African Journal of Management Engineering and Technology

Afr. J. Manag. Engin. Technol., 2023, Vol. 1, N° 1, 47-65

Role and Expectations of the Private Sector in the Implementation of the Nagoya Protocol in Morocco

Benryane M. A. [1] *, Belqadi L. [1], Bounou S. [2]***, Birouk A. [1]******

[1]*Agricultural Biotechnologies, Agro-biodiversity and Local Products Unit (UR6), Hassan II Agronomic and Veterinary Institute, Madinat Al Irfane, B.P. 6202. Rabat, Morocco.*

[2]*Department of Research, innovation and partnerships, EUROMED University, Fes, Morocco*

**M. Mohammed Ali Benryane, Email address: a.benryane@gmail.com*

***Prof. Loubna Belqadi, Email address: l.belqadi@gmail.com*

****Prof. Salim Bounou, Email address: salim.bounou@gmail.com*

*****Prof. Ahmed Birouk, Email address: ahmed.birouk@gmail.com*

Received *20 June 2023,*
Revised *03 July 2023,*
Accepted *05 July 2023*

Keywords:
- ✓ *Genetic resources;*
- ✓ *Biodiscovery;*
- ✓ *Nagoya Protocol;*
- ✓ *Access and Benefit-Sharing (ABS);*
- ✓ *Bio Technology*

Citation*: Benryane M. A., Belqadi L., Bounou S., Birouk A. (2023) Role and Expectations of the Private Sector in the Implementation of the Nagoya Protocol in Morocco, Afr. J. Manag. Engg. Technol., 1(1), 47-65.*

Abstract: This study analyzes the results of a survey of companies in the pharmaceutical, nutraceutical and cosmetic sectors that are users of genetic resources from Morocco. The objective of the survey is to determine the experience of these local and international companies regarding access, monitoring and use of Morocco's genetic resources under the Nagoya Protocol's access and benefit-sharing (ABS) system, as applied in Morocco. The survey reveals limitations in information sharing and in the efficiency of responses and processing of access requests by the relevant administrations and authorities, as well as the unavailability of practical information for potential users on applicable procedures or temporary measures in force in Morocco. In general, the results point to a poor understanding of the expectations of private operators in the relevant sectors regarding ABS, and a lack of communication and coordination between users of genetic resources and the relevant authorities in Morocco. It is therefore recommended to increase transparency and access to information on access procedures, while developing the capacity of the competent authorities to better understand the sectors using genetic resources, in order to develop measures that are adapted to the operators and that do not hinder the R&D processes. This would facilitate the sustainable use of biodiversity in Morocco, to the benefit of the local population and the state.

1. Introduction

The Nagoya Protocol is based on the ABS provisions of the Convention on Biological Diversity (CBD). It contributes to the implementation of the third objective of the Convention: the fair and equitable sharing of the benefits arising from the utilization of genetic resources. Its binding nature and rapid ratification by many countries make it a powerful and effective tool to support efforts to achieve the CBD's benefit-sharing objective and to provide legal certainty for users and providers of genetic resources (UNCTAD, 2017).

By design, the Protocol aims to secure conditions of access to GR and to review the conditions for equitable sharing of benefits arising from their use, through concerted international action, and to

impose specific obligations on users of genetic resources, through so-called "monitoring" and "compliance" measures.

However, when companies along the value chain research and synthesize derivatives from the properties of the resource, the owners of the genetic resources receive only a small fraction of the benefits, if any. The Nagoya Protocol's ABS agreement aims to change this situation.

In the area of ABS, the Nagoya Protocol and the ITPGRFA (FAO Treaty on Plant Genetic Resources for Food and Agriculture) have established principles and obligations that national policy makers should implement through legislative, regulatory and administrative measures. Once these measures are adopted, regulators must implement the rules and procedures. The ABS mechanisms in place at the national level provide flexibility for policymakers to define the precise scope of ABS and BioTrade.

According to the CBD, national benefit-sharing mechanisms must provide for the fair and equitable sharing of benefits arising from the utilization of genetic resources, and from subsequent applications and commercialization, with the party that provided the genetic resources under the contract. Exploitation involves genetic and/or biochemical research and development on the genetic resources. The terms and conditions for the distribution of benefits are mutually agreed upon. Both monetary (such as royalties) and non-monetary benefits (such as sharing of research results or technology transfer) may be provided.

Given that any use of Moroccan genetic resources[1] is conditioned by an access authorization "respecting the principle of equitable sharing of the real benefits arising from the use between the user and the provider, based on the conditions agreed upon between the provider and the user of these resources" (Draft Law 56.17, SGG, 2022), it is important to ascertain how operators in the above sectors and potential users of Moroccan genetic resources assess the feasibility and ease of access to these resources, in order to assess Morocco's level of readiness to grant access rights and the establishment of regulatory mechanisms on this issue. It is also important to identify, through the previous experience of these private operators in Morocco, what are the bottlenecks, obstacles and areas for improvement in the procedures for access to Moroccan genetic resources for users.

In this context, the present study aims to collect answers to two main questions: given that the Nagoya Protocol relies heavily on the use of genetic resources by private researchers and operators, what are the impressions, experiences and expectations of private sector actors on the procedures for access to these resources in Morocco? Secondly, from the point of view of private sector actors, would the planned ABS mechanism in Morocco facilitate or hinder research by local and international bio-prospectors?

2. Methodology

2.1 Methodology for survey to private sector actors

The first objective of the study is to better understand the experience and expectations of private sector actors in the effective implementation of the Nagoya Protocol in Morocco. To do this, we begin by presenting the different sectors and industries that use genetic resources and the value that this could represent for Morocco. This presentation is based on a literature review of various sectoral economic

[1] According to the Draft Law on Access to Genetic Resources and the Fair and Equitable Sharing of the Benefits Arising from their Use 56.17 (General Secretariat of the Government, 2022), this includes "genetic resources in all their forms, but also intangible elements related to them, especially traditional knowledge associated with these resources; all in situ or ex situ genetic resources found in the national territory and in the exclusive economic zone; excluding genetic resources of human origin, genetic resources intended for personal use and those for which access and benefit-sharing are governed by special international instruments".

studies and analyses. Second, the study looks at the perceptions of the "ABS ecosystem" in Morocco by these companies. The research methodology is based on a questionnaire sent to various companies in the pharmaceutical and cosmetic sectors, the main users of genetic resources from Morocco, to identify their thoughts on access and use of genetic resources in Morocco under the Nagoya Protocol. This approach included the following steps:

1. **Development of the questionnaire**: The questionnaire was developed to include questions relevant to the research objective, particularly on companies' perceptions of existing and future access and benefit-sharing (ABS) mechanisms applied to the utilization of genetic resources in Morocco. The questions cover two main aspects: in the first part of the questionnaire, the intention and perception of companies is assessed regarding the alignment of their sourcing policy and approach within the framework of the Nagoya Protocol; in the second part, it is their experience of working in Morocco regarding access to genetic resources that is assessed, through questions on their perception of the effectiveness and quality of interactions between companies and the competent authorities responsible for granting access permits to genetic resources in Morocco (see full questionnaire in the Appendix). To ensure its relevance and alignment with current procedures and private sector practices, the questionnaire was validated by two key entities representing the relevant stakeholders: the Union for Ethical BioTrade[2] (UEBT) on the one hand, and the Department of Climate Change, Biodiversity and Green Economy of the Ministry of Energy Transition and Sustainable Development, which hosts the CBD and Nagoya Protocol Focal Point for Morocco.

2. **Sample design**: The sample of companies to be included in the study had to be formed in a systematic and random way, to ensure that the sample was representative of the target population. To this end, a broad call for interest over several months was used to identify companies on the basis of voluntary and anonymous participation in the questionnaire. In the end, a sample of 21 companies working in the pharmaceutical and cosmetic sectors was established and considered representative of the private sector using or interested in using genetic resources from Morocco[3].

3. **Data Collection**: The questionnaire, which was available in English and French, was developed on the Google Forms platform and could be sent to selected companies via an email link. The data collected included both quantitative and qualitative data.

4. **Data Analysis and Interpretation of Results**: The data collected was analyzed to identify trends in the perceptions of companies representing the private sector user of genetic resources in Morocco. The anonymity of the companies that responded to the questionnaire was respected in the analyses. Descriptive statistics were used to summarize the data and to provide insights for further study.

[2] UEBT is a non-profit association that promotes respectful sourcing. They define best practices for how companies and their suppliers source specialty ingredients for the beauty, food, natural pharmaceuticals, flavors and fragrances, herbs and spices, and other sectors. UEBT is internationally recognized for its work with companies on the ethical sourcing of biodiversity-based ingredients.

[3] The Department of Climate Change, Biodiversity and Green Economy of the Moroccan Ministry of Energy Transition and Sustainable Development estimated that between 2016 and 2022, it would receive an average of 15 to 18 requests for access or information about access to the Kingdom's genetic resources per year, which is less than the size of the sample surveyed.

5. Recommendations based on the results of the analysis: The results were used to identify the key factors that influence the involvement, sourcing and investment decisions of these companies in Morocco. Recommendations are made on the procedures and processing of access requests from companies using genetic resources in Morocco, as well as the potential opportunities they represent under ABS.

2.2 Importance of the private sector in the implementation of the Nagoya Protocol for Morocco

In recent decades, modern biotechnology has allowed us to use genetic resources (GR) in ways that have not only changed our understanding of biodiversity, but have also led to the development of new practices and products that improve human well-being, such as medicines or new foods to enhance food security. It has also led to improved methods for preserving biodiversity.

A company may use GR to create micro molecules, enzymes or extract genes for commercial use. The products of this research can be used to protect crops, develop drugs, make specialized chemical compounds or be used in industrial processes. Genes can be inserted into crops to improve productivity or resistance to disease or pests.

Given the extensive use of GR by key economic sectors, the private sector is a key player in the effective implementation of the Nagoya Protocol on Genetic Resources. By taking steps to ensure that their activities are consistent with the provisions of the protocol, private sector companies can contribute to the sustainable use and conservation of genetic resources, while supporting economic growth and development. The first step is to create an ecosystem that supports the development of a thriving local bioeconomy, supported by appropriate legislation and administrative procedures.

In terms of the bioeconomy, GR are used as renewable raw materials and apply biodiscovery and biotrade for biotechnology R&D and innovation and for the production of food, drugs, chemicals, and cosmetics. These can be of critical importance to Morocco's transition to a greener economy, as advocated in its National Strategy for Sustainable Development, which was reinforced by the New Development Model in 2021. Although concrete, documented examples of access to and use of genetic resources in Morocco are not yet published, due to the lack of existing ABS legislation in the Kingdom.

Currently, national institutions have not yet achieved the capacity to conduct such technical research from start to finish, and call for the strengthening of research infrastructure and resources4 . These institutions are also encouraged by their supervisory ministries to develop international collaborations and partnerships with the private sector and foreign laboratories to benefit from technical and material support. In return, national institutions are asking for the adoption of legal texts related to scientific research, in order to work in a framework of legal certainty and transparency, especially for scientific research for commercial purposes. Thus, given the lack of infrastructure, means and national legislative framework, R&D on Moroccan genetic resources is mainly framed for the moment by the conditions of the Nagoya Protocol and international research entities are the most likely to access and use Moroccan genetic resources by applying ABS principles.

Role of biodiscovery and biotrade in ABS

Biodiscovery is the collection and study of biological samples to find genetic information or biochemicals (Laird, Wynberg, 2021). The pharmaceutical, biotechnology, crop protection, food and

[4] Recommendation from the report of the dialogue and exchange workshop on the theme: "*What role for national researchers in ABS mechanisms and the implementation of the Nagoya Protocol?*" organized in 2019 within the framework of the GEF-UNDP Nagoya Protocol National Implementation Project.

beverage, and other high-tech industries practice biodiscovery. DSI - gene sequence data - is increasingly being used across all industries and companies. As defined by the Convention on Biological Diversity (CBD), genetic resources - plant, animal, microbial or other material containing functional units of heredity - are used in biodiscovery.

Biocommerce is the commercial collection, processing, and sale of specialized biodiversity products for natural cosmetics and personal care, functional foods and beverages, nutraceuticals, botanical medicine, and other raw material-dependent industries (Laird, Wynberg, 2021). Biotrade also uses traditional knowledge in its products and marketing, and some companies are sourcing ethically and sustainably and using certification to inform consumers. Companies are looking for whole organisms containing multiple active compounds. Biotrade uses biological resources, which the CBD defines as genetic resources, organisms, populations and any other biotic component of ecosystems that have utility or value to humans.

Biodiscovery researchers are increasingly using DSI databases to access genetic resources. Many companies use ex situ collections or collect physical samples from their gardens, which are now very small. Ancistrocladus korupensis and the U.S. National Cancer Institute (NCI) in Cameroon, and the International Cooperative Biodiversity Group (ICBG) from 1999 to 2003 in Madagascar, are ABS biodiscovery partnerships that have used genetic resources (Laird, Wynberg, 2021).

Biotrade companies interact more with wild biodiversity than biodiscovery companies and seek whole plants and marine materials, not DSI. In Cameroon, ABS biotrade partnerships have exploited Echinops giganteus and Pentaclethra macrophylla. Biotrade partnerships typically involve the sourcing of wild or cultivated bulk raw materials. Rooibos, aloe, and baobab in South Africa, and Siegesbeckia orientalis (Yves Rocher in 2014) and vanilla (Chanel in 2002) in Madagascar (Laird, Wynberg, 2021).

During the development of the multilateral treaty and its negotiations, the Nagoya Protocol placed more emphasis on physical materials and bilateral agreements, which are more common in the field of biotrade, to the detriment of the genetic resources that were the focus of the original agreement and the information typical of biodiscovery (Nijar 2011). This is particularly due to the reduction of lucrative drug production for the pharmaceutical industry, which had previously been used as the main example of the large commercial revenues generated by the use of genetic resources by negotiators (Laird, Wynberg 2012). Subsequently, the Protocol focused primarily on the issue of fair and equitable sharing, which also pushed the goal of biodiversity conservation to the back burner, bringing actors in the economic sectors using genetic resources to the forefront.

As these sectors are the main users of genetic resources, as defined by the Convention, it is therefore important to improve knowledge of the market, industrial and commercial trends that determine the demand for access to genetic resources and shape benefit sharing.

Industries using genetic resources of interest in Morocco

The cosmetic industry uses many tried and true natural ingredients, companies continue to research natural ingredients to find benefits and develop new products. Cosmetics are used for hair care, fragrances, personal care, beauty supplements and the category of cosmeceuticals, both "cosmetic" and "pharmaceutical" products, is growing rapidly. Over the past 15 years, consumer interest in health, wellness, organic products and fair trade has driven the cosmetics industry to use more natural ingredients. Botanical ingredients are in increasing demand. It is notable that awareness of ABS agreements has increased, with some companies signing voluntary agreements worldwide (Lopez, Potthast, 2019). Companies are protecting intellectual property, distribution systems, and innovations

as science and technology improve the screening and identification of active natural compounds. However, company science and technology, R&D investments, and patenting methods vary considerably in this sector (Koul, 2019).

In the pharmaceutical industry, my drug discovery was based on natural products, including penicillin and anesthetics (such as morphine). Recent studies have shown that 34% of the pharmaceuticals developed in the last 40 years are based on the genetics of natural products. Statins, tubulin and immunosuppressants are examples. Natural products are still being tested for their anticancer and antimicrobial properties (Newman, Cragg, 2020). Pharmaceutical companies are now using genetic resources differently. Large pharmaceutical companies are using external alliances and partnerships rather than internal research functions. Biotech companies and venture capital and government-funded research institutes are doing most of the bioprospecting (Newman, Cragg, 2020). Large pharmaceutical companies license interesting compounds and partner with or acquire small discovery groups. They develop promising drug candidates but are less likely to collect biological samples in situ. Each year brings new ideas and tools that could revolutionize natural product research through scientific and technological advances. Recent advances in screening natural product samples and isolating active components have changed everything detail (Newman, Cragg, 2020).

Finally, a variety of entities collect and conserve agricultural genetic resources for crop protection and agrochemicals. These include multinational biotechnology and chemical companies, small national or regional companies, universities and research institutes. The crop protection and agrochemical sectors use genetic resources for the search for interesting compounds, the selection of active ingredients, the transition to a pre-development process for promising products, and the commercialization of viable products. These sectors use a variety of genetic resources, from ex-situ collections, often held by research institutes, to bio-prospected microbes and insects (Thakur, Sutar, 2018). The Nagoya Protocol and ABS agreements are relevant to crop protection because many of the most common insecticides (neonicotinoids and pyrethroids) are derived from natural products. The industry uses wild plants, animals and microbes, including wild relatives of domesticated species, as well as local, commercial and elite varieties. The crop protection industry is developing insect control traits, particularly for resistance management. Genomic screening and combinatorial chemistry have improved chemical discovery by increasing the number of products screened biologically. A large agrochemical company can work with a small company to collect samples of soil microorganisms, test them and screen their DNA for similarities to insecticides.

The economic value of the utilization of genetic resources and the ABS mechanism

R&D companies often use natural ingredients to make cosmetics, fermented foods, vaccines and chemotherapies. The pharmaceutical, food, cosmetics, agrochemical, and biotechnology industries are the largest users of genetic resources. These sectors generated a combined revenue of US$10.6 trillion in 2021[5]. Traditional economic value estimation methods applied to genetic resources do not by themselves explain this value, but the proportion of end products developed through research on these resources can help us assign some value.

To be considered a "genetic resource dependent economy," the sector must conduct research and development on the genetic properties of natural resources to create new or improved products. The biotechnology sector has grown rapidly in recent years, with many companies investing significant

[5] According to 2021 Statista data: pharmaceutical industry: US$1,430 billion, food industry: US$8,045 billion, cosmetics industry: US$511 billion, agrochemical industry: US$261 billion, biotechnology industry: US$343 billion.

resources in research and development of new products. However, bringing these products to market can be a lengthy process, with most biotech products taking between 2 and 5 years to reach the market. In contrast, pharmaceutical products take an average of 10 to 15 years to reach the market. Despite the longer development times, pharmaceuticals generally generate higher revenues than biotechnology products. This is partly because biotech products require less testing and are generally less expensive to develop (ABS Initiative, 2019). Therefore, although biotech products may generate less revenue, they offer a faster and more cost-effective approach to bringing new products to market.

The International Union for Conservation of Nature (IUCN) estimates that the use of active ingredient resources from biodiversity, which includes the cosmetics, pharmaceutical, food supplement and nutrition sectors, could reach $8.5 billion by 2025. The potential increases when considering all biodiversity products, such as the global market for biodiversity-derived medicines estimated at around $80 billion by the World Bank. However, based on sales of finished products, only a small portion of this value is shared or can be shared with resource holders.

The Access and Benefit Sharing (ABS) mechanism of the Nagoya Protocol allows for a more equitable redistribution of value. When estimating this value, it is important to distinguish between the value generated by local economies from specific genetic resources (local market, value chain) and the value that could be shared with the holders of genetic resources through an ABS agreement with a user, which are inserted in specific clauses for this purpose. Genetic resource holders may already benefit from some of this value through production and marketing under a special "label" (organic, country of origin and other certifications, such as fair trade), as do agricultural producers.

A study conducted as part of Morocco's implementation of the Nagoya Protocol estimated that the Kingdom could potentially generate US$37-160 million per year (MAD 370 million - MAD 1.46 billion / year) in direct revenues, i.e., monetary benefits, in the event that all utilization of genetic resources is subject to royalties through ABS agreements, in accordance with the Nagoya Protocol (Ministry of Energy Transition and Sustainable Development, 2019). The potential for Morocco is therefore significant, and the value of genetic resources seems to be already established economically by the authorities.

Moreover, the Kingdom of Morocco's largest economic partner, the European Union, plans to have a competitive, efficient and low-carbon economy by 2050. The bioeconomy can contribute to this. Indeed, agriculture, food, beverages, agro-industrial products, aquaculture, forestry, wood industry, biochemicals, enzymes, biopharmaceuticals, biofuels and bioenergy represent 2.4 billion euros in Europe alone (European Commission, 2020). As is the case for many products, Morocco could thus be an important "export" source of genetic resources needed by the above-mentioned EU industries.

3. Results and Discussion

3.1 Survey on the private sector and ABS in Morocco

The questionnaire used for the core survey for this study consists of 11 questions divided into two distinct parts (see the full questionnaire in the Appendix). The survey aims to measure the level of integration that private entities operating in key sectors such as biotechnology, pharmaceuticals and cosmetics aim to have with respect to alignment with the Nagoya Protocol and its implementation in Morocco.

The first part includes five general questions designed to gauge the interest of companies in aligning their operations with the recommendations of the Nagoya Protocol, and their views on issues of access and sustainable sourcing, benefit sharing both monetary and non-monetary, and their experience in general with countries implementing ABS mechanisms.

The second part consists of 6 questions more specific to the case of Morocco, where the respondent companies operate or plan to operate in Morocco to access its genetic resources, and their experiences and especially their expectations of the national ABS mechanisms and national competent authority, as users.

3.2 Main results of the survey

In general, the majority of companies surveyed (81%) support and practice sourcing and utilization of genetic resources in accordance with the principles of the Nagoya Protocol. This is also the case where the countries from which the resources are sourced do not have specific ABS or Protocol mechanisms (Figure 1).

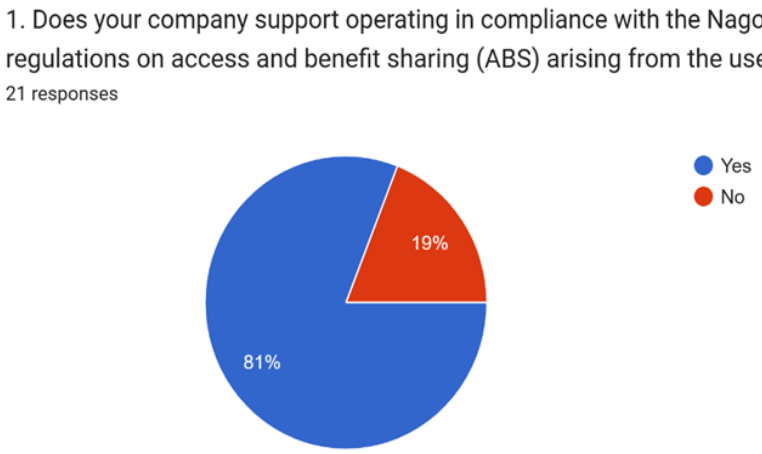

Figure 1: Does your company support operating in accordance with the Nagoya Protocol and international regulations on access and benefit sharing (ABS) from the use of genetic resources?

The vast majority of companies (more than 90%) also believe that monetary and non-monetary benefits should accrue primarily to local populations where the resources originate, and to the main actors in the supply chains and/or producers of these resources (Figure 3). Governments and competent authorities, even if they are sovereign over the genetic resources in question, should not, according to private sector operators, receive the majority of the benefits derived from the use of genetic resources. In Morocco, the vast majority (over 85%) of companies consider collaborating with national research entities, whether governmental, academic or private sector, to access and use the country's genetic resources (Figure 2).

Although a significant portion of the companies surveyed (48%) are concerned about the level of information on national genetic resources, the vast majority (over 80%) are more concerned about the potential lack of information and transparency regarding ABS requirements, as well as the existence of ABS requirements that are inadequate and not adapted to the realities of the sectors and industries involved (Figure 4). This is also the case for Morocco, as 71% of the companies surveyed are using or planning to use genetic resources from the Kingdom. The majority (62%) of these companies have already tried to find out about the procedures for accessing genetic resources in Morocco by requesting information from the National ABS Focal Point (Figure 5).

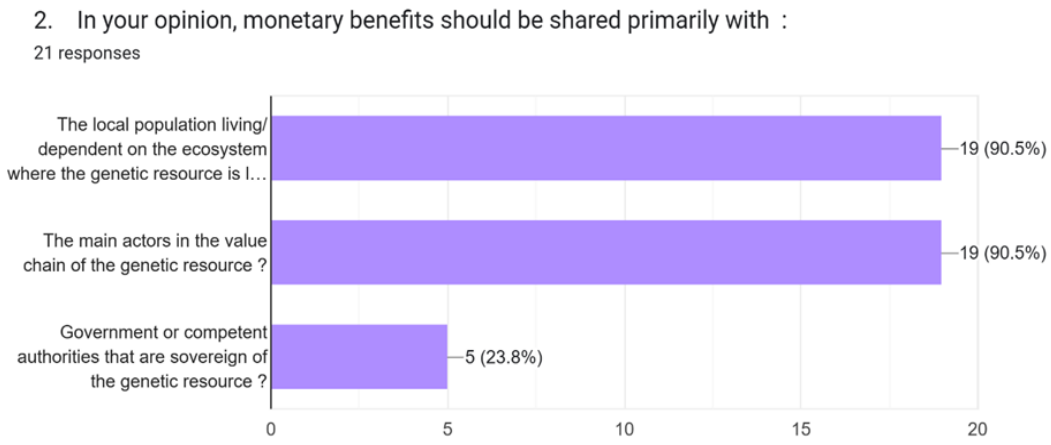

Figure 2: In your opinion, monetary benefits should be shared primarily with?

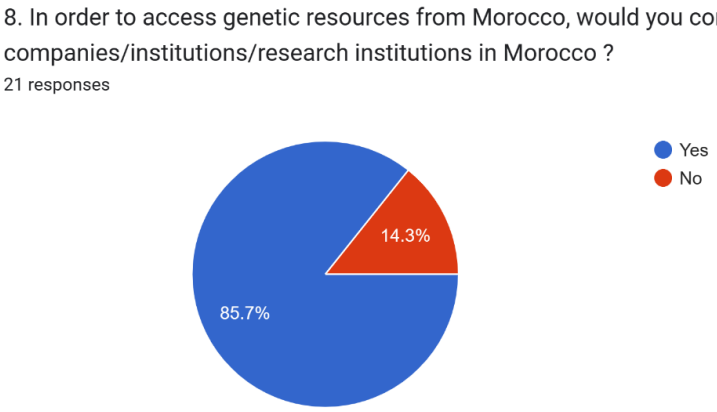

Figure 3: In order to access genetic resources from Morocco, would you consider cooperating with local companies/institutions/research institutions in Morocco?

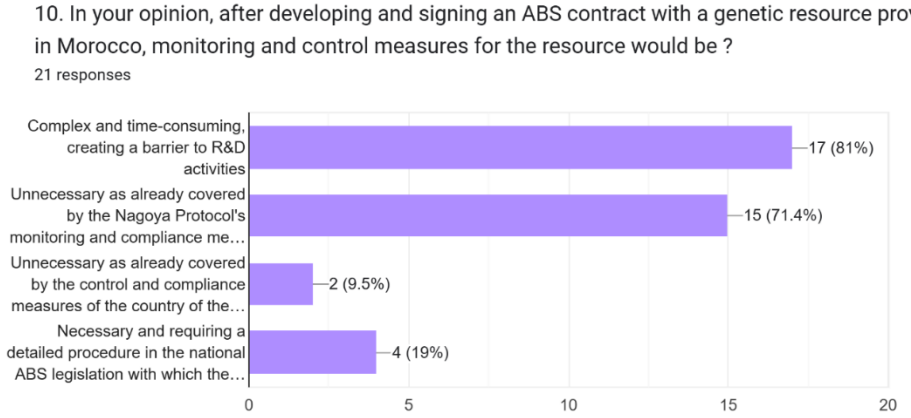

Figure 4: In your opinion, after developing and signing an ABS contract with a provider of genetic resources in Morocco, would measures to monitor and control the use of the resource be?

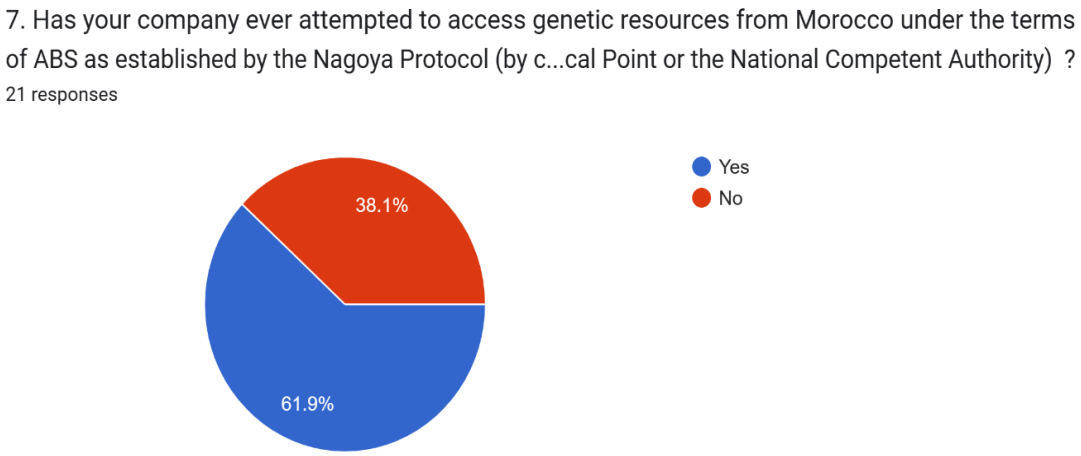

Figure 5: Has your company ever attempted to access genetic resources from Morocco under ABS conditions as established by the Nagoya Protocol (by contacting the Moroccan National ABS Focal Point or the National Competent Authority)?

Finally, the majority of the companies surveyed (over 80%) were not in favor of control and monitoring measures on the use of complex genetic resources, which they saw as time-consuming and thus hindering the R&D process (Figure 6). Most of these entities (71%) also see additional control measures as almost useless given the conditions already set by the Nagoya Protocol, namely the existence of Control Points and official communiqués, as well as certificates of compliance drawn up on the basis of PIC and MAT contracts granted by the holders of the genetic resources.

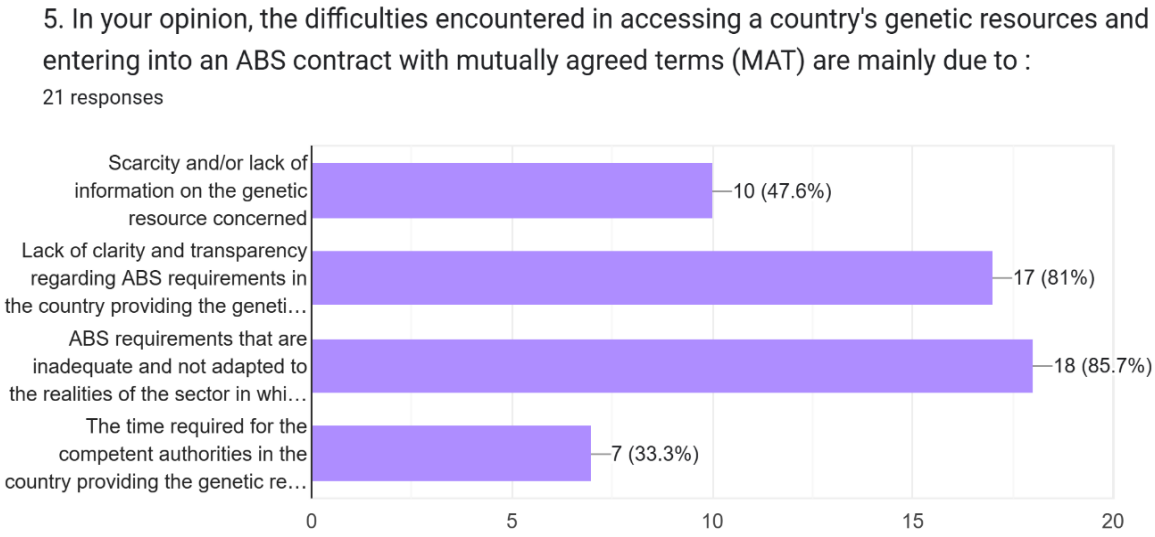

Figure 6: In your opinion, the difficulties encountered in accessing a country's genetic resources and entering into an ABS contract with mutually agreed terms (MAT) are mainly due to?

On the other hand, a strong majority of private actors do not plan to access traditional knowledge associated with genetic resources (Figure 7). For the remaining 34%, they would only consider accessing it if national regulations are clearly established and information on traditional knowledge associated with the genetic resources concerned is available.

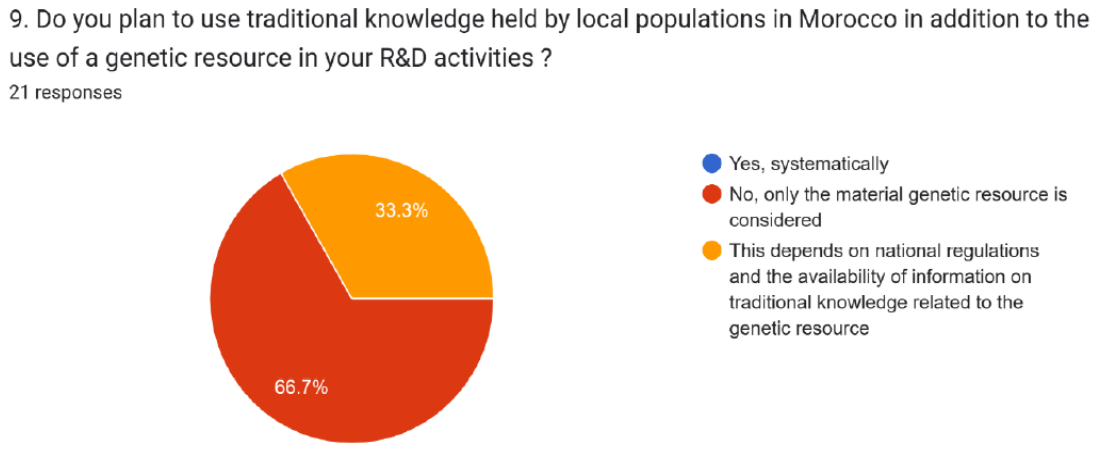

Figure 7: Are you considering using traditional knowledge held by local people in Morocco in addition to using a genetic resource in your R&D activities?

To summarize, in order to improve the effective implementation of the Nagoya Protocol by private and especially foreign operators in Morocco, companies emphasize the importance of having a "legal ABS framework that is better adapted and more in line with the realities of the sectors using genetic resources" (81%) and "simplified/more efficient administrative procedures and improved governance over genetic resources" (91%). Many of these companies (71%) also request more available information on existing biological/genetic resources in Morocco, as well as on existing ABS standards and contact points (Figure 8).

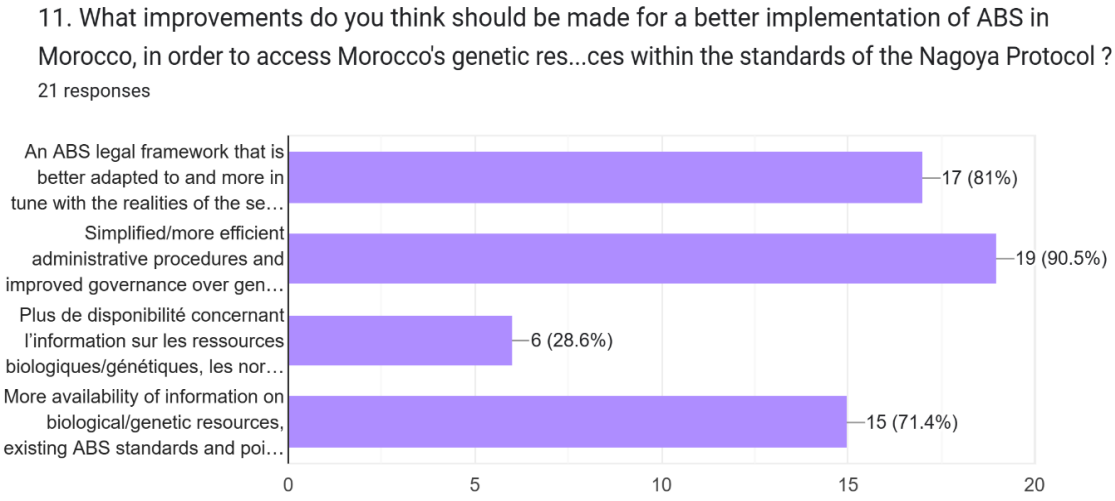

Figure 8: What improvements do you think should be made to better implement ABS in Morocco, in order to access Morocco's genetic resources within the standards of the Nagoya Protocol?

These three points highlight the key areas of improvement around which the development of an ABS mechanism and its legal framework must be articulated to promote interventions and investments by private operators using genetic resources in Morocco, in compliance with the Nagoya Protocol.

3.3 Discussion: Private sector experience and expectations regarding access obligations to genetic resources in Morocco

In general, according to the CBD, the Nagoya Protocol sets out 7 key conditions that national regulatory measures should verify regarding procedures for access to genetic resources:

1. Create legal certainty, clarity and transparency;
2. Provide fair and non-arbitrary rules and procedures;
3. Establish clear rules and procedures for prior informed consent and mutually agreed upon terms;
4. Provide for the issuance of a permit or equivalent when access is granted;
5. To promote and encourage research that contributes to the conservation and sustainable use of biodiversity;
6. Give due consideration to current or imminent emergencies that threaten biodiversity;
7. Consider the importance of genetic resources for food and agriculture, and their unique function in ensuring food security.

By analyzing the results of the survey through the prism of the elements of access conditions provided for by the Nagoya Protocol, we will be able to determine the level of interest, understanding, satisfaction or apprehension of the private sector user of genetic resources to work in Morocco and with local authorities.

A strong interest in Morocco's genetic resources and local partners

The majority of stakeholders surveyed expressed interest in accessing Morocco's genetic resources, and many also indicated that they had already requested information about ABS access procedures in the past. The survey also showed that, contrary to popular belief, companies are supportive of ABS and ethical and responsible sourcing. In general, Morocco's wealth of biological diversity and traditional knowledge positions it as a promising source of genetic resources for the pharmaceutical and cosmetics industries, among others.

But it is not only local genetic resources that are of interest to private actors using Moroccan genetic resources. Foreign companies want to process or ensure that benefits accrue to local actors, and to ensure a positive impact on local populations.

It is generally in the best interest of users of genetic resources to collaborate with research institutions in the country of origin. This is because collaboration with local research institutions can contribute to the ethical, sustainable and legal use of genetic resources. Collaboration with local research institutions can also provide users with access to the knowledge and expertise of local scientists and communities, which can be invaluable in understanding the properties and potential applications of genetic resources. In addition, collaboration with local institutions can facilitate the development of relationships and trust between users and local stakeholders, which is crucial for the long-term success of ABS projects for the exploitation of genetic resources.

In addition, Morocco has a law and several regulations governing access to genetic resources, and collaboration with local research institutions can help ensure compliance with this legislation. In some cases, local research institutions may also be able to facilitate access to genetic resources through established channels, such as national collections or botanical gardens. Collaboration with local research institutions can contribute to the responsible and sustainable use of genetic resources, while fostering productive partnerships and benefiting local communities.

The regional dimension is therefore important to take into account and too much centralization could hamper this dimension, also bringing uncertainties in the proper delivery of benefits, even when they have to transit through governmental mechanisms or entities. One solution would be to facilitate "B2B" exchanges between foreign users and research institutions, laboratories and universities that are implemented at the regional level and benefit from high value-added local knowledge.

Although the interest of private sector actors is well established with respect to genetic resources from Morocco, this does not seem to be applicable to the traditional knowledge associated with them. This may be due to the uncertainty of intellectual property; in most cases scientific and traditional knowledge may not be protected by intellectual property laws. In addition, companies must sign access and benefit-sharing agreements (ABS) with providers of genetic resources, and it is not clear who owns the traditional knowledge, except when it is entirely under state control, but local groups or communities can sue companies for misuse of traditional knowledge, which can potentially damage the company's reputation. While this may be beneficial to their research and development, these constraints may prevent companies from using or accessing traditional knowledge of genetic resources, and their preference in this regard is clear.

Dynamics of R&D and valorization of genetic resources carried by the private sector

Policy makers need to understand and integrate the complexity and dynamics of R&D in the field of biodiversity and genetic resources, especially when designing ABS mechanisms. Inputs, research methods, outputs, timelines, and strategies for use and commercialization of intellectual property vary considerably. This is not the case for basic research and development paradigms, which are best understood by academic institutions.

However, the valorization of biodiversity and national genetic resources depends on the transition between research and development. The valorization of genetic resources promotes the economic development of their host regions and local communities. Depending on national legislation, the Nagoya Protocol and ABS may cover various applied research activities on genetic resources.

The private sector and researchers are increasingly concerned about legal certainty and protection of their reputations against accusations of "biopiracy" or "misappropriation" under the ABS rules of the Nagoya Protocol, especially as more and more countries have ratified the Protocol and are developing appropriate legislation. Good faith and public relations are crucial, especially as consumers become more involved in purchasing decisions (e.g., biodiversity products) by asking about where and how products are produced.

With its financial resources, technology, and R&D expertise, the private sector can contribute to the valorization of Morocco's genetic resources at the national and international levels, adding value to genetic resources through the development of goods or processes that take advantage of their characteristics. With genetic resources, private companies can create new products, including medicines, cosmetics, and agricultural inputs. In doing so, they can benefit from the nation's biological wealth and can also stimulate local product and technology development, promoting job creation and economic growth.

Very often, private companies can fund and advise research on genetic resources in foreign countries. This can strengthen local capacity and economic prospects in poor countries. These companies can enhance the sustainability of genetic resources by developing environmentally friendly products or by supporting biodiversity conservation.

Lack of regulation and limited knowledge of genetic resources

To understand and value biodiversity and genetic resources, it is first necessary to have a good knowledge of what exists. This requires inventorying biodiversity and systematizing data from collections, literature, databases and other sources. Official databases on biodiversity and genetic resources are rare. However, publications on fauna and flora often initiate the centralization of data.

This information can help users and interested authorities to identify the industrial and commercial potential of the resources and the monitoring actions of national authorities. These baseline data are the first step in developing knowledge management systems that value and use biodiversity and genetic resources in R&D and value chains at the global level.

In defining the precise scope of ABS, policymakers and regulators may need to consider whether activities such as the isolation of natural compounds and extracts, the analysis of compositions and extraction processes, the identification of secondary metabolites, the identification and assay of specific enzymes, genetic engineering, the identification of genes and gene sequences, plant breeding through biotechnological processes, and the extraction of plants from the environment are covered by ABS, identification of secondary metabolites, identification and assay of specific enzymes, genetic engineering, identification of genes and gene sequences, plant breeding through biotechnological processes, and extraction of oils or oil fractions are covered by ABS mechanisms established at the national level (UNCTAD, 2017). These research and development (R&D) activities are mainly carried out by private companies in the agrochemical, agribusiness, biotechnology, and pharmaceutical and cosmetic industries (Fromageot, Leriche, Trommetter, 2015). Morocco must therefore develop ABS mechanisms that are as clear and transparent as possible, while ensuring that the requirements and legislation are consistent with the Protocol and do not handicap the industry sectors involved. In other words, the private representatives and operators of these sectors, who are in favor of accessing and using resources in a manner consistent with the Nagoya Protocol, do not want the ABS mechanism to be a hindrance to their activity, but rather the product of collaborative action.

Furthermore, given the low availability of information on genetic resources in Morocco, which is notably due to an irregular census of national biodiversity, and the lack of inter-institutional database sharing practices, private entities rely on collaboration with local institutions and field research to update their data and identify resources that could be the object of research and development.

3.4 Recommendations from the survey results

The entry into force of the Nagoya Protocol and the adoption of compliance measures in user countries, such as the European Union and Switzerland, puts pressure on policy makers in provider countries to verify without delay that their ABS mechanisms are operational and effective. The lack of an operational system to meet regulatory obligations for user compliance can have negative impacts on trade, also affecting regulatory exports of genetic resources or biodiversity goods to user countries (UNCTAD, 2018). Therefore, ABS regulations in provider countries can provide several incentives to promote compliance by projects and companies.

Improving regulatory measures covering genetic resources

Many nations lack clear and standardized institutional arrangements and rules governing access and benefit sharing, such as procedures for obtaining prior informed consent and determining mutually acceptable terms. In addition, they lack the capacity to collect, manage and share information on access and benefit-sharing, and the expertise to effectively perform regulatory functions related to access and benefit-sharing. In addition, awareness of the Protocol and its provisions is extremely low in the majority of nations. The Protocol's requirements are unknown to key stakeholders, including government officials, indigenous and local communities, the private sector and the general public. In addition, all parties need to strengthen and develop their capacity to monitor the use of genetic resources, including at checkpoints.

To facilitate access and benefit sharing (ABS) of genetic resources, several recommendations were made. First, it is recommended that the responsibilities of the competent authorities be clarified to ensure effective and efficient implementation of the ABS system. Second, simplified procedures for Prior Informed Consent (PIC) and Mutually Agreed Terms (MAT) should be provided to facilitate legal access to genetic resources. Third, expedited ABS procedures should be established for BioTrade companies that have already been vetted and comply with the CBD objectives and BioTrade principles and criteria. Fourth, the benefits already provided under the BioTrade initiative should be recognized as part of the benefits of the ABS system. Finally, a mechanism for regularization/amnesty of access prior to the entry into force of the protocol should be provided. These recommendations could help streamline the ABS process, increase transparency and promote compliance with the objectives of the Convention on Biological Diversity (CBD).

Improve administrative practices, access procedures and communication

The protocol has been criticized for a number of reasons, including the fact that it has added an extra layer of bureaucracy to comply with and that a number of studies have been slowed down due to vague and unclear provisions. For some, the concept of benefit sharing from access to genetic resources is only theoretically a win-win situation, involving legal recognition of benefits for resource owners and clear compliance procedures for users. In practice, however, the process is neither smooth nor simple. By engaging with policy makers and making constructive proposals on the best path to implementation, the business community can help ensure that the international system being established is functional, minimizes transaction costs, and helps to build the trust necessary to establish ABS partnerships that can provide benefits to both users and providers over time.

In order to facilitate access and benefit sharing (ABS) of genetic resources by companies, several recommendations can be made. First, contracts and authorizations should be established within a reasonable time frame, as delays can hinder research and be a disincentive to investment in R&D, which is often competitive. Second, binding assessments should be made on request, prior to the application for access, similar to the "advance ruling" mechanism used in customs procedures. Third, expectations of monetary and non-monetary benefits should be managed and quantified. Fourth, single-window systems and electronic processing should be used whenever possible. Fifth, the issuance of internationally recognized certificates of compliance (IRCCs) should be automated once contracts are established or permits are issued. Finally, the CBD and ABS focal points should be included in the administrative decision when companies have applied. These recommendations are intended to facilitate ABS processes for companies, increase efficiency, and promote compliance with ABS regulations.

To address the lack of information sharing among institutions in Morocco on genetic resource databases, a coordinated effort must be made to address these several issues. This could involve activating the national CHM ABS portal, creating a centralized database, providing resources and training to institutions, raising awareness of the importance of information sharing, addressing intellectual property and legal concerns, and promoting collaboration and partnerships among institutions.

Develop economic incentives

The use of biological resources can lead to innovation in many industries, creating jobs and income, but on the other hand, it can stimulate biopiracy and unfair competition, depending on how

they are exploited. The protocol aims to establish a multilateral framework to regulate biodiversity resources and ensure the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from their use.

To this end, a number of recommendations are suggested. First, unnecessary transaction costs should be avoided as much as possible. Recall that the cost of developing products from genetic resources through R&D already represents a considerable investment, to which it would not be advantageous to associate administrative transaction costs, including monetary benefit sharing, that would not benefit the local population or ecosystem. Second, access to genetic resources should be facilitated in cases where R&D or local manufacturing is conducted by the applicant. Third, tax incentives should be put in place for companies that comply with ABS and BioTrade principles and criteria. These recommendations are intended to promote the use of genetic resources for research and development, encourage local manufacturing, and provide incentives for companies to comply with ABS regulations and BioTrade principles.

Build and increase local capacity for ABS

National governments must ensure that the local level participates in the ownership of biodiversity and shares the benefits resulting from their use, and patent law must be amended to require disclosure of the origin of genetic resources before intellectual property is granted. Nagoya is a step forward because it has strengthened the local level by calling for legislative reforms in the parties' countries and administrative or policy measures to ensure that benefits arising from the use of genetic resources held by local communities are shared fairly and equitably with them.

Among capacity building measures at the local level, several recommendations appear to be priorities. First, an understanding of the specificities of biotrade and bio-business and their relationship to ABS should be promoted, both for local research actors and for policy and administrative decision makers. Second, there is a need to promote understanding of the different types of research and development (R&D), such as basic, applied and normative research. This is important for a better understanding of the standards and practices of different sectors and their application. Third, regulators need to be aware of the different business models and types of companies that typically participate in ABS proceedings. These recommendations are intended to increase awareness and understanding of ABS regulations, to promote compliance with ABS regulations, and to ensure effective and efficient implementation of ABS procedures, without hindering research and development of national genetic resources.

Conclusion

Private actors are interested in accessing Morocco's genetic resources under the Nagoya Protocol for several reasons. Morocco is a biodiversity hotspot, with a rich variety of plant and animal species that could provide valuable genetic resources for the development of new products in sectors such as pharmaceuticals, cosmetics and agriculture. Morocco also occupies a strategic position between Europe, Africa, and the Middle East, making it an attractive location for companies seeking access to genetic resources from a wide range of ecosystems.

In addition to the potential benefits for companies, there are also benefits for Morocco as a provider of genetic resources. The Nagoya Protocol provides a framework to ensure that providers of genetic resources receive a fair and equitable share of the benefits arising from the use of their resources. By entering into access and benefit-sharing agreements with international companies,

Morocco can receive financial and non-financial benefits such as technology transfer, training and capacity building.

However, for companies, universities, public research centers and laboratories that use genetic resources, clarity and predictability of international rules governing the subject are crucial. The Nagoya Protocol can establish procedures and facilitate access, promote harmonization of benefit-sharing opportunities, and provide transparency regarding the prior informed consent of providers of genetic resources as well as local communities.

Broader management at the territorial level, using the compliance mechanisms of voluntary sustainability standards, could help harmonize national and global agendas. The real benefits of such a more "decentralized" governance would be the increased capacity to protect biodiversity, avoid barriers to the use of ex situ genetic resources in agriculture, and promote a vision that fosters innovation based on the sustainable use of biodiversity resources and indigenous knowledge.

Morocco can receive many financial and non-financial benefits such as technology transfer, training and capacity building for the use of its genetic resources. But while regulations can, on the one hand, be used as competitive economic differentials with the potential to positively impact ecosystems and local populations, they also have the potential to become new forms of internal, private, and regulatory trade barriers that negatively affect both domestic and international trade. It is these potential barriers, including slow processing time and the lack of responsiveness from authorities to issue access permits, that are being pointed out by private actors. Local authorities must therefore improve their understanding of the industrial, economic, and scientific sectors involved in the use of genetic resources in order to develop appropriate measures that ensure controls but are not restrictive to R&D procedures and practices, to facilitate the use of Moroccan genetic resources and enable a research ecosystem that is conducive to the sustainable exploitation of biodiversity in Morocco.

In any case, there should be a concerted and coordinated effort to harmonize the practices, constraints, and methodologies adopted by private and public standards, so that they are not arbitrary, activity-limiting, or likely to favor only certain groups or convey particular interests.

Acknowledgement: the technical inputs of Ms. Valérie Normand, ABS Specialist for the Union for Ethical BioTrade (UEBT), and M. Mostafa Madbouhi, Head of the Biodiversity Division of the Ministry of Energy Transition and Sustainable Development of Morocco, are acknowledged.

Disclosure statement: *Conflict of Interest:* The authors declare that there are no conflicts of interest.
Compliance with Ethical Standards: This article does not contain any studies involving human or animal subjects.

References

Bhattacharya, T. R., & Managi, S. (2013). Contributions of the private sector to global biodiversity protection: case study of the Fortune 500 companies. *International Journal of Biodiversity Science, Ecosystem Services & Management,* 9(1), 65-86.

Claude Fromageot, Hélène Leriche, Michel Trommetter (2015). Biodiversity management by stakeholders: from awareness to action. Biodiversity & Economics.

European Commission (2020). Agriculture in the European Union - Statistical and economic information 2020. https://ec.europa.eu/info/sites/default/files/food-farming-fisheries/farming/documents/agriculture-in-the-eu-2020_en.pdf Accessed November 15, 2022.

Dedeurwaerdere, T., Broggiato, A., Louafi, S., Welch, E. W., & Batur, F. (2013). Governing Global Scientific Research Commons under the Nagoya Protocol. In E. Morgera, M. Buck, & E. Tsioumani (Eds.), 2010 Nagoya Protocol on Access and Benefit-Sharing in Perspective: Implications for International Law and Implementation Challenges (pp. 389-421). Leiden: Brill Nijhoff.

Economic valuation of bio-resources for access and benefit sharing (2013) National Biodiversity Authority of India.

Ibrahim, M.Y., Hashim, N.M., Mohd Ridzuan, N.R., Mohd Bohari, S.P., Suhaimi, A., Zainal, N., Zainol Abidin, Z., and Omar, H. (2019). Natural Products from Malaysian Forests: Potential for Drug Discovery against HIV-1 and Cancer. Current drug discovery technologies, 16, 45-55. https://www.eurekaselect.com/174656/article

Keswani, C (2020). Bioeconomy For Sustainable Development. Springer.

Koul, O. (2019). Plant-derived bioactive compounds: advances and perspectives. Springer.

Laird, S.A. and R. Wynberg. 2021. Connecting the dots: Biodiversity conservation, sustainable use and access and benefit sharing. BioInnovation Africa (implemented by GIZ and funded by BMZ), Voices for BioJustice, People and Plants International, and University of Cape Town.

Laird, S.A. and R. Wynberg. 2012. Bioscience at a Crossroads: Implementing the Nagoya Protocol on Access and Benefit-Sharing in a Time of Scientific, Technological and Industry Change. Secretariat of the Convention on Biological Diversity, 2012.

Lopez, C., & Potthast, T. (2019). The Nagoya Protocol: Its Implementation and Implications for Indigenous Peoples and Local Communities. Routledge.

McDougall A (2015). Cosmetic companies among only brands that consumers identify with biodiversity. 1 July. Available at http://www.cosmeticsdesigneurope.com/Market-Trends/Cosmetics-companiesamong-only-brands-consumers-strongly-identifywith-biodiversity (accessed 12 June 2017).

Ministry of Energy Transition and Sustainable Development (2019). Study on the Economic Potential of ABS. Developing a National Framework on Access to and Benefit-Sharing of Genetic Resources and Traditional Knowledge as a Strategy to Contribute to the Conservation and Sustainable Use of Biodiversity in Morocco. 2015-2019. Available at: Access and benefit-sharing projects financed by GEF (www.cbd.int) (Accessed September 11, 2022).

Morgera, Elisa; Buck, Matthias; Tsioumani, Elsa (2013). The 2010 Nagoya Protocol on Access And Benefit-Sharing In Perspective. Brill | Nijhoff. Availabe at: Https:// Brill.Com/View/Book/Edcoll/9789004217201/ B9789004217201_015.Xml. Accessed: 31 Aug. 2020.

Newman, D. J., & Cragg, G. M. (2020). Natural products as sources of new drugs over the nearly four decades from 01/1981 to 09/2019. Journal of Natural Products, 83(3), 770-803.

Nijar, G. S. (2011). The Nagoya Protocol on Access and Benefit Sharing of Genetic Resources: Analysis and Implementation Options for Developing Countries. Kuala Lumpur, Malaysia: The South Centre and CEBLAW.

Oberthür S and GK Rosendahl (eds), (2014), Global Governance of Genetic Resources. Access and Benefit Sharing after the Nagoya Protocol, Oxon, UK: Routledge.

Richerzhagen C, 'The Nagoya Protocol: Frag-mentation Or Consolidation?' (2014).

Secretariat of the Convention on Biological Diversity (CBD) (2017). ABS Clearing-house. Secretariat of the Convention on Biological Diversity, Montreal. Available at https://absch.cbd. int (accessed 12 June 2022). National reports.

Secretariat of the Convention on Biological Diversity (CBD). National reports on the implementation of the Nagoya Protocol. Available at https://www.cbd.int/reports/ (accessed 12 June 2022). Parties to Nagoya Protocol.

Secretariat of the Convention on Biological Diversity, Montreal. Available from https://www.cbd. int/abs/nagoya-protocol/signatories/ (accessed 12 June 2022).

Secretariat of the Convention on Biological Diversity (CBD), Montreal. Business 2020, November 2015, Volume 10 - issue 1. Available at https://www.cbd.int/doc

Secretariat of the Convention on Biological Diversity (CBD), Montreal. Business 2020, November 2015, Volume 10 - issue 1. Available at https://www.cbd.int/doc/newsletters/news-biz-2015-11-en.pdf (accessed 20 August 2022).

Statista. (n.d.). Pharmaceutical market: global revenue 2015-2021. Retrieved from https://www.statista.com/statistics/263102/pharmaceutical-market-worldwide-revenue-since-2001/

Statista. (n.d.). Global food industry - statistics & facts. Retrieved from https://www.statista.com/topics/1302/global-food-industry/

Statista. (n.d.). Global cosmetics market - statistics & facts. Retrieved from https://www.statista.com/topics/1003/global-cosmetics-industry/

Statista (n.d.). Agrochemical market worldwide. Retrieved from https://www.statista

TEEB (2010), "The Economics of Ecosystems and Biodiversity for Local and Regional Policy Makers", United Nations Environment Programme (UNEP).

Thakur, M., & Sutar, S. (2018). Biodiversity prospecting: a boon for agrochemical industries. Journal of Applied Biology & Biotechnology, 6(2), 77-80.

UEBT (2017). Ethical BioTrade Standard. Available at http://ethicalbiotrade.org/verification/ethicalbiotrade-standard/ (accessed 4 June 2017).

UEBT Union For Ethical Biotrade. UEBT Biodiversity Barometer'. 2020. Disponível em: Http://Www.Bio-diversitybarometer. Org/. Accessed: 31 Aug. 2020

UNCTAD. Addressing the intersection between the Nagoya Protocol, access and benefit sharing rules, and BioTrade. Available at http://unctad.org/en/pages/MeetingDetails.aspx?meetingid=1156 (accessed 12 June 2022).

UNCTAD, 2017. BioTrade and Access and Benefit Sharing: From Theory to Practice, A Handbook for Policy Makers and Regulators. Available at https://unctad.org/system/files/official-document/ditcted2017d6_fr.pdf (accessed 12 June 2022).

Vivas Eugui D and Adachi K (2016). Presentation at UNCTAD's workshop on "Addressing the intersection between the Nagoya Protocol, ABS and BioTrade", Hanoi, Viet Nam, June 2016. Available at http://unctad.org/en/pages/MeetingDetails. aspx?meetingid=1156 (accessed 12 June 2017).

Watanabe, Me. 'The Nagoya Protocol: Big Steps, New Problems' (2017) 67 Bioscience 400.