current on the overall regime debate). Reluctance also seems to stem from a rejection of additional restrictions and a fear of interference with competencies to negotiate contracts. Confidentiality and competitive aspects are further reasons. An argument raised was the doubt that model clauses could appropriately reflect the heterogeneity of transactions (among others the needs of providers). However, after a lively discussion the participants of the focus group tended to find the idea of supportive checklists and guidelines for contracts feasible.

Plant breeding companies

The International Seed Federation (ISF) calls for an extension of the scope of the ITPGRFA sMTA on all crops. The standard contract is supposed to be workable and could be applied for all ABS-relevant transactions of plant breeders with crops (ISF 2007; ISF 2008). However, in the interviews conducted with plant-breeding companies diverging opinions regarding the applicability and feasibility of model contracts were revealed. Based on their experiences with applying standard-contracts in transactions with gene banks and botanical gardens, some users find this a practical means to keep administrative efforts/costs low, particularly as most small and medium-sized plant breeding companies in Germany have no legal department. On the other hand, actors that are experienced with sourcing directly from provider countries more strongly stress the individuality of cases, for instance the specific needs of providers and the administrative systems and infrastructure in provider countries. In that case agreements would depend more on mutual trust and understanding, what could hardly be reflected in standard contracts like the sMTA. Here model cases would allow for more flexibility.

Breeders in the field of ornamental horticulture did explicitly not favour the approach of applying the same ABS system as the seed industry. They feel as a very distinct industry in terms of the distribution of the value chain, lower monetary benefits created, and less support / engagement of the public sector. The industry trends to be characterised by small or medium sized family driven enterprises, which usually do not have internal legal advisors or even departments who can deal with complex legal issues of ABS. Therefore, if they have to commit to negotiating ABS agreements, instruments that facilitate legal issues would likely be helpful

5 Operationalisation of variables and specification of theory frameworks

Findings from the exploratory survey on utilisation intention indicate a major difference between public research institutes and companies. The latter are motivated to engage in the acquisition of genetic resources for various commercial reasons. Public research institutes in contrast are primarily aiming to answer scientifically relevant research questions. They use genetic resources not necessarily with a commercial intention. Another important difference is the financial and organisational background of utilisation in both sectors.

The utilisation intention and the organisational and economic framework of interaction, supposedly determine different behavior of the user in the acquisition process. Different lines of reasoning regarding “fair” benefit-sharing became evident in the exploratory pre-survey. Companies assess “fair” participation in the case of successful patent applications based on the contribution of the genetic resources to the process of developing a commercial product or a patent. Users in academia, however, indicated that the entire research process is considered. Since the contribution of each party is often difficult to assess, they would plead for equal shares for each party.

Due to differences in the motivation patterns between the private and the public sector, different theories should be applied in the next step of a governance analysis. However, limited capacities in this research project required to select one user group. The private sector was chosen, since here the majority of controversies regarding the feasibility and applicability of a contract-standardisation instrument exist. Moreover, ABS-agreements with the private-sector are more promising regarding monetary benefit-sharing. Also, the private sector has higher capacities for significant capacity building in provider countries.

With the help of the exploratory empirical research and the findings from the topical literature, the theory on governance forms and transaction characteristics is adopted for this research. Empirically observable characteristics for the variables could be derived and a framework of assumptions and hypotheses is defined. These interim findings are presented in the following sections.

The governance elements and transaction variables that were identified as being relevant to survey in a standardised online questionnaire are listed in Table 16. The survey questions are shown in Appendix II (p. 237-249).

Table 16: Selection of variables for further governance analysis

Governance elements for further investigation	Explanatory variables for further investigation
The type of contracting	Provider contribution
Duration of contracts	Strategic demand aspects
Monetary benefit-sharing	Asset specificity
Non-monetary benefit-sharing	Primary uncertainty
Conflict resolution mechanisms	Frequency of interaction
	Indirect capacities of the user
	Transaction environment (national ABS-institutions in the provider country)

Source: Author.

5.1 Operationalisation of the explanatory variables (transaction characteristics)

(1) Demand, provider contribution and strategic aspects of capacity building

When it comes to genetic resources, demand is heterogeneous and the factors determining the choice of a supply source are shifting as well. On the level of individual projects, the provider-contribution can take various forms. The range spans from the mere material provision to extensive scientific collaboration.

Several demand-factors are not primarily motivated by transaction cost minimisation, but have rather other goals such as cost-saving through outsourcing and/or safeguarding long-term access to genetic resources. Further "strategic demand factors" for establishing collaborations with local research-entities can be to use their locational advantage for facilitating administrative access-requirements and as door opener to new markets. These factors supposedly have influence on the governance choice, and are therefore included in the standardised survey through three questions.

In one question users were requested to assess from their companies' perspective the relevance of six supply characteristics in the process of choosing a source for genetic resources (not specifically in the reference case, but in general). Answer options were operationalised as seven-point ordinal response scale ranging from (1) "not important at all" to (7) "very important" (Figure 8 , p. 120).

"Provider contribution" in the case-specific part of the survey was operationalised as a multi-item, multi-response question. The participants could chose out of 10 items those best describing the type of "supply" in their reference project. Each item is later handled as a discrete variable with two possible characteristics: yes (1) and no (0) (Figure 8, p. 120).

To evaluate the relevance of strategic demand aspects, survey participants were asked to evaluate six statements on "synergy effects of capacity building in the provider country". On an ordinal seven-point response scale companies that previously indicated capacity building as part of the benefit-sharing package rated the level of confirmation for each statement (Figure 8, p. 120).

(2) Asset Specificity

The theory suggests treating asset specificity as an explanatory variable for governance decisions, because it exhibits a risk for opportunistic behavior and therefore requires governance safeguards. In the literature dealing with bioprospection and utilisation of genetic resources contrary statements on the relevance of asset specificity are found. RICHERZHAGEN (2007: 111) finds asset specificity not to be a relevant characteristic in her research on critical success factors of national ABS systems. However, the focus on ABS is different in this work. SAMPATH (2005) on the other hand describes asset specificity as highly relevant characteristic of bioprospecting projects in the field of pharmacy and botanical medicine in her analysis of ABS-contracts under the light of efficient property rights systems (p. 95f).

The exploratory research in this dissertation indicated that relation specific investments characterise many projects with the acquisition of genetic resources directly from source-countries. Forms of asset specificity that were identified are investments in physical capital, such as machines (e.g. laboratory equipment), as well as investments in human capital in form of education and training. In addition, SAMPATH (2005) refers to relation-specific investments in buildings (ibid. p. 95).

Seemingly, most relation-specific investments by user companies are made in the provider country, directly linked to capacity building with the aim of supporting the provider in adapting supply to the users' specific needs.

Relation specific investments in form of capacity building can also be understood as a governance variable, as measure of integration and mechanism to safeguard interest harmonisation.

In scientific literature various proxies for the measurement of asset specificity can be found. Often the variable is coded qualitatively, due to the lack of access to quantitative data (SHELANSKI 1995: 338), although hypothetically it could be measured continuously, e.g. in terms of currency or working hours. In this research a qualitative approach is chosen to keep inhibitions to answering as low as possible. Both aspects, (1) the occurrence of investments in their various forms and (2) the level of specificity, are surveyed and combined for the evaluation. Moreover, participants are requested to differ between investments in their company's home country as well as in the provider county. The level of specificity is operationalised through an ordinal scale with 7 categories spanning from "in case the project is called off before completion investments can be utilised otherwise only with high financial disadvantages" to the other extreme "… without financial disadvantages/ no investments are made" (Figure 8, p. 120).

(3) Primary uncertainty

The chain of utilisation spans the identification and evaluation of potentially interesting resources, research and product development, as well as market introduction and sales over the product life cycle. In all these stages primary uncertainty was identified.

The different forms of uncertainty can be summarised to (1) an overall uncertainty regarding the economic outcome of the project, (2) uncertainty about the development of the R&D process, (3) market/demand uncertainty, and (4) technological uncertainty.

Technological uncertainty, which in the theory is thought of as raising the risk of opportunistic behaviour, was not confirmed as a relevant issue in transactions with genetic resources in the exploratory survey. However, since this topic was not exhaustively discussed with users of all potential fields of utilisation, it should be included in the online survey to verify or falsify its relevance basing on a broader sample.

In the literature demand uncertainty is referred to as a rather "simple" form of disturbance, not requiring coordinated response of the transaction parties. For transactions with genetic resource, this assumption holds only partly true. If the resources are needed as raw material for production, a coordinated response to demand/market changes might be necessary. From the pre-survey and the topical literature one can deduce that users carry out capacity building activities - such as know-how transfer for sustainable use or cultivation of natural resources or other measures to safeguard the long-term supply of raw material - in order to enable the provider to carry out specific services. Such activities are likely to become necessary if demand rises after a product was released and the genetic resource is required as raw material for production. A coordinated response would be efficient in order to cope with demand uncertainty.

In the survey four items are included to capture primary uncertainty. They cover the previously elaborated different aspects of uncertainty. Since the predictions for governance choice diverge all items shall be evaluated separately, not as one reflective construct-variable. Each item is operationalised through a statement with a respective seven-point ordinal response-scale spanning from (1) strong disaffirmation to (7) full confirmation (Figure 8, p. 120).

A further proxy for uncertainty is the duration of the utilisation process. The longer the timeframe from accessing genetic resources to possessing a commercial product (or intermediary product) or it being evident that such a product cannot be achieved, the higher is the uncertainty regarding outcomes of the project at the time of contract negotiation. The duration of the utilisation process was included in the survey as closed question with six response categories spanning 1 year up to more than eleven years (Figure 8, p. 120).

(4) Frequency

Theory suggests that the frequency of interaction between two entities matters for the cost-efficiency of "competing" governance forms. If a user procures genetic resources (and related services) over a longer period of time repeatedly from the same entity, investments for developing a more complex but participative kind of relationship might be paid off by reduced transaction costs in each single interaction. In the pre-survey, nonrecurring as well as frequently repeated transactions with genetic resources were found, depending on whether the user knows ex-ante which material is needed and whether it is needed only once or repeatedly in larger amounts.

Frequency is operationalised in the survey as a discrete variable with only two answering categories (see Figure 8, p. 120).

(5) Indirect capacities of user entities

The resource based view suggests that the actors' level of experience handling complex transactions influences the relative transaction costs of different governance forms. Companies with higher indirect capacities are expected to face lower relative transaction costs of more integrated, complex governance forms. The literature (cf. HOLM-MUELLER ET AL. 2005) and the pre-survey confirmed a very heterogeneous level of experience with ABS among users. Moreover, general experiences with projects in a different cultural environments, or research collaboration with partners from developing countries or countries in transition supposedly vary. To capture these aspects, verify heterogeneity and test whether they correlate in the expected way with governance elements, three question-items in the form of statements requiring confirmation or disaffirmation on a seven-point ordinal scale were included in the survey (see Figure 8, p. 120).

(6) The transaction environment

Based on the literature and the results of the exploratory survey, 14 items reflecting different ABS-related aspects of institutional settings in provider countries were identified and operationalised for the online survey. The relevance of each item for users to choose a provider country is surveyed. The items are operationalized as 7-point ordinal response scale ranging from (1) not at all important to (7) very important.

- Competent contact partners in the administration are designated and reachable *
- Information about the national system for access and use of genetic resources (GRs) are available online *
- Information (as defined above) is available in English *
- When necessary, an official representative facilitates communication with local / indigenous groups
- National regulations for the access and use of GRs are in place
- Clear competencies of actors for access negotiations *
- A reliable legal system *
- Legal competency of participants in access negotiations *
- Provider has a concept for resource evaluation *
- Scientific competency of participants in negotiations *
- Centrally managed access procedure for GRs *
- Existence of potential local research partners *
- Self-interest of the provider country's government to attract foreign companies for bioprospecting, etc. *

Ten of these items are also assessed on a case-specific level (marked with *). Item two and three (both on information policy) are aggregated in one question. The response scale ranges in the case-specific questionnaire part from (1) very bad and (7) very good (Figure 8, p. 120)

5.2 Operationalisation of governance variables

The type of contract and the duration of contracts

Two approaches to contracting were identified in the exploratory research: the fully-fledged contract right from the start and the phased-contract, which is developed during the course of a project. Both options are included in the questionnaire as options of one dichotomous variable (Figure 9).

Contract duration has several dimensions: (1) the timeframe in which material or services are transferred from the provider to the user, (2) the timeframe in which the contract obligations remain valid, (3) and the timeframe in which benefit-sharing will be carried out. In the online-questionnaire contract duration is defined as "the timeframe for which mutual requirements were made binding in the contract". This definition was intended to include benefit-sharing obligations, which means the contract duration can span a much longer timeframe than the phase in which the provider actually delivers material or related services.

In the literature and evaluated model agreements a range between short-term contracts (under a year) to long term-contracts over 13 years (covering approximately the timeframe indicated for R&D in pharmacy) were found. In the questionnaire this governance element was operationalised in eight categories (Figure 9).

The monetary element of compensation for access to genetic resources and related services

What is applied in ABS agreements as monetary compensation varies between fixed fees and success oriented payments. Not only does the reference for defining adequate payments vary, but also the timing of concretisation. Negotiated advance payments are found as well as arrangements to negotiate monetary benefit-sharing following the materialisation of the first commercial success.

In the survey monetary compensation is coded as a multi-item question. The category "weight-related or hourly wage-related" payments are closest to market or standard prices. The answering categories presented in Figure 9 are in order of increasing participative risk-sharing and flexibility. Since several measures can be applied in one project, monetary benefit-sharing is coded as a multi-response question.

Non-monetary compensation in transactions with genetic resources

The particularity of ABS is that non-monetary compensation measures are explicitly recommended to supplement or possibly even to substitute monetary benefit-sharing. Under the term non-monetary benefit-sharing the Bonn Guidelines list a whole range of measures and activities users of genetic resources are suggested to carry out within the framework of ABS projects (CBD Bonn Guidelines 2002: Appendix II, p. 19).

Literature and the exploratory pre-survey show that in practice non-monetary benefit-sharing finds broad application - for instance measures to support the conservation of biodiversity as well as measures specifically dedicated to enhancing scientific and technological capacities of provider entities. All these measures can be defined as some form of capacity building. Eight concrete measures with dichotomous answering options and "no measures" as well as "others" were provided as a multi-response question in the questionnaire (Figure 9).

Conflict resolution

Mechanisms to enforce mutual agreements or to resolve disputes can take various forms in ABS-contracts. The stipulation of external mechanisms such as courts is possible as well as measures for cooperative dispute or problem solving. Arbitration assisted by third parties is an intermediary option. All these options were mentioned in the pre-survey and are included as dichotomous items in a multi-response question in the survey (Figure 9).

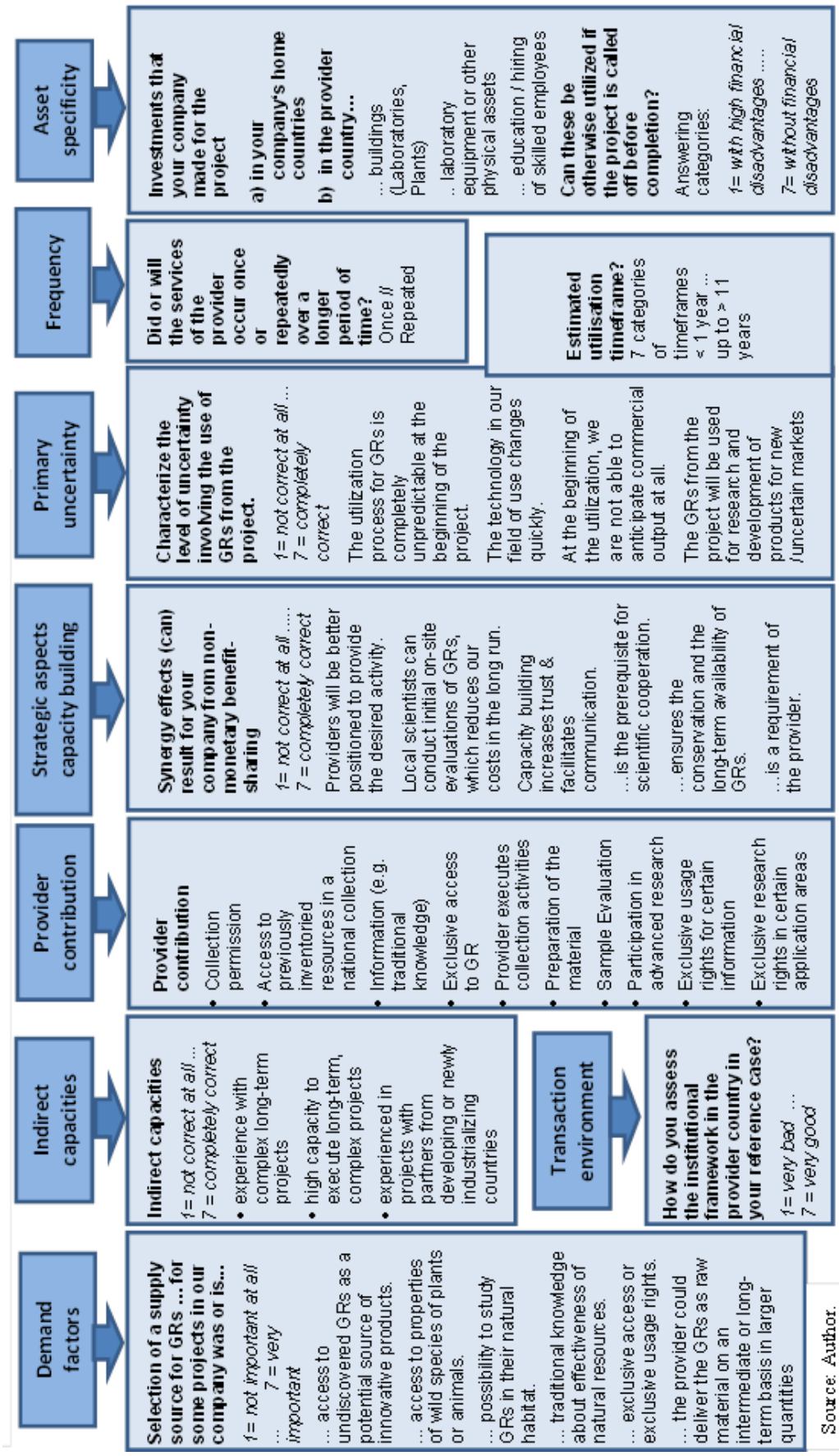


Figure 8: Operationalisation of transaction variables for a standardised survey with closed question

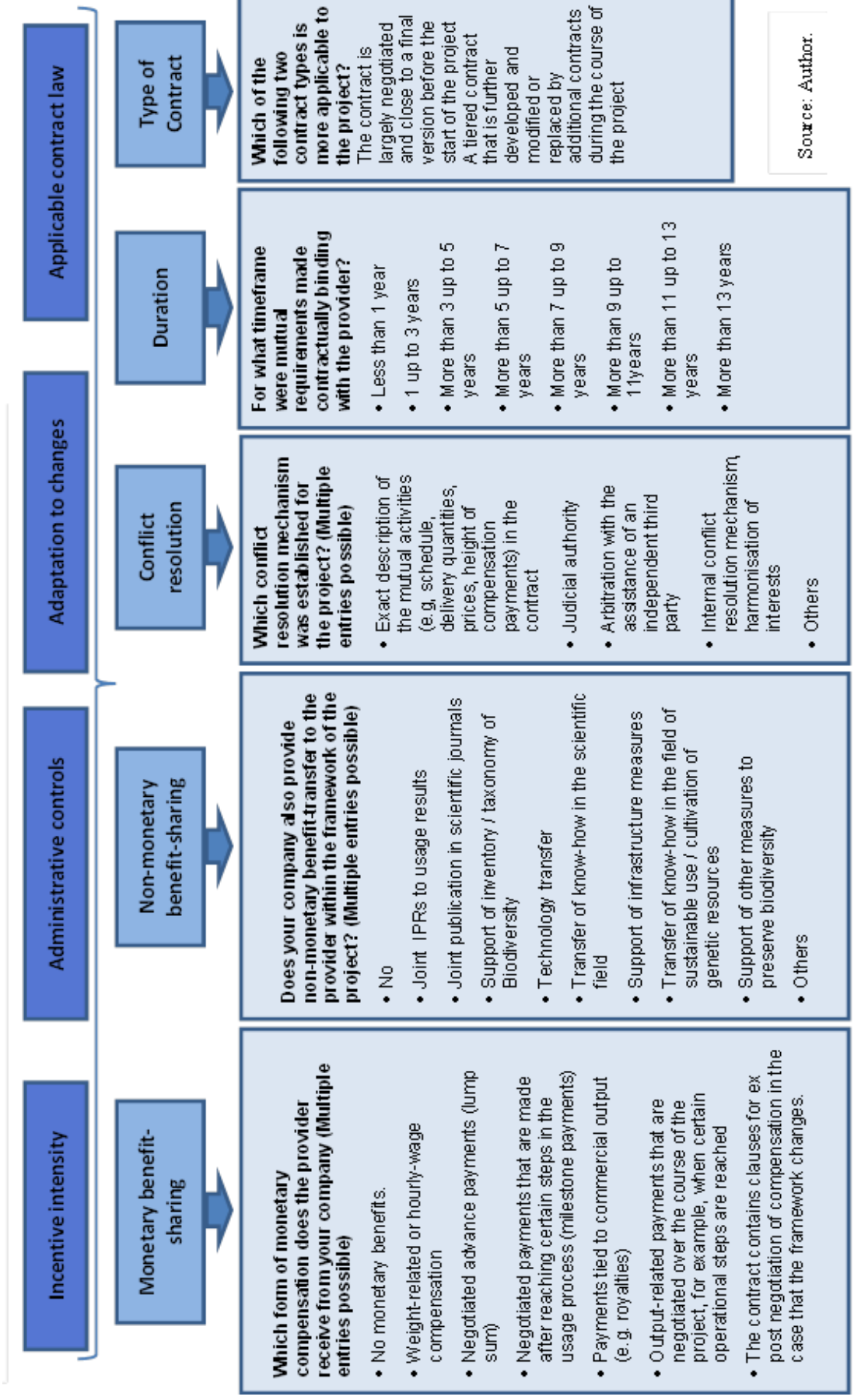
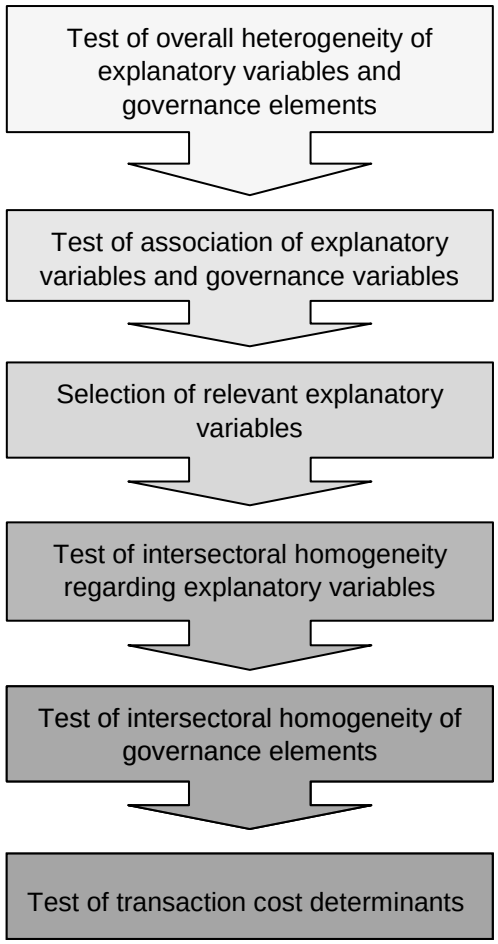


Figure 9: Operationalisation of governance variables for a standardised survey with closed question

5.4 Specification of theory framework for governance choice

Governance analysis of transactions with genetic resources is a fairly new research field. The literature does not comprise quantitative analyses of ABS agreements.

Figure 10: Procedure of survey-evaluation



Source: Author.

In this chapter hypotheses are developed for the construction of the specified theory-framework for evaluating the standardised company survey with regard to governance choice and transaction cost determinants.

Figure 10 visualises the procedure of the evaluations.

Two competing approaches for the governance-categorisation of ABS cases are evaluated: on the one hand the theory-derived differentiation-system of demand characteristics, strategic factors and transaction attributes, and on the other hand the sectoral differentiation.

First the survey questions are evaluated to verify the heterogeneity of transactions with genetic resources, and to identify the specific relevance of certain characteristics (see chapter 5.1 and 5.2)

In the second step correlations between transaction cost determinants and transaction costs proxies are tested. Then hypotheses on associations between potential explanatory variables and governance elements are tested. Accordingly, cases are evaluated to determine if they are intra-sectorally homogeneous regarding the transaction characteristics and governance choice identified as relevant.

5.4.1 Specification of theory framework for transaction costs

With the standardised online survey, data is collected to carry out testing for correlations between transaction costs variables (proxies) and factors that have been identified as potential transaction cost determinants. The assumptions and prediction regarding relationships that shall be tested are outlined in the following.

As explained previously, transaction costs in amount of working hours or a specific currency are not surveyed in the framework of the standardised online-survey. The proxies developed cover (1) the initiation time for the project, (2) the users' assessment of tediousness and problems in the negotiation process, (3) transaction costs in relation to the value of the genetic resources, and (4) transaction costs in relation to other cost components of the utilisation.

The "initiation time" and the "assessment of tediousness and difficulties in negotiations" shall be used as transaction cost proxies in combined evaluations with potential transaction cost determinants. Question three and four contribute to a more meaningful picture of transaction costs in the research context: Are transaction costs a hindrance for potential users to reach and implement ABS agreements? The one-dimensional evaluation of these questions is presented in chapter 6.1.

Users were also asked to indicate what strategies they apply to keep transaction costs low. Testing for correlation of these statements with initiation time and transaction cost assessments is not possible, though. The reason is that the question on acquisition strategy is not related to the specific reference case but rather to general procedures. This means the strategy has not necessarily been applied in the reference project.

A whole range of factors including user characteristics, provider characteristics and transaction attributes have been raised as potential transaction cost determinants.

User characteristics in combination with transaction costs

Theory and the exploratory survey indicate that the company size is likely to matter for (the assessment of) transaction costs in bioprospecting projects, since larger companies tend to have a better international network for seeking information and initiating contacts with "the right people". They also have easier access to experienced lawyers, legal consultancy (in-house or external), and management capacities. *Therefore, a negative association of company size with initiation time and negotiation problems is predicted.*

Strategic management theory states that indirect capacities reduce transaction costs in complex projects. *The prediction is therefore that users with a higher level of indirect capacities indicate fewer problems and a lower initiation time for reaching an agreement*

Provider characteristics in combination with transaction costs

Many different types of institutions can act as providers, depending on the property rights system for genetic resources in the provider country and whom the government has assigned responsibility and rights to negotiate ABS agreements. It is assumed that the provider type influences transaction costs, especially in the negotiation phase and in the initiation time of a project. More specifically: In the literature and the pre-survey it was indicated that the *requirement of involving local and indigenous communities can complicate negotiations*. Another prediction is that *users chose other providers than governmental authorities, particularly local research institutes, in order to keep initiation times and transaction costs low*.

As was elaborated in depth in chapter 3.2.2 and in the problem evaluation of the exploratory pre-survey, the transaction environment in the provider country is a highly relevant factor for transaction costs. With the data from the online survey it shall be determined whether the prediction of *a correlation between a well-designed transaction environment with low initiation times and negotiation problems can be statistically verified.*

Transaction characteristics in combination with transaction costs

The provider contribution is one complexity-factor in ABS agreements. Access to genetic resources can be sought in different ways (ex-situ versus in-situ), and it might be accompanied by certain types of rights, information or services related to the resources, e.g. collecting material, cleaning of samples, etc. *Transaction costs for reaching agreement for more complex provider contributions can assumed to be higher.* It has to be kept in mind though that the value of transactions with more advanced types of provider contribution assumingly is higher, and also overall R&D costs might be higher. Therefore, higher transaction costs cannot automatically be assumed a problem or inappropriate.

In combination with asset specificity, primary uncertainty of the utilisation process (uncertainty of R&D, uncertainty of the commercial outcome of utilisation, technological uncertainty and market/demand uncertainty) is expected to increase transaction costs because safeguards for investments have to be established in the form of more flexible, complex governance forms. *It shall be tested whether, under the condition of asset specificity, primary uncertainty is positively associated with transaction cost proxies.*

Uncertainty relating to the nature of information on genetic resources and the utilisation thereof was elaborated in the theoretical chapter. Lack of information regarding where to find interesting resources and how to find proper contacts and networks induce higher search costs. This aspect of uncertainty was not surveyed in the questionnaire, since it was sufficiently analysed based on the literature and the exploratory pre-survey.

5.4.2 Hypotheses on the choice of contract type and contract duration

In the group discussion with companies from the pharmaceutical and biotechnology industries, it appeared that the internal organisational structure within the company is a factor determining the choice of the contracting approach. The statements supported the assumption that, particularly in large companies with many branches, internal transaction costs are minimised by applying phased decision procedures: low impact and low-cost projects can be decided on a low management level. Only when a higher level of probability for commercial success is reached and costs for R&D increase higher management levels get involved. In comparably smaller companies with flatter hierarchies and a higher degree of specialisation, management is likely to be involved right from the start. Larger companies might also have more legal capacities and power to deal with renegotiations at later stages.

Theory suggests that several transaction and utilisation factors influence the choice of contract type, such as the complexity of interaction, primary uncertainty and asset specificity. The high level of complexity of the transaction subject, long interaction timeframe and high primary uncertainty make it difficult and thereby costly to draft complete contracts right from the start. The user requires flexibility to adapt the project (extend or cease R&D) according to the development of scientific and commercial prospects. Moreover, the definition of an appropriate compensation scheme might be impossible or very costly ex ante. R&D proceeds during the project, so uncertainty decreases and both parties can adapt their efforts. The contracts can be completed at a higher level of information, hence at lower contracting-costs.

High demand uncertainty means that the company faces risks regarding the amount of raw material required for production. This affects the user-provider relation if the biological material source to the genetic resource is needed as raw material in production. In that case the governance structures in the project need to support adjustments, e.g. regarding the amount and timing of raw material delivery and material preparation.

In projects with high technological uncertainty (meaning that the company might be required to make major unanticipated investments during the project) and high relation-specific investments, strong safeguards are required to minimise the risk of strategic hold-ups. The complete contract would be the basis for external enforcement, which is the strongest enforcement mechanism, if full integration is not possible due to the nature of the user and provider.

The pre-survey indicated that in several projects "complete" contracts are used as a reference to monitor and adjust the project, and not how theory suggests primarily as a basis for external enforcement.

A1 An association of company structure and choice of contract approach is assumed. Companies' decision structures are operationalised by company size (number of employees and turnover).

A2 Long timeframes of research increase the uncertainty of outcomes and are assumed to be positively associated with a phased contract approach.

A3 The same holds for a general high uncertainty of R&D outcomes and general commercial uncertainty.

A4 Under the precondition that the resource is used as raw material for production, demand uncertainty is assumed to be positively associated with the phased contract approach.

A5 Asset specificity is likely to be positively associated with a complete contract approach.

A6 It is predicted that for projects with repeated transactions that are carried out over a long period of time (frequency) tiered contracts are applied most commonly

A7 A high level of experience, especially with projects in developing or newly industrialising countries, gives the user the knowledge to handle uncertainty of incomplete and evolving contracts. Therefore, it is predicted that indirect capacities are positively associated with a tiered contract approach.

In the theory, contract duration is assumed to depend on asset specificity. Several empirical studies support this hypothesis (cf. SHELANSKI AND KLEIN 1995: 346, referring to JOSKOW 1985, 1987,1988b, 1990; MASTEN AND SAUSSIER 2000: 222f referring to SAUSSIER 1998 and 1999). In bioprospecting projects this is likely to hold for projects with a long R&D-process, in which result-based payments are used as safeguard for relation-specific investments.

Empirical evidence further indicates that demand or market uncertainty is negatively correlated with contract duration (cf. MASTEN AND SAUSSIER 2000: 222 referring to CROCKER AND MASTEN 1988). This prediction might, however, not necessarily apply to transactions with genetic resources. If the utilisation process requires a coordinated response, demand uncertainty could also influence contract duration in the exact opposite way.

The synergy effects of capacity building, which were identified as potential characteristics of user-provider relations, are assumed to occur more prevalently in long-term projects. The costs of implementing such measures can then be outweighed by a per-transaction cost reduction or cost reduction due to outsourcing.

B1 Contract duration is predicted to be positively associated with several types of capacity building, such as technology transfer and transfer of knowledge and skills in the scientific field.

B2 Strategic aspects of capacity building are predicted being positively associated with contract duration.

B3 Contract duration is assumed to be positively associated with asset specificity

B4 Demand/market uncertainty is positively associated with contract duration, under the precondition that the biological material is needed for production.

5.4.3 Hypotheses on monetary benefit-sharing

The pre-survey indicates that differences in monetary benefit-sharing are strongly related to the heterogeneity of demand as well as the variation of provider contributions. The higher the provider contribution to the success-probability (e.g. through information or the contribution to advanced research), the higher participation in commercial benefits will be (cf. also LAIRD 1993: 111f.).

Theory suggests that the choice of pricing-mechanisms is influenced by several transaction characteristics. SAMPATH (2005) interprets monetary benefit-sharing in the context of bioprospecting projects the same way (p. 153).

The risk of opportunistic behaviour is assumed to vary with the level of asset specificity, while the costs of defining adequate compensation varies with the complexity of interaction (provider contribution) and the primary uncertainty. Empirical evidence indicates that flexible pricing mechanisms and adjustment mechanisms are applied in relation to long performance horizons and high technological uncertainty[31] (MASTEN AND SAUSSIER 2000: 229; CROCKER AND MASTEN 1991).

[31] This is found to support the assumption of increasing specification costs and rigidities associated with detailed performance obligations in uncertain or complex transactions.

In the case of transactions with genetic resources, not only technological uncertainty, but also the general uncertainty about the development of R&D makes the ex-ante definition of rent sharing more difficult.

C1 The type of monetary benefit-sharing is expected to be associated with the type of provider contribution. Provider-contribution types for which the effort level and value are easily identifiable are assumed to be compensated with standard, market-oriented payments. While services with a more complex nature, which are not easily measurable and ex-ante unpredictable impacts are, predicted to be governed with more flexible, output-related compensation measures.

C2 Asset specificity is assumed to be associated with result-based compensation.

C3 Demand uncertainty is predicted to be positively associated with flexible, result-based payment mechanisms.

C4 The type of benefit-sharing is predicted to be associated with the anticipated duration of the utilisation process.

C5 Uncertainty about the development of the research and development process is predicted to be positively associated with output-oriented monetary benefit-sharing.

C6 It is predicted that indirect capacities are positively associated with flexible payment mechanisms.

5.4.4 Hypotheses on non-monetary compensation

Findings from the pre-survey indicate that capacity building can exhibit high relation specific investments from the users' side. However, capacity building is often employed to enable the provider to adjust the supply to the specific demand in a transaction. Bilateral interdependency might arise out of this, which can function as a safeguard against opportunistic behaviour.

Apart from the dependency aspect, capacity building can create an atmosphere of participation, interest harmonisation, cooperation and trust. All of this helps to prevent opportunism and strategic hold-ups. Moreover, integrative hierarchical governance elements simplify monitoring and internal controls and facilitate internal dispute settlement while maintaining the relationship. Hence, capacity building clearly has more dimensions than merely compensation; it can be a governance element.

The exploratory pre-survey and the literature indicate that in bioprospecting projects, companies often achieve positive effects from capacity building they carry out in the provider country. Such synergy effects can be safeguarding utilisation proceedings (material supply in desired quantity, quality, timing etc.), and the reduction of transaction costs. Synergy effects can assumed to be a motivation for capacity building. Also outsourcing of labour-intensive steps in the utilisation process can be a strategic motivation and require capacity building.

Theory suggests that under the presence of asset specificity, primary uncertainty induces a shift from spot-market transaction with classical contracts to hybrid or integrated solutions. Capacity building would be one element of integrated governance, since full hierarchical integration is not possible.

The following hypothesis shall be tested with empirical data:

D1 It is assumed that non-monetary benefit-sharing measures are closely linked to the specific provider contribution, since this enables the user to most efficiently achieve synergy effects. To safeguard a competitive advantage the user might also require exclusive access or utilisation rights in conjunction with capacity building (cf. MULHOLLAND AND WILMAN 2003: 431-432; CBD 2008: 32).

D2 If realising synergy effects is a strategic motive for capacity building, the companies' assessments of potential synergy effects should be positively associated with the actual inclusion of certain non-monetary benefit-sharing measures.

D3 Capacity building with a high integrative nature, such as technology transfer or transfer of expertise in the scientific field, is assumed to be employed as governance measure to reduce the risk of opportunism in projects with high relation specific investments.

D4 The possibility of synergy effects is assumed to be higher in projects with repeated interaction over a longer timeframe, such that investments in internal governance and in enabling the provider to adjust supply pay off. Therefore, certain non-monetary benefit-sharing measures are assumed to be positively associated with frequency.

D5 It is assumed that capacity building is applied more often in projects in which the user has high indirect capacities.

Non-monetary benefit-sharing can be viewed from two different perspectives in conjunction with the transaction environment:

D6 On the one hand capacity building can function as an integrative governance mechanism and therewith substitute external (official) institutions for safeguarding property rights and contract enforcement. Following this interpretation a positive association of capacity building and insufficient national ABS institutions would be predicted

D7 On the other hand, capacity building measures are relation-specific investments. The risk of losing such investments is higher, if the transaction environment exhibits uncertainty. Hence, a negative association of capacity building with insufficient national ABS institutions of certain kinds would be assumed.

5.4.5 Hypotheses on conflict resolution

Theory suggests that especially in transactions with high relation-specific investments, conflict resolution and contract enforcement plays an important role due to the risk of opportunism. Empirical results in other fields than bioprospecting show that with increasing specific investments formal contracting becomes more likely compared to informal agreements[32] (MASTEN AND SAUSSIER 2000: 221 referring to LYONS 1994 and CROCKER AND MASTEN 1988).

In transactions with genetic resources, primary uncertainty, frequency of interaction and the type of exchange supposedly also contribute to determining the stipulation of external and/or internal enforcement mechanisms. As elaborated previously, the pre-survey indicated that bioprospection contracts sometimes contain an extensive specification of the services and compensation to guide monitoring and adaptation during the course of the project, rather than as a basis for external enforcement. Therefore, the specification of mutual claims in the contract is not assumed to be contradictory to the stipulation of internal dispute resolution and interest harmonisation.

The more concrete mutual contribution in a transaction can be formulated and stipulated ex-ante in contractual form, the lower the costs of classical external conflict resolution. If, however, the exchange is highly complex and judicial authorities are not able to assess whether parties fulfill their commitments, external conflict resolution is problematic, or at least very cost intensive. Moreover, the type of interaction in itself requires trust building and information exchange, which is the foundation for cooperative dispute resolution. For such cases, theory suggests relational or internal conflict resolution and interest harmonisation. The more complex the nature of the relation, the more difficult or costly the assessment of fulfillment of agreements by external parties becomes.

The type of relation implicated by the provider contribution and synergy effects of capacity building are likely to influence relative costs of implementing internal dispute resolution and enforcement mechanisms.

[32] This result was understood as providing evidence of an increasing need for safeguards against opportunism as specificity rises. Increasing ex ante transaction costs of drafting a formal contract are accepted to circumvent ex post transaction costs or total failure due to opportunistic behaviour.

Demand uncertainty has several dimensions in transactions with genetic resources. Demand uncertainty requiring a coordinated response between user and provider can be assumed to be governed by contracts including internal dispute resolution mechanisms and measures of interest harmonisation.

Technological uncertainty requires adaptability in the R&D process, which speaks for internal conflict resolution mechanisms and measures of interest harmonisation. However, unanticipated investments also exhibit a high risk of hold-ups, which calls for the stipulation of judicial authorities as the enforcement option of last resort.

If economic interaction takes place repeatedly over a long time period between the same actors, investments in the development and implementation of more complex governance forms including internal dispute resolution and enforcement mechanisms can be outweighed by reduced transaction costs for each subsequent interaction.

E1 Complexity of interaction is assumed to be positively associated with internal dispute resolution mechanisms and interest harmonisation.

E2 Projects, in which user companies can realise synergy effects from capacity building, are predicted to include internal dispute resolution and interest harmonisation measures.

E3 Under the presence of asset specificity, it is predicted that demand uncertainty is positively associated with relational arrangements that facilitate the adaptation of supply. A positive association with internal dispute resolution mechanisms and interest harmonisation is therefore predicted.

E4 Positive correlations of technological uncertainty with the stipulation of judicial authorities as well as internal dispute resolution mechanisms are assumed.

E5 Frequency is predicted to be positively associated with internal dispute resolution and interest harmonisation.

E6 Users' indirect capacities are predicted to be positively associated with arbitration and with internal conflict resolution/interest harmonisation.

E7 If the transaction environment is highly uncertain, external safeguards for contract enforcement are insufficient. Hence, a positive association of environmental uncertainty with "arbitration" and "internal conflict resolution" is predicted.

5.5 Predictions on intra-sectoral homogeneity

Several authors differentiate demand for genetic resources, bioprospecting agreements and the utilisation of genetic resources in accordance with industrial branches, so-called user sectors. They define common practices within these groups (cf. ten KATE AND LAIRD 1999; LAIRD 2000).

In the political negotiations and debates about ABS instruments, the "sectoral approach" has been recognised and is referred to in official documents. However, from an economic governance-analysis point of view, this approach only makes sense if the sector categorisation is a good proxy for those factors actually underlying variation in governance choice.

A closer look at the findings presented in the literature indicates, however, that bioprospecting projects vary in their characteristics and governance forms even within user sectors (cf. CBD 2008). The pre-survey in this research supports this finding. If variation within sectors is significant and cases affiliated with the same sector are not more homogeneous than compared with cases from different sectors, the sector differentiation seems rather inappropriate as a basis for developing a contract-standardisation instrument.

The extent to which sectors can be used as proxies, and therewith as a much simpler starting point for defining menus of model-clauses for ABS contracts, shall be investigated by testing associations between sector affiliation and all relevant explanatory variables. Associations between sector affiliation and governance variables shall also be tested. The following hypotheses are evaluated:

F1 Cases affiliated with different user sectors are significantly different with respect to the characterisation of transaction variables.

F2 Cases affiliated with different user sectors are significantly different with respect to the characterisation of governance variables.

6 Empirical part II - evaluation quantitative company survey

Chapter 6 is separated in four subchapters. Chapter 6.1 presents the evaluation of all survey-questions found to be relevant for the governance analysis and the problem analysis. Bioprospecting projects are characterized on a very detailed level. These variables are then used in bivariate association tests for transaction costs hypotheses (6.2) and the framework of hypotheses on governance choice (6.3). In the fourth subchapter homogeneity of user sectors with respect to transaction characteristics and governance forms is tested.

As explained in the chapter on methods, the sample size varies among the individual questions and sometimes even among items of one question. This is because not all participants answered each question (item).

6.1 Characterising bioprospecting projects

For a differentiation of bioprospecting projects with respect to potential transaction cost factors and governance choice the user and the provider characteristics are relevant, as well as transaction characteristics, such as primary uncertainty, asset specificity, frequency, etc. The survey results on these questions and user statements on transaction costs as well as governance variables are presented in the following.

6.1.1 User characteristics

77 companies that used the link and took a look at the opening page of the survey identified themselves as users of genetic resources in the sense of the survey. For the question “In which fields does or did your company use genetic resources” six answering options were given (multi response possible); additionally, participants could fill in other fields of utilisation.

Table 17 displays the frequency counts including multiple entries.

Table 17: Frequency counts for field of utilisation for genetic resources in the online survey

Frequency of sectors chosen by respondents	**77**
Pharmacy	14
Botanical Medicine	11
Personal Care and Cosmetics	6
Plant Breeding - Seed	27
Plant Breeding - Horticulture	21
Biotechnology, other fields than Pharmacy and Plant Breeding	15
Others	13
Total number of entries	**107**

Source: Author.

The different fields of utilisation – often called user sectors – are represented with a varying number of companies in the survey. By far most survey respondents selected utilisation for plant breeding purposes. Biotechnology in other fields than pharmacy and plant breeding follows on the second place, and pharmacy on the third place. The relation between number of entries (107) and participating user companies (77) indicates that several companies use genetic resources in more than one field.

Table 18 displays how often combinations of certain utilisation areas were selected by one company. The multiple entries cause difficulties for the evaluation of the survey: in combined evaluations of sector affiliation with other variables of interest each case has to be assigned to one sector or one utilisation group exclusively. Therefore, responses for[33] were re-coded. How this was done is explained in the following.

[33] As the survey participants were requested to choose a particular project based on their experiences for answering the questions in part two of the questionnaire, we asked them to specify the field(s) of utilisation for genetic resources acquired within the framework of the project. The operationalisation of responses is analog to the present question.

Table 18: Crosstabulation: Combinations of utilisation-fields of genetic resources

	Botanical Medicine	Personal Care & Cosmetics	Plant Breeding (PB) - Seed	PB Horti-culture	Biotechnology, other than Pharmacy / PB
Pharmacy	8	3	1	0	4
Botanical Medicine		4	2	1	1
Personal Care & Cosmetics			1	0	0
Plant Breeding(PB) - Seed				9	1
PB - Horticulture					2

Source: Author's.

The highest frequency of overlap is between plant breeding in the fields of agricultural crops/seed and plant breeding in the fields of horticulture (nine companies) (Table 18). An aggregation of both types of plant breeding in one sector category would only make sense, though, if not relevant information gets lost by the aggregation. Statistical tests[34] comparing the answering distributions of companies that selected only horticulture versus only seed for each variable of interest were conducted to check this. The test results varied indicating that the two groups should not generally be merged into one category. Instead, two operationalisations of the sector variable were constructed:

(1) Both utilisation groups were kept and a third category was added for companies active in both fields (sector_aggr2).

(2) Aggregation of all plant breeding in one group (sector_aggr5).

Sector_aggr2 was used for bivariate analysis with variables for which the initial tests indicated a significant difference between seed and horticulture. For all other evaluations (majority) sector_aggr5 was used.

A strong overlap was also found between pharmaceutical R&D and botanical medicine: eight companies selected both fields of utilisation. Therefore the category pharmacy was extended to pharmacy and more than one field of application including pharmacy.

[34] For elaborations on the two applied tests, i.e. the Mann-Whitney U test and the Kruskal-Wallis test, see foregoing section. If the distributions do not significantly differ the two utilisation categories can be aggregated.

Only six participants selected personal care and cosmetics, and thereof four indicated that their companies also use genetic resources in the fields of botanical medicine. Hence, both fields were aggregated in the category: Botanical medicine, cosmetics and personal care.

It follows that in further analysis companies' sector affiliation is operationalised as either five or seven categories variable depending on the handling of plant breeding.

The same procedure was applied to the variable "field of utilisation" in the case specific part of the questionnaire: sector_aggr3 has five categories (all plant breeding aggregated) and sector_aggr4 seven categories (three categories for plant breeding).

As proxies for company size (a) the number of employees, (b) the turnover in the year 2008, (c) as well as the average R&D budget in the years 2004 to 2008 were used. Answering categories were defined after conferring with an expert from the German Association of Research-based Pharmaceutical Companies.

The lowest category for number of employees (less than 10) and the third lowest (between 50 and 250) have been selected most often, while only one company selected the highest category (more than 10,000) (see Table A 2). Responses for companies using genetic resources in the field of pharmacy span the smallest as well as the second highest category, whereas plant breeders are concentrated on the lower categories.

Responses on company turnover are concentrated on the three lower categories (up to 74 million US$). Only two companies, both affiliated with the group biotechnology in other fields than pharmacy and plant breeding, selected the highest respectively the second highest turnover category (see Table A 3).

About half of the respondents indicated that the average R&D budget for the years 2004 to 2008 was lower than 1.5 million $ (equal to 1million €), and the accumulated frequency for the lowest two categories (up to 10 million €) is 80% (23 companies) (Table A 4).

Variation of company size is existent in the sample, but higher categories have been selected significantly less often for each of the proxies.

In addition to direct measures of company size the users' so called "indirect capacities" were surveyed. As explained in the theory chapter, indirect capacities shall reflect the level of experience a company possesses regarding the implementation of complex long-term projects, especially with partners in developing or newly industrialising countries.

Table 19: Frequency table: Respondents' perception of companies "indirect capacities"

	1= not correct at all … 7= completely correct									Cum. freq. cat. 5-7
	1	2	3	4	5	6	7	all	Median	
(1) Our company has a high capacity to execute long-term, complex projects.	4	3	6	3	3	4	11	34	5	53%
(2) Our company already has experience in the past of executing complex long-term projects.	2	6	5	3	2	5	11	34	5	53%
(3) Our company is experienced in projects with partners from developing or newly industrializing countries.	5	7	5	4	3	5	4	33	3	36%

Source: Author.

As Table 19 shows, about half of the respondents stated that their company has experience in executing long-term complex projects (1). About the same percentage evaluates their companies' indirect capacities as rather high or high (2). Only 12 out of 33 respondents indicated, however, being experienced in projects with partners from developing or newly industrialising countries (3). The variation was expected.

6.1.2 Provider characteristics

The provider type is a further factor presumably influencing transaction costs. As explained before (chapter 2), survey participants were asked to choose a reference project, in which "the genetic resources were/are acquired directly from their country of origin" and in which "officially authorised actors from the provider country were/ are involved in the negotiations (even if intermediaries are or were involved for support)". However, several types of entities can be authorised from the government to negotiate ABS agreements, and depending on the property rights structure Prior Informed Consent has potentially to be achieved with different stakeholder groups.

In the questionnaire companies were supposed to select from a range of options the provider type(s), with which they negotiated ABS in order to reach an agreement in their specific reference project. Multiple entries were possible.

Table 20: Frequency table: Provider types in bioprospecting projects

Number of entries= 62; Number of cases= 43;	frequency	% of entries	% of valid cases
1: National or regional authority in the provider country, such as environmental agency or ministry	10	16%	23%
2: Local authority in the provider country	8	13%	19%
3: A local group / indigenous community in the provider country	4	7%	9%
4: National biodiversity institute or equivalent institution that is authorised by the government to manage resources and grant access	8	13%	19%
5: Research institutes in the provider country (such as universities)	25	40%	58%
6: Others	7	11%	16%

Source: Author.

Table 20 shows that the overall number of valid entries (62) exceeds the number of cases (43); twelve respondents made multiple entries indicating that several provider types were involved in negotiations. Only 15 users (35%) selected a national or regional authority, and/or a local authority in the provider country[35]. In almost 60% of the cases a "local" research institute was involved as provider entity. 15 users indicated that only a research institute represented the provider country in the negotiations. These figures yield an important result: research institutes in provider countries are key actors for implementing ABS.

The literature and the exploratory survey indicate that users relate a great deal of transaction costs and general implementation problems to the provider countries' institutional framework. 14 items covering relevant identified institutional aspects were included in the survey to validate and specify previous findings, and to assess the relative relevance of different institutional factor. The items span ABS-related information management and measures to guide potential users in complying with ABS requirements. Factors dealing with the organisation of ABS negotiations and the legal capacities of providers, as well as items describing the providers' scientific capacities respectively capacities in the context of biodiversity / genetic resources are included. Finally, the provider countries' self-interest to attract users and implement ABS agreements is tackled in one item.

[35] Multiple entries are not counted double; therefore, the sum is not 18 as the table would suggest.

The survey participants were asked to assess the relevance of each item for determining the selection of a provider country on a one to seven point ordinal scale. Table 21 shows the results. Among 47 to 50 companies answered the question items.

- Three items related to the provider countries' ABS information management and measures to guide potential users in complying with ABS requirements reached over 70% affirmation. These factors are most likely important to keep transaction costs down during the initiation phase of a project.

- Two items related to the provider countries' organisation of ABS negotiations and legal capacities received affirmation by more than 80% of the respondents. Both items certainly affect transaction costs in the negotiation phase.

- Items tackling the providers' scientific capacities and knowledge in the field of biodiversity / genetic resources relate to the users' information search ex ante, as well as potential information asymmetries. It can be assumed that if the provider has a scientific understanding of the users' utilisation propositions and a concept to evaluate the economic potential of genetic resources, information asymmetries are easier to overcome and transaction costs in negotiations can be reduced. Users' assessments of these institutional aspects are also affirmative on average, but less distinct.

- The two items related to the provider countries' own incentives to attract users and implement ABS agreements (self-incentives) reached the lowest rates of affirmation. About 40% of the participants evaluated the "Self-interest of the government of the provider country to attract foreign companies for bioprospecting, etc." as rather up to very important. 28 respondents stated that the existence of potential research partners is a relevant factor. Heterogeneity of responses for these two items underpins the variation of procedures and strategies of user companies for acquiring genetic resources.

In the framework of a gap analysis of national ABS institutions, the results can be helpful, among others to prioritise measures to be taken in order to attract user companies.

Table 21: Companies' assessment of the relevance of ABS-related institutional factors of national ABS systems

How relevant are the following characteristics of institutional frameworks of provider countries for your company in determining the selection of a provider country for genetic resources?	1= not important at all … 7= very important							Cum. Freq. Category 5 to 7 (%)	Median
	1	2	3	4	5	6	7		
1: Competent contact partners in the administration are designated and reachable	3	2	3	5	5	12	20	74%	6
2: Information about the national system for access and use of genetic resources (GRs) are available online	5	2	3	7	8	8	16	65%	5
3: Information (as defined above) is available in English	2	2	3	7	5	8	23	72%	6
4: When necessary, an official representative facilitates communication with local / indigenous groups	2	4	3	5	11	8	16	71%	5
5: National regulations for the access and use of GRs are in place	4	3	4	6	7	10	14	65%	6
6: Clear competencies of actors for access negotiations	2	3	1	3	3	11	25	81%	7
7: Legal competency of participants in access negotiations	3	3	3	4	8	10	17	73%	6
8: Centrally managed access procedure for GRs	5	4	1	12	5	9	11	53%	5
9: A reliable legal system	2	3	3	1	2	7	31	82%	7
10: Provider country can provide information about biodiversity	4	9	0	6	9	7	17	63%	5
11: Provider has a concept for resource evaluation	2	6	3	6	4	10	14	62%	6
12: Scientific competency of participants in negotiations	1	6	6	3	10	15	9	68%	5
13: Existence of potential local research partners	2	4	7	7	10	10	8	58%	5
14: Self-interest of the government of the provider country to attract foreign companies for bioprospecting, etc.	9	10	1	8	4	7	7	39%	4

Source: Author.

In the case-specific part of the survey, users were requested to assess the transaction environment in the provider country of their reference project. Ten out of the 14 institutional items should be evaluated on a 7-point ordinal scale: 1 indicating very bad up to seven indicating very good.

As assumed, the results show strong variation of the transactional environment among cases. More than half of the participants rated the clarity of competence assignment and the legal competency of provider entities as “rather bad to very bad”; whereas the scientific competency, the existence of potential research partners and the existence of a resource evaluation concept were on average assessed significantly more positive (Table A 5).

The positive assessment of research infrastructure might be induced by some kind of sampling bias: provider countries might have been chosen elaborately for the availability of research partners, and projects with involvement of local research partners might be above-average “successful” and therefore be selected by the majority of survey participants as reference case. Hence, the result does not indicate that in the majority of provider countries a good research infrastructure is established.

The items capture different institutional aspects, which do not necessarily have to be correlated, e.g. a country might have a highly reliable legal system, but no research infrastructure in the fields of genetic resources. An aggregation of all items to one single index is therefore not logically appropriate. Nevertheless, some items cover aspects of the same institutional area, and might therefore be correlated: negotiators with scientific competence about utilisation options for genetic resources are, for example, more likely to have a concept for the assessment of the value of genetic resources as well. If this association is statistically verified aggregation of the two items makes sense.

With a factor analysis (and logical considerations) it was evaluated, if and which items should be aggregated[36]. Applying the Kaiser criterion (eigenvalue bigger than one), and logical considerations leads to five components (see Figure A1).

Three aggregated variables and two single items (five factors) are received with this procedure. The components or factors explain together about 93% of the sample variance for transactional environment defined through originally 10 items (see table Table A 6).

Table 22 shows the correlation between each item and the five components, according to which the aggregated variables are composed. Except for item "centrally managed access procedure for genetic resources" all can be relatively clearly assigned to one component. The five components shall be used in bivariate evaluations:

Table 22: Factor Analysis: Factor loadings for transaction environment items

Rotated Component Matrix(a)	**Rescaled Component**				
Items	**1**	**2**	**3**	**4**	**5**
A reliable legal system	**,874**	,159		,301	,152
Scientific competency of participants in access negotiations	**,833**	,124	,373		,301
Clear competencies of actors for access negotiations	**,805**	,110	,245		
Provider has a concept for resource evaluation	**,789**			,540	,139
Self-interest of the government of the provider country for accomplishing ABS agreements		**,895**	,331	,120	,215
Availability of information about the national system for access and use of genetic resources.	,570	**,721**	,116	-,287	
Legal competency of actors involved in negotiations	,180	,270	**,921**	,101	,104
Centrally managed access procedure for genetic resources	,244	,530	**,579**		,336
Competent contact partner in the administration is designated and reachable	,224			**,933**	
Existence of potential research partners in the provider country	,388	,418	,255		**,773**

Extraction Method: Principal Component Analysis; . Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Source: Author.

[36] With a Kolmogorov-Smirnov Test it was tested whether the data of the "transaction environment" variables is normally distributed, which is a prerequisite to apply factor analysis.

6.1.3 Transaction characteristics

In the debate on potential ABS instruments it was stressed that measures should be adapted to "different ways of utilisation". A concrete concept for the operationalisation of "ways of utilisation" was not provided or developed in the discussions, though. In this work such a concept based on transaction costs economics and strategic management is developed. The survey-results provide evidence for the heterogeneity of cases regarding the proxies developed for "ways of utilisation".

Demand heterogeneity

Supposedly, transaction costs are higher for access to in-situ material in source countries compared to acquisitions from international gene-banks, culture collections and botanical gardens. So why would users choose to procure in-situ material directly from a source country? The reason is that demand for genetic resources is often specific, e.g. combined with demand for additional services, information, rights, or even specific ways of access. The survey verifies the heterogeneity of demand as it was conceptualised based on the literature and the exploratory pre-survey.

Table 23: Frequency table: Differentiation of demand in ABS agreements

Please complete the following sentences and assess **how important each aspect is for the selection of a supply source for genetic resources.** **For some projects in our company was or is...**	*1= not important at all ... 7= very important* ***Cumulated frequency category 5-7 (confirmation)***
1: ... access to undiscovered genetic resources (GRs) as a potential source of innovative products very important.	67%
2: ... access to properties of wild species of certain plants or animals very important.	66%
3: ... it very important to be able to study GRs in the context of their natural habitat.	36%
4: ... traditional knowledge about effectiveness of natural resources very important	40%
5: ... exclusive access or exclusive usage rights for genetic resources very important.	45%
6: ... it very important that the provider could deliver the GR(s) as raw material on an intermediate or long term basis in larger quantities.	43%

Source: Author.

Table 23 (and Table A 7) shows that the majority of companies represented in the sample conducts projects in which access to undiscovered genetic resources (item 1). Access to properties of wild species (item 2) is rated rather or very important. As assumed, responses on more specific demand aspects (items three to six) are more dispersed; less than half of the participants confirm the relevance of these demand characteristics.

Looking at the providers' contribution on a case level, demand heterogeneity and potential complexity of ABS cases becomes even more obvious. Table 24 indicates that several respondents made multiple entries (the number of entries exceeds the number of cases). Most participants (45%) made three or more entries (see Table A 8). This supports the assumption that acquisition of genetic resources directly from source countries is often linked with the transfer of certain rights, services, or information.

Table 24: frequency table: Providers contribution for the project with genetic resources

Number of valid cases= 43, All entries= 105 (Multiple entries were possible)	**frequency**	**Percent of valid cases**
Access to previously inventoried resources in national collections	18	42%
Collection permission	15	35%
Provider executes collection activities	11	21%
Information (e.g. traditional knowledge) about usage possibilities	12	28%
Preparation of the material	12	28%
Evaluation of samples	13	30%
Participation in advanced research	9	21%
Some kind of exclusivity rights	9	21%
Exclusive access to genetic resources	6	15%
Exclusive usage rights for certain information	5	13%
Exclusive research rights in certain application areas	4	10%

Source: Author.

The individuality of cases regarding demand characteristics is also supported by the result that only very few provider-contribution items are significantly associated. Moreover, the significant results are mostly negative correlations indicating that neither of the options was selected (see Table A 8).

Synergy effects of capacity building build one group of factors in the theoretical framework for explaining governance choice in this research. Table 25 and Table A 10 show that more than half of the users carrying out capacity building (limited sample) confirm positive (side) effects of non-monetary benefit sharing (capacity building).

The results verify that capacity building safeguards supply in required quality and amount, as well as the long term availability of resources. Also economising of costs for material evaluation (outsourcing) was confirmed as an effect of capacity building. Strategic aspects shall therefore be included in further evaluations combined with governance elements.

Table 25: Frequency table on synergy effects of non-monetary benefit-sharing

What synergy effects (can) result for your company from non-monetary benefit transfers in the project? **1= Not correct at all ..... 7= Completely correct**	**all**	**Cumulated. frequency category 5 - 7**
1: Providers will be better positioned to provide the desired activity, for example, quality / continuity of material supply.	**19**	**53%**
2: Local scientists will be able to conduct initial on-site evaluations of genetic resources, which will reduce costs for us in the long run.	**19**	**53%**
3: Capacity building ensures the conservation and the long-term availability of genetic resources.	**18**	**56%**
4: Capacity building is the prerequisite so that scientific cooperation is possible.	**19**	**37%**
5: Capacity building increases trust and facilitates communication with the providers.	**18**	**78%**
6: Capacity building is a fundamental requirement of the provider.	**18**	**17%**

Source: Author.

Asset specificity

In transaction cost economics asset specificity is seen as one of the most relevant factors for the choice of efficient governance forms. The pre-survey indicated the relevance of relation specific investments, both as transaction characteristic and determinant for governance choice, and as governance element itself. Table A 11 displays the results on the occurrence of asset specificity in transactions with genetic resources differentiated by type of investment and location. In total 28 companies (68%) confirmed to make or have made investments for the utilisation of genetic resources within their reference project. Thereof 26 indicated investments in buildings, laboratory equipment, other physical assets, as well as investments in employees in their "home countries", and 18 companies made investments in the provider country.

An influence of investments on the advantageousness of governance forms, however, is only assumed if investments are relation-specific. Therefore, the survey participants were asked to assess in how far the investments could be reused without financial loss in case the project is called off before completion. Table 26 and Table A 12 display the answers differentiated by investment in the home country and investments in the provider country.

Table 26: Degree of asset specificity for R&D-projects with genetic resources

1= only with high financial disadvantages ... 7= without financial disadvantages **Cumulated frequency of category 1-4 (relation-specificity confirmed)** ↓	
Can your companies' investments in the home country be otherwise utilised if the project is called off before completion? (all: 25 *)	64%
Can your companies' investments in the provider country be otherwise utilised if the project is called off before completion? (all: 16 *)	56%
*These questions were filtered, and only answered by participants that beforehand indicated their company invested/ invests in the framework of the project.	

Source: Author.

16 companies stated that the investments in their home countries are relation specific, and nine companies described investments in provider countries as specific. In total 18 projects in the sample are characteriesd by relation specific investments (7 respondents indicated asset specificity in both categories) (Table A 12).

The results are not fully in line with findings from the pre-survey. They indicate that not only investments in the provider country are relation-specific, but also investments in the company's home countries.

For bivariate evaluations of asset specificity with governance variables asset specificity was re-operationalised. Responses indicating "no investments at all" are aggregated with the answering category "investments can be reused without financial loss". Moreover, to simplify interpretation the response scale is inversed: 1 becomes the lowest level of confirmation of asset specificity and 7 the highest (Table A 13).

Primary Uncertainty

The results displayed in Table 27 verify heterogeneity of primary uncertainty in the utilisation of genetic resources. For each of the four uncertainty variables responses are distributed over the full range of answering categories. 16 out of 39 respondents confirmed or rather confirmed that "the utilisation process for genetic resources is completely unpredictable at the beginning of the project." Technological change, which was not found to be a relevant issue in the pre-survey, is affirmed by about 40% of the respondents. 60% of the users rather to fully agree with the statement: "at the beginning of the utilisation process, we are not able to anticipate commercial output at all." 62% of the projects are dedicated to R&D for products for new and / or uncertain markets.

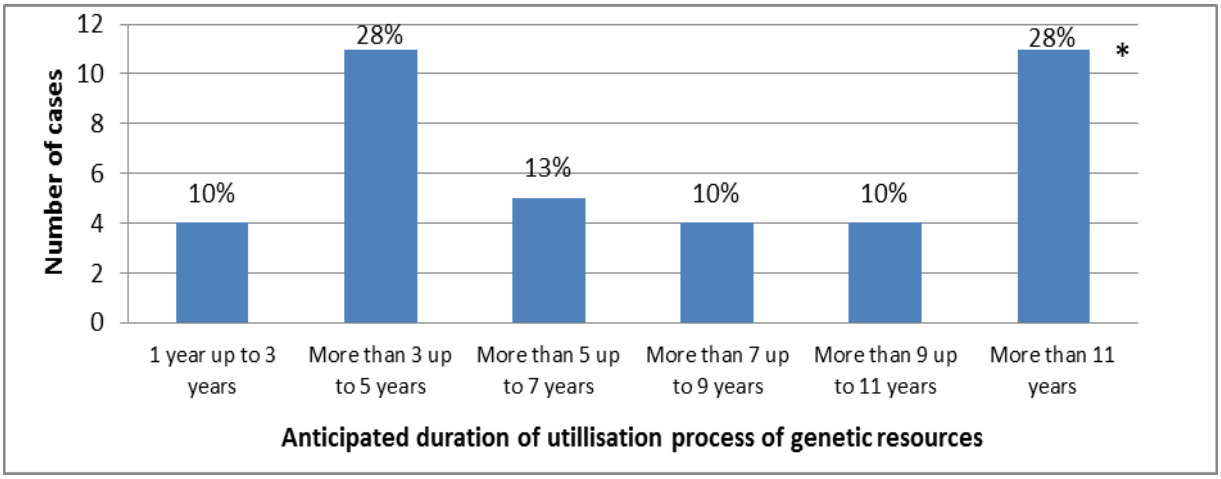
Table 27: Frequency table: Companies' assessment of primary uncertainty

N: number of valid entries	**1= not correct at all ... 7 = completely correct**							**Cum. freq. cat. 5-7**	**N**
	1	**2**	**3**	**4**	**5**	**6**	**7**		
1: The utilisation process for genetic resources is completely unpredictable at the beginning of the project.	1	6	7	5	5	10	5	**46%**	**39**
2: At the beginning of the utilisation process, we are not able to anticipate commercial output at all.	2	11	7	6	2	6	6	**60%**	**40**
3: The technology in our field of use changes quickly.	6	7	4	9	0	6	5	**43%**	**37**
4: The genetic resources from the project will be used for research and development of products for new / uncertain markets	4	8	6	1	3	6	9	**62%**	**37**

Source: Author.

A further transaction characteristic interrelated with uncertainty is the duration of the utilisation process, here understood as the timeframe from access to the resources until a commercial product is received or it is clear that this will not be the case.

Figure 11 shows that all answering categories are represented in the sample, whereby "three up to five years" and "more than eleven years" have been selected most often.



*The sum of percentages diverges from 100 due to rounding error.

Figure 11: Anticipated duration of the utilisation process of genetic resources

Source: Author.

Frequency

Table 28 shows that approximately half of the projects in the sample are characterised by frequently, over a longer period of time repeated transactions with genetic resources. It is important to note that not always acquisition of genetic resources from source countries is characterised by recurring transactions.

Table 28: Repetition of Interaction between User company and Provider

Did or will the services of the provider occur once or repeatedly? (n: 41)	
Once: 20 (49%)	Repeatedly: 21 (51%)

Source: Author.

6.1.4 Governance forms in bioprospecting projects

To characterise and distinguish governance forms for bioprospecting projects respondents were asked to indicate the approach of contracting and the duration of the contract. Subsequently, details on monetary and non-monetary benefit-sharing mechanisms, and measures for conflict resolution, respectively contract enforcement were surveyed. To verify that the sample is heterogeneous and covers all possible options for these governance elements, the questions are evaluated in the following.

Types of agreements and contract duration

The online survey sample is split on the contracting-approach variable: in half of the projects a phasing, tiered approach is applied, in the other half comprehensive contracts are established right from the start of a project (Table A 14).

As timeframes for research and development on the basis of genetic resources vary, contract duration is assumed to vary as well. Standards and recommendations in model agreements or guidelines span five years up to ten years. In practice variation of contract duration is larger. Responses in the online survey span less than one year (9 entries) and more than 13 years (4 entries). The highest frequency occurred for the category “one up to three years” (13 entries) (Table A 15).

Benefit-sharing

Users were requested to select items characterising best the compensation mechanisms applied in their reference project. In a first evaluation step the item batteries for monetary and non-monetary benefit sharing were aggregated to receive an overview on frequencies of the number of monetary and non-monetary measures (Table A 37). In 10 cases no benefit sharing at all is stipulated. Monetary compensation is agreed in 70%, and non-monetary benefit sharing in approximately half of the cases. In about 45% of the projects a combination of monetary and non-monetary measures is appointed.

On a disaggregated level it can be seen that the sample covers the full variety of monetary and non-monetary benefit sharing that was previously identified (Table 29 and Table 30).

Table 29: Frequency table: Monetary benefit-sharing

Which form of monetary compensation does the provider receive from your company in the framework of the project?	yes	No	Affirmation in % of cases [a]
Weight-related, or hourly-wage compensation	8	30	21%
Negotiated advance payments (lump sum)	8	30	21%
Negotiated payments that are made after reaching certain steps in the usage process (milestone payments)	8	30	21%
Payments tied to commercial output (e.g. royalties)	10	28	26%
Output-related payments, that are negotiated over the course of the project, for example, when certain operational steps are reached	5	33	13%
The contract contains clauses for ex post negotiation of compensation in the case that the framework changes.	5	33	13%
[a] number of projects in which this measure is applied divided by the total number of valid cases (**N 38)**			

Source: Author.

Among all items "payments tied to the commercial output" was chosen most often (ten out of 38 projects). The options "Output related payments that are negotiated during the course of the project" and "contract clauses for ex-post renegotiations" have been selected by five respondents only.

It was elaborated that non-monetary benefit sharing can have a range of positive effects for the user company. Measures that supposedly have strong synergy effects are "know-how transfer" and "technology transfer". This might explain (at least partly) why these two measures were most often appointed in the sample (Table 30).

Joint intellectual property rights theoretically have positive governance effects (incentive and risk sharing); while at the same time they increase the risk for hold-up situations. Therefore, the application of such a governance instrument requires a high level of trust and mutual understanding. At the same time patent laws restrict joint ownership of IPRs to cases in which the provider contributes to the invention. Together this might explain the low frequency of joint IPRs as benefit-sharing instrument in the sample (Table 30).

Table 30: Frequency table: Non-monetary benefit-sharing measures

Which form of non-monetary compensation does the provider receive from your company in the framework of the project?	yes	no	Affirmation in % of cases [a]
Joint intellectual property rights to usage results	4	34	11%
Joint publication in scientific journals	13	25	34%
Support of inventory / taxonomy of Biodiversity	8	30	21%
Technology transfer	12	26	32%
Transfer of know-how in the scientific field	14	24	37%
Support of infrastructure measures	5	33	13%
Transfer of know-how in the field of sustainable use / cultivation of genetic resources	9	29	24%
Support of other measures to preserve biodiversity	7	31	18%
[a] number of projects for which this measure is indicated divided by number of valid cases (N 38).			

Source: Author.

Conflict resolution and enforcement of agreements

Companies were asked to select from a list of dispute-resolution and contract-enforcement mechanisms those appointed in their reference project. The aggregation of response shows that in over 40% of the cases more than one mechanism per case was selected (Table A 16). Table 31 shows that "Judicial authorities" is stipulated in only seven out of 38 projects, whereas "internal conflict resolution and the harmonisation of interests" was selected by 45% of the respondents, and "arbitration with third party assistance" by one third.

In contract theory the specification of mutual agreements in contractual form is understood as prerequisite for the employment of external, judicial dispute resolution. In five out of seven cases from the sample, judicial dispute resolution is stipulated and the contract contains precise stipulation of mutual obligations. However, of all possible combinations, concretisation of mutual activities was most often selected in combination with internal conflict resolution measures and interest harmonisation (Table A 9). This supports a finding from the pre-survey, according to which the stipulation of mutual obligations in the contract serves as a guideline for monitoring the project and adapting the collaboration when needed, not necessarily or only for external enforcement.

Table 31: Frequency table: Conflict resolution and enforcement measures

Which conflict resolution mechanisms are appointed for the project? N: 38	**yes**	**no**	**Affirmation in % of valid entries**
Exact description of the mutual activities (e.g. schedule, delivery quantities, prices, height of compensation payments) in the contract	18	20	47%
Judicial authority	7	31	18%
Arbitration with the assistance of an independent third party	12	26	32%
Internal conflict resolution mechanism, interest harmonisation	17	21	45%

Source: Author.

6.1.5 Transaction costs

Three questions were used to survey information about the users' experiences and assessment of transaction costs in bioprospecting projects.

(1) One question evaluates the overall relevance of transaction costs for the choice of a material source (general part of the survey). (2) A second question evaluates the initiation time of bioprospecting projects (case-specific part of the questionnaire). (3) In a third question users were asked to assess transaction-cost aspects in their reference project. The results are evaluated in the following.

Table 32 shows that the majority of survey participants rated "short lead and start times" for a project and "no negotiations about the terms of trade" as rather important (median 5), whereas "standardised processes for material acquisition" has a median of 4, which is the neutral middle category. However, for each item the answers are quit dispersed covering all answering categories from "not important at all" to "very important".

Table 32: Frequency table: Transaction cost aspects of supply sources for genetic resources

Factors for the Selection of Supply Sources for Genetic Resources (If possible consider the activities of your company over the past 10 years.)										
How important are the following aspects?	1= not important at al ... 7= very important									
	1	2	3	4	5	6	7	all	median	Cum. freq. cat 5-7 in %
(a) short lead and start times	8	3	5	10	6	11	13	56	5	54%
(b) no negotiations about the terms of trade with the provider	4	6	5	10	8	8	11	52	5	52%
(c) standardised processes for material acquisition	8	7	4	12	7	4	11	53	4	42%

Source: Author.

As initiation time for a project the questionnaire defined the period from the initial contact to the first "providing" activity of the provider. The question was posed as open question and responses were afterwards aggregated to four categories (see Table 33).

Answer categories (1) "less than six months", (2) "between half a year and one year", and (3) "between one and two years" have each been selected each by between 7 and 10 participants. Only two respondents indicated an initiation time longer than two years. The range is quite large and indicates variation of transaction costs in commercial bioprospecting projects.

Table 33: Frequency table: Initiation time of bioprospecting projects

Initiation time for the project to commence				
< 6 months	6 - 12 months	> 12 - 24 months	> 24 months	all
8	10	7	2	27

Source: Author.

Table 34 shows the companies' assessment of transaction costs in the reference projects. About a third confirmed that "negotiations are/were tedious and difficult". However, three quarter answered that the effort level was rather up to fully acceptable in comparison to the value of the resources and related services. "Not at all correct" was not chosen by a single respondent. Responses on the item "the effort level is low in comparison to other cost components of the project" cover the whole scale of answer categories.

Table 34: Frequency table: Respondents' assessment of transaction costs[1]

	1= not correct at all ..... 7 = completely correct									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**all**	**median**	**Cum. freq. cat. 5-7**
1: Negotiations are / were tedious and difficult.	5	9	0	5	2	4	3	28	3	32%
2: The effort level is acceptable in comparison to the value of the resources and related services acquired in the framework	0	4	2	2	9	10	4	31	5	74%
3: The effort level is low in comparison to other cost components of the project.	1	7	4	4	7	5	3	31	4	48%

[1] Transaction costs are defined as: effort for the initiation of the agreement, on-going communication with the provider, renegotiations, as well as monitoring measures in the project.

Source: Author.

Together the results shape the following picture: the sample covers projects in which transaction costs make a significant part of the total costs, but also projects with negligible transaction costs. In the majority of projects transaction costs are, even though they are possibly high, assessed as acceptable.

Users' strategies to minimise transaction costs

In the literature and the exploratory pre-survey several strategies of user companies for keeping transaction costs low were identified. Survey participants confirming experiences with procuring genetic resources from provider countries were asked to indicate which of the four strategies listed in Table 35 they apply. 60% (31 companies) stated that they rely on previously established relationships as means to keep transaction costs low. Almost as many companies confirmed to work with local research partners partly for this purpose. The two other items have been selected significantly less often.

Table 35: Frequency table: Companies' strategies to minimise transaction costs

Company's strategies to minimise transaction costs resulting from the acquisition of genetic resources from provider countries (Multiple entries possible)			
Number of respondents: 52; Number of valid entries: 92	**Frequency**	**%- of respondents**	**%- of valid entries**
We involve intermediaries.	14	37%	21%
We rely on previously established relationships.	31	60%	34%
We work with local research partners.	28	54%	30%
We select provider countries with solid institutional frameworks.	19	27%	15%

Source: Author.

In some respects these results are surprising. They do not confirm the high relevance of commercial intermediaries indicated in the literature. Provider countries can learn that strengthening local research capacities and supporting local actors in building contacts with user industries are important measures to increase attractiveness for potential users.

6.2 Transaction costs in combination with potential determinants (problem analysis)

In this chapter bivariate evaluations of variables presumably contributing to the variation of transaction costs in bioprospecting projects with transaction cost proxies in reference projects are presented. The results contribute to the problem analysis. The structure of this chapter reflects the three types of transaction-cost factors identified previously: (1) user characteristics, (2) provider characteristics, and (3) transaction attributes.

6.2.1 User characteristics in combination with transaction costs

Statistical tests did not as expected verify a correlation between company size and the initiation time for bioprospecting projects (see Table A 17). The assumption that larger companies due to better networks and higher influence face shorter initiation times for bioprospecting projects was not confirmed.

Association tests between company size and the assessment of problems and tediousness of negotiations yielded three significant results (Table A 18). But they are rather counterintuitive. Table 36 shows that Kendall's Tau-b is positive and significant for the combination of "turnover" as well as "R&D budget" with respondents' assessment of "tediousness and difficulty of the negotiation process". Companies with a higher turnover and/or higher R&D budget indicated on average higher negotiation efforts.

This is contradictory to the hypotheses. It is likely, though that larger companies rather engage in more complex projects. This is supported by the positive correlation of R&D budget with the transaction cost variable. Moreover, Mann-Whitney U tests indicate that companies with higher R&D budget and/or higher turnover more often indicated complex provider contribution in reference projects (Table A 19).

The size of R&D budget is negatively associated with the participants' assessment of transaction costs in relation to other cost components in the reference project. This result is in line with the original predictions.

Table 36: Measures of association: Transaction costs in combination with company size

(variables are aggregated to five category scales)	Kendall' s Tau-b	Approx. Sig.	N
Turnover * Negotiations are / were tedious and difficult.	0.31	.035	27
R&D Budget * Negotiations are / were tedious and difficult.	.369	.015	27
R&D Budget * The effort level is low in comparison to other cost components of the project.	-0.4	.004	30

Source: Author.

The prediction that users with a higher level of indirect capacities would indicate lower transaction costs was not supported by association tests, the results are not significant (see Table A 20 and Table A 21).

6.2.2 Provider characteristics in combination with transaction costs

To test correlations between provider type and negotiation problems respectively initiation time the variable "provider type" was re-operationalised in two ways:

1: Differentiation of the sample in cases in which (a) national regional or local governmental administration entities are/were involved as provider entities and (b) projects in which no such entity was directly involved.

2: Differentiation of the sample in projects in which (a) a local research institute is involved as provider entity and (b) no local research institute is involved.

With the first operationalisation a significant correlation with the transaction cost variable is derived. In cases involving national, regional, or local governmental administration users assessed negotiations as more tedious and difficult (Table 37). This result supports the hypothesis. The differentiation with regard to involvement of local research entities as providers did not yield a significant test result (see Table A 22).

Table 37: Crosstabulation: Transaction costs differentiated by provider type

National, regional and / or local governmental administration entity was involved…	Negotiations are / were tedious and difficult. 1= not correct at all ..... 7 = completely correct							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**all**
Yes	0	3	0	2	2	4	0	**11**
No	5	6	0	3	0	0	3	**17**

Source: Author.

The Mann-Whitney U test indicates also that "initiation time" is significantly longer in projects with involvement of national regional or local governmental administration entities (see Table A 23). This result is also in line with the prediction.

It would be interesting to test whether negotiation problems and initiation time differ, if the sample is split in projects in which (a) no local group/indigenous community is involved in negotiations and (b) projects including this provider type. However, the number of cases involving local groups or indigenous communities is too low for calculating the test.

The transactional environment in the provider country was also evaluated in combination with the users' assessment of negotiations and the initiation time for their reference case. The correlation tests were conducted for the aggregated transaction environment variable (aggregated through factor analysis), but also for all transactional items individually.

None of the aggregated factors is significantly correlated with transaction costs or initiation time (see Table A 24 and Table A 25), but two individual items are: (1) "availability of local research partners in the provider country", and (2) "centrally managed ABS negotiations" are both significantly, negatively correlated with the assessment of tediousness and difficulties of negotiations (see Table A 26). Both results are in line with the predictions.

Initiation time is also negatively associated with the availability of local research partners in the provider country (Table A 27), which underpins the relevance of this institutional aspect to attract users. None of the other items is significantly correlated with initiation time, though.

6.2.3 Transaction characteristics in combination with transaction costs

The provider contribution can be simple, such as access to previously inventoried genetic resources or it can be complex and include, e.g. advanced research. It was tested whether tediousness and difficulties of negotiations are assessed higher in cases including more complex types of provider contribution. Tests with the items "collection activities" and "preparation of material" yielded significant results supporting the hypothesis (Table 38).

Table 38: Crosstabulation and Mann-Whitney U test: Transaction costs differentiated by provider contribution

		1= not correct at all ..... 7 = completely correct							
		1	2	3	4	5	6	7	all
		Negotiations are / were tedious and difficult.							
Provider carries out collection activities	**Yes**	0	2	0	1	2	2	1	**8**
	No	5	7	0	4	0	2	2	**20**
Mann-Whitney U: 44		Asymp. Sig: .061					N: 28		
Preparation of material	**Yes**	0	1	0	3	1	1	2	**8**
	No	5	8	0	2	1	3	1	**20**
Mann-Whitney U: 37		Asymp. Sig: .025					N: 28		

Source: Author.

It was also assumed that in projects with more complex provider contribution the initiation time would be higher. Only the variable "preparation of material" is significantly correlated with initiation time, though (Table 39). Again the result supports the stated assumption.

Table 39: Crosstabulation and Mann-Whitney U test: Initiation time differentiated by provider contribution

		Initiation time				
		< 6 month	6 up to 12 months	> 12 up to 24 months	> 24 months	all
Preparation of material	**Yes**	0	2	4	1	**7**
	No	8	8	3	1	**20**
Mann-Whitney U: 26.5		Asymp. Sig: .011			N: 27	

Source: Author.

Uncertainty was expected to be a transaction cost determinant, particularly under the presence of asset specificity. This overall assumption is not supported by the survey data (see Table A 28). Initiation time of bioprospecting projects is not significantly correlated with uncertainty either (Table A 29).

Summary transaction costs in combination with potential explanatory variables

Table 40: Overview test results on transaction cost

	Users' perception of transaction costs in bioprospecting projects	
Explanatory Variables	**Initiation time of projects**	**Transaction costs assessment**
Heterogeneity of users		
Company size	Not sig.	Partly sig., partly oppose prediction
Indirect capacities	Not sig.	Not sig.
Heterogeneity of providers		
Provider types	Partly sig., support prediction	Partly sig., support prediction
Institutional environment in provider countries	One sig. combination, supports prediction	Two sig. combinations, support prediction.
Type of provider contribution (complexity)	Partly sig., support prediction	Partly sig., support prediction
Primary uncertainty of utilisation	Not sig.	Not sig.

Source: Author.

It can be noted that the survey results support the relevance of previously identified factors as transaction cost determinants less distinct than expected (Table 40). This should not be interpreted as indication of irrelevance of these factors, however. It rather underpins the individuality of projects. In cross-sectional surveys like the one applied here too many transaction-costs relevant factors are shifting, first and foremost the transaction object. As explained earlier, this is one reason why transaction-cost measurement with the aim of hypotheses testing is very rare in the literature, especially in the form of cross-sectional surveys.

None of the reference projects in the sample has been ceased because of prohibitive transaction costs, although in several cases negotiations were assessed as difficult and initiation times long. This verifies individuality of the acceptance level of transaction costs.

The relevance of company size and indirect capacities for transaction costs cannot be generalised basing on the survey results. From the other two categories of explanatory variables, provider characteristics/transaction environment and transaction characteristics, at least several items are significantly associated with negotiation problems and initiation time. These results support the stated predictions. A particular relevance of local research partners could be identified.

Primary uncertainty could not be supported as transaction cost factor; although, which we will see in the governance analysis, it is significantly correlated with several governance elements.

6.3 Governance elements in combination with explanatory variables

The aim of the governance analysis is to test hypotheses on governance choice in empirical transactions with genetic resources. This shall be achieved by testing correlations of governance elements with transaction characteristics, user and demand characteristics as well as the transaction environment.

6.3.1 Contract type and contract duration combined with explanatory variables

The variable "duration of the utilisation process" was aggregated from originally seven to four categories and is in this form significantly associated with governance variable contract type. However, against the prediction [**A2**], projects with longer utilisation duration are governed more often by complete comprehensive contracts right from the start, whereas a phased contracting approach is rather applied in projects with relatively shorter utilisation timeframes (Table 41).

Table 41: Crosstabulation: Contract type combined with duration of utilisation process

How large is the estimated utilisation timeframe? (From access till commercialisation / being evident that no comm. possible)	The contract is largely negotiated and close to a final version before the start of the project	A tiered contract that is further developed and modified or replaced by additional contracts during the course of the project	Total
1 up to 3years	1	1	2
3 up to 7 years	4 (33 %)	8 (64%)	12
7 up to 11 years	3 (66 %)	3 (36%)	6
More than 11 years	7	2	9
	15	14	
N: 29	Mann-Whitney U: 70.5	Asymp. Sig.: .079	

Source: Author.

The prediction of commercial uncertainty being positively correlated with a tiered contract approach [**A3**] is not supported by the survey results either. The majority of company representatives referring to projects with high commercial uncertainty chose the "complete contract approach" (Table 42 and Table A 30).

Table 42: Crosstabulation: Contract type combined with primary uncertainty

Answering categories: **1= not correct at all ... 7 = completely correct**		**Cum. Freq. cat. 5 to 7 (affirmation)**
At the beginning of the utilisation process, we are not able to anticipate commercial output at all.		
Comprehensive contracts right from the start of the project		71%
A tiered contract that is further developed, modified, or replaced during the course of the project		47%
Mann-Whitney U: 84.5	Asymp. Sig.: .036	N: 34

Source: Author.

It was assumed that a tired contract approach is positively correlated with demand uncertainty, if the production requires genetic resources as raw material in larger quantities [**A4**]. The questionnaire includes a question that tackles this matter[37], and the sample was filtered according. Only cases in which material for production is (likely to be) acquired from the user country were included in this evaluation. However, the test results are not significant (Table A 30).

The prediction of asset specificity being positively associated with a complete contract approach [**A5**] was not verified either. The test did not yield significant results (Table A 31).

[37] Do you (plan to) acquire raw material for production from the original provider country?

As expected, frequency is positively associated with a tired contract approach [**A6**]. For single transactions most often complete contracts right from the start are applied, while projects with repeated interaction are mostly governed by phased contracts. The significance level is only 8.4%, though (Table 43).

Table 43: Crosstabulation: Contract type combined with frequency of interaction

		Repetition of Interaction	
Contract type		Once	Repeated
Comprehensive contracts right from the start of the project		11	6
A tiered contract approach		5	11
Fisher's Exact test	Exact significance (2 sided): .084		N: 33

Source: Author.

Users' "indirect capacities" are predicted to be positively associated with a tiered contract approach [**A7**]. However, only the test with "experiences related to projects in developing or newly industrialising countries" is statistically significant (Table 44 and Table A 32). As expected, a higher level of experiences is positively correlated with a tired contract approach.

Table 44: Crosstabulation: Contract type combined with users' indirect capacities

	Our company is experienced in projects with partners from developing or newly industrializing countries. 1= Not correct at all …. 7= completely correct								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**all**	**Cum. freq. cat. 5 – 7**
Comprehensive contracts right from the start of the project	4	3	3	1	2	2	0	**15**	**27%**
A tiered contract	0	3	2	3	1	2	4	**15**	**47%**
Mann-Whitney U: 60	Asymp. Sig.: .028								

Source: Author.

Company size was also tested in combination with the contracting approach. Based on findings from the exploratory pre-study, a positive correlation with a phased contracting approach was predicted [**A1**]. The test results, however, are not significant (Table A 33).

Table 45: Crosstabulation: Contract duration combined with capacity-building measures

Capacity building		Contract duration (years)								
		< 1	> 1-3	>3 - 5	<5 - 7	<7 - 9	< 9 - 11	< 11- 13	> 13	All
Technology transfer	No	9	10	0	2	1	0	1	3	26
	Yes	0	3	5	2	0	1	0	1	12
Mann-Whitney U: 88.5		Asymp. Sig: .029								
Know-how transfer in the scientific field	No	9	9	0	1	1	0	1	3	24
	Yes	0	4	5	3	0	1	0	1	14
Mann-Whitney U: 94		Asymp. Sig: .021								
Support of other measures to preserve biodiversity	No	9	12	3	1	1	1	1	3	31
	Yes	0	1	2	3	0	0	0	1	7
Mann-Whitney U: 54		Asymp. Sig: .035								
Know-how transfer in the field of sustainable use / cultivation of genetic resources	No	9	11	1	2	1	1	1	3	29
	Yes	0	2	4	2	0	0	0	1	9
Mann-Whitney U: 78.5		Asymp. Sig: .066								

Source: Author.

Contract duration was predicted to be positively associated with several types of capacity building, such as technology transfer and transfer of know-how in the scientific field [**B1**]. Table 45 shows some interesting results. As expected, several capacity-building measures are significantly positively associated with contract duration. Most obvious, no capacity-building measure is applied in projects shorter than one year.

Two items of the variable synergy effects of capacity building are highly significantly correlated with contract duration: “Providers will be better positioned to provide the desired activity (e.g. quality / continuity of material supply)” and “facilitation of communication and an increase in trust”. As predicted, the level of confirmation of synergy effects is higher for projects with longer contract duration [B2] (Table A 34).

The association tests for contract duration in combination with asset specificity [B3] and demand uncertainty [B4] did not yield significant results (Table A 35 and Table A 36).

Summary on contract type & contract duration in combination with explanatory variables

Table 46: Overview test results on contract type and contract duration

	Contracting approach	**Contract duration**
Company size (structure)	Not significant	
Timeframe of utilisation process	Significant, but result object prediction	
Capacity building		Significant, result support hypothesis
Synergy effects		Significant, result support hypothesis
Uncertainty on R&D outcomes	Not significant	
Uncertainty on commercial outcome	Significant, but result object prediction	
Demand uncertainty	Not significant	Not significant
Technological uncertainty		
Asset specificity	Not significant	Not significant
Frequency	Significant, result support hypothesis	
Indirect capacities	Significant, result support hypothesis	

Note: Cells with grey shade indicate that not hypotheses were formulated and tested.

Source: Author.

It is notable that several significant test results on the contracting type object the formulated assumptions basing on governance theory. Some of these are in line with the understanding of contracts developed through the pre-survey, however. Highly specified contracts right from the start of a project were classified as monitoring instrument, as guideline and tool for coordinated adaptation in the pre-survey. In the theory this governance form is rather seen as prerequisite for employing external enforcement in the case of disputes.

6.3.2 Monetary benefit-sharing in combination with explanatory variables

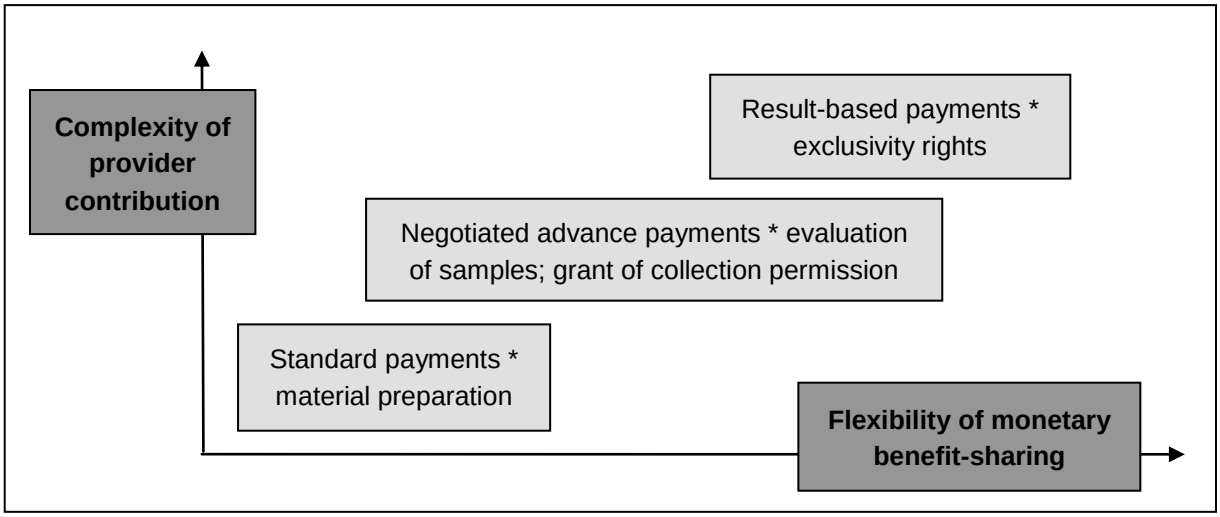
Many projects involving transactions with genetic resources include several forms of monetary benefit-sharing (Table A 37). Therefore, monetary compensation cannot be operationalised as one variable with ordinal categories reflecting increasing flexibility of the pricing mechanism. Instead, each monetary benefit-sharing measure is evaluated separately in combination with potential explanatory variables.

The survey results support the prediction that types of provider contribution that are easier assessable ex ante (e.g. amount of samples, working hours) are more often compensated with standardised, market oriented benefit-sharing forms. In projects with more complex provider contribution, more flexible, output- or even success-related compensation forms are agreed [**C1**]:

- Weight-related or hourly-wage compensation is often agreed in projects in which providers carry out preparation of material.
- Negotiated advance payments are significantly correlated with collection permissions and the provider carrying out sample evaluation.
- Exclusivity rights are a highly complex type of provider contribution. They imply a strong constraint to the providers' property rights over the resources and possibly related information. The opportunity costs for the provider are not easily measurable or definable ex ante. The three forms of exclusivity rights from the questionnaire[38] were aggregated and evaluated as one variable in combination with result-based monetary benefit-sharing measures. The correlation is highly significant. In eight out of nine projects, in which the provider grants some kind of exclusivity, negotiated payments that are made after reaching certain steps in the usage process (milestone payments) and/or payments tied to commercial output are agreed (Table A 38).

[38] (1) Usage rights for certain information, (2) access to genetic resources and (3) research rights in certain application fields

Figure 12 summarises the identified relation between complexity of provider contribution and adaptability of monetary benefit-sharing deduced from the survey results.



Source: Author.

Figure 12: Association between provider contribution and monetary benefit-sharing

If companies make relation specific investments in the context of a transaction, it is assumed that they employ output-related benefit-sharing as countermeasure against opportunistic behaviour from the provider, e.g. strategic motivated project cut off or hold-ups just before patent application or commercialisation [**C2**].

An aggregated variable was composed indicating whether a survey participant selected milestone payments and/or royalties as benefit-sharing measure. The correlation of this variable with asset specificity is statistically significant. Table 47 shows result-based benefit-sharing is significantly more often appointed in projects with higher asset specificity.

Table 47: Crosstabulation: Result-oriented monetary benefit-sharing combined with asset specificity

In case the project is called off before completion, investments can be utilised otherwise… **1: … without financial disadvantages … 7: … only with high financial disadvantages**									
		1	**2**	**3**	**4**	**5**	**6**	**7**	**All**
Milestone payments and/or royalties	**No**	15	0	0	0	2	2	3	22
	Yes	4	1	0	3	1	2	4	15
Mann-Whitney U: 106		Asymp. Sig.: .049							N: 37

Source: Author.

Table 48 shows that weight-related payments or hourly-wage compensation are negatively associated with market/demand uncertainty. This supports the assumption about adaptability requirements for compensation mechanisms in the context of this type of uncertainty [**C3**].

Table 48: Crosstabulation: Monetary benefit-sharing combined with demand uncertainty

		1= not correct at all ..... 7 = completely correct							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**Cum. freq. cat. 5-7**
		The genetic resources will be used for research and development of products for new / uncertain markets							
Weight-related / hourly-wage compensation	**No**	3	0	2	3	8	8	5	72%
	Yes	1	1	1	3	1	0	0	14%
Mann-Whitney U: 40		Asymp. Sig.: .012					N: 36		

Source: Author.

Tests for the combination of "duration of the utilisation process" with flexible payment mechanisms did not yield statistically significant results [**C4**] (Table A 39).

The majority of projects in which negotiated advance payments are appointed are characterised by a rather or totally unpredictable utilisation process (Table 49). This result is not in line with the hypothesis of flexibility requirements under high overall uncertainty [**C5]**. However, it might be interpreted as a providers' requirements for income certainty (participation constraint), as it is stated in MULHOLLAND AND WILMANS' principal-agent model of bioprospecting contracts, which assumes "risk-averse" providers (2003: 419).

Table 49: **Crosstabulation: Monetary benefit-sharing combined with overall uncertainty in the R&D process**

		1= not correct at all ..... 7 = completely correct							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**Cum. freq. cat. 5-7**
		The utilisation process for genetic resources is completely unpredictable at the beginning of the project.							
Negotiated advance payments (lump sum)	**No**	1	5	5	7	3	4	4	38%
	Yes	0	0	0	3	1	2	2	63%
Mann-Whitney U: 69		Asymp. Sig.: .078					N: 37		

Source: Author.

As expected, proxies for users' indirect capacities are positively correlated with more flexible benefit-sharing mechanisms [**C6**]. Almost only respondents confirming a high level of indirect capacities indicated that "output-related payments that are negotiated over the course of the project […]" have been agreed in their reference case (Table 50).

Table 50: Crosstabulation: monetary benefit-sharing combined with indirect capacities

		1= Not correct at all …. 7= completely correct								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**all**	**Cum. freq. cat. 5 – 7**
Our company has a high capacity to execute long-term, complex projects. *										
Output-related payments that are negotiated over the course of the project, for example, when certain operational steps are reached	No	4	3	6	2	3	4	7	29	**48%**
	Yes	0	0	0	1	0	0	4	5	**80%**
Mann-Whitney U: 29		Asymp. Sig: .031								N: 34
Our company already has experience in the past of executing complex long-term projects. *										
Output-related payments that are negotiated over the course of the project…	No	2	6	5	3	2	4	7	29	**45%**
	Yes	0	0	0	0	0	1	4	5	**100%**
Mann-Whitney U: 23		Asymp. Sig: .014								N: 33
….is experienced in projects with partners from developing or newly industrializing countries. *										
Output-related payments that are negotiated over the course of the project…	No	5	7	5	3	3	3	2	28	**29%**
	Yes	0	0	0	1	0	2	2	5	**80%**
Mann-Whitney U: 18.5		Asymp. Sig: .009								N: 33
… is experienced in projects with partners from developing or newly industrializing countries. *										
Payments tied to commercial output, and/or Output-related payments, that are negotiated over the course of the project, e.g. when certain operational steps are reached	No	4	6	4	2	1	1	1	19	**16%**
	Yes	1	1	1	2	2	4	3	14	**64%**
Mann-Whitney U: 56.5		Asymp. Sig: .005								N: 33

Source: Author.

Summary monetary benefit-sharing in combination with explanatory variables

Table 51: Overview test results on monetary benefit-sharing

Explanatory variables	Test results
Type of provider contribution	Significant association, result support hypothesis
Asset specificity	Significant association, result support hypothesis
Uncertainty on R&D outcomes	Significant associations, result partly objects theory-based predictions
Demand uncertainty	Partly significant, support the hypothesis
Timeframe of utilisation process	Not significant
Indirect capacities	Partly significant, support the hypothesis

Source: Author.

Some findings are particularly notable:

The test results indicate that the type of provider contribution plays a role for the choice of pricing mechanisms in contracts for ABS agreements. This result is in line with the suggestions found in existing model agreements and guidelines. The findings allow going one step further, however, by indicating how this relation can be characterised.

The correlation between asset specificity and output-oriented pricing mechanisms supports the interpretation of monetary benefit-sharing as safeguard against opportunism.

Users with higher indirect capacities, particularly with projects in developing and/or newly industrialising countries, were shown to apply output-oriented benefit-sharing measures more often. This can be interpreted as indication for lower relative transaction costs of complex governance forms for actors with a high level of previous experiences.

6.3.3 Non-monetary benefit-sharing in combination with explanatory variables

Non-monetary benefit-sharing functions as (1) compensation for access to genetic resources, related services and rights, but also as (2) governance measure against opportunism, and (3) as tool to enable the provider to deliver the demanded material and services. The evaluations in this chapter tackle all three aspects by testing associations of non-monetary benefit-sharing measures with several demand characteristics and transaction characteristics.

As predicted, test results indicate that in many cases capacity building measures are directly related to the type of provider contribution [**D1**]:

- The majority of projects in which providers contribute to advanced research include the stipulation of joint publications in scientific journals, technology transfer, and the transfer of know-how in the scientific field (Table A 40).
- Projects in which providers carry out collection activities for the user include significantly more often measures to support the inventory and taxonomy of biodiversity, as well as transfer of know-how in the scientific field (Table A 40).
- In all projects, in which joint intellectual property rights are stipulated, some kind of exclusivity right is granted (Table A 40).

The assumption of synergy effects as motive for capacity building [**D2**] was tested by interrelating companies' assessments of synergy effects with the actual appointment of certain non-monetary benefit-sharing measures in reference projects. The results show a significant association for several combinations (Table 52 and Table A 41).

- Know-how transfer in the field of sustainable use and/or cultivation of genetic resources is positively associated with users' affirmation of capacity building contributing to safeguarding a long-term availability of genetic resources.
- Technology transfer is positively associated with the users' assessment of synergy effects of capacity building for enabling providers to carry out the demanded activity […], as well as the positive effect on trust and a facilitated communication.

- Transfer of know-how in the scientific field is positively associated with several capacity building measures: (a) enabling provider entities to better provide the desired activity, (b) as prerequisite for scientific cooperation, and (3) as measure to safeguard long-term availability of genetic resources.
- All companies confirming the positive effect of capacity building on trust and communication carry out know-how transfer in the scientific field in their reference project.

These tests cannot verify cause-consequence relations. However, the significant correlation indicates that companies carrying out capacity building realise highly positive synergy effects: whether intended as such (ex-ante) or as experience (ex post), the assessments made within the survey may indicate the companies' attitude towards non-monetary benefit-sharing in future negotiations for similar projects. Positive experiences are likely leading to repetition.

Table 52: Crosstabulation: Capacity building in combination with the assessment of synergy effects

Answering categories: **1= not correct at all ... 7 = completely correct**		**Cum. Freq. cat. 5 to 7 (affirmation)**
Capacity building ensures the conservation and the long-term availability of GRs.		
Transfer of know-how in the field of sustainable use / cultivation of GRs	No	30%
	Yes	88%
Mann-Whitney U: 10	Asymp. Sig.: .006	N: 18
Providers will be better positioned to provide the desired activity, for example, quality / continuity of material supply.		
Technology transfer	No	25%
	Yes	73%
Mann-Whitney U: 16	Asymp. Sig.: .017	N: 18
Capacity building increases trust & facilitates communication with providers		
Technology transfer	No	57%
	Yes	91%
Mann-Whitney U: 12	Asymp. Sig.: .013	N: 18
Providers will be better positioned to provide the desired activity, for example, quality / continuity of material supply.		
Transfer of know-how in the scientific field	No	17%
	Yes	69%
Mann-Whitney U: 16.5	Asymp. Sig.: .041	N: 19
Capacity building is the prerequisite so that scientific cooperation is possible.		
Transfer of know-how in the scientific field	No	0%
	Yes	54%
Mann-Whitney U: 16	Asymp. Sig.: .041	N: 18
Capacity building ensures the conservation and the long-term availability of GRs.		
Transfer of know-how in the scientific field	No	17%
	Yes	75%
Mann-Whitney U: 6	Asymp. Sig.: .004	N: 18
Capacity building increases trust and facilitates communication with the providers.		
Transfer of know-how in the scientific field	No	33%
	Yes	100%
Mann-Whitney U: 4.5	Asymp. Sig.: .002	N: 18

Source: Author.

Neither relation specific investments in the provider country nor overall asset specificity did yield significant associations with integrative capacity building measures, as was predicted [**D3**].

It is likely that most capacity-building measures can enfold synergy effects for user entities rather in long-term relations with repeated interaction. Hence, a positive correlation between capacity building and frequency was predicted [**D4**]. Table 53 shows the two capacity-building measures with significant associations. Both results confirm the hypothesis. However, for several other measures a positive correlation would have been as logical.

Table 53: Crosstabulation: Non-monetary benefit-sharing combined with frequency

Frequency of interaction		**Once**	**Repeated**
Support of inventory / taxonomy of Biodiversity	No	17	12
	Yes	0	8
Fisher's Exact Test	Exact significance (2 sided): .004		N: 37
Technology transfer	No	15	11
	Yes	2	9
Fisher's Exact Test	Exact significance (2 sided): .036		N: 37

Source: Author.

To carry out capacity building in a provider country organisational skills are required. Therefore, a positive association between indirect capacities and capacity building was predicted [**D5**]. Table 54 shows that this assumption holds for several capacity-building measures. A high level of experiences with partners in developing or newly industrialising countries seems particularly relevant.

Table 54: Crosstabulation and correlations: Non-monetary benefit-sharing combined with users' indirect capacities

Our company ...		1= Not correct at all …. 7= completely correct								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**All**	**Cum. freq. cat. 5 - 7**
… is experienced in projects with partners from developing or newly industrializing countries.										
Yes, joint intellectual property rights to usage results	No	5	7	5	3	3	4	2	29	**31%**
	Yes	0	0	0	1	0	1	2	4	**75%**
Mann-Whitney U: 16.5		Asymp. Sig.: .021								
… is experienced in projects with partners from developing or newly industrializing countries.										
Yes, joint publication in scientific journals	No	5	5	4	3	2	2	0	21	19%
	Yes	0	2	1	1	1	3	4	12	67%
Mann-Whitney U: 47.5		Asymp. Sig.: .003								
… is experienced in projects with partners from developing or newly industrializing countries.										
Yes, support of inventory / taxonomy of Biodiversity	No	5	7	3	3	2	3	2	25	28%
	Yes	0	0	2	1	1	2	2	8	63%
Mann-Whitney U: 46.5		Asymp. Sig.: .023								
… has a high capacity to execute long-term, complex projects.										
Yes, technology transfer	No	4	3	3	3	3	1	5	22	41%
	Yes	0	0	3	0	0	3	6	12	75%
Mann-Whitney U: 72		Asymp. Sig.: .027								
… has experience in the past of executing complex long-term projects.										
Yes, technology transfer	No	2	5	4	2	1	3	5	22	41%
	Yes	0	1	1	1	1	2	6	12	75%
Mann-Whitney U: 77		Asymp. Sig.: .042								
… is experienced in projects with partners from developing or newly industrializing countries.										
Yes, technology transfer	No	5	7	4	2	1	2	0	21	14%
	Yes	0	0	1	2	2	3	4	12	75%
Mann-Whitney U: 23		Asymp. Sig.: .000								
… is experienced in projects with partners from developing or newly industrializing countries.										
Yes, transfer of know-how in the scientific field	No	5	6	3	2	1	3	0	20	20%
	Yes	0	1	2	2	2	2	4	13	62%
Mann-Whitney U: 77		Asymp. Sig.: .002								
… is experienced in projects with partners from developing or newly industrializing countries.										
Transfer of know-how in the field of sustainable use / cultivation of GRs	No	5	6	4	4	2	4	3	28	32%
	Yes	0	1	1	0	1	1	1	5	60%
Mann-Whitney U: 50.5		Asymp. Sig.: .019								
… is experienced in projects with partners from developing or newly industrializing countries.										
Support of other measures to preserve biodiversity	No	5	6	3	4	2	3	1	24	25%
	Yes	0	1	2	0	1	2	3	9	67%
Mann-Whitney U: 43.5		Asymp. Sig.: .034								

Source: Author.

Only three combinations of transaction environment with capacity building yield significant results (Table A 42). Since the absolute majority of tests did not yield significant results, none of the two hypotheses [**D6**] and [**D7**] on transaction environment and non-monetary benefit-sharing can be falsified.

The significant results indicate a positive correlation between a well-established transaction environment and the appointment of a certain non-monetary benefit-sharing measures (Table 55). The assumption of capacity building as integrative governance instrument for substituting insufficient external institutions is not at all supported by the results.

Table 55: Non-monetary benefit-sharing combined with transaction environment

Non-monetary benefit-sharing	Transaction environment
Joint intellectual property rights to usage results	Factor 2
Mann-Whitney U: 2	Asymp. Sig.: .053
Joint intellectual property rights to usage results	Factor 3
Mann-Whitney U: 2	Asymp. Sig.: .053
Support of other measures to preserve biodiversity	Factor 3
Mann-Whitney U: 0	Asymp. Sig.: .025

Source: Author.

Summary on non-monetary benefit-sharing in combination with explanatory variables

Table 56: Overview test results on monetary non-benefit-sharing

Explanatory variables	Test results
Type of provider contribution	Significant association, results support hypothesis
Synergy effects of capacity-building	Significant association, results support hypothesis
Asset specificity	Not significant
Frequency	Significant association, results support hypothesis
Indirect capacities	Significant association, results support hypothesis
Transaction environment	Partly significant

Source: Author.

The significant correlations of (1) provider contribution, and (2) users' assessments of synergy effects with non-monetary benefit-sharing support the assumption that other cost and utility components than transaction costs play a role in the choice of governance forms. Both results indicate that capacity building exhibits synergy-effects for the user, which makes it an efficient compensation form compared to monetary compensation.

The relevance of non-monetary benefit-sharing as countermeasure against opportunism is supported by the significant association of highly integrative measures (e.g. joint IPRs, technology transfer) with asset specificity.

The positive association of users' indirect capacities with non-monetary benefit-sharing measures indicates that users with higher level of experience are more likely to engage in complex projects. This supports the relevance of transaction-costs as decision factor for governance choice, even though the variable comes from the resource based-view (strategic management).

Several hypotheses involving classical variables from transaction cost economics did not yield significant results, whereas strategic variables did. This indicates clearly the necessity and value of a triangulation of theories in this research field.

6.3.4 Conflict resolution in combination with explanatory variables

Theory suggests that particularly in transactions with relation-specific investments conflict resolution and contract enforcement plays an important role. However, which type of instruments (external or internal) is more efficient depends on a range of factors. The type of uncertainty is thought to be relevant, and whether the parties interact repeatedly or only once. Several demand characteristics as well as user characteristics and the transaction environment are also considered being relevant factors.

The more concrete mutual contributions can be formulated and specified ex ante in contractual form, the lower are costs of classical external conflict resolution and contract enforcement. If, however, exchange is highly complex and judicial authorities are not (or only at high costs) able to assess whether parties fulfill to their commitments, external conflict resolution is problematic. Here theory suggests relational or internal conflict resolution and mechanisms, which bring forward interest harmonisation. The type of provider contribution is a complexity factor in this context. Access to previously inventoried material is a standard procedure and can easily be specified in a contract. Contribution to advanced research on the other hand can involve complex interaction between the transaction partners. The effort level is more difficult to determine for external actors.

The evaluations show that most projects in which providers contribute to advanced research stipulate arbitration as conflict resolution mechanism (see Table 57), which is not a classical external enforcement mechanism. This result is in line with the prediction [**E1**].

Table 57: Arbitration in combination with provider contribution "participation of advanced research"

		Participation in advanced research	
		No	Yes
Arbitration with the assistance of an independent third party (N: 38)	No	23	3
	Yes	6	6
Fisher's Exact Test	Exact Significance(2 sided): .016		

Source: Author.

Table 58: Crosstabulation: Judicial authorities in combination with provider contribution

Access to previously inventoried resources in a national collection			
		No	Yes
Judicial authority (N: 38)	No	20	11
	Yes	1	6
	All	21	17
Fisher's Exact Test	Exact Significance(2 sided): .031		
Provider executes collection activities			
		No	Yes
Judicial authority (N: 38)	No	25	6
	Yes	2	5
	All	27	11
Fisher's Exact Test	Exact Significance(2 sided): .014		
Provider grants some kind of exclusivity in connection with genetic resources			
		No	Yes
Judicial authority (N: 31)	No	27	2
	Yes	4	5
	All	31	7
Fisher's Exact Test	Exact Significance(2 sided): .004		

Source: Author.

In total, only few tests of conflict-resolution mechanisms in combination with provider contribution yield significant results. They indicate, however, that projects in which access to previously inventoried genetic resources is sought the stipulation of a judicial authority is significantly higher. The same holds for projects in which the provider carries out collection activities. Exclusivity rights, on the other hand, are negatively associated with the stipulation of judicial authorities (see Table 58).

All three results support the hypothesis [**E1**]. While the first two types of services can be defined rather well ex ante it is hard for external entities to validate compliance with

A transaction relation in which the user can realise synergy effects of capacity building is supposedly more complex and intended to sustain, even if problems in the R&D process or with material delivery, etc. should occur. Conflict resolution mechanisms that support the continuation of the relation are appropriate in that case. The prediction of a positive association between synergy effects of capacity building and internal conflict resolution mechanisms and interest harmonization [**E2**] is verified by the survey results (see Table 59 and Table A 43).

Internal conflict resolution mechanisms and measures of interest harmonisation are applied in 75% of the projects for which users confirmed that "capacity building enables providers to better provide the desired activity". This applies also to all projects for which respondents agree that capacity building increases trust and facilitates communication.

Six out of seven respondents confirming the statement "capacity building is a prerequisite for scientific cooperation", and six out of ten confirming that "capacity building secures the conservation and the long-term availability of genetic resources" selected internal conflict resolution and interest harmonisation

Table 59: Crosstabulation: Internal conflict resolution in combination with synergy effects of capacity building

1= Not correct at all ... 7= Completely correct **Cum. frequency cat. 5 to 7 (affirmation)**		
Providers will be better positioned to provide the desired activity		
Internal conflict resolution (N: 19)	No	36%
	Yes	75%
Mann-Whitney U: 19.5	Asymp. Sig.: .036	
… increases trust and facilitates communication		
Internal conflict resolution (N: 19)	No	60%
	Yes	100%
Mann-Whitney U: 10.5	Asymp. Sig.: .006	
… prerequisite so that scientific cooperation is possible		
Internal conflict resolution (N: 19)	No	9%
	Yes	75%
Mann-Whitney U: 16	Asymp. Sig.: .019	
… secures the conservation and the long-term availability of genetic resources.		
Internal conflict resolution (N: 18)	No	40%
	Yes	75%
Mann-Whitney U: 19.5	Asymp. Sig.: .063	

Source: Author.

Primary uncertainty is assumed to influence the choice of enforcement mechanisms only under the presence of asset specificity. Therefore, only cases characterised by relation-specific investments (category 4 to 7) were included in the evaluations on primary uncertainty in combination with dispute resolution.

Under the presence of asset specificity, a positive association of demand uncertainty with relational, integrated enforcement measures was predicted [**E3**]. Table 60 indicates quite the reverse. For higher levels of demand uncertainty relatively less often internal conflict resolution and harmonisation of interests was selected.

Table 60: Crosstabulation: Internal conflict resolution combined with demand uncertainty

		1= not correct at all ..... 7 = completely correct							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**all**
		The genetic resources from the project will be used for R&D for products for new / uncertain markets							
Internal conflict resolution mechanism, harmonisation of interests	**No**	0	0	1	1	1	4	2	9
	Yes	2	0	1	0	4	1	0	8
Mann Whitney U: 15.5		Asymp. Sig.: .043						N: 17	

Source: Author.

Different types of dispute resolution mechanisms are not mutually exclusive in contracts for transactions with genetic resources. Therefore, it is predicted that under the presence of asset specificity technological uncertainty is positively associated with internal conflict resolution and interest harmonisation, as well as with the stipulation of judicial authorities [**E4**]. The test results object the first part of the hypothesis, but they support the second part. In cases characterised by asset specificity and technological uncertainty internal conflict resolution is applied seldom (Table 61), whereas judicial authorities are often stipulated.

Table 61: Crosstabulation: Conflict resolution mechanisms combined with technological uncertainty

		1= not correct at all .... 7 = completely correct							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**All**
		The technology in our field of use changes quickly							
Internal conflict resolution mechanism, harmonisation of interests	**No**	0	1	0	2	2	2	1	8
	Yes	2	4	0	1	0	1	0	8
Mann-Whitney U: 10		Asymp. Sig.: .018						N: 16	
Judicial authority	**No**	2	4	0	3	2	1	0	12
	Yes	0	1	0	0	0	6	1	4
Mann-Whitney U: 9		Asymp. Sig.: .063						N: 16	

Source: Author.

For the same reason as in the foregoing section, only projects characterised by asset specificity are included in the evaluations of conflict resolution with frequency of interaction.

If transactions take place repeatedly over a longer period of time, efforts for developing and implementing complex governance mechanisms can be outweighed by reduced transactional cost for each subsequent interaction. This should enfold conflict resolution mechanisms as well [**E5**].

Table 62: Crosstabulation: Internal conflict resolution in combination with frequency

Filtered for Asset specificity (N:16)		Repetition of the interaction	
		Once	Repeated
Internal conflict resolution mechanism, interest harmonisation	No	5	4
	Yes	1	6
Fisher's Exact test		Exact Sig. (2 sided): .121	

Without filter (N: 37)		Repetition of the interaction	
		Once	Repeated
Internal conflict resolution …	No	11	10
	Yes	6	10
Fisher's Exact test		Exact Sig. (2 sided): .508	

Source: Author.

The survey results support this prediction to a certain extent: In the filtered sample, internal conflict resolution and interest harmonisation is almost only selected for projects with repeated interaction (Table 62). The significance level of the correlation between frequency and internal conflict resolution is much higher in the filtered sample (12%) compared to the unfiltered sample (51%). However, none of the results is significant at the required 5% level.

The Mann-Whitney U test did not verify a correlation between conflict resolution measures and users' indirect capacities (Table A 44). The same holds for conflict resolution in combination with the transaction environment (Table A 45). Hypotheses about associations of these two variables with conflict resolution [**E6** and **E7**] could therefore not be verified.

Summary conflict resolution and enforcement mechanisms in combination with explanatory variables

Table 63: Overview test results on conflict resolution measures

Explanatory variables	Test results
Type of provider contribution (complexity)	Only few significant association, but those results support hypothesis
Synergy effects of capacity-building	Significant associations, results support hypothesis
Demand uncertainty (under the presence of asset specificity)	Significant associations, result objects prediction
Technological uncertainty	Significant associations, partly support hypothesis
Duration of utilisation	Not significant
Frequency	Significant associations, results support hypothesis
Indirect capacities	Not significant
Transaction environment	Not significant

Source: Author.

Some findings are particularly notable:

The results support the assumption that the complexity of provider contribution is a relevant factor for the choice of conflict resolution measures.

The positive association of synergy-effect items with internal conflict resolution underpins the relevance of sustaining transaction relations, if relation specific investments in form of capacity building are made.

Under the presence of asset specificity, the choice of conflict resolution measures is associated with several aspects of primary uncertainty. However, in contrast to the prediction neither demand uncertainty nor technological uncertainty are positively associated with internal conflict resolution mechanisms and interest harmonisation.

In accordance with the prediction, internal conflict-resolution mechanisms are more often applied in repeated transactions, if asset specificity is present.

6.4 Intra-sectoral homogeneity of transactions with genetic resources

Part of the research question is a revision of the sectoral approach for contract standardisation for access and benefit-sharing. For that purpose it shall be tested whether the users' sector affiliation (which on the case level refers to the field of utilisation of genetic resources) is significantly associated with transaction variables, as well as with the governance variables. Not all transaction variables shall be included in the analyses, only those found to be significantly associated with the governance elements in the previous subchapter.

If variation regarding relevant transaction characteristics among sectors is significant, it can be maintained that sector affiliation is a good proxy for differentiating bioprospecting cases, since it would indicate that cases within a certain field of utilisation are more similar in variables supposedly relevant for governance choice.

A sectoral differentiation for model clauses might be a good option if intra-sectoral homogeneity is strong for all explanatory variables. Otherwise it is deduced that the sectoral approach is not feasible for a "model-clause instrument".

The evaluation of governance variables differentiated by sector affiliation shall serve as double-check for intra-sectoral homogeneity. Moreover, the results can give information on how good the operationalisation of transaction variables was achieved. Inadequateness of the operationalisation is indicated, if sector affiliation is significantly associated with the governance variables but not with the transaction variables.

Two different general operationalisations of the sector variable were applied:

(1) Including all fields of utilisation[39], and differentiated in 4 respectively 6 utilisation categories (see chapter 2.2.5). For each transaction variable it was evaluated beforehand, which of the two sector variables should to be applied.

(2) Only cases that could be affiliated with category "pharmacy" or the category "plant breeding" were included. These are the two largest survey groups, and literature indicates strong differences regarding transaction variables between bioprospecting cases of these two groups.

[39] The category biocontrol was excluded in evaluations with "case-specific" variables, because of the low number of entries.

6.4.1 Homogeneity within sectors regarding transaction characteristics

In Table A 46 all significant results from the combined evaluation of transaction variables with governance variables are summarised. Transaction variables that are significantly associated with at least one governance variable are evaluated in combination with sector affiliation. Table 64 provides an overview on these variables.

Table 64: Transaction variables for evaluation in combination with sector affiliation

<table>
<tr><td rowspan="2">Provider contribution
Only access to previously inventoried GRs
Collection permission
Collection activities
Preparation of material
Evaluation of material
Contribution to advanced research
Exclusivity rights</td><td>Asset Specificity</td></tr>
<tr><td>Primary uncertainty
Uncertainty resulting from technological change
Demand uncertainty
Unpredictability of commercial output at the beginning of the utilisation process
Duration of the utilisation process</td></tr>
<tr><td rowspan="2">Synergy effects of capacity building
Capacity building enables providers to better carry out the desired service
Capacity building increases trust and facilitates communication
Capacity building safeguards long-term availability of GRs
Capacity building is the prerequisite that scientific cooperation is possible</td><td>Frequency of economic interaction between user and provider</td></tr>
<tr><td>Indirect capacities of user companies
Experiences in projects with partners from developing or newly industrializing countries
High capacity to execute long-term, complex projects
Experience in the past of executing complex long-term projects</td></tr>
</table>

Source: Author.

All results are compiled in Table 65; most of the tests did not yield significant results, though. The general hypothesis that sector affiliation is a good overall proxy for transaction variables is therewith not supported **[F1]**. A closer look at the individual significant results shall indicate whether sector affiliation can be used as proxy for individual transaction variables, e.g. provider contribution.

Table 65: Association tests: transaction characteristics combined with field of utilisation

Transaction characteristics	**Sector aggr. 4 ***		**Two user sectors ****	
Provider contribution:	Contingency coefficient		Fisher's Exact test	
	Value	Approx. Sig.	Exact Sig. (2 sided)	
• Access to previously inventoried GRs	.236	.492		.364
• Collection permission	.325	.183		.146
• Collection activities	.334	.162		.137
• Preparation of material	.485	**.006**		.137
• Evaluation of samples	.257	.406		1
• Participation in advanced research	.378	.078		1
• Some kind of exclusivity rights	.376	.080		.216
Frequency of economic interaction	.328	.240	58	.326
Synergy effects of capacity building	Kruskal-Wallis test		Mann-Whitney U test	
	Chi^2	Asymp. Sig	Value	Asymp. Sig
• …enables providers to better carry out the desired service	8.976	**.030**	12.5	.159
• …increases trust and facilitates communication	2.541	.468	15	.448
• …safeguards long-term availability of GRs	1.926	.588	20.5	.787
• …prerequisite that scientific cooperation is possible	2.227	.527	19	.880
Indirect capacities				
• Experiences in projects with partners from developing or newly industrializing countries	6.201	.102	22	**.023**
• High capacity to execute long-term, complex projects	4.541	.209	46.5	.403
• High experience of executing complex long-term projects	3.831	.280	37.5	.163
Asset Specificity	6.617	.085	29	**.011**
Uncertainty				
• Uncertainty resulting from technological change***	5.877	5.575	56	.927
• Uncertainty about the development of the R&D process	3.424	.331	64.5	.692
• Demand uncertainty	1.138	.768	64	.909
• Unpredictability of commercial output at the beginning of the utilisation process	4.039	.257	65.5	.626
• Duration of the utilisation process	5.110	.164	49.5	.784

* Sector_aggr. 4: four groups: (1) pharmacy and pharmacy & botanical medicine; (2) botanical medicine and personal care; (3) all plant breeding; (4) biotech in other fields than pharmacy and plant breeding.

** Only projects with utilisation in (a) pharmacy and (b) plant breeding are compared

*** For these variables sector variable sector_aggr3 was applied, with three categories for plant breeding.

Source: Author.

As Table 65 shows, three *provider-contribution* items are significantly associated with the sector-affiliation variable (sector_aggr4). All three items characterise projects of a more complex nature (Table 66).

Table 66: Crosstabulation: Provider contribution in combination with sector affiliation

		var_sector_aggr4				Total
		Pharmacy; Pharmacy & botanical medicine	Botanical medicine, care & cosmetics	Plant Breeders	Biotech	
Provider grants some kind of exclusivity rights	No	4	2	24	2	32
	Yes	2	1	3	3	9
Total		(yes: 33%) 6	(yes: 33%) 3	(yes: 11%) 27	(yes: 60%) 5	41
Preparation of the material	No	3	0	22	5	30
	Yes	3	3	5	0	11
Total		(yes: 50%) 6	(yes: 100%) 3	(yes: 19%) 27	(yes: 0%) 5	41
Participation in advanced research	No	5	2	24	2	33
	Yes	1	1	3	3	8
Total		(yes: 17%) 6	(yes: 33%) 3	(yes: 11%) 27	(yes: 60%) 5	41

Source: Author's.

Exclusivity rights are least often applied in transactions with genetic resources dedicated to plant breeding. This was expectable considering the property rights system for plant breeding (breeders' exemption, elaboration see chapter 4.2.6) (Table 66). The heterogeneity of answers in the three other groups seems logical from what the literature and the pre-survey indicate: access to genetic resources varies including "random sampling" and acquisition of specific resources with related information about utilisation options.

The provider contribution "preparation of material" would be expected in field of utilisations, in which natural resources are (also) used as "raw material". Preparatory work, such as cleaning and extraction are applied to a large amount of material/samples, and outsourcing to providers can therefore reduce costs. This is presumable for the first two user groups, not for plant breeding, though.

The distribution of results on the item "participation in advanced research" is interesting, but unexpected. Basing on the literature and the pre-survey, the involvement of local research partners and the participation in "advanced" research was expected in projects with pharmaceutical application. This is not supported by the survey results, though.

In a direct comparison of projects in the field of pharmacy versus plant breeding, no significant differences regarding answers on provider contribution were identified (Table 66).

The survey participants were asked to assess in general (not on the case level) a list of supply characteristics for the choice of a provider. Significant differences among user groups were only found for two of six supply aspects: "access to properties of wild species of certain plants or animals" and "access to traditional knowledge" (see Table 67).

Table 67: Crosstabulation: Sector affiliation in combination with two aspects of supply characteristics

Please complete the following sentences and assess how important each aspect is for the selection of a supply source for genetic resources. 1= not at all important … 7= very important	1	2	3	4	5	6	7	Total	Cat. 5-7 in % of total
var_sector_aggr4	**Access to properties of wild species of certain plants or animals is …**								
(1) Pharmacy and Pharmacy & botanical medicine	1	1	1	0	0	2	3	8	**63%**
(2) Only botanical medicine, care and cosmetics	0	0	1	0	0	1	2	4	**75%**
(3) Plant Breeders	1	2	1	4	5	8	11	32	**75%**
(4) Biotech	3	1	1	1	0	1	0	7	**14%**
(5) Biocontrole Agents	1	0	0	0	0	1	3	5	**80%**
Total	6	4	4	5	5	13	19	56	66%
var_sector_aggr4	**Access to traditional knowledge about application possibilities of GRs is …**								
(1) Pharmacy and Pharmacy & botanical medicine	4	0	0	0	2	3	1	10	**60%**
(2) Only botanical medicine, care and cosmetics	0	0	0	0	0	1	3	4	**100%**
(3) Plant Breeders	4	6	5	6	1	5	5	32	**34%**
(4) Biotech	5	1	0	0	0	0	1	7	**14%**
(5) Biocontrole Agents	4	0	0	0	0	1	0	5	**20%**
Total	17	7	5	6	3	10	10	58	40%

Source: Author.

Access to properties of wild species of certain plants or animals was rated as important by the majority of companies in the field of biocontrole agents, plant breeding, as well as botanical medicine, care and cosmetics. Most biotech companies, on the other hand, did not find this aspect particularly important (Table 67).

As indicated in the literature (cf. LAIRD 2000: 92), "access to traditional knowledge about application possibilities of genetic resources" is an important demand characteristic in the field of botanical medicines, cosmetics and care. However, over half of the pharmaceutical companies and eleven out of 32 plant breeders rated this aspect as well as important. Clear disaffirmation was only given by users from biotech and biocontrole agents (Table 67).

In summary it can be stated that "sector affiliation" should not be used as proxy for provider contribution or demand for specific supply. The distribution of answers shown in the crosstabulations (Table 66 and Table 67) cannot be fully explained theoretically, and some results are controversial to what would be expected basing on previous findings. First and foremost, though, because the majority of variables are not significantly associated with sector affiliation and for several significant results the significance level is rather low.

Evaluations in chapter 6.3 indicate that "*synergy effects of capacity building*" are related to the type of provider contribution[40]. Since for most items of provider contribution no significant association with sector affiliation was identified, the assessment of synergy effects is expected to be heterogeneous within sectors as well. Table 65 shows that this holds for all synergy-effect items except "capacity building enables providers to better carry out the desired service". Therefore, sector affiliation is not supported as proxy for synergy effects of non-monetary benefit-sharing. However, the one significant result is in line with the findings previously presented on provider contribution in combination with sector affiliation. Only plant breeders in majority disaffirmed the statement "capacity building enables providers to better carry out the desired service" (Table 68). Such a synergy effect is expected to arise, if the provider receives capacity building to carry out labour or technology-intensive services adapted to the specific demand. In relation, this applies rather seldom to transactions with genetic resources dedicated for plant breeding (see Table 66).

[40] Survey evaluations in chapter 6.3.3 show that capacity building is on the one hand associated with the assessment of synergy effects, and on the other hand with provider contribution.

Table 68: Crosstabulation: Sector affiliation combined with synergy effect of capacity building

var_sector_aggr4		Pharmacy; Pharmacy & botanical medicine	Botanical medicine, care & cosmetics	Plant Breeders	Biotech	Total
"Capacity building enables providers to better carry out the desired service" 1: not at all correct… 7: Completely correct	1	0	0	0	0	0
	2	0	0	2	0	2
	3	0	0	2	0	2
	4	2	0	2	0	4
	5	0	0	0	0	0
	6	3	1	3	1	7
	7	0	1	0	2	3
Total			5	1	9	3

Source: Author.

None of the proxies for "*users' indirect capacities*" is significantly associated with the sector variable operationalised in with four categories. As Table 69 shows, a comparison of only projects in the field of pharmacy (a) versus plant breeding (b) indicates significant differences between the these two user groups, though. Survey participants referring to cases in pharmacy and pharmacy including botanical medicine assess their companies' indirect capacities related to projects in developing and newly industrialising countries on average significantly higher than users in the field of plant breeding.

Table 69: Crosstabulation: Sector affiliation combined with indirect capacities

		Pharmacy and Pharmacy & botanical medicine	Plant Breeders
Our company is experienced in projects with partners from developing or newly industrializing countries 1: not at all correct… 7: Completely correct	1	0	4
	2	0	7
	3	1	3
	4	1	1
	5	1	1
	6	2	0
	7	1	3
Total		(category 5-7 in % of total: 67%) **6**	(cat. 5-7 in % of total: 21%) **9**

Source: Author.

This single result is, however, not sufficient to maintain the assumption of intersectoral homogeneity regarding users' indirect capacities.

A comparison of answer distributions on asset specificity for cases affiliated with pharmacy and pharmacy including botanical medicine versus cases affiliated with plant breeding shows a significant difference (p= .011) (Table 65). Table 70 shows that the percentage of projects in the field of pharmacy characterised by asset specificity is far higher than in the field of plant breeding. However, even in the latter group projects with high relation specific investments exist, hence, using sector affiliation as proxy for asset specificity is problematic.

Table 70: Crosstabulation: Sector affiliation combined with asset specificity

		var_sector_aggr4				
		Pharmacy; Pharmacy & botanical medicine	Botanical medicine, care & cosmetics	Plant Breeders	Biotech	Total
In case the project is called off before completion, investments can be utilised otherwise… 1: no investments /investments can be reused without financial disadvantages … 7: only with high financial disadvantages	1	1	1	16	3	21
	2	0	0	1	0	1
	3	0	1	0	0	1
	4	1	1	0	1	3
	5	0	0	2	0	2
	6	0	0	4	0	4
	7	4	0	2	1	7
Total		6	3	25	5	39
Cumulated cat. 4-7 (asset specificity confirmed) in % of total		83%	33%	32%	40%	41 %

Source: Author.

Summary on intra-sectoral homogeneity for transaction variables

In the introduction to this chapter a decision criterion was defined, under which the hypothesis of sector affiliation as appropriate proxy for variation of transaction characteristics for a governance element should be maintained. This is, if all explanatory variables significantly associated with a governance element are significantly associated with sector affiliation as well. This criterion is obviously not fulfilled for a single governance element, as a comparison of Table A 46: Detailed interrelation of explanatory variables with governance elements) with Table 65: Association tests: transaction characteristics combined with field of utilisation) shows.

Some significant associations of sector affiliation with transaction variables, respectively items thereof were found. However, the overall result is that a differentiation according to user sectors is not feasible for the design of model clauses or model agreements for access and benefit-sharing.

6.4.2 Intra-sectoral homogeneity regarding governance forms

To double-check the findings from chapter 6.4.1 associations between governance elements and field of utilisation (sector affiliation) were evaluated. Table 71 shows the test results.

Only one result is significant at a 5% level, three further on a 10% level. Hence, in general it can be stated that governance choice does not statistically significantly vary with respect to the field of utilisation, as a "sectoral model-clause instrument" would imply. This result confirms the findings from the previous section. Inadequateness of the operationalisation of transaction variables can therefore not be deduced based on the evaluation of sectoral-heterogeneity.

Anyhow we shall take a closer look at the significant results from Table 71.

Table 71: Association tests: Governance variables combined with field of utilisation

Governance Elements	Sector aggr. 4 *		Pharmacy vs Plant breeding **	
	Kruskal-Wallis test		Mann-Whitney U test	
	Chi^2	Asymp. Sig	Value	Asymp. Sig
Contract duration	1.841	.606	62	.585
	Contingency coefficient		Fisher's Exact test	
	Value	Approx. Sig.	Exact Sig. (2 sided)	
Contract type	.329	.274	1.00	
Monetary benefit-sharing				
• Weight-related, or hourly-wage compensation	.215	.617	.571	
• Negotiated advance payments (lump sum)	.298	.307	.254	
• Negotiated payments that are made after reaching certain steps in the usage process	.166	.788	1.00	
• Payments tied to commercial output (e.g. royalties)	.472	***.059	.300	
• Output-related payments, that are negotiated over the course of the project	.343	.177	.366	
Non-monetary benefit-sharing				
• Joint IPRs to usage results	.373	.113	.366	
• Joint publication in scientific journals	.119	.912	1.00	
• Support of inventory / taxonomy of Biodiversity	.345	.173	**.075**	
• Technology transfer	.366	.126	.120	
• Transfer of know-how in the scientific field	.243	.510	.372	
• Support of infrastructure measures	.279	.372	1.00	
• Transfer of know-how in the field of sustainable use / cultivation of genetic resources	.177	.755	.603	
• Measures for biodiversity conservation	.395	**.077**	**.075**	
Dispute resolution and enforcement mechanisms				
• Exact description of the mutual activities in contract	.414	**.054**	.156	
• Judicial authority	.353	.153	.169	
• Third party assisted arbitration	.253	.469	.329	
• Internal conflict resolution, interest harmonisation	.340	.185	.358	

* Sector_aggr. 4: four groups: (1) pharmacy and pharmacy & botanical medicine; (2) botanical medicine and personal care; (3) all plant breeding; (4) biotech others than pharmacy and plant breeding.

** Only projects with utilisation in (a) pharmacy and (b) plant breeding are compared

*** For this variable the sector variable sector_aggr3 was applied, with three categories for plant breeding.

Source: Author.

Laird (2000) writes that in the pharmaceutical industry a “fairly standard package of benefits is employed” (p. 92) is employed. The results of the present research cannot support this statement. Only two out of five monetary benefit-sharing items and one out of eight non-monetary benefit-sharing items are significantly associated with the field of utilisation of genetic resources. The error probability is in all three cases higher than 5%. The respective crosstabulations (Table 72) indicate that some measures are more common in certain fields of utilisation. However, in summary the results rather indicate intra-sectoral heterogeneity of non-monetary benefit-sharing in bioprospecting projects.

Table 72: Crosstabulation: Benefit-sharing items significantly associated with field of utilisation

	Payments tied to commercial output (e.g. royalties)			
(1) Pharmacy and Pharmacy & botanical medicine	No	Yes	Total	Yes in % of Total
(2) Only botanical medicine, care and cosmetics	3	3	6	50%
(3) Plant Breeders	2	0	2	100%
(4) Biotech	19	5	24	21%
Total	3	2	5	40%
	Support of inventory / taxonomy of biodiversity			
	No	No	No	No
(1) Pharmacy and Pharmacy & botanical medicine	3	3	3	3
(2) Only botanical medicine, care and cosmetics	21	21	21	21
	Payments tied to commercial output (e.g. royalties)			
	No	No	No	No
(1) Pharmacy and Pharmacy & botanical medicine	3	3	3	3
(2) Only botanical medicine, care and cosmetics	1	1	1	1
(3) Plant Breeders	21	21	21	21
(4) Biotech	5	5	5	5
Total	30	30	30	30

Source: Author.

The stipulation of exact description of mutual activities in the contract is associated with sector affiliation at a 1.7% significance level (Table 71). Table 73 shows that this dispute-resolution item is applied in the majority of projects in the field of pharmacy, which was also reported in the exploratory pre-survey. However, this type of dispute resolution end contract enforcement strategy is as well stipulated in projects affiliated with other fields of utilisation (Table 73).

Table 73: Exact description of the mutual activities differentiated by field of utilisation

	Exact description of the mutual activities in contract			
	No	Yes	Total	Yes in % of Total
(1) Pharmacy and Pharmacy & botanical medicine	1	5	6	83%
(2) Only botanical medicine, care and cosmetics	1	1	2	50%
(3) Plant Breeders	12	12	24	50%
(4) Biotech	5	0	5	0%
Total	19	18	37	

Source: Author.'

7 Discussion problem analysis

Research on the issue of transaction costs in user-provider relations in the context of genetic resources was conducted in several subsequent steps in this dissertation. The approach was to first deepen the understanding of problems by creating a solid foundation of information and by letting economic theory guide the problem identification and analysis. In the exploratory user survey the identification of problems (transaction costs) and potential explanatory factors provided the focal point. In the next step, findings were translated into a set of variables presumably determining transaction costs and transaction-costs proxies. The standardised online survey was then used to verify the heterogeneity of users' transaction-costs perceptions and the variation of transaction characteristics. Hypotheses about associations between transaction variables and transaction cost assessments were tested.

In the following sections the results of the "problem analysis" are evaluated (1) and comprehended to an overview of the transaction process and transaction costs occurring in projects for the acquisition of genetic resources from source countries. (2) Identified sources and factors of transaction costs are summarised and the contribution of the theory to the problem analysis is discussed. Finally (3) the results are discussed with respect to the feasibility of a model clause instrument to support ABS implementation.

7.1 The transaction process and transaction costs

The process of acquiring genetic resource from source countries differs to some extent between private companies and users from the public research sector, particularly if the latter includes external research funding. Even within both groups projects are individualised. The level of ex-ante information (does the user know what he/she wants and where to get it?) varies. Further factors influencing the transaction process include the possibility of using pre-existing contacts in the initiation phase, and the type of "provider contribution". If the user merely demands access to land or ex-situ material, no technical adjustment or delivery phase occurs in the transaction, while these are essential steps in projects with long-term multiple deliveries of material which the provider pre-processes particularly for the user.

All transactional steps and transaction costs identified in bioprospecting projects are summarised in Table 74. Which of the steps take place, and in which chronological order, varies. The same applies for the type and amount of transaction costs.

Table 74: The ABS-chain from a transaction cost-perspective (user perspective)

Transaction phase	Users' activities	Transaction costs
Search and initiation	⇨ Identification of potential provider ⇨ Assessment of the offer / supply (what exactly does the provider offer, how does it respond to the demand) ⇨ Screening of the provider for reliability ⇨ Identification of authorities for ABS negotiations ⇨ Identification of the national regulations concerning access to genetic resources	- Labour for information search (with scientific understanding of demand) - Labour with knowledge of the language of the provider country (information about ABS procedures, contact persons, laws and regulations might not be available in English) - Travelling expenses for meeting provider & pot. research partners
Negotiations Internal coordination/ decisions Contract drafting	⇨ Obtaining Prior Informed Consent ⇨ Negotiating contents of the matter of exchange (providers contribution, benefit-sharing, IPRs) => reaching Mutually Agreed Terms ⇨ Drafting the of the contract	- Labour with legal capacities or external law consults - Labour with management capacities or external consults - Travelling expenses
Technical adjustment / capacity building	⇨ Communication and support (scientific, technical, infrastructure..) for adjustments to demand on the provider side	- Travelling expenses - Labour with scientific and technical capacities
Monitoring and control	⇨ Legal verification of the contract ⇨ Monitoring / verification of misconduction of the other contracting party (quality, exclusivity of supply)	- Travelling expenses - Labour with scientific &technical capacities - Labour with legal capacities or external law consults
Contract adjustment	Renegotiation of the contract	- Labour with legal capacities… - Travelling expenses
Enforcement	⇨ Dispute settlement (external, arbitration, or internally) ⇨ Sanctioning / Remedies	- Labour with legal capacities… - Costs for lawyers and courts - Costs for arbitration - Costs for internal dispute resolution (travelling, communication)

Source: Author, based on Authors' survey and literature (GEHL SAMPATH 2005: 69ff; KLEINALTENKAMP 1993: 85; NORTH 1992: 32; RICHTER and FURUBOTN 2003: 59-61; VISSER ET AL.2000: 8).

The online survey supported the assumption that bioprospecting projects can be characterised by high transaction costs. Some participants indicated that negotiations were very difficult and tedious. Initiation times from over two years were reported, and in some projects transaction costs are assessed as rather inacceptable in comparison to the value of the genetic resources. However, this negative picture does not hold for the majority of cases described in the framework of either ofthe empirical surveys carried out in this research. Several participants stated the exact opposite and affirmed, for example, that "the effort level is low in comparison to other cost components of the project".

Together the results shape the following picture: the sample covers projects in which transaction costs make up a significant part of the total costs as well as projects with negligible transaction costs. In the majority of projects transaction costs are assessed as acceptable, even if they are high. However, one has to bear in mind that in the online survey, participants were required to describe projects that have reached the contracting phase (initiation is concluded), have not been revoked, and there is also no foreseeable revoking of the agreement. This should secure that the sample projects are successfully implemented, which was an important requirement for the governance analysis. For the problem analysis, however, it might lead to an underestimation of transaction costs and implementation problems in the overall population.

Due to limited capacities in this project, users from public institutions were not considered in the online survey. Findings from the exploratory surveys indicate, however, that in this user group transaction costs matter significantly because of constrained legal and organisational capacities of the researchers, as well as limited access to external legal and management capacities.

7.2 Factors for transaction costs

Sources or factors of transaction costs can be divided into (1) internal and (2) external factors, and (3) factors related to characteristics of the user.

(1) "Internal" in this context means factors induced by the **nature of the transaction subject and the utilisation intention**.

The online survey demonstrated how heterogeneous bioprospecting projects are with respect to the actual object of transaction. The governance analysis verified the prediction that complexity of governance arrangements is correlated with the type of provider contribution. Hence, it was assumed that transaction costs would be associated with types of provider contribution. For two types of more complex activities (provider carries out material collection and material preparation for the user) a significant, positive association with transaction costs was found.

The information and uncertainty characteristics of genetic resources and their utilisation can lead to various information problems causing search costs (filling information gaps ex-ante) and higher transaction costs for designing, implementing and running complex governance mechanisms. This is especially true compared to homogeneous, easily identifiable objects of transactions that can be transferred under standard contracts.

Different types of primary uncertainty were verified for transactions with genetic resources. Transactions characterised by primary uncertainty require complex governance solutions that account for adjustments under various types of potential disturbances, such as unanticipated developments in research and development, technical changes in the utilisation process (requiring new investments), and/or the specification of benefit-sharing with respect to the commercial development and the contribution of the provider during the course of the project. Complex governance forms are more transaction-cost intensive than standard contracts.

The information characteristics of genetic resources and utilisation also bear risk for (two-sided) asymmetric information. Balancing information asymmetry of this sort through control and information search is only possible to a limited extent, besides it causes transaction costs. According to the theory, prevention against opportunism related to asymmetrical information could also be implemented through certain (more complex) governance forms.

The pre-survey shows that providers see a significant risk of hidden information and hidden action (about the utilisation intention, the value of the resource, benefits from utilisation, etc.) from the users' side. This has often slowed down negotiations significantly and has even led to the termination of negotiations, irrespective of the users' actual intension to act opportunistically. This does not constitute a typical principal-agent problem, though, since the provider is the agent.

Hidden information and hidden action on the providers' side have not been named as relevant implementation problems by users[41]. Monitoring and control mechanisms were rather seen as tools to guide and support providers in making necessary adjustments during the course of a project, e.g. regarding the quality and amount of samples.

The conclusions drawn from theory, literature and the exploratory survey could not be supported through the hypotheses testing based on the standardised company survey, though. None of the proxies for primary uncertainty used in the online survey is significantly associated with the transaction cost proxies.

[41] In the literature, principal-agent theory has been employed to analyse bioprospecting and ABS (cf. GEHL SAMPATH 2005: 83-86; OECD 2003: 15f, MULHOLLAND AND WILMAN 2003: 418), but the purpose of analysis was different. MULHOLLAND UND WILMAN analyse ABS agreements as PAP, and interpret outcome-oriented compensation. They assume private information by the provider regarding the effort-level for biodiversity conservation. These efforts are considered relevant for the utilisation results of genetic resources (2003: 420). In the present work, lack of information regarding a genetic resource's potential in a commercial utilisation is rather viewed as both-sided. Possibly the principal (the user) has an information advantage, since he knows the technologies and the state of R&D in his/her field.

(2) "External" factors include the **institutional transaction environment** in the provider country, and ABS institutions on the CBD level.

Uncertainty resulting from ABS institutions on the CBD level was not the focus of this research, but three factors were named repeatedly in the interviews and focus groups. They shall be mentioned here, but not further discussed: (1) insufficient specification of the scope of the ABS provisions in the convention (what kind of resources and what kind of utilisation is affected, the regulation of derivatives), (2) insufficient specification of the term "fair and equitable"; the CBD has not managed to establish a common understanding on this issue, and (3) the variation of implementation of ABS-systems on the national level.

Insufficiencies of the transaction environment created by the CBD increase search and information costs and increase insecurity and therewith impede decision-making procedures.

The third criticism relates to the institutional transaction environment that was in the focus of this work as transaction cost determinant. A whole range of factors of the provider countries' institutional framework were identified in the exploratory pre-survey and from the literature: the organisation of responsibilities in ABS negotiations (number and type of entities involved, hierarchy in decision-making procedures), the providers' legal and scientific capacities, legal security and political stability and the "political will" to attract users.

With the help of theory (mostly property rights and agency theory), 14 institutional factors were defined and operationalised as variables for "transaction environment" to be included in the online survey. Except for one factor (self-interest of the government in the provider country to attract foreign companies for bioprospecting), all were on average rated as relevant in the search for a provider country. This supports the developed definition of the transaction environment. Evaluated in combination with the transaction cost proxies, only two items, namely the "availability of local research partners in the provider country" and "centrally managed ABS negotiations" yield significant results, however.

In the literature it has been stated that users select or avoid specific types of provider entities to keep transaction costs low. The survey results support this statement, and in particular the relevance of the involvement of local research partners.

(3) In the exploratory pre-survey several **user characteristics** were identified that seem to be correlated to problems of initiating and implementing bioprospecting projects.

The lack of access to legal resources is a clearly recognisable problem since the process of creating an ABS agreement includes identifying and understanding relevant legal frameworks as well as negotiating and drafting contracts. Small companies often do not have in-house lawyers, and legal departments at research institutes are often not familiar with ABS and not capable of supporting research projects in this field. In larger, publicly financed research projects, costs for external project management and legal consultancy can be included in financial project planning; in smaller projects this is rather unlikely. Larger companies tend to have capable in-house lawyers or financial resources to consult external experts.

The biggest issues of transaction costs related to legal and management capacities seem therefore to occur for small-scale public research projects and small companies without adequate legal resources.

A user characteristic that was found to supposedly simplify the initiation of a project is an international network and political influence, which larger internationally active companies are more likely to have. Also experiences from previous, similar projects were identified as relevant factors.

Depending on the decision-making structures within a user entity, more than one actor can be involved in an ABS project. In many companies and research institutes the decision-making process involves several departments and hierarchical levels. In this case internal communication costs have to be considered as transaction costs. Particularly at public research institutions, unawareness and uncertainty in administrative and legal departments about the implications of ABS and how to handle it can cause problems, ex ante and ex post.

With data from the online survey a set of different variables representing user characteristics was tested in combination with transaction costs. None of the results can support the hypotheses, however, mostly because of statistical insignificance.

In Table 75 the factors of transaction costs identified based on the literature and the pre-survey are assigned to the transaction steps carried out by the user in ABS projects. As elaborated above, the standardised online survey for user companies supports these findings only to a very limited extent. This should, however, not be interpreted as indication for irrelevance of the theory developed on transaction problems and not as rejection of the previous results either. It rather underpins the limitation of quantitative methods considering the individuality of transactions with genetic resources and the large amount of factors contributing to transaction costs. Also it might indicate a limited quality of the data that was available for the evaluations. Cross-sectional analyses of transaction cost determinants are extremely rare in the literature; data availability and difficulties of data generation are certainly reasons for that.

Table 75: Transaction phase and transaction cost sources in bioprospecting projects

Transaction Phase	Factors leading to problems
Search and initiation	⇨ If property rights system in provider country is not well-defined ⇨ If the information policy of the provider country is insufficient (no information in English, no website, lack of contact person) ⇨ If user lacks network, language and cultural knowledge, lack of experiences in international transactions
Negotiations Internal coordination/ decisions Contract drafting	⇨ Lack of information about the value of genetic resources, due to primary uncertainty of the research subject, the development of R&D (both sided limited information) ⇨ Providers lack of scientific capacities to assess the value of genetic resources in the intended utilisation ⇨ Intended asymmetric information, the user hides information about the utilization intention or the value of the resource in the utilization intention ⇨ Decision competencies on the providers' side are unclear ⇨ Either or both parties lack management skills for complex transactions ⇨ Lack of legal capacities
Technical adjustment (and capacity building)	⇨ Demand is very specific, and requires significant communication and education, technology-transfer… ⇨ Technological and demand/market uncertainty are high, requiring adjustment of the delivery during the course of the project
Monitoring and control	⇨ Strong asymmetric information, and activity of provider is not observable ⇨ Environment change, especially in long term-projects; particularly, if political and/or legal frameworks are likely to change in the meantime
Contract adjustment	⇨ If ex-ante primary uncertainty (utilisation, commercial output, demand…) is high and requires incomplete contracts, which have to be specified ex post (holds for specification of benefit-sharing and for adjustments of the provider contribution
Enforcement	⇨ If contract mutual claims are difficult to verify by external entities, e.g. because

Source: Author.

7.3 How can a model-clause instrument tackle the problems

We learned that transaction costs can pose a problem for the implementation of an ABS agreement. This includes the breakdown after contact initiation or when negotiations have already started. The anticipation of excessive transaction costs can even obviate the initiation from starting. However, the empirical research in this work indicates that transaction costs are not necessarily a problem; they might as well be high but acceptable in relation to the transaction value or they might simply not be very high.

Whether the effort level rises, or becomes prohibitively high is supposedly influenced by a whole range of factors including the characteristics of the users, the institutional transaction environment in the provider country and the characteristics of the transaction object itself. This poses the question, whether the considered instrument addresses these factors.

Which features the instrument has depends largely on its design, predominantly on the types of guidelines that would accompany the menus of model clauses. Accompanying guidelines that would broaden and increase the effectiveness beyond substituting abilities for formulating a legal contract in correct language are:

(a) Guidelines for designing the contract framework

=> *Help the stakeholders defining what has to be specified in the contract and which contractual elements should be included.*

(b) Guidelines for the choice of adequate options from the menu for each contractual element

=> *Guide the stakeholders in deciding which of the many model-clause options fit their specific case, e.g. which type of monetary benefit-sharing is adequate considering the type of provider contribution, the level of primary uncertainty, etc.*

(c) Guidelines for defining compensation that is fair and adequate

=> *What is the value of a genetic resource and how can non-monetary benefit-sharing measures be translated into compensation?*

Obviously a model-clause instrument does not standardise the object of the transaction, which is neither the intention nor possible. Transaction costs related to the users' lack of information regarding the market of genetic resources (where to find what), as well as two-sided ex-ante information deficiencies about the value and the "usability" of the supply are due to the nature of genetic resources and the utilisation process. Neither of these transaction-cost factors can directly be tackled with a model-clause instrument, not even if it is accompanied by the suggested guidelines.

What was defined as the principal-agent problem of actual or suspected hidden information from the user can be addressed if model clauses are supplemented with guidelines for specifying adequate compensation. Such an instrument would create a "neutral" starting point and guidance for both parties in benefit-sharing negotiations. The problem of mistrust from the providers' side due to suspected hidden information regarding the value of genetic resources could thereby be reduced.

Menus of model clauses can be a remedy to users' and providers' lack of legal capacities related to ABS negotiations. The effect would be much more significant, though, if the instrument were to include the supplementary guidelines (a) and (b), since they give information on how to characterise the individual case with respect to what has to be specified in legal form.

Internal coordination and the development of negotiation positions (user and provider) could also be supported if model clauses were accompanied by all three types of guidelines. They can help to create a better information base regarding the case and what has to be regulated in the agreement, as well as what would be appropriate in the individual case. This could simplify internal decision making.

Most of the institutional factors in provider countries - such as a well-established property-rights system for genetic resources, clear and centrally managed competences for negotiations and a user-friendly information system - cannot be substituted by a model-clause instrument. The same applies to the scientific infrastructure (mostly the existence of local research partners), which was evaluated as highly relevant by users.

In conclusion, it can be stated that a model-clause instrument alone would not resolve many of the problems identified. If it were to be supplemented with the suggested guidelines, the chances would be improved significantly. While options for the first and second guideline are subject to this research, a guideline for specifying adequate amounts of benefit-sharing was not dealt with.

The overall impact of a model-clause instrument can be assumed to be rather low, especially for larger companies with previous experience. For users and providers with less legal capacity and experience in translating the characteristics of a bioprospecting project into a governance arrangement the chances are likely to be higher. Still a significant part of the identified problems cannot be addressed with the instrument.

8 Discussion governance analysis

The context of this study is the debate over contract standardisation as an instrument to support the implementation of access and benefit-sharing for genetic resources. Submissions of CBD' member parties (e.g. the EU) suggest a sectoral approach for such an instrument referring to different "ways of utilisation". However, a concept for the differentiation of sectors and their ways of utilisation was lacking.

One of the main goals of this dissertation was to develop and test a theory-based concept for characterising bilateral transactions of genetic resources with respect to efficient governance solutions. This goal was achieved in an iterative research process including a triangulation of methods as well as theories.

Guided by transaction cost economics and strategic management, literature concerning governance aspects of transactions with genetic resources was reviewed. The findings were supplemented by individual exploratory interviews and a content analysis of existing contract-standardisation models. In focus groups the interim findings were discussed and again supplemented. Based upon these findings, a framework of hypotheses on governance choice could be developed and tested with data from a standardised cross-sectional company survey.

The results shall be discussed to assess the theoretical concept as a basis for future governance research in the field of transactions with genetic resources. Furthermore, the findings shall be evaluated as a starting point for developing a model clause instrument including a revision of the "sectoral" approach to contract standardisation. A reflection of the methods applied and a critical assessment of the contribution of the study to the literature conclude this chapter.

8.1 Discussion of the governance-theory framework

The theory was helpful to identify functional elements of ABS contracts, such as the duration of the contract, compensation mechanisms as well as dispute-resolution and enforcement mechanisms. Moreover, it helped to identify and characterise design options of contractual elements (adaptability, contract law, incentives) for ABS agreements. Thereby this work could go one step further than the topical literature, and add a characterisation of governance forms with respect to functionality rather than simply listing observations on governance forms.

The evaluation of online survey questions on transaction variables and governance elements verified that the operationalisation of variables was correct in that no categories without practical relevance were included. With very few exceptions, all response categories of the variable were used by survey participants.

Two proxies for company size had zero entries in the second and third highest categories. An aggregation of higher classes in future surveys should be considered.

Some items of the variable transaction environment (answered with respect to reference cases) and one transaction-costs proxy (the effort level is acceptable in relation to the value) have zero entries for the lowest response category (very bad). Since participants were requested to choose "successful" cases it is likely that the overall picture of the transaction environment and transaction costs is positively skewed. From the distribution of answers it should not be deduced that any of the institutional aspects could not be characterised as "very poorly implemented" or that transaction costs could not be assessed as too high in relation to the transaction value. Therefore, a change of the scale for these variables is not considered necessary.

For two further variables ("technological change" and "negotiations were difficult and tedious"), one intermediate response category of a seven-point ordinal scale has zero entries. An aggregation of categories could be discussed for future surveys with small samples, but it is not considered necessary.

Several hypotheses of the governance-theory framework were supported by the survey data (see all significant results in Table A 46). Due to the nature of evaluation methods the results do not verify causal relationships, though. Non-significance of associations would, however, indicate that causal relationships are very unlikely. The results therefore indicate that further research based on the developed theory construct is promising.

In bioprospecting agreements, it was found that contractual elements are combined in a way that no "pure" governance types (such as those suggested by the theory) could be identified. Often several options of one governance element are combined in one contract (e.g., market price and result-based compensation). This seemed somewhat contradictory and difficult to interpret with the transaction-costs economics approach. It is here understood as an indication of multiple motives related to governance. Transaction cost minimisation is found to be neither the only nor the superior motive for governance choice. This is strongly supported by the result that the variables "synergy effects of capacity building" and "provider contribution" (both characterising demand heterogeneity) are significantly associated with several governance elements. Neither of the two variables belongs to WILLIAMSON'S "explanatory" variables of classical transaction cost economics, which stresses the requirement of a triangulation of theories in this research field.

Not all predictions are supported by the survey results, as some are not statistically significant and some reject the hypotheses. To some extent inadequacies of the theoretical framework and its practical application in this research are likely to contribute.

Imperfections in the specification of the theory can be assumed since the application of the governance approach of transaction cost economics to this research subject is fairly new and has not been advanced to include quantitative empirical analyses. Moreover, strategic management theory has not been applied in this research field before, not explicitly anyhow.

The results indicate that significant adoptions of transaction cost economic theory and a triangulation with other governance theories is required to better reflect the reality of bioprospecting projects. Several hypotheses reflecting also findings from the literature could not be supported. This indicates that some generalisations found in previous publications based either on "expert knowledge" or case studies, might have been drawn to easily and oversimplify reality.

The possibility of measurement errors has to be accepted when methods are applied for the first time in a research field. Since no similar standardised, quantitative survey has been carried out for bioprospecting project, all variables had to be operationalised "from scratch". A pre-test was conducted to ensure that the questions are understandable and the questionnaire answerable in a reasonable time. However, during the survey several addressees initiated contact to indicate problems in responding to the questions. It is then very likely that some survey participants did not interpret the questions and response options in the intended way, leading to distorted responses. The operationalisation of variables could be improved in future research. The findings of this work should be discussed with stakeholders (users and providers) and with researchers who have applied the theories in similar contexts.

8.2 Discussion with respect to design of a model-clause instrument

The governance analysis responds to the call of ABS negotiators for research on practical transactions with genetic resources and the utilisation of such resources. The main contribution to the debate on ABS instruments is an economic theory-based concept for characterising bioprospecting projects in terms of the object of transaction, utilisation forms as well as user and provider characteristics. Based thereupon, the study provides concrete starting points for the development of menus of model clauses and supplementary guidelines that support the application of the instrument.

Several forms of contract standardisation are theoretically considerable for ABS. As elaborated in chapter 1.2, section three, the official debate shifted from fully standardised contracts[42] to voluntary menus of sectoral model clauses for ABS contracts. Clearly there is a trade-off between scope and detail as well as the degree of freedom for stakeholders to adapt the contractual form to the particularities of the individual case. A high level of standardisation best achieves the reduction of transaction costs and an improvement of legal certainty. However, it does not reflect the significant heterogeneity of the transaction object traded under the term "ABS agreement", nor does it take into account the particular capacities of users and providers.

[42] Suggested were standardised Material Transfer Agreements, comparable to the instrument developed under the International Treaty on Plant Genetic resources for Food and Agriculture.

The governance analysis in this research has given a strong indication that transaction characteristics are associated with the choice of contract design in practice. As the case characteristics vary among bioprospecting projects, the governance form will vary to. A high level of contract standardisation for ABS is therefore not feasible; the similarity of requirements regarding transaction object and transaction context (as elaborated in the theory chapter) are not sufficiently fulfilled. Standard contracts might reduce transaction costs significantly for some cases, but they supposedly impede the initiation of a significant number of potential projects. Therefore, if contract standardisation should be implemented as an ABS instrument, menus of voluntary model clauses should be preferred.

As elaborated in the discussion of the problem analysis (chapter 7), a model-clause instrument is likely to support the implementation of ABS agreements to some extent. It was also explained that model clauses should be accompanied by guidelines that (1) instruct the framework setting of contracts and (2) guide stakeholder parties in characterising their case and, based on this, select appropriate model clauses for each contractual element. The results of the governance analysis regarding these instruments shall be discussed in this chapter.

A whole set of framing contract clauses have to be considered in bioprospecting agreements, e.g., the specification of the contracting parties, liability, secrecy, etc. The CBD Bonn guidelines and the Swiss ABS Management Tool provide a solid overview of such clauses. The development of standard formulations for these framing clauses is presumably possible, since they do not significantly vary with the nature of the exchange relationship. One could employ the models that were identified and elaborated in chapter 4.1 of this study.

The “transaction object”, which has to be clearly specified in a contract, was identified as an important transaction variable with a high level of variation in practice. The types of “provider contributions” pointed out in the operationalisation of the variable for the online survey can be used as a basis for the compilation of a list of options from which stakeholder parties can select and specify for their individual case.

With the help of theory and exploratory research, the overall contracting approach (phasing agreement or a complete contract from the start) and four contractual elements were identified as functional units defining the governance nature of an ABS agreement.

- The duration of the contract
- The type of monetary compensation
- Non-monetary forms of benefit-sharing
- The types of conflict-resolution and enforcement mechanisms.

The basic options of each contractual element identified in this research were presented in chapter 5 (Figure 9). The differences regarding the governance function are elaborated in the basic theory chapter (chapter 3) and in the specification of the governance theory framework in chapter 5.

A set of model clauses (one for each "functional" option) should be formulated for each contractual element. However, the model clauses still need to leave room for specification according to the individual case, including, for example, the setting of wages/payments/royalties or the appointment of an arbitration committee/court.

The research results partly support the developed hypotheses on associations between variables defined as governance-choice determinants (transaction attributes, user characteristics, etc.) and governance forms. These results can be used as a starting point for guidelines for the characterisation of cases and the choice of appropriate model clauses.

Table 76 gives an overview of significantly associated transaction variables and governance elements. It indicates which of the explanatory variables should be considered for choosing model clauses for which governance element. The table could instruct the development of guidelines for assisting the stakeholders in choosing model clauses.

Table 76: Summary of associations of transaction variables combined with governance elements

	Governance variables				
Explanatory variables	Contracting approach	Contract duration	Monetary benefit-sharing *	Non-monetary benefit-sharing *	Conflict resolution *
Synergy effects of capacity building *		**X**		**X**	**X**
Provider contribution *			**X**	**X**	**X**
Asset specificity			**X**		
Primary uncertainty*	**X**		**X**		**X****

Frequency of interaction	X			X	X
Users' indirect capacities	X		X	X	
Transaction environment in the provider country				X	
* This is a multi-item variable/element; not all items are necessarily significantly associated with the respective element/variable. ** Several results object the stated hypotheses, several are not significant Grey shade indicates that association was expected, but not found to be significant					

Source: Author.

A guideline for choosing model clauses for the governance element "monetary benefit-sharing" should instruct the applicant to characterise his/her case with respect to (1) the type of contribution by the provider, (2) asset specificity, (3) primary uncertainty, and finally (4) the users' indirect capacities. These characteristics could demarcate "decision nodes", along which stakeholders can specify their case. Working through the decision tree would consider all relevant transaction variables and thereby lead to adapted model clauses.

Because no overall governance forms comprising all contractual elements can be identified, this procedure would have to be repeated for each governance element individually. However, information on the case characteristics inserted in the first decision tree could be transferred (as far as required) to the decision trees of remaining governance elements.

Table A 46 in Appendix IV provides an overview of significant results on the item-level of transaction variables and governance elements. It shows the direction of associations and therewith indicates which model clause is suggested (based on the survey results).

The aim of the governance analysis in this research was to develop and test a theoretical framework for governance decisions in bioprospecting projects. This goal was achieved. As previously indicated, however, not all hypotheses could be maintained. Suggestions for the design of guidelines to complement menus of the model clauses should therefore be understood as a preliminary starting point. Further research for advancing the theory is required.

The transfer of findings from this research into a concrete instrument should be done with the help of lawyers experienced in the field of ABS contracts. Users representing the different possible characteristics of utilisation and demand should be involved. Regarding the applicability of the instrument and its acceptance it is absolutely vital to involve also lawyers

and “resource” experts from the provider side in this process. This procedural requirement is stressed for two reasons: contracts for transactions with genetic resources (should) reflect the interests of both contracting parties, even if the user survey method was appropriate in this research. And secondly, if terminology for model clauses is developed solely based on user perceptions the underlying information is biased. Such an instrument bears the risk of not being applicable and acceptable for providers in practice. Provider entities would rather trust in the fairness of model clauses if “their representatives” contributed to designing the instrument. Mutual trust in bilateral negotiations could be supported by such an instrument. Since mistrust was identified as a central issue in contract negotiations, this aspect has to be considered.

The sectoral approach for contract standardisation was suggested to consider heterogeneity of utilisation among users and therewith safeguard the development of applicable and sufficiently flexible models. One major result of the governance analysis is, however, that intra-sectoral homogeneity for transactions with genetic resources is weak. Bioprospecting projects affiliated with the same sector are not significantly more homogeneous compared to cases affiliated with different sectors. This holds for the majority of transaction variables as well as governance variables. The sectoral approach is therefore not feasible for the development of standards or models for ABS contracts or contract elements. If model clauses would be developed for specific sectors, one would end up with menus of clauses for each sector containing the full range of options. Most menus would be identical for several sectors. The same applies to the characterisation of cases into complementary guidelines for the selection of model clauses.

If one were to rely on generalisations on governance forms for different user sectors mentioned in the topical literature and basing thereupon limit the number of clauses for each sector in order to simplify the selection process, the range of options would become too small. Contracts developed with such a limited instrument would not be adapted sufficiently. The efficiency requirements for governance forms indicated in economic theory would not be fulfilled.

The general idea of a differentiated instrument that reflects the variation of the utilisation of genetic resources is strongly supported by the results of this study. As discussed, the variation of cases regarding relevant transaction variables manifesting utilisation forms is not reflect by a sectoral categorisation. Therefore, it should not be called a sectoral approach.

8.3 Reflection on the methodological approach in the governance analysis

In many respects this research goes beyond the existing literature. An iterative process with a triangulation of methods and a strong focus on empirical results has been applied for the governance analysis. Focus groups and the standardised, cross-sectional online survey are methods that have not been applied in this research field before. Focus groups allowed for the discovery of new aspects, particularly regarding the heterogeneity of practical applications and viewpoints on bioprospecting praxis within sectors. Even within companies projects are heterogeneous. The standardised survey generated data that describes ABS agreements on a very detailed level, more detailed than can be found in literature. The questions are operationalised such that statistical analyses could be carried out in this dissertation. Though very basic, this goes beyond the methods applied in empirical studies found in the literature.

On the whole, the methodological approach can be assessed as valid to answer the research questions. However, reliability and objectivity of the survey results (the exploratory and standardised company surveys) are rather difficult to assess. Due to the novelty of the research subject, a cross-checking result with similar studies is possible only to a very limited extent. Possible inadequacies of the theory were elaborated in chapter 8.1. Specific methodological limitations in each empirical research step are discussed in the following sections.

Model agreements and guidelines were analysed with the method of qualitative content analysis. A methodological shortcoming in this research step, not induced by the method, though, is the low level of information that could be acquired regarding key groups' experiences with the instruments. It was not possible to assess whether the instruments successfully implement the stated objectives in practice. However, the review gave a good overview and introduction to contractual elements and design options and contributed to the research process in the intended way.

The exploratory interviews and focus groups were conducted to receive information on the praxis of acquisition and utilisation of genetic resources and reveal governance options and heterogeneity among and within sectors. First-hand information should feed into the operationalisation of theoretical concepts for the subsequent standardised online survey. The level of experience with ABS varied among interview partners, as well as the external settings of the interviews. Therefore, exploitable data varied among interviews, as well as among the group discussions. This is a clear limitation of the survey though not profound enough to disqualify its application. The exploratory character was chosen deliberately in this research step, and particularly the dynamic character of group discussions created a chance to reveal new aspects and to discuss heterogeneity within user sectors.

In the subsequent **standardised, cross-sectional online survey,** the aim was to generate detailed and comparable data about transactions with genetic resources that would allow this research to take a step beyond a qualitative descriptive governance analysis. However, practical constraints such as the limitation of resources, information about the population, accessibility, willingness, or ability of companies to participate made it impossible to reach equal sub-sample sizes (cases representing user sectors or governance solutions). The subject matter is politically critical and governance of transactions with genetic resources includes sensitive questions (e.g., benefit-sharing), which users are partly reluctant to answer. Hence, the recruitment of survey participants was very challenging and the overall sample size smaller than intended.

The sample size and composition, as well as the operationalisation of variables (many dichotomous, multi-response variables) did constrain the evaluation options for the survey data. In future studies this may partly be enhanced, but several limitations are given by the research subject: compensation - though theoretically possible to code as one ordinal variable with increasing flexibility or as standard market price versus result-based compensation - have a much more complex nature in bioprospecting projects. The same applies to conflict resolution.

As noted before, several options for one governance element are often combined, such as standard market prices in the form of hourly wages and the stipulation of royalties, or the appointment of a judicial authority and internal conflict resolution measures. This makes an aggregation of all response categories on one scale impossible.

A particular challenge was the affiliation of respondents and their companies and reference cases with sectors or fields of utilisation[43]. This is a consequence of companies being active in many fields. Many participants indicated that genetic resources are used for several purposes, sometimes the same resources or at least resources acquired in the same transaction. Therefore, sectors had to be aggregated in the survey. This supposedly limits the scientific reliability of conclusions drawn from association tests of sector affiliation with transaction and governance variables regarding the sectoral approach. On the other hand, multidisciplinary application within one company and even within one project as such implies the unfeasibility of a sectoral approach to distinguishing cases.

The provider perspective was not explicitly surveyed in the empirical part of this research. This of course limits the perspective and disregards certain information. However, it is common practice in empirical studies on governance decisions to survey data only from the entity acquiring a good, service or right. Moreover, most of the variables in this governance analysis correspond to the characteristics of demand and the utilisation of genetic resources, which can be described most appropriately by the user. Also the "user friendliness" of the transaction environment in the provider country can be assessed by the user. In addition, collecting data from both the user and provider on the same bioprospecting case would not be possible in an anonymous survey, which was chosen as survey method to reach a high level of willingness to answer.

43 For more in depth explanation see chapter 4, Part A.

9 Outlook

This work provides background information that can be used as starting point for developing a contract-standardisation instrument in the form of menus for model contract clauses for ABS agreements. It was not possible and not the goal of this dissertation, however, to develop a full-fledged instrument.

The 10.th Conference of the parties (COP10) took place in Nagoya, Japan, in October 2010. The negotiations on an international ABS regime led to the adoption of the "Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation to the Convention on Biological Diversity" [44] (hereafter the protocol). The protocol refers to "sectoral and cross-sectoral model contractual clauses" at some points, but it does not assign any entity or committee to develop a comprehensive instrument. It is left to the member countries of the protocol to "encourage, as appropriate, the development, update and use of sectoral and cross-sectoral model contractual clauses for mutually agreed terms" (Art. 19 (1)). The CBD institutions shall merely serve to "collect and make available on the clearinghouse mechanism sectoral and cross-sectoral contractual clauses for mutually agreed terms" (Section II, No. 18), and the Conference of the Parties shall "periodically take stock of the use of sectoral and cross-sectoral model contractual clauses," (Art. 19 (2). The decisions fall far short of the suggestions for the design and development procedures of a model-clause instrument suggested in this work. This might reflect the ambiguity regarding the cost-benefit ratio of developing and implementing a comprehensive measure. However, the ideas developed in this dissertation will possibly be taken up and advanced by a group of stakeholders or a team of researchers in the future.

The formulation "sectoral and cross-sectoral model contractual clauses" indicates that the sectoral approach is maintained among decision takers on the CBD level, however, to a much lesser degree than when the idea of contract-standardisation was first brought to the agenda.

[44]Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization to the Convention on Biological Diversity, Nagoya, 29 October 2010, available at http://www.cbd.int/decision/cop/?id=12267

Several problems that cannot be resolved with a model-clause instrument are related to imprecise provisions and definitions in the convention text. The protocol makes advancements in this area. It reaffirms the national sovereignty of member countries over their natural resources (introductory statements), but it specifies provisions for the implementation of domestic ABS institutions (laws and procedures) with several decisions in Art. 6.

Moreover, the protocol defines in Art.2(c) the term utilisation of genetic resources falling under the scope of ABS regulations more concretely than the convention does. The inclusion of "biochemical composition" of natural resources in the scope of ABS provisions is a major change to how many user-countries and user-representatives interpreted "utilisation of genetic resources" during the course of the negotiations.

Biotechnological utilisation of genetic resources and the term "derivatives" are also specified in the Protocol (Art.2 (c) and (d)). The definition of derivatives of genetic resources and whether they should fall under the scope of ABS provisions has been a major issue in the previous negotiations.

Amount of monetary benefit-sharing

The political debate has not led to a common understanding on how to determine fairness of the amount of (monetary) benefit-sharing. So far, in bilateral cases benefit-sharing is most likely a product of the following factors: the actual value of the resource for the user, negotiating power, and the market situation and substitutability of the resource. Within this study it was indicated that diverging ideas about benefit-sharing and mistrust on this issue can be a major impediment in bilateral negotiations. Concepts for more objective ways of defining benefit-sharing should therefore be subject to future research. Possible leads are the investigation of value chains in different application fields, providers' opportunity costs of conserving genetic resources, and granting access.

Stressing non-monetary benefit-sharing

The real value of non-monetary benefit sharing measures for users and providers should be investigated more in-depth and communicated among stakeholders. It was shown in this research that capacity building in provider countries can create synergy effects for users. It can be assumed that if synergy effects are high, expenses for non-monetary benefit-sharing measures might have a higher return for the user than monetary benefit-sharing. Also, non-monetary benefit sharing measures presumably create higher values for providers in the longer run, if they establish a foundation for development[45]. Capacity building is likely to have an efficient overall cost-benefit ratio for both parties to an agreement.

It has to be noted though, that especially small companies and research institutes have limited resources to conduct capacity building. It should be investigated how such user entities could engage in non-monetary benefit-sharing, for example, in the framework of joint projects.

Supportive measures

Search costs and initiation costs in the chain of creating ABS agreements were indicated by several users within our empirical studies. To reduce these transaction costs, information measures and training of users or the implementation and training of central consultant entities could be more suitable. Also information systems in provider countries should be revised and possibly harmonised to a certain extent.

Users from public research institutes suggested the implementation of a superordinate entity (e.g. at the CBD level, with representatives of providers and users) to check best practice initiatives such as codes of conduct and guidelines for ABS regarding their consistency with general ABS provisions in the CBD. Such an entity could also provide guidelines for Memorandums of Understanding (MOUs). MOUs seem to be a useful tool to communicate complex research projects.

[45] This has been stressed in many case studies in academic literature. See, for example: CBD 2008: 53).

Advancements of research on governance choice

The theories developed in this work could be advanced. The operationalisation of variables and the relevance of variables could be discussed. For a more comprehensive causal analysis of overall governance hypotheses, e.g. with the help of structural equation models, a refined concept of operationalisation for governance variables could be developed. Aggregating all or at least the most relevant options as discreet response categories in one variable would be required. Whether this is possible should be investigated in future research.

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Appendix I - List of Interview Partners

Interview partner	Institution
Belinda Brown	Department of the Environment, Water, Heritage and the Arts, Government of Australia
Jane Bulmer	IUCN Environmental Law Center, Bonn
Philip Desmeth	Belgian Co-Ordinated Collections of Micro-Organisms
Juanita Chaves; Selim Louafi; Kent Nnadozie	International Treaty on Plant Genetic Resources for Food and Agriculture, Rome
Dr. Ricardo von Gent	German Association of Biotechnology Industries (DIB)
Dr. Christoph Herrlinger	German Plant Breeders' Association (BDP)
Thinh Nguyen	Counsel for Science Commons
Prof. Wilhelm Barthlott	University of Bonn, Nees-Institut for Biodiversity of plants
Prof. Andreas Bechthold	University of Freiburg, Professorship of Pharmaceutical Biology und Biotechnology, Institute for Pharmaceutical Sciences
Dr. Reinhard von Broock	KWS Lochow GmbH
Prof. Dr. Wolf Dieter Bluethner	Firma Chrestensen (Erfurter Samen- und Pflanzenzucht GmbH)
Dr. Helge Bode	Saarland University, Institute for Pharmaceutical Biotechnology
Dr. Claudio Cerboncini	Research Centre Caesar (Centre for Advanced European studies and research)
Dr. Ulf Feuerstein	Euro Grass
Dr. Peter Goertz	Suedwestsaat
Dr. Cristoph Haeuser	Natural Museum of Nature Science Stuttgart
Prof. Juergen Heinze	University of Regensburg, Institut for Biology I (Evolution, Behaviour and Genetics)
Dr. Thomas Hurek	University of Bremen, Department General Microbiology

Dr. Walter an den Kerckhoff	Consultant for Intermed Discovery
Prof. Gabriele Maria Koenig	University of Bonn, Institute for Pharmaceutical Biology
Dr. Thomas Koths	Bayer
Dr. Wolfram Lobin	University of Bonn, Botanical Gardens
Lohwasser, Ulrike	Leibniz-Institut für Pflanzengenetik und Kulturpflanzenforschung (IPK), Abteilung Genbank, Forschungsgruppe Ressourcengenetik und Reproduktion, Gatersleben
Dr.Frank Petersen	Novartis
Dr. Manfred Reiffen	Boehringer Ingelheim
Professor Ernst Rühl	Forschungsanstalt Geisenheim, Section of Grapevine Breeding and Grafting
Dr. Walter Schmidt	KWS Saat AG
Dr. Nadja Seibel-Thomsen	DSM Nutritionals
Annika Wiekhorst	University of Mainz, Biota Project

Appendix II: Questions from an online survey with user companies

(Only questions evaluated in the framework of this dissertation)

(Qa2) In which fields does or did your company use genetic resources?

Note: Multiple entries possible.

Pharmacy

Botanical Medicine

Personal Care and Cosmetics

Plant Breeding - Seed

Plant Breeding - Horticulture

Biotechnology, other fields than Pharmacy and Plant Breeding

Others:

(Q3) Factors for the Selection of Supply Sources for Genetic Resources (If possible consider the activities of your company over the past 10 years.)

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7 // I do not know

1= not important at al ..... 7= very important

How important are the following aspects?

1: Short lead and start times

2: Standardized processes for material aquisition

3: No negotiations about the terms of trade with the provider

(Q4) Please complete the following sentences and assess how important each aspect is for the selection of a supply source for genetic resources.

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7 // I do not know

1= not important at al ..... 7= very important

For some projects in our company was or is...

... access to undiscovered genetic resources as a potential source of innovative products very important.

... access to properties of wild species of certain plants or animals very important.

... it very important to be able to study genetic resources in the context of their natural habitat.

... traditional knowledge about effectiveness of natural resources very important

... exclusive access or exclusive usage rights for genetic resources very important.

... it very important that the provider could deliver the genetic resource(s) as raw material on a intermediate or long-term basis in larger quantities.

(Q5) Which methods of acquiring genetic resources has your company utilized in the past 10 years?

Note: Please mark in each line the response that applies.

Answering categories: never // rarely // sometimes // frequently // always // maybe

- Collection of genetic resources in nature
- Research partners have collected genetic resources in nature
- Acquisition from official and authorised supplier institutes from the country in which the genetic resources appear in their natural habitat
- Acquisition from international Ex-Situ collections (such as gene banks or microorganism collections)
- Acquisition from commercial brokerage firms
- Other sources of acquisition:

(Q6) How relevant are the following characteristics of institutional frameworks of provider countries for your company in determining the selection of a provider country for genetic resources?

(Provider country: simplified term for the country in which the genetic resource can be found in its natural habitat.)

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7 // I do not know

1= not important at al ..... 7= very important

(a) National regulations for the access and use of genetic resources are in place

(b) Competent contact partners in the administration are designated and reachable

(c) Information about the national system for access and use of genetic resources are available online

(d) Information (as defined above) is available in English

(e) Centrally managed access procedure for genetic resources

(f) Clear competencies of actors for access negotiations

(g) A reliable legal system

(h) When necessary, an official representative facilitates communication with local / indigenous groups

(i) Legal competency of participants in access negotiations

(j) The provider country can provide information about its biodiversity

(k) Provider has a concept for resource evaluation

(l) Scientific competency of participants in access negotiations

(m) Existence of potential research partners in the provider country

(n) Self-interest of the government of the provider country to attract foreign companies for bioprospecting

(o) Which other factors do you assess relevant:

(Q9) Which strategies does your company use to minimize the transation costs involved in the acquisition of genetic resources from provider countries?

(Transaction costs include the time invested by employees, costs for external expertise, and travel costs for initiation, communication, and monitoring measures and renegotiations.)

Note: Multiple entries possible.

- We select provider countries with solid institutional frameworks.
- We rely on previously established relationships.
- We involve intermediaries.
- We work with local research partners.
- Others:

(Q11) Please clarify in detail the field(s) of usage for the project you selected.

Note: Multiple entries possible.

- Pharmacy
- Botanical Medicine
- Personal Care and Cosmetic
- Plant breeding- seeds
- Plant breeding - horticulture
- Biotechnology, others than Pharmacy and Plant breeding
- Others:

(Q14) How large is the estimated timeframe from accessing the genetic resources to possessing a commercial product or intermediary product or it being evident, that such a product cannot be achieved?

Less than 1 year

1 year up to 3 years

More than 3 up to 5 years

More than 5 up to 7 years

More than 7 up to 9 years

More than 9 up to 11 years

More than 11 years

I do not know

(Q15) With which provider type did your company negotiate access and use for genetic resources and related services in order to reach an agreement for this project?

Note: Multiple entry possible.

- National or regional authority in the provider country, such as environmental agency or ministry
- Local authority in the provider country
- A local group / indigenous community in the provider country
- National biodiversity institute or equivalent institution that is authorized by the government to manage resources and grant access
- Research institutes in the provider country (such as universities)
- Others:

(Q18) Approximately how long did the initiation of the agreement take? (in months / years)

(Initiation includes the timeframe from the initial contact to the first activity of the provider.)

.....

(Q19) Please characterize the service / effort of the provider respectively institutions in the provider country in this project.

Note: Multiple entries possible.

- Collection permission
- Access to previously inventoried resources in a national collection
- Information (for example, traditional knowledge) about usage possibilities
- Exclusive access to genetic resources
- Provider executes collection activities
- Preparation of the material
- Evaluation of samples
- Participation in advanced research
- Provider grants exclusive usage rights for certain information
- Provider grants exclusive research rights for resources in certain application areas
- Others:

(Q20) Did or will the services of the provider occur once or repeatedly over a longer period of time?

Answering categories: Once // Repeatedly

(Q22) This block of questions addresses investments that your company made for the project in your company‘s home countries.

(Home countries means business locations that were selected independently of the project or previously existed.)

Answering categories: Yes // No // I do not know

Has your company invested or is your company investing for the use of genetic resources from this project in its home country/ies in ...

... Buildings (Laboratories, Plants) ?

... Laboratory equipment or other physical assets ?

... education / hiring of skilled employees ?

(Q23) Specificity of investments for the utilization of genetic resources (and related inputs) made in your companies home countries.

Can your company‘s investments in the home country be otherwise utilized if the project is called off before completion?

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7 // I do not know

1= only with high financial disadvantages ..... 7= without financial disadvantages

(Q24) This block of questions addresses investments that your company has made for the project in the provider country.

(Provider country: simplified term for the country in which the genetic resource can be found in its natural habitat.)

Answering categories: Yes // No // I do not know

Has your company invested or is your company investing for the use of genetic resources from this project in its home country/ies in ...

... Buildings (Laboratories, Production Plants)

... Laboratory equipment or other physical assets

... Education / hiring of skilled employees

(Q25) Specificity of investments for the utilization of genetic resources (and related inputs) made in the provider country?

Can your company‘s investments in the home country be otherwise utilized if the project is called off before completion?

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7 // I do not know

1= only with high financial disadvantages ..... 7= without financial disadvantages

(Q30) Please characterize the level of uncertainty involving the use of genetic resources from the project, based on the following statements.

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7

1= not correct at all ..... 7 = completely correct

(a) The utilization process for genetic resources is completely unpredictable at the beginning of the project.

(b) The technology in our field of use changes quickly.

(c) At the beginning of the utilization process, we are not able to anticipate commercial output at all.

(d) The genetic resources from the project will be used for research and development of products for new /uncertain markets.

(Q31) For what timeframe were mutual requirements made contractually binding with the provider?

Less than 1 year

1 up to 3 years

More than 3 up to 5 years

More than 5 up to 7 years

More than 7 up to 9 years

More than 9 up to 11years

More than 11 up to 13 years

More than 13 years

(Q32) Which of the following two contract types is more applicable to the project?

The contract is largely negotiated and close to a final version before the start of the project

A tiered contract that is further developed and modified or replaced by additional contracts during the course of the project

(Q33) Which conflict resolution mechanism was established for the project?

Note: Multiple entries possible.

- Exact description of the mutual activities (for example, schedule, delivery quantities, prices, height of compensation payments) in the contract
- Judicial authority
- Arbitration with the assistance of an independent third party
- Internal conflict resolution mechanism, harmonization of interests
- Others:

(Q35) Which form of monetary compensation does the provider receive from your company within the framework of the project?

Note: Multiple entries possible.

- No, the provider does not receive any monetary benefits.
- Weight-related or hourly-wage compensation
- Negotiated advance payments (lump sum)
- Negotiated payments that are made after reaching certain steps in the usage process (milestone payments)
- Payments tied to commercial output (e.g. royalties)
- Output-related payments that are negotiated over the course of the project, for example, when certain operational steps are reached
- The contract contains clauses for ex post negotiation of compensation in the case that the framework changes

(Q36) Does your company also provide non-monetary benefit-transfer to the provider within the framework of the project?

Note: Multiple entries possible.

- No
- Yes, joint intellectual property rights to usage results
- Yes, joint publication in scientific journals
- Yes, support of inventory / taxonomy of Biodiversity
- Yes, technology transfer
- Yes, transfer of know-how in the scientific field
- Yes, support of infrastructure measures
- Yes, transfer of know-how in the field of sustainable use / cultivation of genetic resources
- Yes, support of other measures to preserve biodiversity

(Q37) What synergy effects (can) result for your company from non-monetary benefit transfers within the framework of the project?

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7

1= not correct at all ..... 7 = completely correct

(a) Providers will be better positioned to provide the desired activity (for example, quality / continuity of material supply).

(b) Local scientists will be able to conduct initial on-site evaluations of genetic resources, which will reduce costs for us in the long run.

(c) Capacity building increases trust and facilitates communication with the providers.

(d) Capacity building is the prerequisite so that scientific cooperation is possible.

(e) Capacity building ensures the conservation and the long-term availability of genetic resources.

(f) Capacity building is a fundamental requirement of the provider.

(g) Others:

(Q38) How would you most closely describe the type of agreement between your company and the provider?

We purchase genetic resources and possibly additional goods and services from the provider.

We carry out a scientific cooperation project with institutions in the provider country and receive access to genetic resources within this framework.

Our company participates in the provision process through considerable capacity building activities in the provider country.

(Q40) How would you assess your company's (anticipated) effort for the initiation of the agreement, ongoing communication with the provider, renegotiations, as well as monitoring measures in this project?

Note: effort includes working hours, travel costs, and costs for external expertise.

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7

1= not correct at all ..... 7 = completely correct

(a) The effort level is low in comparison to other cost components of the project.

(b) The effort level is acceptable in comparison to the value of the resources and related services acquired in the framework of the project.

(c) Negotiations are / were tedious and difficult.

(Q41) How much experience does your company have in executing complex projects?

Answering categories: 1 // 2 // 3 // 4 // 5 // 6 // 7

1= not correct at all ..... 7 = completely correct

(a) Our company has a high capacity to execute long-term, complex projects.

(b) Our company already has experience in the past of executing complex long-term projects.

(c) Our company is experienced in projects with partners from developing or newly industrializing countries.

(Q45) The number of employees in your company in 2008

Under 10

10 up to 50

Above 50 up to 250

Above 250 up to 500

Above 500 up to 1.000

Above 1.000 up to 10.000

Above 10.000

No statement possible

(Q46) Company turnover in the year 2008

Note: in Million Euro (in Million US Dollar)

Euro under 2 (US Dollar: under 3)

Euro: 2 up to 10 (US Dollar: 3 up to 15)

Euro: above 10 up to 50 (US Dollar: above 15 up to 74)

Euro: above 50 up to 250 (US Dollar: above 74 up to 370)

Euro: above 250 up to 1.000 (US Dollar: above 370 up to 1,500)

Euro: above 1.000 up to 5.000 (US Dollar: above 1,500 up to 7,400)

Euro: above 5.000 (US Dollar: above 7,400)

No statement possible

(Q48) R&D Budget of your company

Note: in Mio Euro (in Mio US Dollar); approximate average between 2004 and 2008

Euro: Under 1 (US Dollar: under 1.5)

Euro: 1 up to 10 (US Dollar: 1.5 up to 15)

Euro: above 10 up to 50 (US Dollar: above 15 up to 74)

Euro: above 50 up to 100 (US Dollar: above 74 up to 150)

Euro: above 100 up to 250 (US Dollar: above 150 up to 370)

Euro: above 250 up to 500 (US Dollar: above 370 up to 740)

Euro: Above 500 (US Dollar: above 740)

No statement possible

Appendix IV: Additional evaluations of the online survey with user companies

Table A 1: Elements for inclusion in an ABS-agreement suggested by Bonn Guidelines and the Swiss ABS management tool

ABS management tool	Bonn Guidelines
• Recitals • Definitions • Source and Amounts • Uses • Licences • Price/Benefits • Right to Patent/Protection of IPRs • Exclusivity • Copyrights • Trademarks • Trade Secrets • Contractual Protection • Dispute Resolution • No Liability • No Warranty • Authorization • Confidential Information • Publications • Indemnification • Standards of Conduct • Accounting and Records	**Introductory provisions** … **Access and benefit-sharing provisions** • Description of genetic resources covered by the material transfer agreements, including accompanying information • Permitted uses, bearing in mind the potential uses, of the genetic resources, their products or derivatives under the material transfer agreement (e.g. research, breeding, commercialization) • Statement that any change of use would require new prior informed consent and material transfer agreement • Whether intellectual property rights may be sought and if so under what conditions • Terms of benefit-sharing arrangements, including commitment to share monetary and non-monetary benefits • No warranties guaranteed by provider on identity and/or quality of the provided material • Whether the genetic resources and/or accompanying information may be transferred to third parties and if so conditions that should apply • Definitions • Duty to minimize environmental impacts of collecting activities **Legal provisions** • Obligation to comply with the material transfer agreement • Duration of agreement • Notice to terminate the agreement • Fact that the obligations in certain clauses survive the termination of the agreement • Independent enforceability of individual clauses in the agreement • Events limiting the liability of either party (such as act of God, fire, flood, etc.) • Dispute settlement arrangements • Assignment or transfer of rights • Assignment, transfer or exclusion of the right to claim any property rights, including intellectual property rights, over the genetic resources received through the material transfer agreement • Choice of law • Confidentiality clause • Guarantee

Source: Author based on IISD and State Secretariat for Economic Affairs 2007: 24-29, and CBD 2002: 17-20.

Table A 2: Crosstabulation: Number of employees in differentiated by companies' fields of utilisation

N: 35	**Number of employees in the year 2008**						
Fields of utilisation selected by the respondents	< 10	10 - 50	> 50 - 250	> 250 - 500	> 500 - 1,000	> 1,000 - 10,000	Above 10,000
Pharmacy and more than one application field including Pharmacy	2	0	0	2	2	1	0
Botanical Medicine; Cosmetics and Personal Care	0	1	0	0	1	0	0
Plant Breeding (Seed & Horticulture)	4	4	8	1	2	0	0
Biotechnology, other fields than Pharmacy and Plant Breeding	2	1	0	0	0	2	1
Biocontrole Agents	0	0	0	0	1	0	0
All	**8**	**6**	**8**	**3**	**6**	**3**	**1**

Source: Author.

Table A 3: Crosstabulation: Companies' turnover in fields of utilisation

N: 30	**Turnover in Million Euro (€) and US Dollar ($) (numbers refer to the year 2008)**							
Fields of utilisation	**€**	< 2	2-10	> 10-50	> 50-250	> 250-1,000	> 1.000-5,000	> 5,000
	$	< 3	3-15	> 15-74	>74-370	< 370-1,500	> 1,500-7,400	> 7,400
Pharmacy and more than one application field including Pharmacy		2	0	1	2	0	0	0
Botanical Medicine; Cosmetics and Personal Care		0	0	0	1	0	0	0
Plant Breeding (Seed & Horticulture)		5	5	7	1	0	0	0
Biotechnology, other fields than Pharmacy and Plant Breeding		2	1	0	0	0	1	1
Biocontrole Agents		0	0	0	1	0	0	0
All		**9**	**6**	**8**	**5**	**0**	**1**	**1**

Source: Author.

Table A 4: Crosstabulation: R&D budget differentiated by companies' fields of utilisation

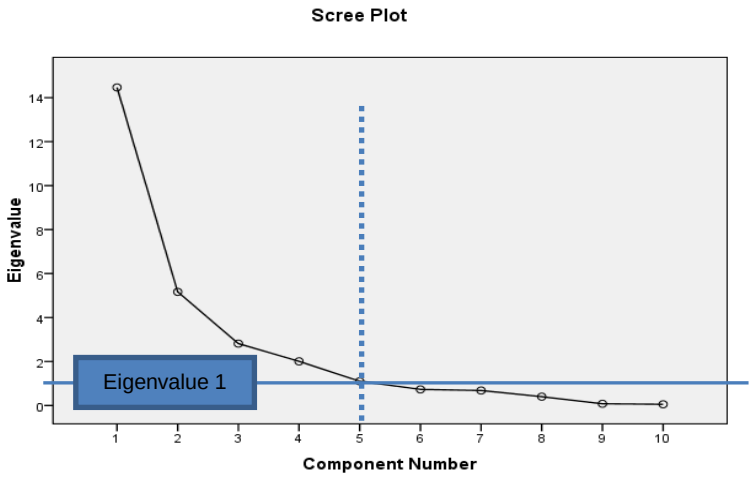
N: 29	R&D budget in Million Euro (€) or US Dollar ($) (average 2004 to 2008)							
Fields of utilisation	€	<1	1-10	>10-50	>50-100	>100-250	>250-500	>500
	$	<1.5	1.5-15	>15-74	>74-150	>150-370	>370-740	>740
Pharmacy and more than one application field including Pharmacy		2	1	1	0	0	0	1
Botanical Medicine; Cosmetics & Personal Care		0	1	0	0	0	0	0
Plant Breeding (Seed & Horticulture)		9	6	1	1	0	0	0
Biotechnology, other fields than Pharmacy and Plant Breeding		3	0	0	0	2	0	0
Biocontrole Agents		0	1	0	0	0	0	0
All		**14**	**9**	**2**	**1**	**2**	**0**	**1**

Source: Author.

Table A 5: Frequency table: The transactional environment in the sample cases

How would you assess the institutional framework in the provider country from which you receive resources for this case?	1= very bad ... 7= very good							all	Cum. freq. cat. 1-3
	1	2	3	4	5	6	7		
Availability of information about the national system for access and use of genetic resources	1	7	7	6	3	5	1	30	50%
Competent contact partner in the administration is designated and reachable	2	5	6	4	5	5	3	30	43%
Centrally managed access procedure for GRs	2	12	2	3	3	6	1	29	55%
Clear competencies of actors for access negotiations	1	9	4	4	3	4	1	26	54%
Legal competency of actors involved in negotiations	2	10	1	4	2	2	2	23	57%
Provider has a concept for resource evaluation	1	2	6	6	8	3	5	31	29%
Scientific competency of participants in access negotiations	0	2	4	2	9	9	3	29	21%
Existence of potential research partners in the provider country	0	1	5	3	9	6	5	29	21%
A reliable legal system	0	3	4	9	3	5	2	26	27%
Self-interest of the government of the provider country in the execution of the project	4	4	3	4	0	3	4	22	50%

Source: Author.



Source: Author.

Figure A 1: Scree plot Factor analysis for transaction environment

Table A 6: Factor Analysis Transaction Environment (case specific part): Total variance explained

Component		Initial Eigenvalues[a]			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
		Total	% of Variance	Cum. %	Total	% of Var.	Cum. %	Total	% of Var.	Cum. %
Raw	1	14,466	52,605	52,605	14,466	52,605	52,605	7,879	28,652	28,652
	2	5,168	18,792	71,397	5,168	18,792	71,397	6,574	23,907	52,559
	3	2,814	10,231	81,628	2,814	10,231	81,628	5,358	19,484	72,042
	4	2,007	7,299	88,927	2,007	7,299	88,927	3,016	10,967	83,010
	5	1,102	4,008	92,935	1,102	4,008	92,935	2,729	9,925	92,935
	6	,731	2,659	95,594						
	7	,680	2,474	98,068						
	8	,401	1,457	99,525						
	9	,077	,280	99,805						
	10	,054	,195	100,000						
Rescaled	1	14,466	52,605	52,605	5,017	50,174	50,174	3,346	33,459	33,459
	2	5,168	18,792	71,397	2,146	21,465	71,638	1,903	19,027	52,486
	3	2,814	10,231	81,628	,968	9,678	81,316	1,588	15,877	68,364
	4	2,007	7,299	88,927	,647	6,470	87,786	1,385	13,846	82,210
	5	1,102	4,008	92,935	,359	3,592	91,378	,917	9,169	91,378
	6	,731	2,659	95,594						
	7	,680	2,474	98,068						
	8	,401	1,457	99,525						
	9	,077	,280	99,805						
	10	,054	,195	100,000						

Extraction Method: Principal Component Analysis.

a. When analyzing a covariance matrix, the initial eigenvalues are the same across the raw and rescaled solution.

Source: Author.

Table A 7: Frequency table: Differentiation of demand in ABS agreements

Please complete the following sentences and assess how important each aspect is for the selection of a supply source for genetic resources. **For some projects in our company was or is...**	**1= not important at all ... 7= very important**							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**all**
1: ... access to undiscovered genetic resources (GRs) as a potential source of innovative products very important.	2	9	3	5	6	12	20	57
2: ... access to properties of wild species of certain plants or animals very important.	6	4	4	5	5	13	19	56
3: ... it very important to be able to study GRs in the context of their natural habitat.	12	10	9	6	8	6	7	58
4: ... traditional knowledge about effectiveness of natural resources very important	17	7	5	6	3	10	10	58
5: ... exclusive access or exclusive usage rights for genetic resources very important.	13	11	3	4	4	11	10	56
6: ... it very important that the provider could deliver the GR(s) as raw material on an intermediate or long term basis in larger quantities.	21	4	2	4	9	6	8	54

Source: Author.

Table A 8: Frequency table: Provider contribution in reference projects

Frequency multiple response provider contribution	**Frequency**	**Valid percentage**
one service item	13	31
2 service items	10	23,8
3 service items	10	23,8
4 service items	3	7,1
5 service items	5	11,9
7 service items	1	2,4
Total	42	100

Source: Author.

Table A 9: Crosstabulation: for certain provider-contribution items (Mann-Whitney U differentiating cases with and without the respective provider contribution item)

Fisher's Exact Test		Provider executes collection activities		
Exact Significance (2 sided): .034		no	yes	Total
The provider grants some kind of exclusivity rights in connection with genetic resources	no	28	6	34
	yes	4	5	9
Fisher's Exact Test		Participation in advanced research		
Exact Significance (2 sided): .073		no	yes	Total
The provider grants some kind of exclusivity rights in connection with genetic resources	no	29	5	34
	yes	5	4	9
Fisher's Exact Test		Preparation of the material		
Exact Significance (2 sided): .005		no	yes	Total
Provider executes collection activities	no	27	5	32
	yes	4	7	11
Fisher's Exact Test		Participation in advanced research		
Exact Significance (2 sided): .034		no	yes	Total
Provider executes collection activities	no	28	4	32
	yes	6	5	11
Fisher's Exact Test		Participation in advanced research		
Exact Significance (2 sided): .014		no	yes	Total
Evaluation of samples	no	27	3	30
	yes	7	6	13

Source: Author.

Table A 10: Frequency table on synergy effects of non-monetary benefit-sharing

What synergy effects (can) result for your company from non-monetary benefit transfers in the project?	1= Not correct at all ... 7= Completely correct							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**all**
1: Providers will be better positioned to provide the desired activity, for example, quality / continuity of material supply.	0	2	3	4	0	7	3	**19**
2: Local scientists will be able to conduct initial on-site evaluations of genetic resources, which will reduce costs for us in the long run.	0	1	3	5	3	4	3	**19**
3: Capacity building ensures the conservation and the long-term availability of genetic resources.	1	1	3	3	1	5	4	**18**
4: …is a prerequisite so that scientific cooperation is possible.	2	3	5	2	3	1	3	**19**
5: … increases trust and facilitates communication with the providers.	1	0	0	3	3	4	7	**18**
6: … is a fundamental requirement of the provider.	3	6	2	4	1	0	2	**18**

Source: Author.

Table A 11: Frequency table: companies specific investments for projects with genetic resources

Has your company invested or is your company investing for the use of genetic resources from this project in ...	**Yes**	**No**	**I do not know**	**Number of valid entries**	**yes in valid %**
- its home country/ies [a]					
... for buildings (Laboratories, Plants)	9	25	3	37	24%
... for laboratory equipment or other physical assets	19	20	2	41	46%
... for education / hiring of skilled employees	21	17	2	40	53%
Number of cases with "yes" entry for at least one item: 26					
- the provider country [b]					
... for laboratory equipment or other physical assets	11	29	1	41	27%
... for education / hiring of skilled employees	16	23	2	41	39%
Number of cases with "yes" entry for at least one item: 18					
[a] Home countries means business locations that were selected independently of the project or existed previously. [b] Provider country: simplified term for the country in which the genetic resource can be found in its natural habitat.					

Source: Author.

Table A 12: Degree of asset specificity for R&D-projects with genetic resources

1= only with high financial disadvantages ... 7= without financial disadvantages	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**All**
Can your companies' investments in the home country be otherwise utilised if the project is called off before completion?	4	2	4	6	1	2	6	25
Can your companies' investments in the provider country be otherwise utilised if the project is called off before completion?	5	3	1	0	2	0	5	16
Aggregated: Can your companies' investments in the home country and/or the provider country be otherwise utilised if the project is called off before completion?	7	4	4	3	1	1	7	27
These questions were filtered, and only answered by participants that beforehand indicated their company invested/ invests in the framework of the project.								

Source: Author.

Table A 13: Frequency table: Asset specificity, aggregated in one variable, reverse scale

In the framework of the reference project the company's investments can be reutilised in case the project is called off before completion…	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**All**
1= without financial disadvantages (we made no investments) … 7= only with high financial disadvantages	21	1	1	3	4	4	7	41

Source: Author.

Table A 14: Frequency table: Type of contract chosen to govern the project

	Frequency
The contract is largely negotiated and close to a final version before the start of the project	17
Tiered contract that is further developed, modified, or replaced during the course of the project	17

Source: Author.

Table A 15: Frequency table: Timeframe of contracts for bioprospecting projects

For what timeframe were mutual requirements made contractually binding with the provider?	**frequency**	**Percentage of valid entries**
Less than 1 year	9	23%
1 up to 3 years	13	33%
More than 3 up to 5 years	6	15%
More than 5 up to 7 years	4	10%
More than 7 up to 9 years	1	3%
More than 9 up to 11years	1	3%
More than 11 up to 13 years	1	3%
More than 13 years	4	10%
All	**39**	

Source: Author.

Table A 16: Frequency Table: Stipulation of conflict resolution measures

	Yes	No	All	Affirmation in % of valid entries
Exact description of the mutual activities (for example, schedule, delivery quantities, prices, height of compensation) in contract	18	20	38	47%
Judicial authority	7	31	38	18%
Arbitration with assistance of independent third party	12	26	38	32%
Internal conflict resolution mechanism, harmonization of interests	17	21	38	45%

Source: Author.

Table A 17: Correlation initiation time and company size

Proxy for company size	**Kendall- Tau-c**	**Approximate significance**	**N**
Number of employees in the year 2008	.185	.244	24
Turnover in the year 2008	.054	.742	21
R&D budget (average between 2004 and 2008)	.208	.0108	24

Source: Author's.

Table A 18: Correlation transaction costs and company size

Proxy for company size (aggregated in 5 categories)	**Transaction costs variables** (aggregated in 5 categories)	**Kendall's Tau-b**	**Approx. Sig.**
Number of employees in the year 2008 (N: 30)	The effort level is low in comparison to other cost components of the project.	-.211	.0102
	The effort level is acceptable in comparison to the value of the resources and related services acquired in the framework	-.176	.233
	Negotiations are / were tedious and difficult.	-.396	.004
Turnover in the year 2008 (N: 30)	The effort level is low in comparison to other cost components of the project.	-.007	.961
	The effort level is acceptable in comparison to the value of the resources and related services acquired in the framework	-.030	.845
	Negotiations are / were tedious and difficult.	-.014	.926
R&D budget (average between 2004 and 2008) (N: 27)	The effort level is low in comparison to other cost components of the project.	.192	.178
	The effort level is acceptable in comparison to the value of the resources and related services acquired in the framework	.307	.035
	Negotiations are / were tedious and difficult.	.369	.015

Source: Author's.

Table A 19: Mann-Whitney U test for company size with sample differentiation according to provider contribution (only significant results)

R&D budget * provider executes collection activities			
Mean Rank group (**a**): 16.13 (provider contribution not indicated)	Mean Rank group (**b**): 22.09 (provider contribution indicated):	Mann-Whitney U: 49.5	Asymp. Sig: .069
R&D budget * Preparation of material			
Mean Rank group **a**: 13.23	Mean Rank group **b**: 18.94	Mann-Whitney U: 54.5	Asymp. Sig: .071
R&D budget * Participation in advanced research			
Mean Rank group **a**: 13.17	Mean Rank group **b**: 19.81	Mann-Whitney U: 45.5	Asymp. Sig: .043
Number of employees * Participation in advanced research			
Mean Rank group **a**: 15.73	Mean Rank group **b**: 24.56	Mann-Whitney U: 58	Asymp. Sig: .023

Source: Author's.

Table A 20: Correlation between transaction cost and users' indirect capacities

Transaction cost * users' indirect capacities (both variables aggregated in 5 categories)	**Kendall's-Tau-b**	**Approx. Sig.**	**N**
The effort level is acceptable in comparison to the value of the resources & related services *			
Our company has high capacity to execute long-term, complex projects.	.1	.426	29
Our company has experience of executing complex long-term projects.	.1	.574	29
Our company is experienced in projects with partners from developing or newly industrializing countries	-.1	.547	28
Negotiations are / were tedious and difficult. *			
Our company has high capacity to execute long-term, complex projects.	-.09	.535	26
Our company has experience of executing complex long-term projects.	-.03	.819	27
Our company is experienced in projects with partners from developing or newly industrializing countries	.1	.327	27

Source: Author.

Table A 21: Correlation between initiation time and users' indirect capacities

Proxy for company size	**Kendall- Tau-c**	**Approx. Sig.**	**N**
Our company has a high capacity to execute long-term, complex projects	-.156	.402	23
Our company already has experience in the past of executing complex long-term projects	-.190	.247	24
Our company is experienced in projects with partners from developing or newly industrializing countries	-.190	.274	24

Source: Author's.

Table A 22: Mann-Whitney U test for transaction costs with sample differentiation by provider type

National, regional and, or local governmental administration entity versus other provider types *		
Negotiations are / were tedious and difficult.	Mann-Whitney U: 54	Asymp. Sig: .057
Local research institute is involved as provider *		
Negotiations are / were tedious and difficult.	Mann-Whitney U: 76	Asymp. Sig: .341

Source: Author.

Table A 23: Mann-Whitney U test for initiation time with sample differentiation by provider type

National, regional and/ or local governmental administration entity versus other provider types * initiation time			
Mean Rank group a:18.14	Mean Rank group b: 11.16	Mann-Whitney U: 42.5	Asymp. Sig: .018
Local research institute is involved as provider * initiation time			
Mean Rank group a: 14.19	Mean Rank group b: 13.73	Mann-Whitney U: 85	Asymp. Sig: .876

Source: Author.

Table A 24: Correlation between transaction costs and transactional environment

Transaction cost-variable aggregated in 5 factors	Kendall's Tau-c	Approx. Sig.	N
*** Factor 1**			
Negotiations are / were tedious and difficult	.-147	.276	17
*** Factor 2**			
Negotiations are / were tedious and difficult	.061	.767	17
*** Factor 3**			
Negotiations are / were tedious and difficult	-.216	.339	17
*** Factor 4**			
Negotiations are / were tedious and difficult	.009	.962	17
*** Factor 5 (individual item!)**			
Negotiations are / were tedious and difficult	-.493	.012	17

Source: Author.

Table A 25: Correlation between transaction environment and initiation time

Initiation time * transactional environment (Initiation time aggregated in 5 categories)	Kendall's Tau-c	Approx. Sig.	N
Initiation time * Factor 1	-.083	.674	15
Initiation time * Factor 2			
Initiation time * Factor 3	.201	.41	15
Initiation time * Factor 4	-.273	.167	15
Initiation time * Factor 5 **(individual item!)**	-.154	.572	15

Source: Author.

Table A 26: Correlation between transaction costs and transactional environment (individual items)

Transaction costs * transaction environment	Kendall's Tau-b	Approx. Sig.	N
Availability of information about the national system for access and use of genetic resources *			
Negotiations are / were tedious and difficult	-.365	**.001**	26
Competent contact partner in the administration is designated and reachable *			
Negotiations are / were tedious and difficult	-.126	.301	26
Centrally managed access procedure for GRs *			
Negotiations are / were tedious and difficult	-.308	**.024**	26
Clear competencies of actors for access negotiations *			
Negotiations are / were tedious and difficult	-.258	.077	23
Legal competency of actors involved in negotiations *			
Negotiations are / were tedious and difficult	-.099	.522	21
Provider has a concept for resource evaluation *			
Negotiations are / were tedious and difficult	-.038	.771	27
Scientific competency of participants in access negotiations *			
Negotiations are / were tedious and difficult	-.129	.297	26
Existence of potential research partners in the provider country *			
Negotiations are / were tedious and difficult	-.097	.449	26
A reliable legal system *			
Negotiations are / were tedious and difficult	-.191	.153	24
Self-interest of the government of the provider country in the execution of the project *			
Negotiations are / were tedious and difficult	-.098	.567	21

Source: Author.

Table A 27: Correlation between initiation time and transaction environment (individual items)

Initiation time *	Kendall's Tau-c	Approx. Sig.	N
Availability of information about the national system for access and use of genetic resources	-.231	.220	22
Competent contact partner in the administration is designated and reachable	-.253	.228	22
Centrally managed access procedure for GRs	-.294	.119	22
Clear competencies of actors for access negotiations	-.242	.140	21
Legal competency of actors involved in negotiations	.104	.602	18
Provider has a concept for resource evaluation	-.167	.280	23
Scientific competency of participants in access negotiations	-.249	.098	23
Existence of potential research partners in the provider country	-.309	**.043**	22
A reliable legal system	-.226	.133	20
Self-interest of the government of the provider country in the execution of the project	-.028	.834	17

Source: Author.

Table A 28: Correlation between transaction costs and primary uncertainty

	Without correction for asset specificity			With correction for asset specificity		
Transaction costs * primary uncertainty	Kendall's Tau-b	Approx. Sig.	N	Kendall's Tau-b	Approx. Sig.	N
Negotiations are / were tedious and difficult *						
The utilisation process for genetic resources is completely unpredictable at the beginning of the project.	.098	.517	28	-.291	.236	12
At the beginning of the utilisation process, we are not able to anticipate commercial output at all.	.167	.282	28	-.071	.766	12
The technology in our field of use changes quickly.	.086	.633	27	-.386	.111	12
The genetic resources from the project will be used for research and development of products for new / uncertain markets	.147	.387	28	-.017	.948	12

Source: Author.

Table A 29: Correlation between primary uncertainty and initiation time

	Without correction for asset specificity			With correction for asset specificity		
Proxies for primary uncertainty * initiation time of bioprospecting projects	Kendall-Tau-c	Approx. Sig.	N	Kendall-Tau-c	Approx. Sig.	N
The utilisation process for genetic resources is completely unpredictable at the beginning of the project.	-.051	.734	26	.204	.412	12
At the beginning of the utilisation process, we are not able to anticipate commercial output at all.	.071	.694	26	-.185	.531	12
The technology in our field of use changes quickly.	.119	.511	25	-.074	.780	12
The genetic resources from the project will be used for research and development of products for new / uncertain markets	.016	.922	26	.-039	.865	12

Source: Author's.

Table A 30: Crosstabulation and Mann-Whitney U test differentiating for contract type and combined with primary uncertainty

	1= not correct at all ..... 7 = completely correct								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**All**	**Cum. frequency cat. 5 to 7**
Contract type	**At the beginning of the utilisation process, we are not able to anticipate commercial output at all.**								
Comprehensive contracts right from the start of the project	0	3	2	0	0	7	5	17	71%
A tiered contract that is further developed, modified, or replaced during the course of the project	2	2	0	5	5	2	1	17	47%
Mann-Whitney U: 84.5	Asymp. Sig.: .036							N: 34	
Contract type	**The technology in our field of use changes quickly.**								
Comprehensive contract	2	2	0	1	4	5	3	17	71%
Tiered contract	2	6	0	3	1	2	1	15	27%
Mann-Whitney U: 79	Asymp. Sig.: .062							N: 32	
Contracting approach									
* The genetic resources from the project will be used for research and development of products for new / uncertain markets								Mann-Whitney U: 125.5	Approx. Sig: .699
* The utilisation process for genetic resources is completely unpredictable at the beginning of the project.								Mann-Whitney U: 119.5	Approx. Sig: .381

Source: Author

Table A 31: Mann-Whitney U test differentiating for contract type and combined with asset specificity

Contracting approach * Asset specificity (seven-point scale)	Mann-Whitney U: 119.5	Approx. Sig: .530

Source: Author.

Table A 32: Contract type combined with users' indirect capacities

Contracting approach		
* Our company has a high capacity to execute long-term, complex projects	Mann-Whitney U: 113.5	Asymp. Sig.: .791
* Our company already has experience in the past of executing complex long-term projects.	Mann-Whitney U: 119	Asymp. Sig.: .968

Source: Author.

Table A 33: Mann-Whitney U test differentiating between two contract types combined with company size

Contracting approach		
Number of employees	Mann-Whitney U: 89.5	Asymp. Sig: .257
Companies turnover	Mann-Whitney U: 67	Asymp. Sig: .231
R&D Budget in	Mann-Whitney U: 56	Asymp. Sig: .118

Source: Author.

Table A 34: Crosstabulation and correlations: Synergy effects in combination with contract duration

	1= not all important … 5= important						
	1	**2**	**3**	**4**	**5**	**all**	**Cum. frequency category 4 & 5**
Contract duration	**Providers will be better positioned to provide the desired activity (e.g. quality / continuity of material supply)**						
less than 1 year	0	0	1	0	0	1	0%
one year up to 5 years	0	5	1	3	0	9	33%
over 5 years up to 9 years	0	0	1	2	2	5	80%
over 9 years up 13 years	0	0	1	2	0	3	67%
over 13 years	0	0	0	0	1	1	100%
Kendall's Tau C: 0.4	**Approx. significance level: 0.000**						**N: 19**
	Capacity building increases trust and facilitates communication with the providers						
less than 1 year	0	0	1	0	0	1	0%
one year up to 5 years	1	0	2	4	1	8	63%
over 5 years up to 9 years	0	0	0	2	3	5	100%
over 9 years up 13 years	0	0	0	1	2	3	100%
over 13 years	0	0	0	0	1	1	100%
Kendall's Tau C: 0.5	**Approx. significance level: 0.000**						**N: 18**

Source: Author.

Table A 35: Correlation test: Contract duration and asset specificity

Contract duration (eight categories)		
* Asset Specificity (seven-point scale)	Kendall's Tau C: .133	Approx. Sig.: .285

Source: Author.

Table A 36: Correlation test: Contract duration and demand uncertainty

Contract Duration		
* The genetic resources from the project will be used for research and development of products for new / uncertain markets	Kendall's Tau C: .112	Approx. Sig.: .339

Source: Author.

Table A 37: Benefit-sharing measures

N: 38	**Frequency**	**Valid percentage**
Either monetary or non-monetary	11(9 only monetary ; 2 only non-monetary)	29%
Monetary and non-monetary	17	45%
No benefit-sharing at all	10	26%
Number of Monetary benefit-sharing measures		
One	15	39,5
Two	6	15,8
Three	3	7,9
Four	2	5,3
None	12	31,6%
Number of non-monetary benefit-sharing items		
One	19	25%
Two	6	8%
Three	3	4%
Four and more than four	9	60%
None	1	3%

Source: Author.

Table A 38: Crosstabulation and Fisher's Exact test for monetary benefit-sharing in combination with provider contribution

Information (for example, traditional knowledge) about usage possibilities *		No	Yes
Weight-related, or hourly-wage compensation	No	20	10
	Yes	8	0
Fisher's Exact Test	Exact Significance (2-sided): .082		
Preparation of the material *		No	Yes
Weight-related, or hourly-wage compensation	No	25	5
	Yes	2	6
Fisher's Exact Test	Exact Significance (2-sided): .004		
The provider grants some kind of exclusivity rights in connection with genetic resources*		No	Yes
Negotiated advance payments (lump sum)	No	25	5
	Yes	4	4
Fisher's Exact Test	Exact Significance (2-sided): .071		
Evaluation of samples *		No	Yes
Negotiated advance payments (lump sum)	No	23	7
	Yes	3	5
Fisher's Exact Test	Exact Significance (2-sided): .081		
Collection permission *		No	Yes
Negotiated advance payments (lump sum)	No	22	8
	Yes	2	6
Fisher's Exact Test	Exact Significance (2-sided): .034		
Preparation of the material *		No	Yes
Some kind of ex-ante determined fix payments	No	20	4
	Yes	7	7
Fisher's Exact Test	Exact Significance (2-sided): .061		
The provider grants some kind of exclusivity rights in connection with genetic resources *		No	Yes
Negotiated payments that are made after reaching certain steps in the usage process (milestone payments)	No	25	5
	Yes	4	4
Fisher's Exact Test	Exact Significance (2-sided): .071		
Participation in advanced research *		No	Yes
Milestone payments	No	25	5
	Yes	4	4
Fisher's Exact Test	Exact Significance (2-sided): .071		
The provider grants some kind of exclusivity rights in connection with genetic resources*		No	Yes
Payments tied to commercial output (e.g. royalties)	No	24	4
	Yes	5	5
Fisher's Exact Test	Exact Significance (2-sided): .036		
The provider grants some kind of exclusivity rights in connection with genetic resources *		No	Yes
Milestone payments, and / or royalties	No	22	1
	Yes	7	8
Fisher's Exact Test	Exact Significance (2-sided): .001		

Source: Author.

Table A 39: Mann-Whitney U test differentiating for the application of monetary benefit-sharing

measures in combination with duration of utilisation process

Utilisation Duration		
* Weight-related, or hourly-wage compensation	Mann-Whitney U: 77.5	Asymp. Sig.: .331
* Negotiated advance payments (lump sum)	Mann-Whitney U: 57.5	Asymp. Sig.: .259
* Milestone payments	Mann-Whitney U: 89	Asymp. Sig.: .634
* Payments tied to commercial output (e.g. royalties)	Mann-Whitney U: 71.5	Asymp. Sig.: .218
* Milestone payments, and / or royalties	Mann-Whitney U: 98	Asymp. Sig.: .225
* Output-related payments that are negotiated over the course of the project	Mann-Whitney U: 17	Asymp. Sig.: .071
* The contract contains clauses for ex post negotiations in case that the framework changes	Mann-Whitney U: 57.5	Asymp. Sig.: .518

Source: Author.

Table A 40: Fisher's Exact test: non-monetary benefit-sharing in combination with provider contribution

Participation in advanced research *		No	Yes
Joint publication in scientific journals	No	22	3
	Yes	7	6
Fisher's Exact Test	Exact Significance (2 sided): .040		
Some kind of exclusivity rights related to genetic resources *		No	Yes
Technology transfer	No	24	2
	Yes	5	7
Fisher's Exact Test	Exact Significance (2 sided): .002		
Participation in advanced research *		No	Yes
Technology transfer	No	23	3
	Yes	6	6
Fisher's Exact Test	Exact Significance (2 sided): .016		
Participation in advanced research		No	Yes
Transfer of know-how in the scientific field	No	23	1
	Yes	10	4
Fisher's Exact Test	Exact Significance (2 sided): .052		
Provider carries out collection activities *		No	Yes
Support of inventory / taxonomy of Biodiversity	No	25	5
	Yes	2	6
Fisher's Exact Test	Exact Significance (2 sided): .004		
Preparation of material *		No	Yes
Support of inventory / taxonomy of Biodiversity	No	24	6
	Yes	3	5
Fisher's Exact Test	Exact Significance (2 sided): .031		
Some kind of exclusivity rights related to genetic resources *		No	Yes
Joint intellectual property rights to usage results	No	29	5
	Yes	0	4
Fisher's Exact Test	Exact Significance (2 sided): .002		
Some kind of exclusivity rights related to genetic resources *		No	Yes
Transfer of know-how in the scientific field	No	22	2
	Yes	7	7
Fisher's Exact Test	Exact Significance (2 sided): .006		
Access to previously inventoried resources in a national collection*		No	Yes
Transfer of know-how in the field of sustainable use and cultivation of genetic resources	No	13	16
	Yes	8	1
Fisher's Exact Test	Exact Significance (2 sided): .026		

Source: Author.

Table A 41: Crosstabulation: Capacity building in combination with synergy effects

		1= not correct at all ..... 7 = completely correct							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**All**
Capacity building ensures the conservation and the long-term availability of genetic resources									
Transfer of know-how in the field of sustainable use / cultivation of GRs *	No	1	1	2	3	1	2	0	10
	Yes	0	0	1	0	0	3	4	8
Providers will be better positioned to provide the desired activity, e.g. quality / continuity of material supply.									
Technology transfer *	No	0	2	2	2	0	2	0	8
	Yes	0	0	1	2	0	5	3	11
Capacity building increases trust & facilitates communication with providers.									
Technology transfer *	No	0	0	0	3	2	2	0	7
	Yes	1	0	0	0	1	2	7	11
Providers will be better positioned to provide the desired activity, e.g. quality / continuity of material supply.									
Transfer of know-how in the scientific field *	No	0	1	2	2	0	1	0	6
	Yes	0	1	1	2	0	6	3	13
Capacity building is the prerequisite so that scientific cooperation is possible.									
Transfer of know-how in the scientific field *	No	1	2	2	1	0	0	0	6
	Yes	1	1	3	1	3	1	3	13
Capacity building ensures the conservation and the long-term availability of genetic resources.									
Transfer of know-how in the scientific field *	No	1	1	2	1	1	0	0	6
	Yes	0	0	1	2	0	5	4	12
Capacity building increases trust and facilitates communication with the providers.									
Transfer of know-how in the scientific field *	No	1	0	0	3	1	1	0	6
	Yes	0	0	0	0	2	3	7	12

Source: Author.

Table A 42: Crosstabulation: Non-monetary benefit-sharing in combination with the transaction environment (aggregated through Factor Analysis)

Yes, joint intellectual property rights to usage results								REGR factor scorefactor 2									
	-1,57	-1,35	-1,22	-0,68	-0,66	-0,46	-0,39	-0,35	-0,27	-0,04	0,51	0,59	0,65	0,88	1,06	1,17	2,12
no	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1
yes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Yes, joint intellectual property rights to usage results								REGR factor score factor 3									
	-1,59	-1,50	-0,94	-0,93	-0,50	-0,46	-0,36	-0,36	-0,34	0,22	0,24	0,28	0,92	0,96	1,04	1,44	1,88
no	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	1
yes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Yes, support of other measures to preserve biodiversity								REGR factor score factor 3									
	-1,59	-1,50	-0,94	-0,93	-0,50	-0,46	-0,36	-0,36	-0,34	0,22	0,24	0,28	0,92	0,96	1,04	1,44	1,88
no	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
yes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Source: Author.

Table A 43: Crosstabulation: Stipulation of internal conflict resolution and interest harmonisation in combination with synergy effects of capacity building

	1= Not correct at all ..... 7= Completely correct							
		1	**2**	**3**	**4**	**5**	**6**	**7**
	Providers will be better positioned to provide the desired activity (e.g. quality/continuity of supply)							
Internal conflict resolution	**No**	0	2	2	3	0	4	0
	Yes	0	0	1	1	0	3	3
	… increases trust and facilitates communication							
Internal conflict resolution	**No**	1	0	0	3	2	3	1
	Yes	0	0	0	0	1	1	6
	… prerequisite so that scientific cooperation is possible							
Internal conflict resolution	**No**	2	2	4	2	0	1	0
	Yes	0	1	1	0	3	0	3
	… ensures the conservation and the long-term availability of genetic resources.							
Internal conflict resolution	**No**	1	1	2	2	1	2	1
	Yes	0	0	1	1	0	3	3

Source: Author.

Table A 44: Mann-Whitney U test differentiating for the dispute resolution measures in combination with indirect capacities

Exact description of the mutual activities (for example, schedule, delivery quantities, prices, height of compensation payments) in the contract *		
Our company has a high capacity to execute long-term, complex projects.	Mann-Whitney U: 122.5	Asymp. Sig: .448
Exact description of the mutual activities in the contract *		
Our company already has experience in the past of executing complex long-term projects.	Mann-Whitney U: 122	Asymp. Sig: .437
Exact description of the mutual activities in the contract *		
Our company is experienced in projects with partners from developing or newly industrializing countries.	Mann-Whitney U: 126.5	Asymp. Sig: .756
Judicial authority *		
Our company has a high capacity to execute long-term, complex projects.	Mann-Whitney U: 72.5	Asymp. Sig: .338
Judicial authority *		
Our company already has experience in the past of executing complex long-term projects.	Mann-Whitney U: 76	Asymp. Sig: .420
Judicial authority *		
Our company is experienced in projects with partners from developing or newly industrializing countries.	Mann-Whitney U: 71.5	Asymp. Sig: .385
Arbitration with the assistance of an independent third party *		
Our company has a high capacity to execute long-term, complex projects.	Mann-Whitney U: 97	Asymp. Sig: .267
Arbitration with the assistance of an independent third party *		
Our company already has experience in the past of executing complex long-term projects.	Mann-Whitney U: 76.5	Asymp. Sig: .092
Arbitration with the assistance of an independent third party *		
Our company is experienced in projects with partners from developing or newly industrializing countries.	Mann-Whitney U: 65	Asymp. Sig: .079
Internal conflict resolution mechanism, interest harmonisation *		
Our company has a high capacity to execute long-term, complex projects.	Mann-Whitney U: 131	Asymp. Sig: .747
Internal conflict resolution mechanism, interest harmonisation *		
Our company already has experience in the past of executing complex long-term projects.	Mann-Whitney U: 139	Asymp. Sig: .901
Internal conflict resolution mechanism, interest harmonisation *		
Our company is experienced in projects with partners from developing or newly industrializing countries.	Mann-Whitney U: 96.5	Asymp. Sig: .159

Source: Author.

Table A 45: Mann-Whitney U test differentiating for the dispute resolution measures in combination with the transaction environment (aggregated through factor analysis)

Exact description of the mutual activities (for example, schedule, delivery quantities, prices, height of compensation payments) in the contract *		
Factor 1 (includes: (1) A reliable legal system, (2) Scientific competency of participants in access negotiations, (3) Clear competencies of actors for access negotiations, (4) Provider has a concept for resource evaluation)	Mann-Whitney U: 20	Asymp. Sig: .124
Exact description of the mutual activities in the contract *		
Factor 2 (includes: (1) Self-interest of the government of the provider country in the execution of the project; (2) Availability of information about the national system for access and use of genetic resources)	Mann-Whitney U: 25	Asymp. Sig: .290
Exact description of the mutual activities in the contract *		
Factor 3 (includes: (1) Legal competency of actors involved in negotiations; (2) Centrally managed access procedure for genetic resources)	Mann-Whitney U: 30	Asymp. Sig: .564
Exact description of the mutual activities in the contract *		
Competent contact partner is designated and reachable	Mann-Whitney U: 24	Asymp. Sig: .248
Exact description of the mutual activities in the contract *		
Existence of potential research partners in the provider country	Mann-Whitney U: 33	Asymp. Sig: .773
Judicial authority *		
Factor 1	Mann-Whitney U: 14	Asymp. Sig: .378
Judicial authority *		
Factor 2	Mann-Whitney U: 15	Asymp. Sig: .450
Judicial authority *		
Factor 3	Mann-Whitney U: 3	Asymp. Sig: .023
Judicial authority *		
Competent contact partner is designated and reachable	Mann-Whitney U: 20	Asymp. Sig: .900
Judicial authority *		
Existence of potential research partners in the provider country	Mann-Whitney U: 12	Asymp. Sig: .257
Arbitration with the assistance of an independent third party *		
Factor 1	Mann-Whitney U: 22	Asymp. Sig: .399
Arbitration with the assistance of an independent third party *		
Factor 2	Mann-Whitney U: 28	Asymp. Sig: .833
Arbitration with the assistance of an independent third party *		
Factor 3	Mann-Whitney U: 21	Asymp. Sig: .343

Continued Table A 45		
Arbitration with the assistance of an independent third party *		
Competent contact partner in the administration is designated and reachable	Mann-Whitney U: 26	Asymp. Sig: .673
Arbitration with the assistance of an independent third party *		
Existence of potential research partners in the provider country	Mann-Whitney U: 29	Asymp. Sig: .916
Internal conflict resolution mechanism, interest harmonisation *		
Factor 1	Mann-Whitney U: 27	Asymp. Sig: .546
Internal conflict resolution mechanism, interest harmonisation *		
Factor 2	Mann-Whitney U: 32	Asymp. Sig: .920
Internal conflict resolution mechanism, interest harmonisation *		
Factor 3	Mann-Whitney U: 26	Asymp. Sig: .482
Internal conflict resolution mechanism, interest harmonisation *		
Competent contact partner is designated and reachable	Mann-Whitney U: 22	Asymp. Sig: .269
Internal conflict resolution mechanism, interest harmonisation *		
Existence of potential research partners in the provider country	Mann-Whitney U: 22	Asymp. Sig: .269

Source: Author.

Table A 46: Detailed interrelation of explanatory variables with governance elements

Explanatory variables	Correlation	Governance Element (Items)
Governance variable: Contract type		
Primary uncertainty of R&D with genetic resources		
Timeframe of utilisation	-	Tired contract (against prediction)
Uncertainty about commercial outcome of utilisation	-	Tired contract (against prediction)
Interaction takes place frequently over a longer period of time	+	Tired contract approach
Indirect capacities: experiences related to projects in developing or newly industrializing countries	+	Tired contract approach
Governance variable: Contract duration		
Capacity building		
Technology transfer	+	Contract duration
Know-how transfer in the scientific field	+	Contract duration
Support of other measures to preserve biodiversity	+	Contract duration
Know-how transfer in the field of sustainable use / cultivation of genetic resources	+	Contract duration
Synergy effects of capacity building		
Providers will be better positioned to provide the desired activity	+	Longer timeframes for contract duration
Capacity building increases trust and facilitates communication	+	Longer timeframes for contract duration
Governance variable: Monetary benefit-sharing		
Provider contribution		
Exclusivity rights	+ +	Negotiated payments that are made after reaching certain steps in the usage process Payments tied to commercial output
Evaluation of material	+	Negotiated advance payments
Preparation of material	+	Weight-related, or hourly-wage compensation
Collection permission	+	Negotiated advance payments
Asset specificity	+	Output-related types of monetary benefit-sharing

Table A 46 continued	**Correlation**	**Governance Element (Items of Element)**
Primary uncertainty of R&D with genetic resources		
Demand and Market uncertainty	-	Weight-related, and hourly wage compensation
Uncertainty about the development of the utilization process	+	Negotiated advance payments (against prediction)
Indirect capacities	+	Flexible payment mechanisms
Governance variable: Non-monetary benefit-sharing		
Provider contribution		
Contribution to advanced research	+	Joint publications
	+	Technology transfer
	+	Transfer of know-how in the scientific field
Collection permission	+	Support inventory and taxonomy of Biodiversity
	+	Transfer of know-how in the scientific field
Exclusivity rights	+	Joint IPRs
Preparation of material	-	Support inventory and taxonomy of Biodiversity
Strategic factors of capacity building		
Providers will be better positioned to provide the desired activity	+	Transfer of know-how in the scientific field
	+	Technology transfer
Capacity building increases trust and facilitates communication	+	Transfer of know-how in the scientific field
	+	Technology transfer
Capacity building ensures long-term availability of GRs	+	Transfer of know-how in the scientific field
	+	Know-how transfer in the field of sustainable use and/or cultivation of GRs
Interaction takes place frequently over a longer period of time	+	Support of inventory and/or taxonomy of biodiversity
	+	Technology transfer

Table A 46 continued	Correlation	Governance Element (Items of Element)
Indirect capacities		
Experiences in projects with partners from developing or newly industrializing countries	+	Joint IPRs to usage results
	+	Joint publication in scientific journals
	+	Support of inventory / taxonomy of Biodiversity
	+	Technology transfer
	+	Transfer of know-how in the scientific field
	+	Transfer of know-how in the field of sustainable use / cultivation of GRs
	+	Support other measures to preserve biodiversity
High capacity to execute long-term, complex projects	+	Yes, technology transfer
Experience in the past of executing complex long-term projects	+	
Transaction environment		
Factor 2	+	Joint IPRs to usage results
Factor 3	+	
Factor 3	+	Support other measures to preserve biodiversity
Governance variable: Conflict resolution		
Provider contribution		
Contribution to advanced research	+	Third party assisted arbitration
Collection activities	+	Judicial authorities
Provider grants some kind of exclusivity in connection with genetic resources	+	
Only access to previously inventoried GRs	+	
Synergy effects of capacity building		
Providers will be better positioned to provide the desired activity	+	Internal conflict resolution and measures for harmonization of interests.
Capacity building increases trust & facilitates communication	+	
…ensures long-term availability of GRs	+	
…prerequisite for scientific cooperation	+	
Primary uncertainty of R&D with genetic resources		
Demand and Market uncertainty	-	Internal conflict resolution…
Uncertainty resulting from technological change	-	Internal conflict resolution…
	+	Judicial Authority
Unpredictability of commercial output of utilization	-	Internal conflict resolution …

Source: Author.

Table A 47: Kruskal Wallis test: differentiation of user companies' sectors affiliation in combination with demand aspects for genetic resources

Sector affiliation aggregated in five categories (sector_aggr5) * For some projects in our company was or is access...	Chi-Square value	Kruskal Wallis Test Asymp. Sig [a]	N
... to undiscovered genetic resources as a potential source of innovative products very important.	1.476	.831	57
... to properties of wild species of certain plants or animals very important.	10.105	**.039**	56
... it very important to be able to study GRs in the context of their natural habitat.	6.201	.185	58
... traditional knowledge about effectiveness of natural resources very important	14.623	**.006**	58
... exclusive access or exclusive usage rights for genetic resources very important.	5.016	.286	56
... it very important that the provider could deliver the genetic resource(s) as raw material on an intermediate or long-term basis in larger quantities.	6.481	.166	54

Source: Author.