THE APPROACHES OF 'BENEFIT-SHARING' IN THE NAGOYA PROTOCOL

A CASE STUDY ON 16 ACCESS AND BENEFIT-SHARING (ABS) AGREEMENTS IN THE GLOBAL SOUTH

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Abstract

Introduction. Worldwide climate change is having a big negative impact on food security and poverty. Therefore, there is an increasing urge for crops which are more resilient to heat waves, droughts, etc. Crucial in adaptation of crops to climate change is the diversity and exchange of plant genetic resources.

The Nagoya Protocol (NP) is an international convention that regulates access to plant genetic resources. Under the NP, countries have the authority to regulate access to their genetic resources and set out conditions for sharing of benefits. However, hardly any genetic resources have been exchanged after the establishment of the NP. One of the major hurdles is the establishment of access and benefit-sharing (ABS) agreements. These issues arise from a lack of clarity to the types of benefits that can be shared.

This study will seek to fill this gap by looking at the limited number of ABS agreements that have been successfully established under the NP and to study what types of access and benefit-sharing these parties have managed to agree upon. This research focuses on ABS agreements in the Global South. Therefore, the following research question is established: *How are the different approaches of benefit-sharing practically applied in making ABS agreements under the Nagoya Protocol in the Global South?*

Theory. To answer the research question, the theory of de Jonge & Louwaars (2009) on six different approaches for engaging in benefit-sharing is used. The six approaches are 1) South-North imbalance in resource allocation and exploitation 2) Need to conserve biodiversity 3) Biopiracy and the imbalance of property rights 4) A shared interest in food security 5) An imbalance between Intellectual Property Rights (IPR) protection and the public interest 6) Protecting the cultural identity of traditional communities.

Methods. The research is conducted by seventeen semi-structured interviews and additional written material, studying 16 ABS successful agreements in nine different countries in the Global South.

Results. Each of the six approaches has it own set of benefits and a total of twenty-three types of benefits are found. This includes monetary and non-monetary benefits, ranging from paying a percentage of the sales to national authorities to co-publication. Moreover, in addition to the benefits in the formal agreement, also a set of external benefits was found, such as helping with socio-economic projects in local communities. And lastly, a local partner played a crucial role in almost all the agreements

Conclusion & Discussion. This research showed comparable results to previous literature on benefit-sharing, but also made an addition to academic literature by conceptualizing the concept of 'benefit-sharing' in the context of plant genetic resources.

Key words: access and benefit-sharing, Nagoya protocol, agreements, benefits

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List of abbreviations

ABS	Access and benefit-sharing
CBD	Convention on Biological Diversity
IPR	Intellectual Property Rights
IRCC	Internationally Recognized Certificate of Compliance
ITPGRFA	International Treaty for Plant Genetic Resources
MAT	Mutually Agreed Terms
NP	Nagoya Protocol
PGR	Plant Genetic Resources
PIC	Prior Informed Consent
PIPRA	Public Intellectual Property Resource for Agriculture
TK	Traditional Knowledge
TRR	Traditional Resource Rights

1. Introduction

Worldwide climate change is having a big negative impact on food security and poverty (FAO, n.d.). Therefore, there is an increasing urge for crops which are more resilient to abiotic and biotic stresses, such as heat waves, droughts, floods and pests. Crucial in adaptation of crops to climate change is the diversity of plant genetic resources (Brink & van Hintum, 2020; Hoisington et al., 1999; Jump et al., 2009; Pauls et al., 2013). Diversity is needed for crossing and selection of plant genetic resources. For example, wild relatives can be used to breed new varieties that can cope with changing conditions (Brink & van Hintum, 2020). Plant Genetic Resources (PGR) not only include wild relatives, but also cultivated varieties, obsolete varieties, landraces, wild species, mutants and research populations (Brink & van Hintum, 2020).

Regarding conservation of plant genetic resource diversity, in-situ and ex-situ can be distinguished. In-situ conservation means 'conditions where genetic resources exist within ecosystems and natural habitats, and, in the case of domesticated or cultivated species, in surroundings where they have developed their distinctive properties' (e.g., wild plants; and local communities, farmers and Indigenous people). And ex-situ conservation means 'the conservation of components of biological diversity outside their natural habitats' (e.g., seedbanks, botanical gardens and formal sector plant breeders) (CBD, 2011).

There are several international conventions that regulate access to genetic resources, including the Nagoya Protocol (NP) and the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA). In the NP, countries have sovereign rights over their resources, which means that countries have the authority to decide whether they wish to regulate access to their genetic resources and set out conditions for sharing of benefits. Under the NP, countries also have the authority to set out conditions for sharing benefits that may be derived from the use of genetic resources (CBD, 2011). This is also known as 'benefit sharing'. This refers to ''*the action of giving a portion of advantages/profits derived from the use of non-human genetic resources or traditional knowledge to the resource providers, to achieve justice in exchange*" (Schroeder, 2007, p. 207). In this way, the NP creates incentives to conserve and sustainably use genetic resources, and thereby enhances the contribution of biodiversity to climate change adaptation. Also it focuses on fair and equitable sharing of the benefits arising out of the utilization of genetic resources, which means that measures (e.g. compliance with ABS regime and mutual agreement terms for benefit-sharing) are given to ensure that users of GR do not misuse genetic resources and traditional knowledge associated with those resources (CBD, 2012; Morgera, 2016).

In the past, there was no fair and equitable benefit sharing, and plant genetic resources were seen as common heritage of humankind. This meant that genetic resources were freely collected and used by other countries rather than the country of origin. This could lead to negative consequences for developing countries (Deplazes-Zemp et al., 2018; Hamilton, 2008; Mgbeoji, 2014; Suiseeya, 2014). For example, this could result in cases where developed country companies patented crops of local and indigenous people and did not give any of benefits back to these groups - a phenomenon also known as biopiracy (Mgbeoji, 2014). The NP tries to reduce this problem by recognizing the sovereignty of each state over its natural resources (Secretariat of the Convention on Biological, 2011).

However, whereas the NP was intended to incentivize both the fair sharing of benefits *and* the conservation and exchange of plant genetic resources, in practice, hardly any genetic resources have been exchanged after the establishment of the NP in 2010 (UN Environment, 2020). In 2020, 1211 certificates have been published on the website of the Convention on Biological Diversity (CBD). In comparison to the ITPGRFA, another key protocol for the exchange of plant genetic resources, this is

quite low. In this protocol 76,000 standard material transfer agreements have been exchanged (UN Environment, 2020). Thus, this is much bigger than the exchange of genetic resources in the Nagoya Protocol. There are several reasons for this. For one, there are problems with national level implementation of the NP (Halewood et al., 2021; Morgera et al., 2014; Robinson, 2014). Examples are a lack of commitment of relevant national institutions to provide access to genetic resources. Or a lack of financial, technical and human capital resources to implement the NP in a sufficient way (Morgera et al., 2014).

Besides problems with implemeting the NP in the country of origin, another major hurdle that has prevented the exchange of plant genetic resources has been the establishment of access and benefit-sharing (ABS) agreements (Heinrich et al., 2020; Ruiz Muller, 2018; Schroeder et al., 2020). Under the NP, genetic resources can only be shared after an ABS agremeent has been established. In such an agreement, the parties involved in the exchange have to describe the conditions for the parties to access those resources, and they have to describe how the party will share the benefits that are derived from using those resources within the country of origin. For example, the parties are a country with genetic resources and a company from another country who wants to use those resources. Establishing such an ABS agreement has been found to be a major stumbling block for exchanging genetic material (Heinrich et al., 2020; Ruiz Muller, 2018; Schroeder et al., 2020). Importantly, these issues do not only arise from difficulties in establishing how many benefits should be shared, the issues also arise from a lack of clarity as to the types of benefits that can be shared (Heinrich et al., 2020; Schroeder et al., 2020). The NP tries to ease the process by giving a list of possible (non-) monetary benefits which can be shared, such as up-front payments or milestone payments (See Appendix I - Overview of Possible Benefits of ABS Agreements of the Nagoya Protocol). However, these benefits are quite abstract, and it has proven difficult to agree on concrete benefits that could be shared. Despite it being a major obstacle for accessing genetic resource, there are no studies on the current ABS agreements of the NP.

This study will seek to fill this gap by looking at the limited number of ABS agreements that have been successfully established under the NP and to study what types of access and benefit-sharing these parties have managed to agree upon. This research focuses on ABS agreements in the Global South because most ABS agreements are established there (ABSCH, n.d.). The reason is that the objective ‘fair and equitable benefit-sharing' of the NP, is mainly designed to reduce inequalities for the providers in the Global South. This inequality originated from the commercial utilization of genetic resources by the users in the Global North, and not sharing the benefits with the providers in the Global South (Deplazes-Zemp et al., 2018).

Currently, there is only one suitable conceptual framework on benefit-sharing with a focus on PGR, which was developed by De Jonge & Louwaars. De Jonge & Louwaars (2009) identified six different approaches for engaging in benefit-sharing. These different approaches are defined based on “central motivations for benefit-sharing that are extracted from the debate with respect to plant genetic resources” (de Jonge & Louwaars, 2009, p. 3). The six approaches are 1) South-North imbalance in resource allocation and exploitation 2) Need to conserve biodiversity 3) Biopiracy and the imbalance of property rights 4) A shared interest in food security 5) An imbalance between Intellectual Property Rights (IPR) protection and the public interest 6) Protecting the cultural identity of traditional communities. Each of these different approaches derives from diverse types of ‘access and benefit-sharing’. For example, if one approaches ABS as a mean to safeguard biodiversity, then the benefits that should be agreed upon in the ABS should be relevant for safeguarding biodiversity. Thus, these different approaches can help to better understand what types of access and benefit sharing exist and it will help to identify and categorize the different types of benefits that I will identify in this empirical study.

As a result, the following research question and subquestions arose:

How are the different approaches of benefit-sharing practically applied in making ABS agreements under the Nagoya Protocol in the Global South?

The findings of this research may also be relevant beyond the field of agriculture. Benefit sharing has become more popular across a number of sectors in recent years, such as the healthcare industry and human research subjects. But its conceptual foundations, terminology, and framework are still vague and underdeveloped (Schroeder, 2007; Wynberg & Hauck, 2014). Therefore, this study contributes to the conceptualization of the concept 'access and benefit-sharing'.

Besides the theoretical relevance, this research also aims to be socially relevant. This research can encourage users to seek access to genetic resources in developing countries by easing collaboration and negotiation on ABS agreements. This can help in reducing the transactions costs and time. An increase of ABS agreements, and thus an increase in diversity of PGR, can be valuable for researchers trying to find more climate resilient crops, such as project 'Plant XR', which tries to find new climate extra-resilient crops by using 'smart' data and intelligent analytics (NWO, n.d.). In the end, the increase of more resilient crops can have a positive impact on farmers and society by increasing food security. Farmers have more reliable and stable yields and need to invest less in adaptation management. Additionally, citizens will have a higher level of food security and a higher insurance of access to more affordable food (FAO, 2010; NWO, n.d.).

The outline of the research is as follows. Chapter 2 discusses the background information of the Nagoya Protocol. In Chapter 3, previous research on the NP, and the theory of De Jonge & Louwaars (2009) on access and benefit-sharing approaches is explained. In Chapter 4, methodology, the case study research design, collection, and the analysis are explained. In Chapter 5, the results are explained. In Chapter 6, the research findings, method, and theory are discussed and recommendations for future research are suggested. And lastly, in Chapter 7, a conclusion is provided.

2. Background information Nagoya Protocol

In the past, PGR used to be seen as common heritage of humankind, which means that genetic resources in one country could be freely collected and used by other countries. The lack of possibilites to regulate access to PGR resulted in outcomes that were widely seen to be unfair (Halewood, 2013). An example is the tumeric case, where the United States awarded a patent on tumeric to a university for wound healing property. Tumeric is known as a medicine, food ingredient and natural dye and has been known and used since ages by Indian households. Thus the TK on tumeric is not something new and patenting would privatize traditional knowledge (Balasubramanian, 2017). This was just one example, but there are many cases where developing countries worked for centuries to improve certain plant properties and did not achieve any benefits (Deplazes-Zemp et al., 2018; Hamilton, 2008).

The CBD sought to address this issue by recognizing the sovereignty of each state over its natural resources. However, the implementation of the CBD did not carefully address the inclusion of traditional knowledge holders and local communities in the protocol. For example, the local communities and indigenous people were excluded from decision-making processes; received nearly no additional benefits; and steadily losed control over their resources and related traditional knowledge. Even though their resources and traditional knowledge are highly valuable in enriching the knowledge about the use of biodiversity (Suiseeya, 2014).

Therefore, the NP was established in 2010 with the objective to ensure that benefits from utilizing genetic resources are shared in a fair and equitable way (CBD, 2011). A central mechanism to achieve this was the provision that genetic resources could be exchanged only if the exchanging parties would agree on so-called access and benefit-sharing agreements. There are a few important actors involved in access and benefit-sharing: providers, users, and national focal points (see Figure 1). The providers of genetic resources give access to genetic resources and receive the benefits resulting from their use. Providers are competent national authorities (governments) or civil society bodies, which can include private landowners and communities. Some countries decide to include Indigenous and local communities to negotiate on terms of access and benefit-sharing. Participation of this group can be important when traditional knowledge associated with genetic resources is being accessed (CBD, 2011).

The users of genetic resources are actors who want to have access to genetic resources and are responsible for sharing the benefits that derive from the use of those resources. The users are divided in two groups based on how they use the genetic resource: commercial use or non-commercial use. According to the CBD (2011), commercial use is when *"companies use genetic resources to develop specialty enzymes, enhanced genes, or small molecules. These can be used in crop protection, drug development, the production of specialized chemicals, or in industrial processing"*. The commercial users can be divided in plant breeders and collectors; horticulture companies; and biotechnology companies, such as pharmaceutical companies, cosmetics companies and seed companies. And non-commercial use is when "*genetic resources are used to increase knowledge or understanding of the natural world, with activities ranging from taxonomic research to ecosystem analysis*". The non-commercial users are mostly public research institutes and botanical gardens (CBD, 2011).

The last actors are national focal points. Every country has one national focal point. The national focal points can be seen as 'helpdesks' and ease the facilitation of access by saving time and costs (CBD, 2011; IUCN, 2012). They are institutions that provide information to the users on the processes of gaining access to genetic resources. Additionally, they share knowledge on the competent national authorities and relevant stakeholders (IUCN, 2012).

The process of access and benefit-sharing consists of multiple steps. First, permission to access the genetic resources is given by the competent national authority of a provider country to the users, also known as the Prior Informed Consent (PIC). After signing the PIC, Mutually Agreed Terms (MAT) are reached between providers of genetic resources and users. This is another agreement reached between providers of genetic resources and users on the use of the resources, and the benefits to be shared between both parties (CBD, 2011). The Nagoya Protocol helps by giving a list of possible (non-) monetary benefits, such as up-front payment and sharing of R&D results. This list can be found in Appendix I .

Under the NP, each country can make their own rules and procedures for accessing and sharing benefits. For example, countries may choose to extend the scope of their ABS regime to not only cover genetic but also biological resources. Additionally, each country has its own legal system, national authorities and stakeholders. Furthermore, they can have different ways for regulating access: a very restrictive approach or they provide free access. This is widely perceived to have increased the complexity of the NP (Greiber et al., 2012). These complex situations can resist and discourage the potential users from seeking access to genetic resources (Brink & van Hintum, 2020; Greiber et al., 2012).

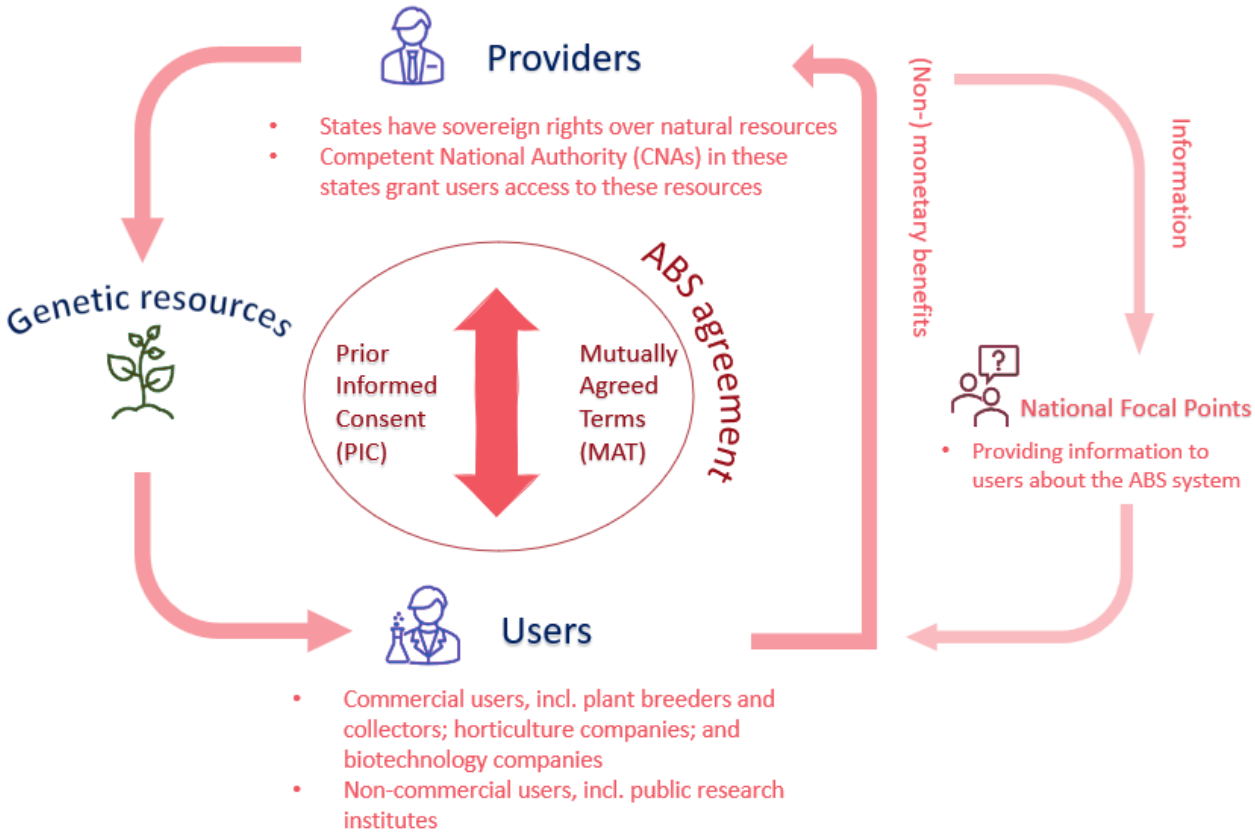

Figure 1 Overview of the different actors (adapted from CBD, (2011))

3. Theory

3.1 Previous research

In last decades there has been a shift of the conceptualization of genetic resources from being a public good, available to everyone without restriction, to seeing genetic resources as a commons. A commons refers to 'a shared resource, co-governed by a community of users according to their rules and norms' (Halewood, 2013). This implies that it is not available without restriction. This shift is mainly due to the arise of various forms of exclusive technological and legal restrictions (Halewood, 2013). There are multiple institutions that govern these genetic resources as commons, such as the International Treaty for Plant Genetic Resources (ITPGRFA) focusing on accessing PGR for food and agriculture; the Pandemic Influenza preparedness (PIP) framework focuses on the exchange of human genetic resources, for the concern of human kind; and lastly the Nagoya Protocol which focuses on the exchange of genetic resources for conservation efforts (Schroeder, 2020). Thus, seeing genetic resources as commons can help to increase global justice.

In 2010, the NP came into effect. Ever since, almost no genetic resources have been exchanged. Current research on this issue has mainly focused on problems related to the implementation of the NP in the country of origin (Halewood et al., 2021; Morgera et al., 2014; Robinson, 2014). The research of Morgera et al. (2014) explains the challenges of implementing the NP in the country of origin. There are difficulties with the engagement and commitment of the relevant national institutions, which provide access to the genetic resources. Furthermore, there is a lack of financial, technological and human capital resources to effectively implement the NP.

Additionally there are problems with representing local communities and indigenous people in the ABS agreements (Bavikatte & Robinson, 2011; Jonas et al., 2010; Robinson et al., 2021). For example Bavikatte & Robinson (2011) and Jonas et al. (2010) have shown that local communities and indigenous people were not included in the decision-making processes and received nearly no benefits. Their resources and related traditional knowledge are important for enriching biodiversity. Therefore, to increase their participation, customary laws, community protols and procedures were established. The community protocols are formed by investigating the needs and values of local communities and indigenous peoples and thereby engaging them in ABS agreements (Jonas et al., 2010).

Next to the explained problems, there is another major bottleneck that is also crucial for the exchange of PGR that has not been addressed: the type of benefits that can be shared. For example, there is trouble with establishing the level of (non-)monetary benefits. Most studies on access-and benefit sharing agreements give advice on how to negotiate successful ABS agreement, or show model contractual clauses, and show which topics and sentences should be included in ABS contracts. However, no examples of specific benefits are given (CBD, 2018; Schroeder et al., 2020). Additionally countries find it hard to quantify the percentage of total benefits shared by users with provider countries (UNCTAD, 2016). This confusion is clearly shown in the ABS laws of Vietnam. They state that the user should share at least 30% of the total benefits on the use of the genetic resource with the provider in money. It is not completely clear what they mean with total benefits. But this is quite a high percentage of the monetary benefits, if you compare it with African and Latin American countries, which ask between 1-4 percent of the sales of the end-product (UNCTAD, 2016). Thus, actors involved in establishing ABS agreements often struggle in agreeing on the type of benefits that should be shared, how these should be shared, and how much should be shared.

There are some studies on ABS-agreements before the NP (Barizah & Winarsi, 2020; Robinson, 2014). In the research of Robinson (2014), sixteen ABS agreements, or case studies, are studied between 1980-2010 ranging from plants for medicinal, cosmetic, biotech and food products. These case studies

helped to make the steps of an ABS agreement clearer and show types of benefits which can be included in an ABS agreement. In the research of Barizah & Winarsi, (2020) three cases are studied, namely the Kani case in India, the Kava case in the Pacific Ocean and the Hoodia case in South Africa. This research tried to investigate whether ABS agreements in practice can empower the economy of local communities (Barizah & Winarsi, 2020). However, these ABS agreements are established before the NP, and thus do not shown the current situation of the NP. Thus, there are no studies on the current ABS agreements of the NP. Therefore, it can be valuable to learn from these existing, successful access and benefit-sharing agreements and the motivations behind these agreements. This will help to ease the collaboration and negotiation on ABS agreements.

3.2 Diversity of approaches to access & benefit-sharing

In this thesis, I will use the theory of de Jonge & Louwaars (2009) theory on access and benefit-sharing to identify the types and amounts of benefits that actors have agreed upon in the exisiting ABS agreements. This theory describes six different approaches based on "*central motivations for benefit-sharing that can be extracted from the debate with respect to plant genetic resources*" (de Jonge & Louwaars, 2009, p. 3). The approaches range from establishing ABS in order to ensure global equality, to establishing ABS in order to safeguard biodiversity. Each of these approaches comes with different types of 'access and benefit sharing'. For example if one approaches ABS as a mean to safeguard biodiversity, then the benefits that should be agreed upon in the ABS should be relevant for safeguarding biodiversity, like funding for improving gene banks or trainings for farmers to conserve landraces. Yet, if one approaches ABS as a means to reduce income inequality, the benefit agreed upon should relate to that objective, for example providing monetary means to the poorest communities. These different approaches can thus help to better understand what types of access and benefit sharing exist.

De Jonge and Louwaars (2009) identified six different approaches for engaging in benefit-sharing (See Table 1). The approaches consist of a basic description of the approach, the establishing mechanisms, and the intended outcome, which can be found in Table 1.

Table 1 Summary of the basic approaches and their establishing mechanisms and outcomes (De Jonge & Louwaars, 2009)

	Basic Approach	Establishing Mechanism	Intended Outcome
1	South-North imbalance in resource allocation and exploitation	National sovereignty over plant genetic resources	Equity in international economic relations
2	Need to conserve biodiversity	Benefits to support conservation efforts	Conservation and sustainable use of PGR
3	Biopiracy and the imbalance of property rights	Countervailing rights systems and user measures	Equity in legal rights over PGR and related knowledge
4	A shared interest in food security	Facilitated access and exchange of PGRFA	Food security and sustainable agriculture.
5	An imbalance between IPR protection and the public interest	Stimulating technology transfer and knowledge sharing	Equity in distributing the benefits of research and development
6	Protecting the cultural identity of traditional communities	Recognition for customary laws in ABS regimes	Preserving and restoring traditional communities and their cultures.

Under the first approach 'South-North imbalance in resource allocation and exploitation' parties engage in ABS, because this promotes equity in international economic relations. The genetic resources of developing countries used to be seen as free goods and were used in the Global North for research and commercialization of seeds, medicines, and chemical products. The countries in the Global North accrued the economic benefits and did not share the benefits with the Global South (Kloppenburg, 2005). To reduce this imbalance in resource allocation, actors who adhere to this approach see plant genetic resources not as a common heritage, and states should have sovereign rights over their plant genetic resources. The NP gives the states sovereign rights over their genetic resources.

Under the second approach 'the need to conserve biodiversity' parties engage in ABS, because it can provide funds to enable biodiversity conservation. The conservation of biodiversity is important, because a wide variety of genetic resources copes better with threats, such as pollution, climate change or human activities and thus the ecosystem is better able to adapt and survive (Chivian & Bernstein, 2010). When taking this approach, actors see access and benefit sharing as a means to achieve the goal of more conservation of biodiversity. This can take different forms, such as paying special fees to trust funds supporting conservation and sustainable use of biodiversity (de Jonge & Louwaars, 2009). Fees can be paid to trust funds, such as BioTrade and INBio.

Under the third approach 'biopiracy and the imbalance of property rights' parties engage in ABS, because this promotes equity in legal rights over PGR and related knowledge. The imbalance in allocation of Intellectual Property Rights (IPR) over PGR and related knowledge started during the 20th century when industrialized countries expanded their IP systems to include new plant varieties and genetic material. They made misuse of the IPR system by patenting biological resources from Indigenous people and local communities, without compensating them (Robinson, 2010). To increase equity in legal rights over PGR and related knowledge, various countervailing rights systems and user measures can be established. An example of such a system is Traditional Resource Rights (TRR), which helps to protect both the genetic resources and traditional knowledge of Indigenous people through a 'bundle of rights'. This not only encompasses intellectual property rights, but also human rights, land rights, religious rights, and cultural property. Another mechanism to reduce cases of biopiracy is to disclose the 'origin,' 'source' or 'legal provenance' of the genetic resources and their associated knowledge by patent applicants (de Jonge & Louwaars, 2009). However, in some cases it is quite difficult to find the basis of origin (Bagley & Perron-Welch, 2020).

Under the fourth approach 'a shared interest in food security' parties engage in ABS, because this promotes food security and sustainable agriculture. Food and agriculture can be seen as a common heritage of humankind. This is strengthened by the observation that countries are interdependent regarding their agricultural plant germplasm. However, because of population growth and threats of diseases, pest and climate change, diversity in crops is increasingly important (Galluzzi et al., 2016). The conservation and exchange of plant genetic resources is thus considered essential for food security. To increase this, access and exchange of PGRFA should be facilitated. This can be done by the benefit sharing mechanisms 'sharing research and development results around PGR for agriculture' (de Jonge, 2011).

Under the fifth approach 'the imbalance between intellectual property protection and the public interest' parties engage in ABS, because this promotes equity in distributing benefits of research and development. Current intellectual property legislation may block the sharing of research and development in society. Not all people in society benefit from the present IP system, and the R&D that is being developed from it. For example, in biotechnology, here the focus is mainly on commercial crops for developed countries, and less attention is paid to developing countries and their needs (de

Jonge & Louwaars, 2009). Another problem is that since genetic material and knowledge can be protected, R&D in this field is in an 'anti-commons trap' (de Jonge & Louwaars, 2009; Heller, 1998). The anti-common trap exists when too many entities have exclusive rights to a given resources, which leads to underuse of the resource. An example of a drug company which had difficulties with making the medicine, because too many patents were involved. Eventually, they did not make the medicine, which led to a negative influence on human health (Heller, 1998).

To have more equity in distributing benefits of research and development, technology transfer and knowledge sharing can be stimulated. There are various mechanisms to establish this. One of these mechanisms is the Public Intellectual Property Resource for Agriculture (PIRPA), which aims to 'enable technologies developed in the public sector to have the broadest possible impact in society' (PIPRA, n.d.). Another mechanism is the Humanitarian Use Licenses, in which the right holder allows the use of a specific technology to be used in certain uses, e.g., golden rice. In the golden rice case, farmers from developing countries can freely gain access to the technology for golden rice (de Jonge & Louwaars, 2009; Golden Rice Humanitarian Board, n.d.).

Under the sixth and last approach 'protecting the cultural identity of traditional communities in a globalizing world' parties engage in ABS, because this promotes preserving and restoring traditional communities and their cultures. This relates to the differing worldviews of traditional communities on different topics, such as protection of intellectual property. For example, small farmers can see protecting themselves against biopiracy via IPR as a form of globalization, one that intrudes their traditional lifestyles and cultures. It is important to take their differing worldviews as a starting point for access and benefit-sharing agreements (de Jonge & Louwaars, 2009).

To protect the cultural identity of traditional communities, a wider view on the role of nature, traditional knowledge and its relationship to traditional resource management systems should be considered. This can be established by customary laws in ABS regimes. Customary laws relate '*to use of and access to natural resources, rights and obligations relating to land, inheritance, and property, conduct of spiritual life, maintenance of cultural heritage and knowledge systems, and many other matters*' (WIPO, 2016). A good example of a customary law is the reversing of the ABS regime in the Potato Park in Peru. Here, the interests and customary laws of indigenous farms were central by aiming to return the genetic resources and traditional knowledge once taken from them. And to ensure that the genetic resources and traditional knowledge were not subject to IPR and remained under their custody. And lastly, to recognize the ability of the farmers to conserve and sustain the genetic resources for the benefit of all humankind and their people (Argumedo, 2008).

4. Methodology

4.1 Research Design

This research aims to provide an answer to the research question via exploratory, qualitative research design of a multiple case study. The research took a qualitative approach, which was beneficial as it conveys the processes and deeper meanings behind events and activities. Therefore, this qualitative perspective generally takes a more social constructivist approach, as "truth and meaning do not exist in some external world but are constructed through peoples' interactions with the world" (Gray, 2013, p. 193). This social constructivist approach is also relevant in this research, as the focus is put on the perspective of the users and providers of the ABS agreements.

As described in the introduction, the conceptual foundations, terminology and framework of benefit-sharing are still vague and underdeveloped (Schroeder, 2007; Wynberg & Chennells, 2009). Therefore, this research is exploratory, which means that research questions are explored that have not previously been studied in depth. According to Yin (2009), case study research is a suitable research method when studying an exploratory concept.

Additionally, contextual conditions are relevant to the phenomenon under study in case study research. The ABS agreements cannot be considered without their context, namely the national access and benefit sharing mechanisms and policies. These national policies have a significant impact on establishing ABS agreements. Contextual conditions are therefore important for this research. Lastly, case study research is suitable for answering 'how' or 'why' research questions, which is in line with the research question (Yin, 2009).

4.2 Case Study Selection

In this research a case is a successful ABS agreement that was signed by users/providers. These agreements are all collected at the so-called ABS Clearing-House. That is why the first step in my case selection was to explore this database. The ABS Clearing House is a global platform for exchanging information on access and benefit-sharing under the NP (ABSCH, n.d.). It is good to note that in the ABS Clearing House, the ABS agreements are called internationally recognized certificate of compliance (IRCC). The IRCC acts as proof that genetic resources have been accessed in accordance with the NP (ABSCH, 2018). Thus, this database presents a clear overview of all the established ABS agreements, and therefore this database is suitable for data collection on ABS agreements.

Next, in the ABS clearing house, I looked for plant genetic resources, commercial and non-commercial use, and developing countries. This gave me a comprehensive list of all successful ABS agreements. I selected this based on different reasons. The first filter 'subject matter' was selected on Plant Genetic Resources (PGR), because the focus of this research is on genetic resources for the adaptation of crops to climate change. The second filter 'developing countries' selects only countries in the Global South. The reason is that the objective 'fair and equitable benefit-sharing' of the NP, is mainly designed to reduce inequalities for the providers in the Global South, as explained in the introduction (Deplazes-Zemp et al., 2018).

After applying the filters, a selection of 102 ABS agreements in nine different countries was found (See Table 2). It is important to investigate ABS agreements in multiple countries in the Global South because every country can have his own interpretations of the ABS system, and thus making their own rules and procedures for accessing and sharing of benefits (Brink & van Hintum, 2020; CBD, 2011). Therefore, different types of benefits could occur in the different countries.

Due to time constraints, it was not possible to gain knowledge about all the ABS agreements. Therefore, I focused on two ABS agreements per country. Ethiopia was an exception with only one agreement in the ABS Clearing house. Therefore, I tried to investigate a total of seventeen ABS agreements (10% of the total amount of ABS agreements). I investigated an equal amount of commercial and non-commercial agreements. By investigating two different types of ABS agreements, I gained a broad perspective on ABS agreements.

Table 2 Overview of the IRCCs (Internationally Recognized Certificate of Compliance) by country based on the first three criteria

Position	Country	Amount of IRCCs (available ABS agreements)
1	South Africa	29
2	India*	23
3	Kenya	14
4	Peru	14
5	Panama	13
6	Mexico	7
7	Benin	3
8	Ethiopia	1
9	Guatemala	2
	Total	**103**

**India divides their IRCCs in four distinct categories based on different sorts of applications: Form I, II, III and IV. Form I is access to biological resources and/or associated traditional knowledge; Form II is transferring the results to foreign companies; Form III application for IPR; and Form IV third party of the accessed biological resources. For this research Form I is most interesting, because the focus is solely on biological resources, and in comparison, to the other groups can also include non-monetary benefits. Therefore, I decided to only include Form I in my research. The biggest group is Form III, which works more as a database for patents.*

4.3 Data Collection

To collect data about these ABS agreements, I interviewed various actors involved in the selected ABS agreements and used written material available on these cases to gain deeper knowledge on the specific ABS agreements. The interviews are semi-structured to gain a deeper understanding on the types of benefits, which is needed for answering the research questions (Cassell & Symon, 2004). Another reason to conduct interviews was that the data about the ABS agreements in the ABSCH platform only consist of a concise description of the ABS agreement and no in-depth description of the specific (non-) monetary benefits.

After the selection of the interesting ABS agreements in the ABSCH House, I got a list of 107 agreements. The goal was to investigate at least two agreements for the countries with multiple ABS agreements and one ABS agreement for the countries with only one ABS agreement (e.g., Ethiopia) (See Table 2). The interviewees were gathered by means of convenience sampling. I made a comprehensive list of all the ABS agreements and started sending emails to the first ABS agreement of each country on the list. This list was randomly ordered. For each ABS agreement, I tried to interview the provider or the National Focal Point (NFP) as well as the user of the GR. The providers are the ones facilitating access to genetic resources and consist of the competent national authority or civil society bodies, such as local communities. The users seek access to genetic resources, and consist of a more diverse group, such as botanical gardens, industry researchers, collectors, and research institutes (CBD, 2011). These multiple observations on the same ABS agreement helped to increase the credibility and validity of the research (Bashir et al., 2008). The contact information of 'users' and 'providers' can be found on the website of the ABS-Clearing House. Sixty-five emails were sent out to different 'users' and 'providers'. Despite (repeated) attempts to reach these different users and providers, eighteen

interviews were conducted. All the interviews were done via MS teams, and each interview was between 45 and 80 minutes. An overview of the geographical location of the interviewees can be found in Figure 2.

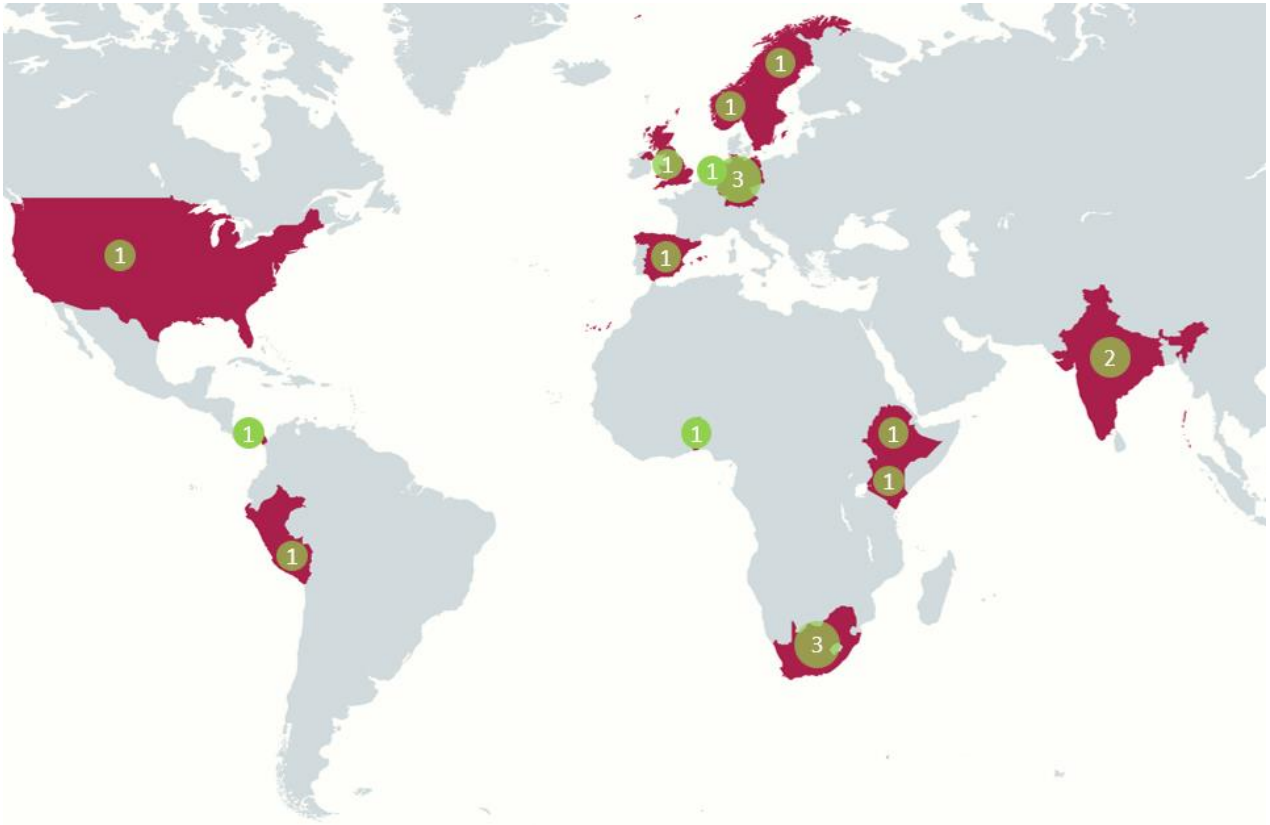

Figure 2 Geographical Indication of the Interviewees

The initial plan was to have an interview with the user as well as the provider of a specific ABS agreement. However, it turned out that it was quite difficult to contact the providers of most ABS agreements. Therefore, I tried to interview NFP as well, because they are collaborating closely with the providers of the GR. In the end, I managed to interview three NFP. But it turned out that NFP found it quite hard to talk about the specific ABS agreements, because they participated in multiple other ABS agreements and had difficulties to remember all the details. In addition, some NFP found it really hard to speak English. To reduce this problem, one of the interviews was with a Spanish interpreter. Therefore, the interviews with the NFP provided more as background information about the ABS system in the country of origin.

Also, during the interviews, I decided two include two other ABS agreements which were not included in the ABS Clearing House. Firstly, the Rooibos agreement is included. Multiple interviewees mentioned the Rooibos agreement in South Africa. This is an industry wide agreement, which means that multiple users are involved in the negotiations and the benefits are bundled. This agreement gave a unique perspective on benefit-sharing, and thus gave valuable insights for this research. Secondly, the ABS agreement on the discovery of new plant species in Indonesia is also included. The interviewee was involved in multiple agreements. I firstly talked with him about the discovery of new plant species in India, afterwards he started to talk about the ABS agreement in Indonesia. Therefore, I decided to include this case as well. A final overview of the case sample can be found in Table 3 and in Appendix III a more detailed description per agreement can be found. In total, sixteen agreements were studied in ten different countries from both Asia, Africa and Latin-America (1 Ethiopia, 1 Benin, 1 Guatemala, 3 India, 1 Indonesia, 1 Kenya, 2 Mexico, 2 Panama, 1 Peru, and 3 in South Africa).

Table 3 Overview of the sample. The abbreviations of the letters mean the following: AC = Agreement Commercial; AN = Agreement Non-Commercial; ACN = Agreement Commercial / Non-Commercial; *did not talk about a specific ABS agreement

Agreement	Name of the plant species	Actor type	Objective of access	Country of origin	Country of use
AC1	Osiris Species	NFP	Commercial	Ethiopia	Ethiopia/India
AC2	Baobab	User/Local partner	Commercial	Kenya	Kenya/Germany
AC3	Herbal plant -	User	Commercial	South Africa	South Africa
AC4	Herbal plant - Mexican arnica	User	Commercial	Mexico	Spain
AC5	Resurrection bush	User	Commercial	South Africa	South Africa
AC6	Plant material of 7 species in different regions	User	Commercial	India	India
AC7	Maize	User	Commercial	Mexico	USA
AC8	Rooibos plant (no interview)	/	Commercial	South-Africa	
AN1	Symbiose plant & ants	User	Non-commercial	Peru	Germany
AN2	Fungi	User/Local partner	Non-commercial	Benin	Benin
		User	Non-commercial	Benin	Germany
AN3	Discovery of new plant species Himalaya?	User	Non-commercial	India	United Kingdom
AN4	Discovery of new plant species	User	Non-commercial	Indonesia	United Kingdom
AN5	Symbiose Chelymorpha and host plant	User/Local partner	Non-commercial	Panama	Panama
AN6	Seagrass	User	Non-commercial	Panama	Germany
AN7	TK on dioecious species	User	Non-commercial	India	Norway
AN8	Mahogany	User	Non-commercial	Guatemala	Worldwide
ACN1*	*No specific plant*	NFP	Commercial/non-commercial	Peru	
ACN2*	*No specific plant/plankton*	National Focal Point	Non-commercial/ Commercial	Panama	Germany (?)
ACN3*	*No specific plant*	National Focal Point	Non-commercial/ Commercial	India	Worldwide

The interviews itself were semi-structured, which gave the researcher some flexibility to probe for more detailed answers (Bryman, 2016). The interviewees were asked about their knowledge on the specific ABS agreements, as well as their knowledge on the overall ABS system. Part I started with general questions on the concept of 'access and benefit-sharing'. Part II zoomed into the specific ABS agreements and consisted of the most important questions for the answering of the research questions. The interview questions in this part were formulated based on the framework of De Jonge & Louwaars, (2009). Asking these questions ensured me that I captured all the types of benefits I could find. Questions such as 'which benefits are included in the ABS agreement'; 'what problem does this benefit tries to solve?'; or 'why do you think this benefit is important for the country?' helped me to find all the potential benefits and link it to the approaches. Part III finished with questions about the difficulties and easiest parts of an ABS agreements; the lessons learned and factors of a good ABS agreements. The interview protocol of the semi-structured interviews can be found in Appendix II – Interview protocol.

To provide more insights and to check whether the users provided the right information on the specific ABS agreements, I used grey (e.g., policy documents and research documents) and academic literature. For this, the search engines Google and Google Scholar were used for finding the written materials on the various ABS agreements. In Table 4 an overview of the used search terms can be found. For all the agreements written material was searched. In total I found written material for six agreements (five commercial agreements and one non-commercial agreement).

Table 4 Search terms of Written Material

"ABS agreement" OR "access and benefit-sharing" OR "Nagoya Protocol"	AND	*"Country of origin"* (Ethiopia, Kenya, Benin, South Africa, Mexico, Panama, Guatemala, India)	AND	*"Name of specific genetic resource"* (List can be found in Table 3)
			AND (if possible)	*Name of specific region of GR*
			AND (if possible)	*Name of user (company/research institute)*

4.4 Data analysis

To analyze the collected data of the interviews and written material, multiple steps were used to code the data. In the first step, I coded every ABS agreement on the type of plant, country of origin, type of actor, objective of access and involvement of a local partner. In the second step, I categorized the different types of benefits I found in the data within the different approaches of my theoretical framework (de Jonge & Louwaars, 2009). For example, the benefit 'research funding on the conservation of biodiversity in Peru' can be coded under the approaches 'an imbalance between IPR protection and the public interest' and 'the need to conserve biodiversity'.

In the third step, I formed codes for the types of benefits within these approaches. This meant that I categorized the specific benefits of each agreement into larger categories, also known as types of benefits. For example, when I found under the approach 'the need to conserve biodiversity', the benefits 'research funding on the conservation of biodiversity in the Himalaya region' and 'research funding on the conservation of biodiversity by farmers', I could categorize it under the benefit 'research funding on conservation of biodiversity'. This process was repeated for all the benefits. Once the process of coding was finished, I rationalized the codes by re-reading all the codes and coded interviews, and eliminating all double codes (Atkinson, 2002).

And in the fourth and final step, I searched for patterns in the data by looking at different variables, such as the country of origin; the date of the ABS agreement; the difference in the ABS system of the country of origin; the difference in continents on the use of benefits; stability of the ABS system; and how often the user/provider was involved in negotiations on ABS agreements.

4.5 Quality of the Research

To make sure that the research was seen as credible, special attention is given to the criteria: validity and reliability. The first criteria validity is defined as 'identifying correct operational measures for the concepts being studied' (Yin, 2009, p. 40). To ensure validity, multiple sources of evidence in the form of interviews and written articles were used. Also, the interviews have been recorded and transcribed to increase the congruency of the participants' views with the researchers' observations. The second criteria external validity or generalizability means the extent to which research findings can be generalized to the entire population. In this research, the ABS agreements of ten different countries in different continents were studied, also for all countries multiple cases were studied. Therefore, this increases the generalizability. The third criteria reliability is defined as 'repeating the operation of a study – such as the data collection procedures –and having the same results' (Yin, 2009, p. 40). The interview guide, coding schema and the case study database helped to increase the reliability of the study.

5. Results

The main finding from the sixteen successful ABS agreements that I analyzed is that a variety of different benefits can be agreed upon. In the sixteen agreements that I studied, I found twenty-three different types of ABS benefits. This includes both monetary and non-monetary, and it includes benefits ranging from simply paying a percentage of the sales to national authorities, to offering employment opportunities, purchasing of plants for a fair price, co-publication and teaching local communities about their biodiversity. In other words, an incredibly diverse set of benefits.

I found benefits for almost each of the different approaches of De Jonge's framework. The benefits contributed to address the imbalance between the Global North and Global South; conserve biological diversity; tackle biopiracy and the imbalance in property rights; share interest in food security; address the imbalance between IPR protection and the public interest; and lastly protect the cultural identity of traditional communities. This once more underlines that I indeed found diverse benefits.

Moreover, in addition to these benefits that were included in the formal ABS agreement, I also found a range of other benefits that were shared but that were not included in the formal agreements. I will call these 'external benefits'. In the process of formalizing ABS agreements, users and providers agreed on sharing various benefits that were not included in the agreement, including helping local communities with socio-economic projects via foundations and teaching local communities about their biodiversity.

In the next sections I will describe the benefits that I found for each category of my theoretical framework. One important finding is that these benefits were different for different types of users. Commercial companies gave different benefits than public institutes who wanted to use the resources. In total, I examined eight commercial agreements and 8 non-commercial agreements. I will discuss the two different types of agreements in the following sections.

5.1 Imbalance Global South and Global North

I found thirteen different types of benefits that contribute to redressing the imbalance between the Global North and Global South in all agreements. This includes benefits paying a percentage of the sales of the end-product, upfront payment and sharing research equipment. There was a clear division between benefits that were agreed upon with commercial companies, and those with research institutes. Also, there is a clear distinction between monetary and non-monetary benefits. In Table 5 an overview of the types of benefits can be found and in how many agreements these types of benefits occurred.

Table 5 Overview of Benefits for Approach 1 and the Number of Agreements Covering the Benefits

2.Need to conserve biodiversity				
	Commercial Use		**Non-commercial use**	
Monetary benefits	- Pay a percentage of the sales - 'Fair' income generation on the cultivation of the plants - Only buy the plants of local communities - Upfront payment - Annual license fee	4 4 1 1 1	- Temporary payment of fieldworkers	1
Non-monetary benefits	- Sharing of research results - Employment opportunities of local communities	2 1	- Sharing research equipment - Training the students of country of origin - Co-publication - Sharing of research results	2 2 6 4
External benefits	- Financing/helping socio-economic projects of local communities on basic needs	4	- Giving small incentive to local communities for attending research	2

To begin with, commercial companies mostly bring monetary benefits. In total, five types of monetary benefits were shared by commercial companies. The first monetary benefit, paying a certain percentage of the sales of the end-product to the national authorities, is shared by four commercial companies (AC3; AC4; AC6; AC7). This percentage lies between 1 and 3 percent. This seems like a low percentage, but one of the interviewees explained that a higher percentage would have a negative impact on some companies. The interviewee talked about the cosmetics industry and the use of plant genetic resources in cosmetics. For example, a company produces a cosmetics product consisting of a substance of the plant, which is only a small percentage of the total end-product. Therefore, it would be out of proportion to pay the country of origin a high percentage of the sales of the end-product.

The second benefit is paying a fair income generation on the cultivation of the plants for the local farmers. In four agreements (AC1; AC2; AC4; AC8), the plant was used for their organic compounds, such as essential oils, flavonoids or extracts. To produce these organic compounds constant inputs of the plants are needed, therefore steady cultivation of the plants is essential. In all the four cases, the local communities and farmers cultivated the plant and sold them to the companies. According to one of the interviewees a fair price helps the local communities with income security and on the other hand it helps the companies to have certainty about the supply. According to one of the interviewees "*A fair price originates when farmers and companies discuss the price of the plant"* (AC4). In only the rooibos agreement in South Africa, it was clear what was meant by a fair price. In this case they paid an additional amount on the farm gate price of 1.5 percent, also known as annual levy *(AC8).* The farm gate price is what processors (those who clean, dry, ferment, pasteurize, extract, etc.) pay for unprocessed rooibos.

The third benefit is only buying the plant from local communities in the habitat of the plant. This benefit was only used in the agreement on the Mexican Arnica plant (AC3), which meant that the company was only allowed to buy the plant of the local community where the company found the plant. This gives the local community certainty about a stable income for a certain period.

The fourth monetary benefit is upfront payment, which means that a certain amount of money will be given when signing the agreement. There was only one commercial case where upfront payment was included in the agreement, namely in case of the Osiris plant in Ethiopia (AC1). In this case, one of the interviewees stated that they gave "*50,000 dollar when signing the agreement to the national authorities"* (AC1). The interviewee (AC1) did not know how the amount of upfront payment was established.

The fifth and final benefit, annual license fee, is shared by one company (AC1). An annual license fee is a fee for exporting materials to foreigner countries. In the Osiris species agreement in Ethiopia, the commercial company exported the end-product and therefore they had to pay an annual license fee equal to 2000 dollar to the national authorities. The interview with the NFP (AC1) did not know how this amount of the annual license fee was established.

As is shown in the section above and Table 5 most benefits shared by commercial companies are monetary benefits. It is good to note that in most cases it was not the decision of the commercial company (user) to include mostly monetary benefits. In three cases of eight commercial cases, the initial plan of the companies was to give non-monetary benefits, however this got rejected by the local communities or national authorities. One of the interviewees notes:

"Eventually monetary benefits are the preference. And so, it is for us it is difficult, because we have always tried to have non-monetary benefits in there. For example, you are dealing with a local community that has traditional knowledge and you want to put up a bursary for a student or helping to build a creche or a school or something like that. But that is a non-monetary benefit, and they do not prefer it. In the end, they are the benefactors to decide it themselves and they prefer a monetary benefit" (AC4).

The interviewees gave different reasons why local communities prefer money over non-monetary benefits. Firstly, some communities are spread over a large area, and they want to distribute the benefits evenly over the community. For communities it is easier to divide money than non-monetary benefits. The communities used the money for basic needs, such as education, building schools, etc. The reason why local communities want to have monetary benefits is also stated by an interviewee: "[…] *There's not one leader in the community that takes care of it but there are multiple people spread around the country that needs to negotiate with each other. Therefore, financial benefits that we accrued to these traditional knowledge holders are easier to administer than the projects. So, it is easier to have money" (AC3).*

And a second reason is that some national authorities prefer to include mostly monetary benefits. This was the case in the ABS agreements in India, where only monetary benefits were given in commercial agreements. In this case, the user of the GR gave the money to the government, and they gave it to special biodiversity management committees. The biodiversity management committees decided what happened with the monetary benefits. It was not exactly clear what these committees did with the money, but according to Sudhi (2019) most of the money is used for socio-economic projects.

Furthermore, one public research institute (AN8) shared one monetary benefit, namely the temporary payment of community members for helping in the field work. This benefit was found in the agreement on the Mahogany tree seedlings in Guatemala. In this case, the local community helped with the fieldwork on the seedling of the Mahogany tree in return for temporary payment. These payments acknowledge and legitimize community members' engagement and responsibilities for their surroundings. After the research, even without the help of the public research institute, the community members continued to be responsible for their surroundings by breeding their own Mahogany plants.

The above explained monetary benefits were predominantly included in ABS agreements where commercial companies were interested in using genetic material. I also found several non-monetary benefits that sought to address the imbalance between North and South. Public research institutes shared four non-monetary benefits, including co-publication, sharing of research results and sharing of research equipment. Additionally, commercial companies shared three non-monetary benefits, namely sharing of research results and financing/helping socio-economic projects of local communities on basic needs.

The first non-monetary benefit, co-publication with research institute of origin, was shared by six out of eight public research institutes, and thus the most shared benefit in this approach. This was found in almost all the cases. This not only entails the agreement to write down the name of the research institute on the paper, but really to conduct the research together. As one of the interviewees noted: "*In the agreement it should be clear that both parties are part of the publication. Not that the other researcher will write the paper alone and, in the end, write my name on this. That is cheating and not normal. There should be an equal contribution in the paper"* ($AN_{2)}$. According to the interviewees there are many advantages of co-publication for the country of origin. These advantages are for example researchers that are ranked higher in international journals, which is better for the reputation of the researchers. Additionally, it can also help applying for a grant if you are ranked in higher journals via co-publication. Furthermore, co-publication helps for making a stronger relationship between partner universities.

The second benefit is sharing of research results and found in six agreements (AC3; AC4; AN1; AN5; AN6; AN7). In four cases this concerned a research institute, in the other two cases it concerned a commercial company. For example, a Spanish company that sought to access genetic resources of the Arnica plant in Mexico to find the active substance. The results of the research on the chemical analysis of the plant were shared with a university of the country of origin.

The research results produced by public research institutes are used by the provider country in different ways. One way is by storing the research results in a data base of the country of origin. Another way is by giving a workshop by the researchers about how to use the outputs of the research, which makes it more valuable for the country of origin. According to the research of Martins (2020) the sharing of research results helps to reduce the gap between Global North and Global South. For example, it helps the country to stay up-to date about different research topic, which makes it easier for researchers in the country of origin to do follow up research on the topics studied in the ABS agreements. This helps to increase the engagement of the Global South in international research (Martins, 2020). Thus, co-publication and sharing of research results help to reduce the imbalance between North and South.

It is important to note that while the benefit sharing of research results were included in the official agreements, four interviewees (AN1; AC3; AC4; AC5) noted that this benefit is sometimes not really beneficial in agreements. This is remarkable since this benefit is often suggested in ABSs official documents. The website of Convention on Biological Diversity notes the sharing of research and development results (Secretariat of the Convention on Biological, 2011). According to the interviewees, sharing of research results can be valuable for local communities if it is practical, such as knowledge about the cultivation of plants. However academic results are hard to interpret for local communities due to a lower level of education.

The third benefit is the sharing of research equipment, which occurred in two non-commercial agreements (AN2; AN5). This entails the equipment that can be used for laboratory and/or field research. Often the research institutes in the country of origin cannot afford to buy the research equipment. An improvement of the research equipment can help the researchers in the country of origin to perform better research and be equal to their fellow Western researchers. This is also stated by the interviewee:
"[…] When I talk about facilities, such as access to modern equipment and laboratory facilities. And in most projects' facilities are the most important part. How to make it easy for us and improve our working environment. As benefit I do not want to focus on scientific publication. Yes, its nice. But for the process to get the publication, we also need to improve the entire process of scientific publication" (AN2).

And the last non-monetary benefit shared by two public research institutes (AN2; AN6) is training the students of the country of origin. This can be done via various ways, such as the funding of scholarships, summer schools, on-the-job-training or a training course for students. The training of students is important for the transfer of knowledge, and it gives them more opportunities. This is also mentioned by the interviewee: *"For example, 'Peter' already hosted two or three of my students for one or two months to work in the laboratory. This is some kind of soft knowledge. It lays a very important role in the access and benefit sharing. And for us, it is very important for the transfer of knowledge" (AN2).*

In addition, there was one external benefit shared by two public research institute (AN2; AN7), namely, to give a small incentive to the local community when they participated in the research.

Also, five commercial companies shared two non-monetary benefits and one non-monetary external benefit. The first non-monetary benefit is sharing of research results shared by two commercial companies (AC3; AC4), which is already explained in the above section. The second benefit is employment opportunities for local communities (AC1). This was included in the ABS agreement on the Osiris species in Ethiopia, where the user of the Genetic Resources (GR) agreed to build a factory in Ethiopia and to hire employees who lived in the surrounding of the factory. As one interviewee stated: "*125 Ethiopians are provided with permanent employment" (*AC1).

Lastly, the external non-monetary benefit was to fund and support socio-economic projects in local communities. This external benefit was found in four commercial agreements (AC3; AC4; AC5; AC7). In these agreements, different types of projects were agreed upon, namely building a school or creche, building new infrastructure, education of teachers and scholarships for smart students. For example, in the agreement on Mexican Arnica in Mexico, the cosmetics company agreed to help women to start their own micro-enterprise selling cosmetics. They financed a general course on cosmetics, a course on cosmetics production and they financed the facilities to produce new cosmetics. In the article of UNDP (2018), one of the women of the local community showed her delight: "*I am so happy to work here, to go to the university in Querétaro and sell all our products. I really never imagined how beautiful it would be to do this job with my family. Actually, all my daughters are helping me, collecting plants, drying them and making cosmetics"* (p.200)

The interviewees (AC3; AC4; AC5; AC7) mentioned various reasons why this external benefit was not included in the official agreement. At first, they found it too difficult to formulate this benefit in sufficiently concrete terms. It was too hard to state the number of specific benefits the company could offer, because the outcome of the commercialization of the end-product was uncertain. Second, the companies do not have a big budget to invest in socio-economic projects. The companies do not have a huge amount of turnover or volume, and thus have not enough money to invest in these (bigger) projects. This is explained by one of the interviewees: "*When it comes to benefit sharing, we do not have millions of millions to share, it is relatively modest amounts" (AC3).* To solve this problem, one company started a foundation, where they received funds from their partners in Europe, to achieve a higher amount of money to invest in socio-economic projects.

5.2 Need to Conserve Biodiversity

In the approach 'need to conserve biodiversity' I found four types of benefits, consisting of three non-monetary benefits and one monetary benefit (See **Error! Reference source not found.**). Examples of b enefits are the training of local communities on the cultivation process and participatory research. Also, three external benefits are found, namely trust funds for conservation efforts, teaching local communities about biodiversity and knowledge generation about national biodiversity. Again, there is a clear distinction in the benefits given by commercial companies and research institutions.

Table 6 Overview of Benefits Approach 2 and the Number of Agreements Covering the Benefits

2.Need to conserve biodiversity				
	Commercial Use		**Non-commercial use**	
Monetary benefits	- Income generation on the cultivation of the plant	3	*None*	
Non-monetary benefits	- Training local communities on the cultivation process - Helping socio-economic projects of local communities on conservation efforts	3 1	- Participatory research	1
External benefits	- Trust funds for conservation efforts	1	- Teaching local communities about biodiversity - Knowledge generation about national biodiversity	3 7

Three commercial companies shared benefits on the approach 'need to conserve biodiversity'. Two non-monetary benefits were shared, namely training local communities on the cultivation process and helping socio-economic projects of local communities on conservation efforts. And one monetary benefit is shared, namely the income generation on the cultivation of the plant.

The first non-monetary benefit is the training of local communities on the cultivation process. In three different commercial agreements (AC1; AC2; AC4), companies provided the local communities with information about different topics, such as how to (sustainably) grow the plants and how to see when the plant is mature. These insights helped local communities to gain knowledge on their own biodiversity. A good example of the effect of these trainings on conservation efforts can be seen in the agreement in Ethiopia on the Osiris plant (AC1). The Osiris plant grows in multiple regions, however due to overexploitation there is a decrease in the population of Osiris plant. Research of Sifu et al., (2019) has shown that the regions where the Osiris species was influenced by the commercial company, a steadier population of Osiris plants occurred. An interviewee explained what the commercial company did: *"The company has supplied a training manual to the zone and district experts which gives step-by step instructions on how to grow Osiris from seed, air layering and cuttings. The manual was translated into local languages" (AC1).* Thus, the commercial company helped to grow the plant in a sustainable way, which helps with the conservation of the plant.

This non-monetary benefit was combined with the monetary benefit 'income generation on the cultivation of the plant'. In all three agreements, the local communities received money from the companies for the cultivation of the plant. This incentive ensured that the local communities started to take better care of the cultivation process of the plant, which led to a more sustainable conservation of the plant. One interviewee clearly mentioned that financial incentives could contribute to conservation of biological diversity: "*They [custodians of the specific genetic resource] are not in a position to conserve and sustainably utilize resources. So, the very nature of ABS system is to incentivize the local communities to do to conserve and sustainably utilize their resources. Because if they did not get any kind of benefits from the genetic materials, they are not interested to preserve and sustainably place in the signatories of genetic materials. (AC1)"*

The second non-monetary benefit, helping/financing socio-economic project of local communities related to the conservation efforts, is shared by one commercial company (AC4). In this project, the company helped to install of the irrigation for the watering of the Mexican Arnica plants in Mexico. This region had to deal with water scarcity, and thus the installation of the water helped not only to grow the Mexican Arnica plant, but also other plants, which were harvested in the surrounding.

It is good to note that only a small number of commercial ABS-agreements (3 out of 8) consist of one of these benefits related to conservation efforts. This is mainly because local communities prefer monetary benefits, as explained in Approach 1. This is explained by the interviewees as the lack of education on the importance of biodiversity in local communities, which is clearly illustrated by one of the interviewees: "*So in that vein, education plays a big role in conservation efforts. This will help to get these communities to protect their biodiversity and from an early age to teach the children what it is all about. So that they understand the bigger picture and the long-term picture" (AC5).*

In addition, one public research institute (AN8) shared one non-monetary benefit on the conservation of biodiversity, namely participatory research. Participatory research is different than regular research on tropical biology and conservation, because in participatory research local communities are more involved in the research (van Zonneveld et al., 2018). This kind of research is a useful alternative for providers and users because it benefits local communities (providers and/or potential beneficiaries) through knowledge sharing and training or even some temporary payments. Moreover, the researchers (users) receive benefits by support for their collection, monitoring, and experimental activities. The more local communities are involved in the participatory research, the more likely the findings will be implemented (van Zonneveld et al., 2018). As one of the interviewees mentioned: "*So they were really involved in the research, and it was also clear that the research results of the research could also be used by themselves. So, it had personal value" (AN8).*

This benefit was shared in the agreement on the restoration of the Mahogany plant in Guatemala. Here, local communities were trained and paid to help with the fieldwork on the Mahogany plant. After finishing the research, the local community continued with the conservation of the Mahogany plant. The interviewee tells what the local communities did with their gained knowledge: "*They used the seedlings to restore a degraded pastureland of 11 hectares, establish a progeny trial, and compare three restoration treatments" (AN8).* Thus, participatory research can help to implement the research findings on tropical biology and conservation.

To finish, there are three external benefits in the approach to conserve biodiversity. Two external benefits are shared by eight public research institutes, and one benefit is shared by one commercial company. Public research institutes shared two external benefits, namely teaching local communities about biodiversity with local communities and knowledge generation about biodiversity. The first external benefit shared is teaching local communities about biodiversity and can be done via training. An example of teaching local communities was in the research on the ant and symbiose plant in Peru, where local tour guides were educated about their biodiversity by the researcher.

The other external benefit shared in almost all agreements is knowledge generation about national biodiversity. In almost all agreements with public research institutes, the work of the researchers contributes to the national knowledge on biodiversity. For example, research about specimens can help to find tropical biodiversity hotspots or how much carbon a forest can capture. These research results can be used by national governments to make their conservation efforts plans. However, it must be noted that according to the interviewees these research results were not always used by governments.

Finally, one commercial company (AC1) also shared an external benefit, namely the investment in a trust fund for conservation efforts. In this agreement on the Osiris species in Ethiopia, the monetary benefits are not only shared with the local community, but also with the national authorities. The local communities receive 95% of the percentage of the sales of the end-product, the rest belongs to the government. The money of the government is stored in a trust fund for conservation purposes. This is used to plant special, different endemic species to highly degraded ecosystems. However, this plan

was not successful, as the government had difficulties with implementing these plans. One of the reasons was the insufficient monitoring mechanism for the implementation of projects

5.3 Biopiracy and imbalance property rights

The approach 'biopiracy and imbalance property rights' refers to agreements that address biopiracy and/or agreements that ensure that the benefits derive from the intellectual property rights are shared with the provider of the genetic resources. I found two examples of benefit-sharing agreements that fit in this approach. In both cases, it concerns commercial companies who agreed to share monetary benefits, namely annual royalties and annual license fee (See Table 7).

Table 7 Overview Benefits of Approach 3 and the Number of Agreements Covering the Benefits

3.Biopiracy and imbalance property rights			
	Commercial Use		**Non-commercial use**
Monetary benefits	- Annual royalties	2	*None*
Non-monetary benefits	*None*		*None*
External benefits	*None*		*None*

The first benefit annual royalties are shared in two commercial agreements. According to the World Intellectual Property Organization (2004), annual royalties are usage-based payments from one party to another. In the ABS agreements, the holders of the property rights were the commercial companies (users), and the provider countries received part of the benefits of property right. In the first agreement on the Osiris species in Ethiopia (AC1), the provider country received annual royalties of 3.5% of the net profits of the end-product of the Osiris species from the commercial company.

In the second agreement on special maize in Mexico (AC7), they found a special self-fertilizing gene inside the maize. This fertilizing gene helps plants to fix their own nitrogen from the air, which could lead to use of less nitrogen fertilizer. Nitrogen fertilizer leads to water pollution, dead zones in waters, and is an important source of greenhouse gases (Psowski, 2019). Eventually, this fertilizing gene could be placed in more plants, such as corn. The commercial company acquired the intellectual property rights over this biological resource. In the agreement, it stated that the net income from any patent royalties will be shared 50-50 with the community. It is not clear whether, the commercial company has already acquired any income from the patent.

Public research institutes did not share any benefits on IPR. A reason could be that public research institutes did not have intellectual property rights on their findings. This can be explained by the fact that the public research institutes did not engage in commercial research, and therefore did not have property rights, such as a patent on a product.

5.4 A shared interest in food security

In the approach on a shared interest in food security, only one commercial company shared one non-monetary benefit, namely the sharing of research results related to food security, and an external benefit, namely income of the cultivation of the plant. The other commercial companies and all the public research institutes did not share (non-) monetary benefits on this approach.

Table 8 Overview Benefits of Approach 4 and the Number of Agreements Covering the Benefits

4.A shared interest in food security			
	Commercial Use		**Non-commercial use**
Monetary benefits	*None*		*None*
Non-monetary benefits	- Sharing of research results related to food security	1	-
External benefits	- Income of the cultivation of the plant	*1*	*None*

The non-monetary benefit that I found concerned the benefit 'sharing of research results related to food security'. This benefit was included in one ABS agreement (AC2), namely the Baobab plant agreement in Kenya. Baobab is a plant which grows in dry areas, and the local communities living in these dry areas, where dealing with droughts. This led to a reduced yield of their edible crops, and thus food insecurity. In this agreement, they examined the composition of the plant, and found a high nutritional value of the Baobab plant. This was something the local communities did not know yet. Therefore, the Baobab plant could be used as a substitute and addition to the diets of the local communities, and thereby increasing the food security of the local communities.

In addition, I found one external benefit included in one agreement, namely food security through income of the cultivation of the plant. This benefit was also found in the agreement on the Baobab plant in Kenya. As explained the baobab plant grows in dry areas. In these areas local communities had difficulties with earning money. The extra income of the cultivation of the Baobab plant gave them the possibility to buy more and higher nutritional food. Eventually leading to higher food security.

This small number of benefits can be explained by multiple reasons. One reason could be that most commercial companies did not utilize the genetic resources for food purposes, and therefore did not think of benefits which are related to food security. And another reason is that food security is more tackled in the International Treaty for Plant Genetic Resources for Food and Agriculture (ITPGRFA).

5.5 An imbalance IPR protection vs public interest

The approach an imbalance IPR protection vs public interest refers to agreements that address an imbalance in IPR protection and/or agreements that ensure that the benefits derive from the intellectual property rights are shared with the public.

I found two non-monetary benefits in this approach, namely sharing of research results and co-publication. The first benefit sharing of research results is shared by three public research institutes and the second benefit co-publication is shared by six public research institutes (See Table 9).

Table 9 Overview Benefits of Approach 5 and the Number of Agreements Covering the Benefits

2.Need to conserve biodiversity				
	Commercial Use		**Non-commercial use**	
Monetary benefits	*None*		*None*	
Non-monetary benefits	*None*		- Sharing of research results - Co-publication	4 6
External benefits	*None*		None	

In four non-commercial agreements (AN1; AN5; AN6; AN7), research results were shared with the country of origin. A good example of how the sharing of research results can help to protect the public interest is the agreement on the TK dioecious species in India (AN7). The documentation of the TK can help to protect the public interest. In all the non-commercial agreements it was clear that the research findings could only be used for non-commercial use. If the researchers wanted to use the findings for commercial use, they had to negotiate on a new ABS agreement. Therefore, the research findings contributed to the public interest because it will not be easy for commercial companies and researchers to gain IPR on these findings, because the research results are freely available.

It is good to note that commercial companies sometimes also shared the research results with local communities. However, it is not clear whether the sharing of research results contributed to the approach 'an imbalance IPR protection vs public interest'. It was not clear if companies shared the knowledge with the local communities before patent application, and whether the local communities were allowed to share the findings with other people. And thus, if the commercial companies not only invested in their own interest, but also in the public interest. Therefore, I decided not to include this benefit under the category commercial use. Additionally, commercial companies did not share any other benefits in this approach.

And the second and final benefit is co-publication and occurred in six agreements with public research institutes. This benefit fits in this approach, because co-publication promotes equity in distributing the benefits of research by *jointly* publishing articles. This jointly publishing of articles helps in making sure that the benefits of the research cannot be acquired by only the researchers in the Global South.

5.6 Protecting the cultural identity of traditional communities

I found one non-monetary benefit in this approach, namely the incorporation of highly educated people of the local community in the research, which is shared by only one commercial companies (AC7), and one external benefit, sharing of research results on TK, which is shared by one public research institute (AN7) (See Table 10).

Table 10 Overview Benefits of Approach 6 and the Number of Agreements Covering the Benefits

6 Protecting the cultural identity of traditional communities				
	Commercial Use		**Non-commercial use**	
Monetary benefits	*None*		*None*	
Non-monetary benefits	- Incorporation of educated people of the local community in research	1	- Sharing of research results on TK knowledge	1

External benefits	*None*		None

The non-monetary benefit I found was the incorporation of highly educated people of the local community in the research. This was the case in the agreement on the specialized maize, where the local researchers were included in the research on the plant. On the one hand, *the inclusion of the highly educated people helped with embracing the values of the local community*. On the other hand, *increasing the trust between the two parties, because the highly educated people worked as bridge between the commercial company and the local community (AN7)*.

Moreover, there is another non-commercial benefit, which is shared in only one agreement by a public research institute, namely sharing of research results on TK. In this case, the researcher documented TK on dioecious species of Indian folk healers. The sharing of the research results helps to store the TK and eventually can help to prevent patenting of TK without inclusion of the TK holders. The interviewee also explains another reason why it is important for the Indians to store the traditional knowledge: "*The traditional knowledge is like people are forgetting the traditional knowledge. You think the younger generation is not following the tradition. They are moving out of their village. They do not want to live in the forest with their parents. So, the traditional knowledge is getting lost and documenting this knowledge is a benefit for Indians" (AN7).*

It is good to note that even though not that many benefits were shared on the topic of protecting the cultural identity of traditional communities. All the users acknowledged the importance of Traditional Knowledge (TK) and respected the values of traditional communities. They recognized that TK mostly helped in doing basic research. As one of the researchers stated: "I *deeply believe that local people have a strong knowledge, that even sometimes challenges modern knowledge. I have been working with Fungi resources, and it is already 20 years ago but I can say that sometimes my scientific knowledge has been challenged by local knowledge. Especially when it comes to ecological knowledge" (AN2).*

5.7 Aggregated results

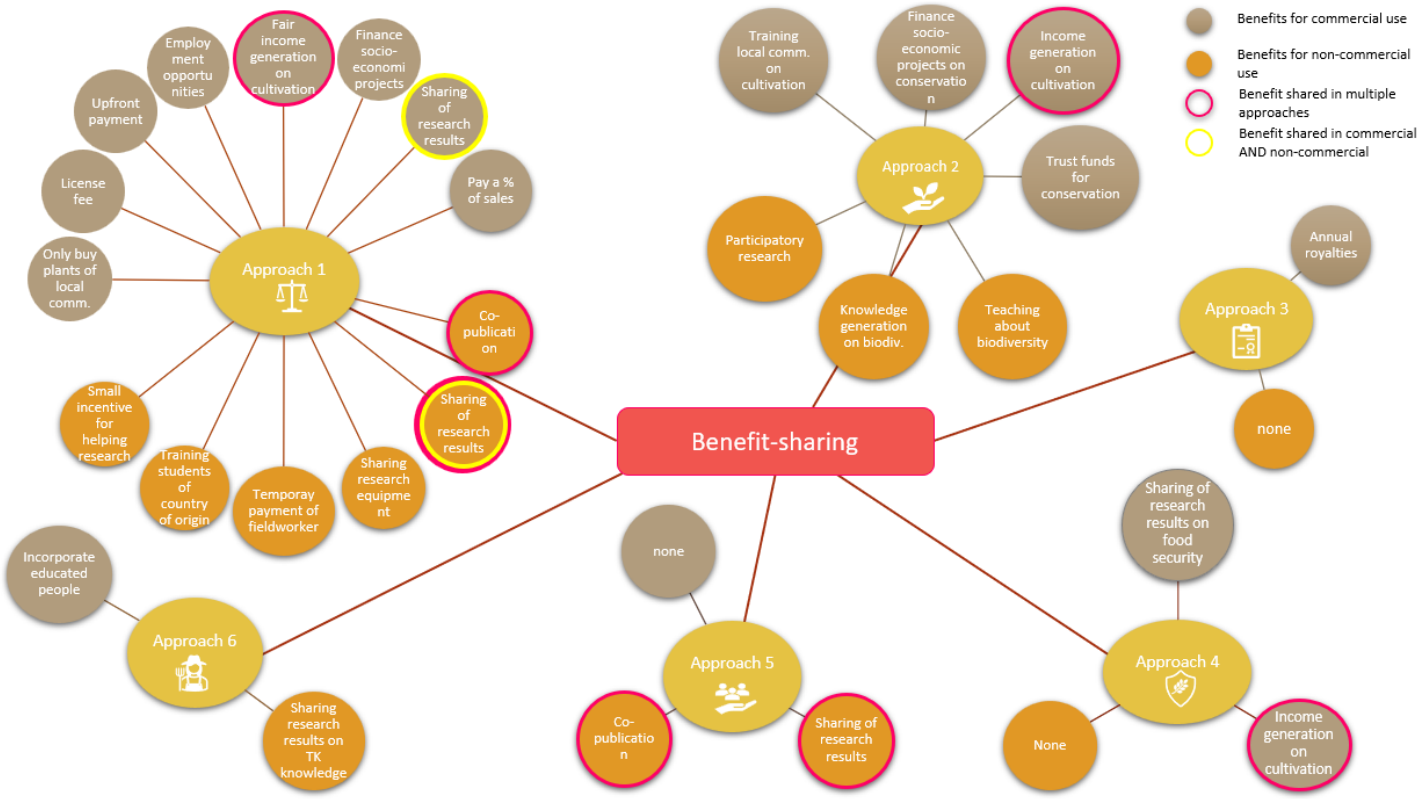

Figure 3 Overview of the Benefits linked to the Approaches Incl. the External Benefits

What do we find when we take all these findings together? First, as was mentioned at the start of the empirical chapter, these findings first and foremost show that a wide variety of benefits were included in ABS agreements. Over twenty-three different types of benefits were found, and these contributed to all six different approaches to sharing genetic resources. A good overview can be found in **Error! Reference source not found.**. It is good to note that only three benefits contributed to multiple approaches of benefit sharing. This was the case for the benefits 'sharing of research results' and 'co-publication'. On the one hand they contributed to the imbalance between the Global South and the Global North and on the other hand they contributed to the imbalance of IPR rights and the public interest. Also, the benefit 'fair prices for the cultivation of the plant' can be found in multiple approaches, namely 'the imbalance between the Global South and North'; 'conservation of biodiversity' and 'a shared interest in food security'. This is illustrated by the *pink* circle.

A second finding is commercial companies that seek to access genetic resources for commercial use, include different benefits in ABS agreements than public research institutes seeking to access genetic resources for non-commercial use. There was only one benefit they had in common, which was again the sharing of research results. This is shown in **Error! Reference source not found.** with the *yellow* circle. Also, the commercial companies shared a mix of monetary and non-monetary benefits, while public research institutes mainly shared non-monetary benefits.

It is good to note that no other patterns were found. I for example, also searched for whether the types of benefits included in ABS agreements changed over time, whether these varied from whether these varied from country to country or region to region, or whether the involvement of different types of

users or providers resulted in different types of benefits. However, no clear patterns were found in these categories.

A third finding is that all the agreements I studied had at least one benefit referring to Approach 1 'the imbalance between Global South and Global North'. Not only did every agreement include a benefit that contributed to this approach, also the most benefits were found in this approach. This is also clearly illustrated in **Error! Reference source not found.**, where Approach 1 is surrounded by the most benefits. Several interviewees explain this by arguing users generally feel a strong need for investing money in basic needs, such as infrastructure and education. This subsequently lowers the number of monetary resources left to invest in other matters, such as biodiversity. Thus, the need for basic investments makes it such a prominent approach in the agreements.

The fourth important finding is that in some cases different approaches can complement one another, but in other cases different approaches can contradict each other. In particular, I found that in most non-commercial agreements, the approaches that can strengthen each other are 'the imbalance between the Global South and Global North' and 'the imbalance of IPR protection vs public interest'. The agreements consist of benefits which can be found in both approaches. The reason why these two approaches complement each other is not completely clear. However, it can be explained to the fact that two benefits are located in both approaches, namely 'co-publication' and 'sharing of research results'. On the one hand these benefits help to increase the resources (e.g., knowledge) these countries have (Approach 1). And on the other hand, these benefits also contribute to making sure that more people can benefit from the generated knowledge, and not only the research institutes (Approach 5).

Moreover, the approaches that potentially contradict each other are the approach 'the imbalance of biopiracy' and the approach 'the imbalance of IPR protection and public interest'. The inclusion of both of these benefits in the agreements might be a difficult combination, which is shown in the agreement of the special fertilizing maize in Mexico. The local community agreed that the genetic resource could be used for commercial purpose, and thus be patented. The local community would receive 50% of the patent royalties, which relates to the approach about the biopiracy and imbalance IPR. However, patenting this fertilizing gene can at the same time negatively influence the public interest, because a patent prevents other small local farmers to freely use the genetic resource. Thus, this would negatively influence the approach 'the imbalance of IPR protection and public interest'.

And the fifth and last finding is that having a local partner that assists prospective users in creating ABS agreements is very important for a successful agreement. This was mentioned in fourteen different interviews. A local partner could be a local person who helps the user, such as a local researcher, local NGO, or local company. These local partners helped with knowledge about the culture, religion, biodiversity system and knowledge generation on the rules of the ABS agreement in the country of origin. This is also mentioned by one of the researchers: "*And I think that that is a true potential benefit to involve people who are knowledgeable in the ecosystem or in the habitat of the species that are then also partner in the publication" (AN6).* Also, these local partners could help to gain trust of the government of the country of origin, which fastened the process of negotiating on the ABS agreement.

6. Discussion

6.1 Discussion of the results

This research aimed to identify the different approaches of benefit-sharing applied in making ABS agreements under the NP in the Global South. The results indicated that there is a wide variety of benefits in each of the different approaches. In this section, the important insight from the interviews and differences and similarities between the results and previous research are discussed.

One of the important insights from the interviews is, even though there is a wide set of benefits, reaching agreements was incredibly challenging for a variety of reasons. This includes bureaucracy, political instability, and unrealistic expectations of local communities and governments. The first challenge, bureaucracy, is shown by the long time it takes to sign an agreement. The signing of the agreements took between one and seven years. Additionally, there are difficulties in the formulation of the ABS agreements. Many agreements must be corrected multiple times, which takes a long time. Lastly, sometimes there are too many other permits included, which must be signed by various authorities. These authorities do not communicate well enough with each other, which delays the process. The observation that there are a variety of challenges in the bureaucratic process confirms earlier findings in the literature that pointed at difficulties in implementation (Beninger & Francis, 2016; Heinrich et al., 2020; Morgera et al., 2014; Normand et al., 2021).

The second challenge is political instability. Several interviewees indicated that a change in government could have severe implications for the implementation of the Nagoya Protocol. For example, in Mexico the government changed the last years and moved from a pro-Nagoya Protocol policy to an anti-Nagoya Protocol policy. This change in government also leads to a loss of knowledge on the NP and sometimes a change in the rules of the NP, because new people fulfill the role of providing access to genetic resources. This political instability creates a lot of uncertainty among users, making it more difficult to arrive at ABS agreements. This is also confirmed from earlier literature (Coolsaet & Pitseys, 2015).

And the last challenge that interviewees identified is that local communities and governments may have unrealistic expectations about the benefits that can be accrued from sharing genetic resources. According to interviewees, this shows that the local communities and governments not always have a clear understanding how industries and research institutes work. For example, when governments ask high fees for the use of a sample (e.g., a plant or seed) for non-commercial use. Governments must keep in mind that most researchers only have a small amount of scientific budget and are not able to pay monetary benefits. The challenge of having unrealistic expectations about benefits was also found in other literature (Heinrich et al., 2020).

A similarity between the results and previous literature is the types of benefits shared in non-commercial agreements. In the research of Biber-Klemm et al. (2014), they investigated thirteen non-commercial ABS agreements in Latin America before the Nagoya Protocol went into effect. They found four types of benefits which were shared between researchers, national authorities and communities: (1) scientific benefits (e.g., publication of articles); (2) capacity building and knowledge sharing (e.g. summer school for students); (3) sharing of research results; and (4) providing infrastructure to local communities (e.g. building of laboratory for high school). In my research I found nearly all these benefits, only the benefit 'providing infrastructure to local communities' did not occur. Instead, I found another benefit, namely participatory research.

And another similarity with previous literature is the focus of governments and local communities on earning money and short-term development in non-commercial research (Kamau et al., 2010). Many

governments of countries in the Global South have supported the development of the Protocol with the aim of avoiding unauthorized bioprospecting by foreign companies and safeguarding Indigenous knowledge. In addition, a lot of governments saw ABS as a method to make money. The benefits of non-commercial molecular genetics research may be difficult for governments and local populations to understand. Additionally, governments and communities might be more interested in ABS money or prefer tangible short-term development benefits, even though research findings may ultimately be beneficial to science, society, and/or the environment (Kamau et al., 2010).

Finally, the research of Ramsdell et al. (2016) shows that it is better to combine monetary and non-monetary benefits for conservation efforts. This also shown in this research by four companies combining the monetary benefit 'income generation on the cultivation of the plant' with the non-monetary benefit 'training local communities on the cultivation process'. The research of Ramsdell et al. (2016)shows that farmers motivations to continue to conserve the plants stops if the financial incentive no longer exists. Therefore, it is good not only to work with financial benefits, but also to have campaigns and courses about the importance of the conservation of biodiversity. This triggers the intrinsic motivation, which helps with the conservation of biodiversity on the long term (Ramsdell et al., 2016).

6.2 Limitations

Even in the face of the quality measures taken to overcome barriers of qualitative research (see 3.5), a few limitations should be considered. Two important criteria for social research are reliability and validity. In terms of reliability of the data, the recording of the data from the interviews and written material in an Excel sheet offered a comprehensive evaluation of the data collection procedure and an evaluation of the results. The use of the table for recording of data helped the researcher to quickly interpret the results and see the progress of the research. In addition, the overview of the investigated ABS agreements in Appendix III helped for reliability as well.

The second quality measure is validity and is assessed by looking at data triangulation and generalizability. The research made use of two sources of evidence, namely interviews and written material. The additional written material helped to validate the findings of the interviews. To increase the validity of the findings, the initial idea was to interview multiple actors on one ABS agreement. However, it turned out that the national focal points (NFPs) found it hard to remember the specific agreements. Most of the time the NFP helped to generate a general understanding of the ABS system in the country of origin. Therefore, most of the time only one actor was interviewed on a single agreement, which lowers the validity of the outcomes.

As is often the case for qualitative studies, the generalizability in this research is relatively low (Bryman, 2016). First, the results are based on a rather limited number of participants. The conclusions are thus applicable to the research population. Second, the study's duration and scope also made it difficult to include a large set of participants, and thus limiting the generalizability.

Furthermore, there are four more limitations of the data collection. The first limitation is related to the language of the interviews. For most interviewees and the interviewer English was not their native language. This could in some occasions have resulted in misunderstandings or misinterpretations. In one case, a Spanish translator was used to reduce this problem. This was a clever way to solve the problem, however it made it harder for the interviewer to guide the interview.

The second limitation of the research is that there are no interviews with Indigenous and local communities who were involved in ABS agreements. It would have been a good addition to have their perspectives incorporated in the results. Sometimes interviewees made statements about Indigenous

people and local communities, such as that Indigenous people preferred monetary benefits over non-monetary benefits. Also, it was not clear how large their voice was in the negotiations in the ABS agreement.

The third limitation is that the all seventeen interviews were conducted via video calls and not in-person. Virtual interviews can have a negative impact on the quality of the interviews for a number of reasons. One of the reasons is technical difficulties, such as time-lags on video and disconnected calls. These technical difficulties happened during multiple interviews. Furthermore, it makes it more difficult to make personal contact. It is harder to make people feel comfortable in the interview. However, this use of video calls can also be seen as an advantage, because it easier to include a large population of people in research. Many of the interviewees were located in different countries, which would have made it difficult to interview them in-person.

And lastly, there is a limitation related to the research design. In this research there was a focus on successful agreements in order to understand what types of benefits can be included. However, there were no failed agreements included, which may provide complementary understanding of what benefits cannot be used.

6.3 Recommendations for Future Research

There are four suggestions for future research. The first focuses on the objectives of the CBD. The CBD has three objectives, namely the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of benefits (CBD, 2011). Currently, in most ABS agreements the conservation and sustainable use of GR is not satisfied, which is also shown in the research of Sirakaya (2022). As is shown in the results, most benefits focused on decreasing the imbalance between Global North and Global South. In this case, local communities receive the money which they use for their basic needs, such as education or infrastructure. They do not see the conservation of biological diversity as their first need, and they think it is the government's role to invest in the conservation of biological diversity. Thus, this led to a lack of investment in conservation of biological diversity, even though it is one of the main pillars of the CBD. Therefore, we should question how we can increase the focus on conservation of biological diversity in ABS agreements.

And the second suggestion focuses on the effectiveness of benefits. In my research I found twenty-three different benefits. Currently there is no research on how effective these benefits for fair and equitable benefit sharing. Co-publication showed a lot of advantages in comparison to sharing of research results. Therefore, future research could investigate the potential of these benefits.

And the third suggestion would be to investigate how to decrease complexity of the ABS system. All the interviewees mentioned that it was still exceedingly difficult to make ABS agreements due to various reasons, such as the number of different authorities involved. Therefore, adjustments in the ABS system might be needed. One recommendation from the interviews was to use industry wide agreements. This can be helpful in agreements where multiple actors want to use the plant, such as in the case on the resurrection bush. An industry wide agreement could lead to reduced monitoring and negotiation costs and more importantly a bundling of the benefits, which lead to an increased effect of the benefits on topics, such as conservation efforts and basic needs.

A more radical recommendation would be to switch to a national trust fund as the only benefit. This research indicated that government do not have a good understanding local communities do with the money from the ABS agreement. There were some examples that local communities invested it in basic needs and not in conservation efforts. A national trust fund could help with transparency into benefit-sharing and saving on monitoring costs (Sirakaya, 2019). Additionally, a national trust fund would help

with the issue of governments not knowing who the owner is of the GR. Unlike the ITPGRFA, a national trust fund would give governments the right to decide for themselves in which topics they want to invest. However, a national trust fund will only work if there is political stability in the country of origin. To conclude, we do not know which recommendations are best to make the ABS system less complex. Therefore, I would recommend future research to examine that.

And the fourth and final recommendation would be to investigate the concept 'access'. In my research I zoom in on the concept benefit-sharing, however this concept is closely related to access. Access to plant genetic resources is a pre-condition for benefit-sharing (Sirakaya, 2019). The importance of access is also shown in the approaches 'conservation efforts' and 'food security' in the research of De Jonge (2009). The benefits that are shared with local communities work as an incentive to conserve biodiversity and protect food security. Thus, it is the possibility for benefits that incentivizes practices to ensure access to PGR. Moreover, in the approach 'protecting the cultural identity of TK holders' the pre-conditions to give access to PGR are more important. This was shown by one of the interviewees by giving a list of pre-conditions to protect the cultural identity of TK holders, and by following these pre-conditions getting access to PGR. Such as signing a prior informed consent by traditional communities and commercial companies; speaking the language of the traditional communities during the negotiations; and lastly, in some cases biocultural protocols have been established and followed to reduce the power imbalance between companies and the TK holders. Thus, this shows the importance of access in ABS agreements. Therefore, I would suggest further research to also investigate the concept 'access'.

7. Conclusion

The research aimed to provide an answer to the following research question: "*How are the different approaches of benefit-sharing practically applied in making ABS agreements under the Nagoya Protocol in the Global South?"*. Based on a qualitative analysis of sixteen agreements, it can be concluded that each of the six approaches has its own set of benefits. Furthermore, there was a clear distinction in the approaches between commercial use and non-commercial use, and non-monetary and monetary benefits. In the agreements, most commercial companies paid a monetary benefit, while public research institutes mostly shared non-monetary benefits.

The first approach, *the imbalance between the Global South and Global North*, was the approach with the most benefits and consisted of thirteen types of benefits. Additionally all the agreements contained at least one benefit in this approach. For commercial use, most benefits were monetary benefits, such as the payment of a percentage of the sales, fair income generation on the cultivation of the plants, and the financing of socio-economic projects of local communities for basic needs. For non-commercial use, most benefits were non-monetary, such as sharing research equipment, co-publication and sharing of research results. As can be seen these benefits mostly focus on an inequality of the number of resources in the Global South.

The second approach, *the need to conserve biodiversity*, is significantly smaller than the first approach, and consists of four benefits. In this approach there is a mix of monetary and non-monetary benefits. Three commercial companies shared a mix of monetary and non-monetary benefits, such as a fair price for selling the plants and training local communities on the cultivation process. One public research institutes shared the non-monetary benefit 'participatory research'. Moreover, external benefits shared by nearly all the public research institutes are important, namely knowledge generation about national biodiversity and teaching local communities about biodiversity.

The third approach, *biopiracy and imbalance property rights*, only has one monetary benefit shared by two commercial companies, namely annual royalties. The reason why public research institutes did not share any benefits in this approach is that they did not have intellectual property rights on their research.

The fourth approach, *a shared interest in food security*, is also a smaller approach. One commercial company shared one non-monetary benefit and one external benefit, respectively the sharing of research results related to food security and income for the cultivation of the plant. This enabled people in resource scare regions to buy more high-quality food.

The fifth approach, *imbalance IPR protection vs public interest*, included benefits shared by almost all the public research institutes, namely co-publication and sharing of research results.

And the last approach, *protecting the cultural identity of traditional communities*, has two benefits shared in two agreements, namely the incorporation of educated people of the local community in the research and the sharing of research results on TK. This helped by securing the interests of the local community.

This research showed comparable results to previous literature on benefit-sharing, but also made an addition to academic literature in two ways. Firstly, this research contributed to the conceptualization of the concept of benefit-sharing in the context of plant genetic resources. As explained in the research of Schroeder (2007) and Wynberg & (2014) the conceptual foundations, terminology, and framework of benefit-sharing are still vague and underdeveloped in the sharing of (plant) genetic resources.

Therefore, this research helped with the conceptualization of the concept by placing the different types of benefits under the different approaches.

Also, an important finding of the research are the external benefits. Most research on benefit-sharing in the NP focuses on (non-) monetary benefits in the formal ABS agreements (Robinson, 2014; Schroeder et al., 2020; Sirakaya, 2019). However, in this research it is shown that external benefits, which are not included in formal agreements can play a significant role in benefit-sharing as well. An example of an external benefit which occurred quite often is helping in socio-economic projects on basic needs of local communities. These projects have a positive impact on the lives of local communities. Therefore, it might be that the effects of formal ABS-system are smaller, because a lot happens outside the system.

Even though, all agreements that were studied have successfully negotiated an ABS agreement. It was noted that it was still an extremely complicated process. Therefore, the ABS system in the Nagoya Protocol should not only focus on making a *fair* and *equitable* benefit-sharing, but also on a *smooth* and *straightforward* process. Eventually this will contribute to the goal of the CBD to conserve biodiversity.

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Appendix

Appendix I - Overview of Possible Benefits of ABS Agreements of the Nagoya Protocol

Monetary benefits
(a) Access fees/fee per sample collected or otherwise acquired; (b) Up-front payments; (c) Milestone payments; (d) Payment of royalties; (e) Licence fees in case of commercialization; (f) Special fees to be paid to trust funds supporting conservation and sustainable use of biodiversity; (g) Salaries and preferential terms where mutually agreed; (h) Research funding; (i) Joint ventures; (j) Joint ownership of relevant intellectual property rights.
Non-monetary benefits
(a) Sharing of research and development results; (b) Collaboration, cooperation and contribution in scientific research and development programmes, particularly biotechnological research activities, where possible in the Party providing genetic resources; (c) Participation in product development; (d) Collaboration, cooperation and contribution in education and training; (e) Admittance to ex situ facilities of genetic resources and to databases; (f) Transfer to the provider of the genetic resources of knowledge and technology under fair and most favourable terms, including on concessional and preferential terms where agreed, in particular, knowledge and technology that make use of genetic resources, including biotechnology, or that are relevant to the conservation and sustainable utilization of biological diversity; (g) Strengthening capacities for technology transfer; (h) Institutional capacity-building; (i) Human and material resources to strengthen the capacities for the administration and enforcement of access regulations; (j) Training related to genetic resources with the full participation of countries providing genetic resources, and where possible, in such countries; (k) Access to scientific information relevant to conservation and sustainable use of biological diversity, including biological inventories and taxonomic studies; (l) Contributions to the local economy; (m) Research directed towards priority needs, such as health and food security, considering domestic uses of genetic resources in the Party providing genetic resources; (n) Institutional and professional relationships that can arise from an access and benefit-sharing agreement and subsequent collaborative activities; (o) Food and livelihood security benefits; (p) Social recognition; (q) Joint ownership of relevant intellectual property rights.

Appendix II – Interview protocol

Introduction

My name is Anniek and I am Master student at the University of Utrecht, and I am currently studying 'Sustainable Business and Innovation'. The research I am conducting is about access and benefit-sharing agreements in the Global South. For my research I am trying to collect a lot of different perspectives on access and benefit-sharing.

Do you have any questions before we start?

I would also like to let you know that if at any moment you feel you do not want to answer the question, you can just let us know.

Okay, one last question before we start. Is it okay for you that I record this conversation so that I can re-listen the interview? The interviews will be anonymized and only used for this research.

General Information

I would first like to collect some general info.

- Name, age, location (country)
- Can you shortly describe your job?

Concept 'Access and benefit-sharing'

- What does access and benefit-sharing mean according to you?
- Which factors should be included in a good access and benefit sharing agreement?

Questions about the ABS agreement

- Can you explain the ABS agreement?
    - Non-commercial/commercial
    - *Why did you choose to collaborate with this country? Only relevant for interviewing 'users'*
    - Was it easy to contact the provider of the genetic resource?
        - If no, why not?
- Who was involved in the ABS agreement?
    - *Actors who can be involved: National Focal Points, Intermediary parties, local communities, gene banks, etc.*

Questions about the concept 'access and benefit-sharing' in the ABS agreement

- What are the monetary benefits in the ABS agreement?
- What are the non-monetary benefits in the ABS agreement?
    - *Important question!*
- Why did you choose this [specific] benefit? *Let them explain it by each benefit!*
- What is the motivation behind choosing the [specific] benefit
    - *The South-North imbalance in resource allocation and exploitation*
        - *More focused on economic related*
    - *The need to conserve biodiversity*
    - *Biopiracy and the imbalance of property rights*
    - *A shared interest in food security*
    - *An imbalance between IPR protection and the public interest*
    - *Protecting the cultural identity of traditional communities*
- Are there any problems you try to solve with this [specific] benefit?
- Do you agree with the given benefits?

- Do you think these benefits help with establishing fair and equitable benefit sharing?
    - If yes, why? If no, why not?
- Was it easy to come to a good result on the negotiation on the ABS agreement?

Final questions

- What are lessons learned from the ABS agreement?
- What kind of advice would you give to other companies or researchers when establishing ABS agreements?