

Valorization Potential Assessments: Kenya

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Comment from Kenya

This valorisation assessment was positively received by Kenya and it provided the following comment.

The report is representative of the Kenyan situation at the time when the research was carried in 2014 / 2015. Since there has been some changes but they are not quite significant. It's finding that a favorable landscape exist in the country for developing ABS agreements and engaging business is accurate.

A range of recomandations for future research are made; as they were outside the scope of the valorisation assessment:

- Analysis linking patent documents to markets and value chains:
 - o Enlarge to other cases such as biotrade and GMOs
 - o Specify more clearly, for the patent documents based on microorganism, those with clear markets outputs and/or clear value chains
 - o Provide recommendations on how to engage these cases in the spirit of Nagoya to establish a favorable framework
 - o Clarify the economic potential of the species that have economic potential beyond the value chain and markets identified in relation to the patent documents
- Analysis on the legal landscape: extend beyond the provider to include user countries hosting the mult-nationals and engage them engage to facilate implementation.

Kenya is planning for a busines dialogue that could address some of these elements.

Introduction

The main objective of this assesment is to inform the development of national ABS frameworks and contribute to establishing an enabling environment for the valorization of genetic resources (GR). With a view to increasing the potential benefits arising from the utilization of GR, there is a need to bridge the gap between providers of GR and their potential users. For this purpose, key elements are examined to assess the current situation at national level and identify potential opportunities for the valorization of GR.

Section one examines the national bioprospecting strategy and key components of the national ABS regulatory framework in order to assess how the existing framework can contribute to an enabling environment for the valorization of Kenya's GR.

In section two, an overview of Kenyan actors potentially using or involved in R&D on GR is presented. It seeks to answer the following questions: Which actors are valorizing and/or utilizing GR in Kenya? How are they connected to each other and to foreign users? Are they capable to meet the users R&D requirements? What are the gaps?

In section three, an overview of the economic potential of the species is drawn from the separate study 'Biodiversity in the Patent System: Kenya', where the main question examined is what can patent information teach us about the range of potential economic uses of African GR and traditional knowledge (TK)?

In section four, the link between patent documents, value chains and markets is presented. Examples were selected to illustrate different types of commercialization and to highlight the economic potential of the species. Analysis of the value chain or profits that have been derived from the commercialization of products based on these GR/species is beyond the scope of this study.

Finally, a conclusion is presented and recommendations are suggested in order to answer the following questions: What are the practical steps to improve the valorisation of GR? What kind of business, legislative and regulatory environment is favorable for this purpose?

1. The national framework

1.1 A national bioprospecting strategy

A national bioprospecting strategy¹ was established in 2011. It contributes to the achievement of Kenya's 'Vision 2030', which includes a common vision on biodiversity management to enhance the economic wellbeing of the Kenyan people. This strategy provides a solid basis for examining opportunities for Kenya to valorize its GR. Some key features of the document include a definition of bioprospecting², a holistic problem analysis (see extract below), the identification of bioprospecting challenges and best practices for bioprospecting.

Bio-prospecting practice has not been adequately developed and institutionalized in Kenya, despite extensive consultation in local, national and international fora. Kenya has also acceded to many Multilateral Environmental Agreements (MEAs) related to bioprospecting, some of which have been domesticated but lack structures of implementation. (...) This state of affairs is attributed to the following:

- I. Inadequate legal and institutional framework on bio-prospecting.*
- II. Lack of standard partnership model for benefit sharing between resource owners and users.*
- III. Inadequate infrastructure and low level technological support for academic, industrial, agricultural and biomedical research.*
- IV. Inadequate financial support for research, innovations and development as well as technology transfer.*
- V. Inadequate awareness of the intellectual property rights associated with innovations from bioprospecting³.*

The strategy recognizes the multi-dimensional and transversal nature of bioprospecting and sets out the following strategic objectives:

- Enhance **institutional capacity** and review the statutory and regulatory framework for sustainable bioprospecting
- Develop a bio-informatics system that includes a **central biodiversity database** on all taxa and inventory including TK associated with bioprospecting

¹ Strategy for bioprospecting within and outside protected areas of Kenya, 2011.

² Bio-prospecting involves collection, research, discovery, development and commercialization of biodiversity and associated traditional knowledge.

³ Strategy for bioprospecting within and outside protected areas of Kenya, 2011.

- Develop **guidelines for sharing of benefits** derived from the use of biodiversity and associated knowledge for economic development
- Enhance information access and develop a **communication system**
- Develop a financial and **resource mobilization** mechanism for bioprospecting.

A strong focus, with nearly 50% of the entire budget, is given to: *‘Enhance capacity of public and private sector in Bio-prospecting including; research, product development, creating good value chains, access to markets and sustainable management and utilization of natural resources.’*

While the development of an information management network for bioprospecting is mentioned as a monitoring indicator, it is yet unclear how this is implemented. So far, an evaluation of the strategy was not carried out.

1.2 National ABS regulatory framework

Kenya adopted ABS measures prior to the adoption of the NP, in accordance with the ABS provisions of the Convention on Biological Diversity (CBD). Kenya may therefore need to revise its national regulatory framework in order to meet the obligations of Parties under the NP. However, the purpose of this assessment is not to evaluate the existing regulatory framework in light of the obligations of the NP. This assessment rather examines the regulatory framework in place in order to determine whether it contributes to an enabling environment for the valorization of GR, by establishing clear procedures for ABS that provide legal certainty to potential users of GR while helping to ensure fair and equitable benefit-sharing arising out of the utilization of GR.

For this purpose, a list of questions was developed in order to examine elements of the ABS regulatory framework of particular relevance to this study. Both the questions and their responses are included in annex one⁴.

Access and benefit-sharing in Kenya is addressed by the following measures:

- The Environment Management and Coordination Act (1999), no.8 of 1999, entered into force on 14 January 2000.
- The Environmental Management and Co-ordination Regulations 2006, Legal Notice no.160⁵
- The Wildlife Management and Conservation Act 2013 (art.22)
- The Constitution 2010 (art. 69 and 71).

The Environmental Management and Coordination Act 1999 (the Act) establishes the National Environment Management Authority (NEMA). NEMA is to exercise general supervision and co-ordination over all matters relating to the environment and is to be the principal instrument of Government in the implementation of all policies relating to the environment (Art. 9 (1), Act).

⁴ The list of questions was developed to guide the authors in examining the national regulatory framework in order to assess whether it contributes to an enabling environment for the valorization of GR. The answers to the questions were reviewed and completed by Veronica Kimutai from NEMA.

⁵ Available online at: http://www.nema.go.ke/index.php?option=com_docman&task=cat_view&gid=145&Itemid=99999999

The Act provides that the Authority shall issue guidelines and prescribe measures for the sustainable management and utilization of GR for the benefit of the people of Kenya. In accordance with this Act, the Environmental Management and Co-ordination Regulations 2006 (Regulations) were developed and adopted. They focus on conservation of Biological Diversity and Resources, Access to GR and Benefit-sharing. It is worth noting that the same procedures apply to access to GR for research or for commercialization purposes.

The following definitions are laid down in order to clarify ownership of GR in the country:

- Wildlife is a national resource and it includes microbes, plantae and animalia not recognized under the Agriculture Act or regulated under International Treaty on Plant GR for Food and Agriculture (ITPGRFA)
- The State means the National and county government.

Kenya ratified Nagoya Protocol on ABS on 1st May 2014 and Nagoya protocol is now in force. There are discussions to designate National focal point, Competent Authorities, ABS Clearing House, Checkpoints and publishing Authority. This will enhance certainty and clarity. As further described in Annex one, a number of elements of the national ABS regulatory framework contribute to legal certainty for potential users:

- As indicated above, a competent national authority, the National Environment Management Authority, has been established. However, this act does not fully comply at the moment in respect to the Nagoya Protocol. It does not state who the competent authority is, instead it refers to lead agencies:
 - Wildlife resources: Kenya Wildlife Services in line with local communities
 - Forest resources: Kenya Forest Services in line with Community forest association.

According to Nagoya Protocol the Provider is the competent authority. Hence, in Kenya the providers will include Wildlife Managers, Forest managers and Local indigenous communities whose mandate have been defined as per the constitution (Kenya Constitution 2010 and existing Legislations).

- Procedures for access include:
 - The need to obtain PIC from the provider before an access permit can be delivered;
 - Standard forms for applications and permits, including a list of the information that must be provided;
 - An access permit is valid for a period of one year and is renewable under specific conditions;
 - A clear schedule of fees for an access permit has been established;
 - In the event that a permit is refused, reasons for such refusal are provided in writing;
 - Nationals and non-Kenyans are treated the same in all aspects of access.

In accordance with the regulations, an access permit can only be granted once prior informed consent (PIC) has been obtained from the provider. The providers grant PIC as per the existing legislation, where PIC include among others MAT and MTA. The PIC is a government document. In cases where local communities are involved in the grant, the PIC is given jointly between the community and the responsible competent authority/lead agency. The Regulations do not provide for any specific

procedures to obtain PIC from providers. However, NEMA is in the process of developing guidelines for this purpose and a template/model for the PIC.

In addition, no specifications are included with respect to MAT. MAT, including the sharing of benefits, are to be negotiated between the potential user and the resource provider at the time of acquiring PIC. The time needed to obtain PIC and negotiate MAT with the resource provider may therefore vary depending on the circumstances on the ground.

The regulations also address the issue of confidentiality, which is often a key concern to potential users of GR. They provide that the Authority may hold some information relating to access to GR, which is the subject of the application, as confidential. The information held as confidential would then not be accessible to a person inspecting the register of access permits.

The following elements help to ensure the fair and equitable sharing of benefits arising from the utilization of GR:

- The sharing of benefits is specifically addressed under Part IV of the Regulations and provides a list of monetary and non-monetary benefits. A specific reference to the active involvement of Kenyan citizens and institutions in the execution of activities under the permit can contribute to building national capacity.
- Reporting requirements provide for reporting at regular intervals on the status of research, including discoveries from research involving GR.
- In the event of failure to comply with the conditions of the access permit, the permit can be suspended, cancelled or revoked. Non-compliance with the Regulations can constitute an offence and one may become liable to imprisonment or a fine.

In light of the above, it can be concluded that the ABS framework in place establishes a number of clear rules and procedures for ABS that should contribute to legal certainty for users while helping to ensure the fair and equitable sharing of benefits. It is however not possible to determine, based on an examination of these measures, whether their implementation has facilitated access to GR for their utilization and the fair and equitable sharing of benefits or whether improvements are still needed to contribute to an enabling environment.

The Authority has received 36 applications (between November 2009 and December 2015) and has issued 26 access permits⁶. All of them have been for Academic purpose (non commercial). Significant commercial bioprospecting took place before the legal notice and were mostly managed through the Wildlife Management Authority. Kenya has not received a commercial research application under the current ABS law. However, Kenya indicates that this number does not accurately reflect the volume of R&D in the local universities, private and public research institutions.

Furthermore, a practical case to draw lessons from recently emerged with Novozymes volunteering to share benefits resulting from the utilization of Kenyan resources. Novozyme contributed both in upfront for laboratory facilities and royalties. Royalties were channeled to community through the

⁶ See response to question 20 in Annex 1.

KWS CSR program. The sharing of the royalties has been discussed at various gatherings including the Copenhagen Business dialogue organised by the ABS initiative for Capacity Development. It remains a challenge but benefit sharing through institutional CSR to support key components of Wildlife conservation and community livelihood is critical. The royalties accrued from this venture have supported school fees for 250 students and some of the money is to support the community biocultural governance. So far Kenya is satisfied with these benefits sharing arrangements⁷.

A new project is to lay a framework for practical ABS model to inform policy for effective legislative development. The microbial bioprospecting project is due to start in the Soda lakes, bringing together industry and provider⁸. This project was funded by Nagoya Protocol Implementation Fund. It act as an incentive for both users and providers in meeting some of the cost in R&D value chain before commercialization.

According to a national source⁹, current challenges faced by the country regarding its ABS regulatory framework include the following:

- Compliance and enforcement both at local and international level¹⁰
- Quantifying ABS contributions in National Development Agenda for biodiversity conservation and livelihoods
- Ex-situ collections linkage to in-situ within the ABS framework
- National ABS law has not been realigned to the Constitution 2010, and does not capture emerging issues including addressing adequately article 6 of the NP.

2. Overview of Kenyan actors potentially using or involved in R&D on GR

Overall, limited information is available on the internet on the Kenyan actors, however the national bioprospecting strategy has facilitated the identification of relevant actors. The following analysis is based on publicly available information found through internet research, which limits its depth¹¹, and interviews with resource persons. These actors have a limited public profile as they are often a technical intermediary in long and complex R&D processes.

2.1 Methodology

The methodology used to identify the actors that are potentially using or involved in R&D on GR was based on the following steps:

- The characteristic of the country's economy was first examined to identify the key players that could be involved in the utilization of GR (e.g. biodiversity conservation, main economic actors)
- An internet search based on key words was carried out. The key words used are presented in annex two
- When possible interviews were realised with individuals having a good knowledge of the actors related to R&D and the valorisation of biodiversity in the country¹²

⁷ Mukonyi Kavaka Watai (Head Bioprospecting/Biotechnology, KWS), pers. com. 2015 He indicates that this is public information available at www.kws.go.ke and other Kenyan websites.

⁸

http://www.thegef.org/gef/sites/thegef.org/files/gef_prj_docs/GEFProjectDocuments/Biodiversity/Kenya%20-%20285626%29%20-%20Developing%20the%20Microbial%20Biotechnology%20Industry%20for%2011-21-13_MSP_Request_Document_NPIF.pdf

⁹ Mukonyi Kavaka Watai (Head Bioprospecting/Biotechnology, KWS), pers. com. 2014

¹⁰ For example it exempts institution with clear IP policies among others, which is a loopwhole.

¹¹ Actors that do not have an internet website could not be identified and are therefore not taken into account in the assessment.

¹² M. Mukonyi Kavaka Watai (Kenya Wildlife Service) and Ms. Veronica Kimutai (National Environment Management Authority)

- Specific internet research for each actor was carried out to identify: area(s) of R&D, maintenance of collections (e.g. genes), potential uses of GR; any collaborations with foreign actors (as a basis for potential exchanges of genetic material). For the last two categories, a basic Yes / No / Unclear categorization was used
- Based on the facts compiled, 38 institutions stood out as potentially relevant for ABS as their activities are related to the utilisation and valorisation of GR.

While a total of 68 actors were identified (listed in the annex three¹³), the most 38 relevant actors are examined in this report (and listed in annex two). They are categorised as follow:

- **Actors providing GR:** they are officially designated under national legislation as institutions with mandate to provide GR
- **Actors which may utilize GR in the context of their broader activity:** it is unclear if they specifically use GR, but it is a possibility in consideration of their mission statement, activities and area of expertise. Based on the limited information available, it is not possible to formally confirm this. They are classified in two categories: public research institutions and other institutions (e.g. NGOs, private sector).
- **Actors of the support environment:** they do not directly use GR but they contribute to an enabling valorization environment by providing financial, technical and organizational support to providers, users and other actors. They are classified in two sub categories: those that effectively contribute to the support environment and those that present a potential to do so.

2.2 Main results: the most relevant actors related to GR

The following examines the actors that seem of particular relevance to the valorization of GR. Due to the limited information available, it was not possible to examine the specific areas of research, projects, technical capabilities or the network of these actors. There are three actors who are providers of GR. In most cases the other actors seems to be involved in activities related to the valorization of biological resources (BR), however it is unclear how they utilize GR.

2.2.1 Providers

Actors providing GR

As per the legislative mandate, a range of institutions are designated as provider of GR. They are separated between Agriculture, and other GR/BR. It is worth noting, that the providers also include the local communities.

Kenya Wildlife Service¹⁴ (KWS) for wildlife within and outside protected areas as defined under the Act 2013. It provides for Wild genetic resource on behalf of the country. It is the main government competent technical arm to grant PIC, MAT and MTA on accessing the country's GR. KWS is one of the main custodian of the country's in-situ GR. Initially it used to act as the ABS focal point before NEMA

¹³ Considering the limited information available, further analysis may indicate that they should be integrated into the core actors concerned by ABS and the economic valorisation of GR.

¹⁴ www.kws.org

came in place, but currently it's the Competent National Authority. Though this has not been clarified in law as indicated previously.

It has various memoranda of understanding with local and international institutions for bioprospecting activities. Some of the collaborating institutions include: the International Centre of Insect Physiology and Ecology (ICIPE); Diversa; DuPont Corporations; Novozymes; the Ministry of Education and Science of Germany; and the Royal Botanic Gardens (KEW) on a Millennium Seed bank project.

The **Kenya Forest Service**¹⁵ manages both plantation and natural forest areas specifically for the conservation of forest. It also manages ex-situ conservation programs such as the National Arboretum where there are plantations of high commercial value of tree species such as *Prunus africana*, *Juniperous procera*, *Podocarpus sp*, *Croton sp*. and *Vitex keniensis*. Some of these species are subject to on-going R&D by actors operating in international markets.

County Governmnet and local communities. They grant PIC jointly with the National government for example with KWS where the resource is under definition of Wildlife.

There are current proposals to merge KWS and KFS as single entity to enhance timely granting of PIC to users.

2.2.2 Potential users

Actors which may utilize GR include both public and private research, CGIAR bodies in the country, International NGOs, ex-situ collections and universities. A range of Public research institutions were identified. However, there is limited information available on the private sector actors and NGOs in Kenya and their potential involvement in the utilization of GR. Very limited companies operating in the medicinal plants and forest sectors could be identified, although some databases could be explored as a next step¹⁶.

Public research institutions

A range of national research centers on industrial R&D, agriculture, insect, marine and fisheries as well as **five universities** were identified. They have various research departments working on BR resources and potentially using GR. There is a national gene bank and a range of ex situ collections. A range of laboratories, insitutes and other authorities have also been identified but less information was available on their activities related to GR.

The **Kenya Forestry Research Institute**¹⁷ has a tree seed centre which serves as a repository for commercial and research purposes. It establishes botanical gardens and also has research programs including the screening of bioactive products from plants, for resistance to pests and diseases.

¹⁵ www.kenyaforestservice.org

¹⁶ List of companies in the agro-industry : www.commonwealthofnations.org/sectors-kenya/business/trade_associations_and_chambers_of_commerce/#

List of actors related to health research : www.healthresearchweb.org/en/kenya/institution

¹⁷ www.kefri.org/servicp.aspx

The **Kenya Industrial Research and Development Institute**¹⁸ (KIRDI) undertakes multidisciplinary industrial research and development. For instance, the Food Technology Divisions focus on reducing post-harvest food losses through process and product development.

The **Kenya Agricultural Research Laboratories**¹⁹ (KARI) promotes agricultural research, technology generation and dissemination to ensure food security through improved productivity and environmental conservation. It has a range of research programmes including food crops, horticultural and industrial crops.

The **Kenya Marine and Fisheries Research Institute**²⁰ carries out ex-situ marine and freshwater conservation. No further information was found regarding their potential utilization of GR.

The **Horticultural Crops Development Authority**²¹ carries out trials for horticultural crops and technologies, mainly on new varieties of crops in the market and seeks to develop partnerships with industry.

The **Kenya Animal GR Centre**²² manages the National Livestock Resources Genebank and acts as a reference laboratory for exportation and importation purposes.

Other institutions such as Kenya Agricultural Research Laboratories (KARI), Kenya Medical Research Institute (KEMRI), Kenya Trypanosomiasis Research Institute (KETRI), Kenya Veterinary Vaccines Production Institute (KEVEVAPI) and Veterinary Laboratories have kept various types of culture collections ranging from microbes, tissue and blood serum. However, the type of research carried out and whether they utilize GR is unclear.

With regard to agricultural and food research, due to the limited information available, it is unclear if the activities of these actors are covered by Multilateral System of the FAO Treaty (MLS) of the ITPGRFA or by the NP.

The **International Centre of Insect Physiology and Ecology** (ICIPE) is an international NGO with activities in food, health and biodiversity. Some products have been commercialised after internal research.

The **National Gene Bank**²³ undertakes ex-situ conservation of Kenya's plant genetic resource. The genebank main mandate has been on Standard Material Transfer Agreement (SMTA) under ITPGRFA. But it is being expanded for other insitu collections. A central genebank is under construction and it establishes a network among existing national research stations. The National gene bank indicates that over 60% of the accessions for GR are from Kenya actors, while the remaining ones are from more than 137 countries. A significant proportion of the collection consists of cultivated species although there is substantial amount of demands for wild species of economic value such as medicinal plants (over 4000

¹⁸ www.kirdi.go.ke/

¹⁹ www.kari.org

²⁰ www.kmfri.co.ke

²¹ www.hcda.or.ke

²² www.kagrc.co.ke

²³ <http://www.kari.org/genebank>

accessions representing over 1000 species)²⁴. Hence, there is certainly scope to improve the connection between domestic R&D actors and foreign users.

Furthermore, two networks of public institutions, the **National Museums of Kenya** and some **universities**, which carry out research activities, hold ex-situ collections.

The **National Museums of Kenya**²⁵ (NMK) collect, study and preserve Kenya's cultural and natural heritage. They are comprised of around 20 museums. NMK house the East African Herbarium (over 1 million specimens) and the Nairobi Botanic Garden whose functions are the identification of specimens, verification of plant names and propagation and preservation of live plant specimens. The NMK currently holds over three million biological specimens and is also the regional reference centre for botany and a national repository of botanical knowledge. Furthermore, some **universities**²⁶ have established a system for the exchange of biological material.

Some **universities** have relatively advanced research programmes covering a wide spectrum of biodiversity (GR, BR, ecosystems) for various industrial and market applications. In particular two universities have collaborations with foreign partners. One has even a benefit sharing agreement however no further information was found.

The **Kenyatta University**²⁷ research includes work in human and animal health, screening of bioactive products from plants, crop and animal resistance to pests and diseases. The School of Environmental Management is developing technologies for the treatment of waste water from abattoirs, tanneries and organic waste. Collaborating institutions include local and international universities and research institutions. Their notable achievements include two joint patents with ICIPE with a 50-50 benefit-sharing plan.

The **Egerton University**²⁸ has a bioprospecting initiative including anti-microbial and pesticide substances, marker genes for high food yielding, for disease resistance and indigenous chicken genotypes and livestock improvement projects. In addition there are projects on marker genes for heat stress tolerance, drought tolerance, water use efficiency and nutritional health properties. The university has Memorandum of Understandings and Material Transfer Agreements involving both local and international partners.

The **University of Nairobi**²⁹ has a large collection of biological specimens and cultures for research and training. Research includes phytochemistry and screening of plants for herbal medicines, a postgraduate program on natural products, bioprospecting and value chain, research on enzymes from extremophilic micro-organisms, biofertilizers, plant and animal genetic improvement. It is a long standing partner in many research including bioprospecting cooperation projects with foreign Universities (e.g. England, Germany, Austria, Sweden). Thus in cooperation with other partners a

²⁴ Strategy for bioprospecting within and outside protected areas of Kenya, 2011.

²⁵ www.museums.or.ke/#

²⁶ Universities such as Nairobi University, Moi University, Kenyatta University, JKUAT, Egerton University, Masinde Muliro University of Science and Technology and Maseno universities

²⁷ www.ku.ac.ke

²⁸ www.egerton.ac.ke

²⁹ www.uonbi.ac.ke

scientific workshop³⁰ on the soda lakes was organized in 2013 on the state of the art of research cooperation and potential commercial applications.

At the **Jomo Kenyatta University of Agriculture And Technology**, research projects include tissue culture of horticultural and commercial plants, Oyster and button mushrooms, microbial bioprospecting and organic farming practices.

The Moi University³¹ bioprospecting projects includes: a comparison of soil fertility management practices in Western Kenya, Bean germplasm evaluation, chick pea improvement, French variety development and Snap bean improvement.

2.2.3 Foreign research institutions that operate in Kenya which may utilize GR

The International Livestock Research Institute³² (ILRI) and the World Agroforestry Center (ICRAF³³) are potential users of GR.

2.2.4 Actors of the support environment

A few actors were identified which seem to contribute and/or support the valorization of BR and possibly include GR. The **Export Promotion Council**³⁴ promotes the export of Kenyan products and has knowledge of foreign markets. It is however unclear to which extent it is involved in the promotion of projects related to the utilization of GR.

There is a range of sector specific business associations that can potentially support the valorization of GR, including compliance with international standards. Certain actors could potentially contribute to the valorization of GR:

The **Tegemeo Institute**³⁵ conducts policy research and analysis in the domain of agriculture, rural development, natural resources and the environment.

A range of **industry business associations**³⁶ have been identified including the Private sector alliance³⁷ (KEPSA) and Kenya association of Manufacturers (KAM)³⁸.

A **Natural Products Initiative Platform** is under creation³⁹. It aims to develop policy on Natural product industry with a focus on traditional medicines. The **Business Incubation Association of Kenya** supports innovative entrepreneurship.

³⁰ http://www.kws.org/export/sites/kws/info/events/2013/Downloads/Kenyas_Soda_Lakes_workshop.pdf <http://www.ttuc.ac.ke/wp-content/uploads/2014/03/Program+-+abstracts.pdf>

³¹ www.mu.ac.ke

³² www.ilri.org

³³ www.worldagroforestry.org/country/kenya

³⁴ www.epckkenya.org

³⁵ The Institute aims at addressing Micro and Macroeconomic policy issues bearing on farming, processing, marketing, and trade of agricultural products and inputs; sustainability of agricultural systems, natural resources as well as the environment; and commercialization, income growth and food security. www.tegemeo.org/partners.asp

³⁶ Agrochemicals association of Kenya (AAK) (<http://agrochem.co.ke>), Fresh Produce Exporters Association of Kenya (www.fpeak.org), Horticultural Growers Association & Kenya Flower Council (www.kenfap.org), The Kenya national chamber of commerce and industry (www.kenyachamber.org.ke), Seed Trade Association of Kenya & Kenya Seed Company (www.stak.or.ke, www.kenyaseed.com), AAA Growers (www.stak.org.ke).

³⁷ www.kepsa.or.ke

³⁸ www.kam.co.ke

³⁹ No further information is available and the website is under creation.

A range of **community based organizations** (CBOs) and **NGOs** conduct ex-situ conservation activities.

The **Intellectual Property** landscapes is constituted of **Kenya Industry Property Inistiutel**⁴⁰ (KIPI) for patent documents, trademarks, and designs, **Kenya Copyright Board**⁴¹ (KECOBO), and **Kenya Plant Heath Inspector Service**⁴² (KEPHIS).

The **regulators** include as previously menentioned NEMA, KWS, KFS, as well as the National Commission for Science, Technology and innovation⁴³ (NACOSTI), Kenyan Bureau of Standard⁴⁴ (KEBS) and Customs⁴⁵ (KRA).

2.3 Key findings

In summary, a few experienced and highly relevant actors demonstrate a good expertise in some specific R&D phases. The following are some key findings arising from the identification of actors involved in activities related to R&D, which may utilize GR:

There is a a **diverse network of public institutions providing and potentially utilizing GR** in diverse R&D programs, including bioprospecting projects and research in biotechnology. Of particular relevance are 3 types of **gene databases** (plant, tree, animal) housed in institutions with the mandate to promote their exchange.

Universities have research programmes covering different scales of biodiversity (e.g. GR, BR, ecosystems), a wide spectrum of species (e.g. marine, microbes, enzymes, animal, plant, tree) for various industrial and market applications. Some clearly have expertise in bioprospecting and related intellectual property issues. Some have relatively advanced foreign collaborations for the exchange of GR. There are also 2 institutions with potential to use GR related to trees with high commercial value and horticultural crops.

Overall, there is **limited information available on the Kenyan private sector** but there are **business organisations** for particular sectors. It is unclear to which extent they cover a) market opportunities related to GR and b) compliance with international regulations such as ABS.

There is a **large support** environment. Of particular relevance are two public institutions related to intellectual property and the promotion of export; which are two key components of an efficient valorization framework. Furthermore, there is a dedicated program to promote **natural products based on TK**, and a **business incubation association**. There is however limited information on community based organizations (CBOs) and NGOs.

⁴⁰ www.kipi.go.ke

⁴¹ www.copyright.go.ke

⁴² www.kephis.org

⁴³ Oris.nacosti.go.ke

⁴⁴ www.kebs.org

⁴⁵ www.kra.ke

3. Biodiversity in the patent system for Kenya: overview of the species' economic potential

The separate study “Biodiversity in the patent system: Kenya’ available at http://www.abs-initiative.info/fileadmin/media/Knowledge_Center/Pulications/Patent_Studies/Kenya_Country_Report_14072013_complete_SMALL.pdf. It presents the results of the analysis of patent activity for the country’s GR and TK. Key insights are drawn from this patent study, related to the economic potential of species.

3.1 Species that are known to be distributed in Kenya and elsewhere

GBIF⁴⁶ indicates 16 594 records for species names for Kenya. In total, 3 134 species names that are known to occur in Kenya were identified in the patent data from the major jurisdictions (e.g. North America, Europe, Patent Cooperation Treaty).

The assignees in the overall data for species of relevance to Kenya range across a spectrum from biotechnology (e.g. Genentech), companies in areas such as biocides/insecticides (BASF and Bayer), agriculture (e.g. Du Pont) and personal and household products such as Proctor and Gamble. More detailed analysis of technology areas revealed pharmaceutical companies such as Mondobiotech which specialises in rare and neglected diseases such as amoebiasis, TB and leishmaniasis while the US Army is conducting research and development for leishmaniasis and plasmodium (malaria). As this makes clear there are a wide range of general and specialised technology areas and markets of relevance to biodiversity from Kenya (Oldham P, et al. 2013).

3.2 Species that were directly sourced from, or potentially originate from, Kenya

In total, 29 species were identified that were directly sourced from or likely to originate from Kenya (amongst these, nine were examined to link the patent documents to value chains and markets). There is a diversity of species, mostly plantae, but also fungi, archae and bacteria. The main market is the pharmaceutical sector but other sectors such as nutraceuticals, biotechnology and insecticides are present too. The main technology areas are biotechnology, pharmaceuticals, and peptides.

The top three claims in the patent documents refer to:

- Plant / variety,
- Methods of producing a plant, a compound or other desired outcome,
- And / or composition (e.g. extracts, compounds or combination of ingredients).

These types of claims may take a variety of forms as there are different ways to write and interpret them. While providing an overview of how claims relating to the country’s biodiversity are framed in patent documents, close attention is needed to both the type and the content of patent claims as well as where and whether the a patent grant is in force.

The analysis based on patent citations, revealed two species (*Acokanthera ouabaio* and *Natrialba magadii*) where there could be further economic potential related to the patented inventions. The analysis of the patent family allowed the identification of two species (black tea, *Natronococcus*

⁴⁶ The Global Biodiversity Information Facility (GBIF) is an international open data infrastructure, funded by governments. It allows anyone to access data about all types of life on Earth, shared across national boundaries via the Internet.

occultus) of potentially high business importance to the applicants, where further R&D partnerships could be explored.

4. Links between patent documents, value chains and markets

Out of the 29 species identified, nine species were selected to illustrate different types of commercialization and to further explore the economic potential of the species. In some cases this analysis uncovered additional information on the current R&D and commercial developments that can be of interest for future exploration of the economic potential of the species or the specific GR. The table in annex five presents the patent documents with all the information identified on the status of the R&D and linkages with value chains and markets. Based on this data, a summary table of the patent documents examined is presented below.

Finally, the existence of TK related to the species was also reported. This information was either obtained from the patent document or incidentally found during the internet search. It is important to note that the information is only about the existence of TK on the species and it is not specifically related to the innovation.

4.1 Methodology

An internet search was conducted in order to link patent documents to value chains and markets. This consisted of the following steps:

- The study of Kenya' biodiversity in the global patent systems provides a list of patent documents of potential economic interest as they directly relate to Kenya (see separate study 'Biodiversity in the patent system: Kenya')
- From this list, nine species, found in over 49 patent documents⁴⁷, were selected using the following criteria:
 - The species that were most referred to in the patent documents, or that had a high number of patent citations⁴⁸ or large patent families⁴⁹ were analyzed in priority
 - When there were too many patent documents to examine for a same species, either a focus was given to those held by the patent assignees that hold the majority of them or in some complex cases a random selection was realized
- Finally, 35 specific patent documents (spanning across the nine species) were selected
- Each patent document was then analysed in two phases:
 - First, in order to understand what the innovation is about, a thorough understanding of the patent document was necessary. For this purpose the analysis focussed on some sections of the patent document: title, abstract, main claims and prior art.
 - Secondly, an internet search was conducted in order to identify the status of the R&D and the presence of the GR in a value chain or on a market. For this purpose, specific

⁴⁷ Two reasons explain the difference between the number of species and the number of patent documents. First, different organisations can hold a patent application or grant for a compound or extract from the same species. For instance, there are over 10 public and private actors holding a total of 186 patents for *Nocardia transvalensis*. Secondly, an inventor generally seeks to protect its innovation at different points in time as its R&D progresses and also diversifies.

⁴⁸ The more often that a patent document is cited by later patents is a measure of importance and impact of that patent within the patent system.

⁴⁹ A patent family is a set of patent documents that links back to an original parent filing.

key words were used (e.g. the species name, the patent assignee, the inventor, the innovation patented and the targeted market)

- When no product, service, or ongoing R&D could be found a second search was done by visiting the patent assignee's website to identify potential R&D hints
- Finally, the following classification, with a basic Yes / No / Unclear categorisation, was devised to indicate the degree of linkages with a value chain or a market :
 - Evidence that a product or service is marketed or under active R&D (code : yes)
 - Presumption that a product or a service is marketed or under active R&D but there is no clear evidence (code : unclear)
 - No information could be found about a product, a service or active R&D (code : no)

One limitation of this approach, is that it mostly allows to access information regarding marketing activities in the 'business to consumer' segment, as information is often publicly and readily available. Other types of commercialization protected through licenses and trade secrets for example in the 'business to business' segment are difficult to capture because they are seldom publicly available. Furthermore, in many cases it was difficult to confirm the presence of a species in a product due to corporate marketing practices that infrequently disclose such information (e.g. rebranding of species active molecule, trademarks). Also, in some jurisdictions companies are not legally required to disclose the product's list of ingredients.

4.2 Main results of analysis

4.2.1 Linking patent documents to value chains and markets

The nine species (covered in the 35 patent documents examined) are the focus of development of products in the pharmaceutical, health food, biotechnology / genetic engineering and the insecticide sectors. In summary, out of 35 patent documents, three were clearly related to a market, in three other cases the link was unclear, and for the remaining 29 patent documents no relevant information was found.

The three patent documents where the innovation was clearly found to be linked to a market or a value chain are: *Actinomadura kijaniata* (sector: Biotechnology / Genetic Engineering) and for *Chrysanthemum cinerariaefolium* (sector: Insecticide). It is interesting to note that for *Chrysanthemum cinerariaefolium*⁵⁰ the patent assignee marketing literature promotes the Kenyan origin of the species and the **product's positive environmental impact**⁵¹.

In three patent documents, the link between value chains and markets was unclear. In the case of *Camellia sinensis*, it was not possible to link new products to the patents documents. In particular, because it is a process innovation. Considering the importance of the species to the assignee (a world leading household consumer products manufacturer that seeks to constantly innovate) it is possible that the innovation from these patent documents is used. In the case of *Wigglesworthia glossinidia*,

⁵⁰ Pyrethrum is the generic name given to a plant-based insecticide derived from the powdered, dried flower heads of the pyrethrum daisy, chiefly *Chrysanthemum cinerariaefolium*, but also *C. coccineum* and *C. marshallii*. <http://web.pppmb.cals.cornell.edu/resourceguide/pdf/resource-guide-for-organic-insect-and-disease-management.pdf>

⁵¹ 'Natural pyrethrum does not pose a risk to warm blooded creatures such as humans, cats, dogs and other mammals. Due to the pyrethrum's rapid breakdown there need only be a short waiting period prior to harvest when used on edible fruit and vegetables. Neudorff's Pyrol Bug & Larvae Killer is approved for organic agriculture by the Organic Farmers and Growers Association.' www.neudorff.co.uk/fileadmin/b2buk/product_catalogue_2014.pdf

considering the lack of disclosure on the species used in the company's large product portfolio, it is unclear if the species is used.

For the remaining 29 patent documents no commercial outcome or ongoing R&D was found for the following species: a) *Acokanthera ouabaio*, b) *Actinomadura kijaniata*, c) *Ganoderma simulans*, d) *Moringa arborea*, e) *Natrialba magadii*, *Natronobacterium magadii*, f) *Zanthoxylum gilletii*.

It is also interesting to note that for six species there is traditional knowledge related to the 16 patent documents (i.e. *Acokanthera ouabaio*, *Camellia sinensis*, *Chrysanthemum cinerariaefolium*, *Moringa arborea*, *Natrialba magadii*; *Natronobacterium magadii*, *Zanthoxylum gilletii*). In two cases a scientific article confirmed the validity of the traditional knowledge (i.e. *Zanthoxylum gilletii*, *Acokanthera ouabaio*). Further details are presented in the next section and in annex five. The link between TK and the invention subject to the patent documents was not examined.

Species	Geographical origin of the species ⁵²	Methodology to analyse the patent document	Kingdom	Sector	Market status for commercialisation	TK on the species
Acokanthera ouabaio	Distributed outside Kenya	There are five patent documents, published between 1992 and 2010. The research focused on two patent assignees, and covered one patent document for each.	Plantae	Pharmaceutical	No evidence.	Yes, with scientific evidence.
Actinomadura kijaniata	Kenyan origin	There are 13 patent documents, published from 1981 to 2009. They were all examined.	Bacteria	Pharmaceutical and biotechnology	No evidence (12 patent documents)	No information found.
				Biotechnology/Genetic Engineering	Yes (one patent document)	
Camellia sinensis	Kenyan origin	There are four patent documents, published from 2002 to 2008. The research focused on the two patent documents of one assignee.	Plantae	Health food	Unclear	Yes
Chrysanthemum cinerariaefolium	Kenyan origin	There are two patent documents published in 2007. They were both examined.	Plantae	Insecticide	Yes	Yes
Ganoderma simulans	Distributed outside Kenya	There are six patent documents, published from 2006 to 2010. The research focused on the patent assignee and five patent documents.	Fungi	Pharmaceutical and food.	No evidence.	No information found.
Moringa arborea	Distributed outside Kenya	There are three patent documents. One, published in 2009, was examined.	Plantae	Nutraceutical	No evidence.	Yes
Natrialba magadii; Natronobacterium magadii	Distributed outside Kenya	There are 14 patent documents, published from 1993 to 2010. The research focused on the five different patent assignees and covered 8 patent documents.	Archaea	Pharmaceutical	No evidence.	Yes
Wigglesworthia glossinidia	Distributed outside Kenya	There is one patent document published in 2007.	Bacteria	Biotechnology	Unclear	No information found.
Zanthoxylum gillettii	Kenyan origin.	There is one patent document, published in 2004.	Plantae	Pharmaceutical	No evidence.	Yes, with scientific evidence.

Table 1: links between species in the patent documents with value chains and markets

⁵² This column indicates if the patent document directly refer to the species as originating from the country (Kenyan origin) or if distribution data suggest that the species is distributed in other countries (Distributed outside Kenya).

4.2.2 Wider industrial and scientific information related to the patent document(s)

Based on the internet research conducted it would seem that some species have economic potential beyond the value chain and markets identified in relation to the patent documents. As found on the internet, one species is sold on-line. Others are subject to on-going research, especially in the pharmaceutical and biotechnological sectors. No particular additional conclusions can be drawn from this information with regard to the valorization of GR, as it is unclear if these products or R&D are based on the GR. There is however a clear indication of the economic potential of the species. Hence, the following cases are of potential interest for further exploration.

The species is an ingredient or a product sold on-line.

Theaflavin, made from *Camellia sinensis* (tea), is a major commodity and is widely distributed by a number of international suppliers. Their connection to the patent documents examined above is unclear. In the business to consumer segment there are food supplements retailed within a price range from \$10 to \$134 per product. In the business to business segment there is a considerable product range of *Camellia sinensis* extracts manufactured in China.

Camellia sinensis is also the subject of on-going research. For instance, there are many recent patent documents regarding the **process for producing Theaflavin**. More fundamental research includes: "**Antibacterial effects** of theaflavin and synergy with epicatechin against clinical isolates of *Acinetobacter baumannii* and *Stenotrophomonas maltophilia*⁵³ and how tea helps against **Alzheimer's disease and obesity, cervical carcinoma and human breast cancer**⁵⁴.

The species are potentially under active R&D:

- *Acokanthera ouabaio*:

"A research showed that the extracts of *Acokanthera schimperi* and *Euclea schimperi* showed **antiviral activity** against coxsackievirus B3 (CVB3), influenza A virus and herpes simplex virus type 1 Kupka (HSV-1). Thus, this supports their traditional use in the treatment of skin diseases of viral origin" (Gebre-Mariam et al., 2005).

- *Actinomadura kijaniata*:

There is ongoing research on the species in areas such as its **antibiotic and antiviral properties** (Betzer et al., 2001). A sponsor of this research is Aventis. There is no information to connect it with the development of a medicine. Another area of research is the **biodegradation of plastics by microorganisms and enzymes** (Tokiwa Y., 2009).

- *Natrialba magadii*; *Natronobacterium magadii*:

There is extensive research on the species in the field of **production of microbial fuel**. For instance, the Joint Genome Institute (Department of Energy, USA) sought to sequence the species in 2008⁵⁵. It further notes that '*Natrialba magadii* is an extremophile in the extreme. It thrives in alkaline

⁵³ Betts et al., 2010

⁵⁴ <http://science.naturalnews.com/Theaflavin.html>

⁵⁵ <http://jgi.doe.gov/why-sequence-natrialba-magadii/>

hypersaline conditions (pH 9.5, 3.5 M NaCl) and encodes enzymes that are not only salt tolerant but also often tolerant of high pH, high temperatures, and the presence of solvents.' which seems highly relevant to the current R&D needs in the biotechnology industry. Other recent scientific publications include Siddaramappa S, Challacombe JF, De Castro RE, Pfeiffer F, Sastre DE, et al. (2012), and Ordóñez MV., et al. (2012).

- *Wigglesworthia glossinidia*:

There is important research on the species. Scientists are currently looking into ways that **tsetse fly** populations could be controlled or eliminated by taking advantage of its reproductive reliance on "W. glossinidia". The World Health Organisation indicates⁵⁶: *'Recent advances in molecular technologies and the availability of genomic information could lead to the development of new control strategies aimed directly at the fly or its parasite transmission ability. Genomics of tsetse symbiotic bacteria are of interest since in the absence of their gut flora, tsetse flies are severely impaired in their longevity and reproduction. Two bacteria have been implicated in modifying vector competence of their host (Sodalis glossinidius and Wigglesworthia glossinidia).'* Further scientific literature is indicated in annex five.

- *Zanthoxylum gillettii*:

*'The genus Zanthoxylum has been recognised for a number of biological activities like **allelopathic activity, analgesic activity, anticonvulsant activity, anthelmintic activity, anti-inflammatory activity, antimicrobial activity, antinociceptive activity, antioxidant activity, antiparasitary activity, antiplatelet activity, citotoxic activity, trypanocidals activity, antileishmanial activity, antiCestodal property, gastroprotection activity, anti-sickling activity, hypnotic activity** etc. A few species of the genus has been recommended as dietary supplements to protect against emergent diseases such as **cardiovascular problems, cancer and diabetes**. Different parts of Zanthoxylum have been popularly used traditionally in different ethno medicines for different ailments. (Medhi et al., 2013)*

4.3 Key findings

Considering the small number of species analyzed, only preliminary conclusions can be drawn. Generally, these cases confirm that R&D is currently taking place on species found in Kenya and that in some cases the patent documents can be linked to concrete products on the markets (i.e. pharmaceutical, insecticides).

The R&D is concentrated in the pharmaceutical sector but other sectors are present such as Biotechnology, Health food and Insecticide. Most patent documents focus on plantae but other species are covered such as bacteria, archaea and fungi. The species are mostly used in the 'business to consumer' segment (e.g. anti-cancer agent) although there are a few in the 'business to business' (e.g. improvement of an extraction process). All the patent holders are foreign companies. There is no information available on the potential (Kenyan) partners or providers of these GR.

The information available did not allow us to find evidence that ABS requirements were taken into account for the R&D activities that were examined for the species referred to above. Considering the intensity and the diversity of the R&D, a next step could be to explore the cases that were successfully

⁵⁶ www.who.int/trypanosomiasis_african/vector_control/en/

linked to a market or that were unclear in order to determine if compliance with the Kenyan regulations in place at the time of the access was respected. This would also allow better appreciation of current R&D practices and challenges in these markets and possibly further support R&D on these species.

Finally, internet research provided evidence that there is ongoing research on some species in areas that seems highly relevant to the development challenges of Kenya (e.g. biofuel, tsetse fly). Finally, the properties of some GR revealed by TK were scientifically confirmed. These scientific results could potentially offer economic valorization opportunities.

Conclusion and recommendations

This assessment shows that there is ongoing R&D on the country's biodiversity and that GR are of value for public and private actors doing R&D across different sectors. In three patent documents a link was identified with a value chain or a market. Hence, there are potential economic opportunities to further valorize Kenyan species and GR.

The analysis of actors provides a clearer picture of the institutions related to the valorization of BR and GR. There are official providers of GR. However due to the limited information publicly available, it is not possible to determine with certainty: a) which Kenyan actors are clearly using the GR and b) which actors provided the genetic material used for the R&D related to the patent documents. Hence, based on the information available, it is impossible to establish a link between identified users and potential providers. This could be further researched in next steps.

On this basis, the country's strengths and weaknesses with regard to R&D on GR and their economic valorization can be evaluated as presented in the table two below. The strengths relate to features that were identified in this project. The weaknesses relate to characteristics that are clearly missing.

Strengths	Weaknesses
<ul style="list-style-type: none"> - High biodiversity with R&D carried across a range of species (e.g. plantae, bacteria) and diverse areas (e.g. cosmetics, biotechnology) - Diversity of national actors doing R&D (e.g. universities, public research centers) - A national bioprospecting strategy and clear ABS procedures have been established - Institutions formally provide GR (i.e. plant, tree and marine resources) through genebanks - Diverse public bioprospecting initiatives, including KWS international bioprospecting partnerships - Domestic collaboration amongst universities to exchange genetic material and experience within universities on ABS agreements (e.g. Kenyatta University has joint patents with foreign actors) - Diversity of foreign actors doing R&D on the countries GR - A range of ongoing research on species that are potentially highly relevant to the country's development targets (e.g. biofuel, tsetse fly, pest control for organic farming) - A large support system capable to link research with value chain development 	<ul style="list-style-type: none"> - Few corporate actors, NGOs or civil society organisations involved in the valorization and the utilization of GR

Table 2: Strengths, weaknesses for R&D and for the valorisation of GR under the ABS framework

Some key elements of an enabling framework for the valorization of GR could not be assessed due to the limited information found. They could be further explored in order to continue informing the analysis of the country strengths and weaknesses. This includes the following:

- Evaluation of successes and challenges of the bioprospecting strategy and ABS implementation in Kenya
- Valorisation of TK
- Capacity to transit from the research to the development phases (e.g. stable production for industrial phase) and to respond to users R&D requirements

In summary, despite some weaknesses, the strengths identified (e.g bioprospecting strategy, national ABS framework, strong research base) position the country well for the valorization of its GR. The given set up offers a range of opportunities for Kenya to consider for further valorizing its GR. These opportunities are classified in two sub-categories:

General opportunities and potential leads:

- A wide range of general and specialised technology areas and markets of relevance to biodiversity from Kenya
- The wide spectrum of R&D activities undertaken by the public research institutions is a positive foundation to explore connections with potential users' R&D needs, considering that research areas are well aligned with user needs (e.g. extremophile for biotechnology, pollution control, health food)
- The better understanding of the trends behind the access requests could uncover new opportunities. For instance, for wild species, over 4000 accessions were made for over 1000 species
- The providers could consider improving the gene databanks and other collections to better meet user requirements for systematic sampling with high quality taxonomic information
- Further exploration of the R&D activities on the species examined (to link patent documents with markets and value chains) in order to uncover potential Kenyan and foreign user partners, as well as lessons to learn. Obstacles to overcome may also be drawn from the cases that failed
- The confirmation of the link between the innovation in the patent documents and the TK can lead to further valorisation opportunities

Specific opportunities for species and sectors: These opportunities are related to the examination of some patent documents for links with value chains and markets, as well as the sectoral analysis presented in a separate report.

- Companies using high quality leather are looking for **green alternatives to the tanning process**. There could be a synergy with the Kenyatta University's School of Environmental Management that is developing technologies for the treatment of waste water from tanneries
- Considering Kenya's objective to **reduce fertilizer costs**⁵⁷, a synergy could be explored between the Jomo Kenyatta University of Agriculture and Technology, that has a research projects on organic farming, and the patent assignee that develops organic insecticide from the Kenyan GR *Chrysanthemum cinerariaefolium* (see section 4.2.1 above)
- In section three, the analysis based on patent citations revealed two species (*Acokanthera ouabaio* and *Natrialba magadii*) where there could be further **economic potential related to the inventions**. The analysis of the patent family allowed to identify one **species** (*Natronococcus occultus*, an archaea) **of importance to the applicant**; where further R&D partnerships could be explored
- Synergies could be explored between the **University of Nairobi** which has research on **enzymes from extremophilic micro-organisms** and foreign users interested in this emerging area.

Overall, this assessment raises two key questions for the public policy on ABS and the economic valorisation of GR. First, in practice, how to close the gap in order to take advantage of economic valorisation opportunities related to GR. Second, what are the policy needs to create a favourable

⁵⁷ <http://www.vision2030.go.ke/index.php/pillars/project/Economic/33>

institutional and business environment in order to facilitate access to GR and share in fair and equitable manner the benefits arising from their utilization? For this purpose, general recommendations are presented in the “Economic potential and valorization opportunities for genetic resources in six African countries” for the six countries. However, in light of the current opportunities and challenges identified, specific recommendations can be put forward.

- Compliance and enforcement both at local and international level

Monitoring R&D practices: the information publicly available is incomplete and does not provide a comprehensive picture of the use of GR in R&D processes. Furthermore, valorisation activities in the business-to-business segment are almost invisible. This may call for further consideration of monitoring mechanisms adapted to different types of users or R&D partnerships in order to monitor the utilisation of GR along the value chain and in the markets. In addition, the development of partnerships between domestic actors and foreign users should be encouraged and can contribute to building trust.

- The *ex-situ* collections linkage to *in-situ* within the ABS framework

Ex-situ collections and research organisations seeking to promote partnerships and demonstrate compliance with ABS could consider voluntarily including a statement on ABS compliance in material transfer agreements. Companies and research organisations adopting such practices could receive recognition from partner countries and enjoy reputational gains.

In light of the existing gaps between users and providers in innovation and R&D processes and of the recommendations above, policy makers may wish to take into account these elements for the valorization of BR and GR in the implementation of their bioprospecting strategy.

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Annex 1: Questionnaire on national ABS measures in Kenya

The following list of questions was developed in order to assess whether the national ABS regulatory framework created an enabling environment for the valorization of GR while also contributing to the fair and equitable sharing of benefits arising from their utilization.

1. What do national ABS measures apply to? What is their scope?

According to the Act, the guidelines are to specify appropriate arrangements for access to GR of Kenya by non-citizens of Kenya including the issue of licenses and fees to be paid for that access (art. 53 (2)(a) of the Act), the sharing of benefits derived from GR in Kenya (art. 53 (2) (c) of the Act) and any other matter that the Authority considers necessary for the better management of the GR of Kenya (art. 53(2) (f) of the Act). The scope of these Regulations is defined by way of exemption and the exemptions are provided in regulations 3 (a-d) as follows:

- (a) “the exchange of GR, their derivative products, or the intangible components associated with them, carried out by members of any local Kenyan community amongst themselves and for their own consumption;
- (b) access to GR derived from plant breeders in accordance with the Seeds and Plant Varieties Act;
- (c) human GR;
- (d) approved research activities intended for educational purposes within recognized Kenyan academic and research institutions, which are governed by relevant intellectual property laws.” (art. 3, Regulations)

2. Is there one or more clearly designated competent national authority (CNA) to receive applications for access and grant PIC? If there is more than one CNA, what are their respective responsibilities?

The competent national authority established by the Act is the National Environment Management Authority (NEMA) referred to as the Authority. However, NEMA has not been designated in law specifically as a competent authority for PIC but it is responsible for Access permit which may qualify it as a competent authority. However it has been issuing Access permit and also acting as the focal point. With entry into force for Nagoya Protocol, the country is in the process of discussing the institutional arrangement clarity in terms of article 6 of the NP.

3. Are specific procedures established to obtain PIC for access to GR? What are they?

The procedures set out for obtaining PIC contained in the Regulations are as follows:

- “Any person who intends to access GR in Kenya shall apply to the Authority for an access permit in the form set out in the First Schedule, and such application shall be accompanied by the fees prescribed in the Second Schedule to these Regulations” (Art. 9(1))

- “The application shall be accompanied by evidence of Prior Informed Consent from interested persons and relevant lead agencies, and a research clearance certificate from the National Council for Science and Technology.” (9(2))

- The Authority upon receipt of the application shall give notice of the application by notice in the Gazette and at least one newspaper with nationwide circulation, or in such other manner as the Authority may consider appropriate, specifying (Art. 10 Regulations):

- (a) the name and other particulars of the applicant;

- (b) the activity to be undertaken for which the access permit is required; and
- (c) the time within which representation or objections in respect of the proposed access permit may be made to the Authority.

- “The Authority shall, on receipt of representations or objections to the proposed access permit from the public, review the application and if satisfied that the activity to be carried out shall facilitate the sustainable management and utilization of GR for the benefit of the people of Kenya, issue an access permit to the applicant.” Art. 11(1)

The form of an access permit is set out in the Third Schedule of the Regulations. The form includes a list of the information that must be provided regarding:

- the GR for which access is sought, including scientific names of taxa, specific sites in which access will be undertaken, possible location, parts of the genetic resource to be collected, derivatives and/or products, quantities to be collected.
- Information with respect to the planned collecting mission, including the identification of the provider of the genetic resource for which access is sought, collection methods to be used, if Kenyan nationals or institutions are to be used, expected commencement and completion of the activity, information regarding immigration status in Kenya of foreign individuals that will visit Kenya.
- Information regarding the proposed use of GR, including the form of use to which the genetic resource will be put, expected research results and the geographical location in which each element of the research programme will take place.
- Details on any royalties, payments and/or compensation that the applicant offers for access to genetic resource are also to be provided.
- A copy of the PIC document signed by the relevant lead agencies, local community or private owner of the GR is also to be made available.

In addition, the Regulations specify that “an access permit shall contain such terms and conditions as the Authority may deem necessary to impose”(Art. 15, Regulations). They also provide that “In addition to such terms and conditions as may be contained in the access permit, the following conditions shall be implied in every access permit:

- (a) Duplicates and holotypes of all GR collected shall be deposited with the relevant lead agency;
- (b) Records of all intangible components of plant genetic material collected shall be deposited with the Authority;
- (c) Reasonable access to all GR collected shall be guaranteed to all Kenyan citizens whether such GR and intangible components are held locally or abroad:
....” (Art. 15(2), Regulations).

4. Is the PIC process different when GR are being accessed for research or for commercial purposes? For example, is there a “two step” PIC process in place in order to facilitate basic research and then negotiate more detailed MAT if/when the user proceeds to commercialization?

a. If there is a two phase approach, what is the trigger for the second phase (e.g. clinical trials, patenting)?

No distinction is made in the Regulation with respect to the purpose of use. The access permit is granted for a period of one year and is renewable.

5. Is the decision to grant or refuse PIC provided in writing? In case of refusal, are explanations provided?

In Kenya, where the Authority has reasonable grounds for refusing to issue an access permit, it shall inform the applicant of the reasons for such refusal in writing. (art. 11 (2) of the Regulations).

In addition, "A person aggrieved by refusal of the Authority to grant a licence may appeal to the National Environment Tribunal in accordance with section 129 of the Act." (Art. 11(3) of the Regulations)

6. *Is a permit granted at the time of access as evidence of the decision to grant PIC? If so, over what period of time is the PIC or access permit valid?*

An Access permit is a form of PIC at national level that shows that the State has granted the PIC. This permit is issued by NEMA. Otherwise before the grant of the access permit the applicant has to seek for consent from the provider of the GR i.e either local community, private owner, or public institutions, and this is provided in the form of PIC which accompanies the application.

The application shall be accompanied by evidence of PIC from interested persons (local community or private owner) and relevant lead agencies, and a research clearance certificate from the National Council for Science and Technology. (Art. 9(1)(2), Regulations)

Standard forms for applications and permits are available in the Regulations (see First Schedule and Third Schedule of the Regulations).

The Regulations do not provide for any specific procedures to obtain PIC from providers. However, NEMA is in the process of developing the guidelines on obtaining PIC from providers and template/model for the PIC.

An access permit shall be valid for a period of one year from the date of issue and shall not be transferable. (art. 14(1) Regulations)

Upon expiry, an access permit may be renewed for a further period of one year upon payment of the fee prescribed and upon such terms and conditions as the Authority may deem necessary to impose. (art. 14(2) of the Regulations).

7. *What is the average lead time from application to conclusion of PIC:*
a. *For non-commercial purposes?*
b. *For commercial purposes?*

N/B: responding to the Q considering that the PIC is the same as the Access permit.

There is no distinct provision for commercial or non-commercial purposes in the regulations. Regulation (13) stipulates that the Authority shall within sixty days from the receipt of the application determine the application and communicate the decision to the applicant in writing.

8. *Are fees requested to obtain access\PIC? Is an upfront payment required? Is it pre-defined or established on a case by case basis?*

Monetary benefits are listed under Art. 20(3) of the Regulation include access fees or fees per sample collected or acquired. These are to be determined on a case-by-case basis.

However the access permit fee is determined in the First Schedule of the Regulations. It is 20,000.00 Kshs for individual applicants and double for corporations. This fee is paid to NEMA for access permit application processing.

A schedule of fees related to applications for an access permit, renewal of a permit and to peruse the register of access permits is included in annex to the regulations. Permit fees are lower for individuals than they are for corporations. In addition, fees to peruse the register are lower for residents than for non-residents. (Second schedule of the Regulations)

9. Are clear rules and procedures set out for requiring and establishing MAT? Is an SMTA or MAT template in use?

a. In particular, is there a requirement for MAT to include the following:

- **a dispute settlement clause**
- **terms on benefit-sharing, including intellectual property**
- **terms on subsequent third party use, if any**
- **terms on change of intent, where applicable**

The MAT is usually associated to PIC and therefore at the time of acquiring the PIC the benefits are supposed to be negotiated for in the MAT.

Article 18 provides that “Notwithstanding any provisions contained in these Regulations, no person shall transfer any GR outside Kenya unless such a person has executed a Material Transfer Agreement.”

No additional specifications are included in the regulation with respect to the MTA or its content.

The regulations do not refer per say to MAT. However, the access permit imposes a certain number of terms and conditions with respect to access.

10. Must MAT be renegotiated each time a new access is sought to the same GR accessed by the same user for the same purpose?

No. At the time of the application the applicant will indicate the time the activity will take. If for instance it will take three years, the MAT will cover the entire duration; however, the access permit will be renewed annually as indicated in Article of the Regulations, an access permit is valid for a period of one year from the date of issue and may be renewed for a further period of one year upon payment of the fee prescribed and upon such terms and conditions as the Authority may deem to impose.

This would imply that different terms and conditions could be imposed for the renewal which sometimes can affect the terms in the MAT.

11. Are there specific requirements regarding the sharing of benefits (monetary/non-monetary)?

The Regulations address benefit-sharing under Part IV. They provide that the holder of an access permit shall facilitate an active involvement of Kenyan citizens and institutions in the execution of the activities under the permit (Art. 20(1), Regulations).

This facilitation is to include enjoyment of both monetary and non-monetary benefits arising from the right of access granted and the use of the GR (art.20 (2) Regulations).

Exhaustive lists of monetary and non-monetary benefits are also included in the Regulations (art. 20(3)(4) Regulations).

12. *Is there a national strategy in place to encourage certain types of benefit (e.g. training of national researchers, sharing of royalties)?*

No such strategy appears to be in place. However at the time of determining the application, the applicant may be requested to include the training of the researchers/students if the research is done in collaboration with research or academic institution. This is in fulfillment of the provision 20 (1) which calls for active involvement of Kenyan citizens and institutions in the execution of the activities by the permit holder.

13. *Are different requirements applicable to national and foreign users?*

In accordance with the Environmental Management and Coordination (Conservation of Biological Diversity and Resources, Access to GR and Benefit Sharing) Regulations, 2006, nationals and non-Kenyans are treated the same in all aspects of access except the perusal fee for the access permit register.

14. *What is the average lead time for the conclusion of MAT*

- a. *For non-commercial purposes?***
- b. *For commercial purposes?***

The MAT is done together with the PIC and according to the Regulations; the timeline is not defined as the MAT is done between the applicant (potential genetic resource user) and the resource provider. Therefore time varies depending on circumstances on the ground.

15. *Is there a national process in place to facilitate desirable partnerships? Or, is the system predominantly designed to regulate and control applications reactively?*

The regulations promotes active involvement of Kenyans (Reg.20 (1) in the executions of the activities under the permit and as such it is mandatory that an applicant must be affiliated to a local institution.

16. *Is there a control system and/or reporting requirements in place? What are they?*

Conditions for an access permit established in the Regulations include the following reporting requirements:

- the furnishing of quarterly reports to the Authority on the status of research, including all discoveries from research involving GR and/or intangible components thereof. (art. 15(2) (e))
- the holder of the access permit shall inform the Authority of all discoveries made during the exercise of the right of access granted under the access permit. (15(2)(f))
- the holder of an access permit shall provide the following reports (15(2)(g)):
 - o (i) a semi-annual status report on the environmental impacts of any ongoing collection of GR or intangible components thereof
 - o (ii) a final status report on the environmental impacts of collection of GR or intangible components thereof, in the event that the collection is of a duration of three months or less.

17. Are there penalties imposed on users for failure to comply with PIC and/or MAT? What are they?

Failure to comply with the conditions imposed by the access permit:

The standard form of access permit (see Third Schedule of the Regulations) provides that the permit “issued subject to the Regulations and all agreements concluded pursuant to its grant may be suspended, cancelled or revoked should the holder breach any of those agreements and the conditions of issue and those contained in the Regulations”.

Art. 16(1) of the Regulation provides that the Authority may suspend, cancel or revoke any access permit issued under these Regulations where the holder thereof is in contravention of any of the conditions imposed on the access permit or those implied under the Regulations, or of the agreements concluded pursuant to its grant.

Before taking the actions described above, the Authority shall give a written notice of its intention to the holder of the access permit and invite the holder to make representations within 30 days of the date of such notice (Art. 16(2)).

Where the Authority suspends, cancels or revokes a permit, it shall publish the order suspending, canceling or revoking the permit in the Gazette and it at least one newspaper with nationwide circulation (Art. 16(3)).

Failure to comply with the Regulations:

In addition, a contravention or failure to comply with any of the matters provided in the Regulations shall constitute an offence (art. 23). Any person convicted of an offence under the Regulations shall be liable to imprisonment for a term not exceeding eighteen months, or to a fine not exceeding three hundred and fifty thousand shillings, or both. (art. 24).

18. Do ABS procedures take into account confidentiality requirements of potential users? For example, on the request of an applicant for PIC, can the CNA hold some information relating to access to GR that is the subject of an application as confidential?

The issue of confidentiality is addressed in Part V of the Regulations, Art. 21. It provides that “on the request of an applicant of an access permit, the Authority may hold some information relating to access to GR the subject of the application as confidential” (Art. 21(1)). The information held as confidential would then not be accessible to a person inspecting the register of access permits (art. 21(2)).

19. Are requests for access to GR recorded? If so, since when? How many have you received since they are recorded?

The Authority keeps, manages and updates a register of all access permits which it has granted and the register is a public record of the Authority and is accessible in a prescribed manner to any person on application to the Authority and upon payment of fees. The amount is lower for nationals than it is for foreigners and is prescribed in the Second Schedule of the Regulations. The Authority has received thirty six (36) applications so far as from November, 2009.

20. Out of the number of requests for access received, how many were accepted? How many were refused?

The Authority has issued 26 access permits.

21. In situations where access was granted, what types of benefits related to the utilization of these GR have returned to the country?

- Scholarships for students
- Short training for academic and regulators (Institutional capacity building)

Annex 2: Key words used to identify actors relevant to R&D on GR

Note: TK was not in the scope of this institutional assessment.

- a. Generic websites
 - For all countries : World Bank : strategy for developing agriculture in the country, focusafrica.gov.in,
 - For English speaking countries : www.commonwealthofnations.org
- b. Generic key words for key stakeholders
 - Chamber of commerce
 - Trade associations and business federation
 - University
 - Herbarium
 - Museum
 - Laboratory
 - Research institutes
 - Botanical gardens
- c. Specific actors (mostly international actors likely to do R&D and use GR from the country)
 - Research (CIRAD, CIFOR, Kew, IRD (Sud Expert Plantes), CBI)
 - Development (FAO, ITCSD, UNDP)
 - Development agencies (AFD, GIZ, USAID)
- d. Types of genetic resource: forest, marine, animal, agricultural, plantae, microbe, microorganisms, bacteria, fungi
- e. Sectors and R&D⁵⁸:
 - Pharmaceutical
 - Biotechnology
 - Horticulture
 - Food : crop improvement, breeding, pest protection, stress resistance
 - Health food : nutraceutical, agro-biodiversity, plant for food and alimentations
 - Cosmetics: Oils, fats and waxes, gums, extracts and saps, colorants, formulation, anti-oxidant
- f. R&D activities, processes and technologies: bioprospection, raw material, sample, valorisation, extraction, metabolic processes, molecular technique, nanotechnology, liquid chromatography devices, nuclear magnetic resonance, spectrometers.

⁵⁸ A focus was put on the health food and cosmetics sectors as they are thought to be the easiest targets for providers of GR to engage with in R&D processes.

Annex 3: List of all the actors found in the scope of the study related to R&D and the economic valorisation of biodiversity, biological and genetic resources

Name of institution	Principal activity	R&D on GR	Focus of the R&D on biodiversity	Contact with foreign actors	Website	Other
Providers of GR						
Kenya Wildlife Service (KWS)	The main technical competent government authority on wildlife protection, conservation and management as per Wildlife Act 2013. Manages insitu biological resources. The main goal of Kenya Wildlife Service is to “Conserve, in perpetuity, Kenya’s rich diversity of species of microbes, plants and animals, habitats and ecosystems, in partnership and consultation with other government agencies and stakeholders for the well being of the Kenyan people and the global community.”	Yes	Insitu biological resources	Yes	www.kws.org	KWS has signed various memoranda of understanding with local and international institutions for bioprospecting activities . Some of the collaborating institutions include, International Centre of Insect Physiology and Ecology (ICIPE), Diversa, DuPont Corporations, Novozymes, Ministry of Education and Science-Germany on BIOTA project and Royal Botanic Garden (KEW) on Millennium Seed bank project.
Kenya Forest Service	The Kenya Forest Service manages a large expanse of indigenous or natural forest areas specifically for the conservation of forest and forest related biodiversity and for provision of ecosystem services such as water catchment function and carbon sequestration among others.	No	Forest	Yes	www.kenyaforestservice.org	Ex-situ conservation programme such as the National Arboretum for certain important indigenous tree species are being undertaken in addition to specially dedicated seed stands or plantations of high commercial value tree species such as <i>Prunus africana</i> , <i>Juniperus procera</i> , <i>Podocarpus</i> sp, <i>Croton</i> sp. and <i>Vitex keniensis</i> among others.

Public research institutions						
Government of Kenya - Ministry of Environment Water and Natural Resources (MEWNR)	Policy on Management of Natural resources, coordination function	No	N.A.	Yes	www.e-government.go.ke/	National Biodiversity Strategy Action plan. A bioprospecting strategy is hosted by KWS. This document is used in this list as a source to describe the bioprospection activities of some key players.
Natural Products Initiative Platform	This initiative is under creation.	yes	TK	Yes, initiating	No website	Developing policy on Natural product industry with main focus on traditional medicines
Agriculture development corporation (ADC)	Promote sustainable agriculture, including provision of seeds and training.	No (KARI does research for ADC)	Agriculture-crops and livestock	Yes	www.adc.or.ke/	
Kenya forestry research institute	Conduct research and provide information and technologies for sustainable development of forest and allied natural resources.	Yes. Genetic improvement of major plantation species.	Forest	Unclear	www.kefri.org/service.aspx	Some of these research programs include: work on screening of bioactive products from plants, resistance to pests and diseases, establishment of botanical gardens and the tree seed centre which serve as repositories for natural resources. The tree seed centre has wide range of indigenous tree seeds that have been collected from wide range of ecological zones in the country. The seeds are for commercial purpose as well as for research and exchange programs.

National environmental management authority (NEMA)	General supervision and coordination over all matters relating to environment	No	All	No/Regulator	www.nema.go.ke/	
Kenya Animal GR centre	It has 2 main activities: a) establishment of a National Livestock Resources Genebank. B) serve as reference laboratory for certification, testing of semen, embryos, and related livestock reproductive materials, for purposes of exportation and importation	Yes	Animal	Yes	www.kagrc.co.ke	
Kenya Industrial Research and Development Institute (KIRDI)	A national research institute under the Ministry of Trade and Industry and mandated to undertake multidisciplinary research and development in industrial.	Yes	Food	Yes	www.kirdi.go.ke/	The major RTI divisions are: Engineering, Energy and Environment, ICT, Leather & Textiles, and Food Technology Divisions (reduce post-harvest food losses through process and product development)
Kenya Agricultural Research Laboratories (KARI)	KARI promotes agricultural research, technology generation and dissemination to ensure food security through improved productivity and environmental conservation.	Yes	Food, agriculture	Yes, International R&D partners	www.kari.org/	It has research programmes in food crops, horticultural and industrial crops, livestock and range management, land and water management, and socio-economics.
Kenya Plant Health Inspector Services (KEPHIS)	KEPHIS is the agency in Kenya with mandate to protect Kenya's agriculture from pests and diseases that could impact upon	Unclear	Agriculture	Unclear	www.kephis.org/	Grants plant variety and phytosanitary certificate on export.

	the environment, economy and human health.					
National Museums of Kenya	It collects, preserves, studies, documents and presents Kenya's cultural and natural heritage. It gaver around 20 museums.	Yes	Biodiversity	Yes	http://www.museums.or.ke/#	The NMK houses one of the largest biodiversity collections in the region, including indigenous knowledge . Biological collections comprise of zoological and botanical specimens. The NMK currently holds over 3 million biological specimens and is also the regional reference centre for botany and a national repository of botanical knowledge. There is an established Resource Centre comprising of a Library that covers all academic disciplines. NMK houses the East African Herbarium and the Nairobi Botanic Garden whose functions are the identification of specimens, verification of plant names and propagation and preservation of live plant specimens respectively. The herbarium has a comprehensive databank with over 1 million specimens.
Kenya International property (KIPI)	KIPI receives, examines and grants industrial property rights. It promote inventive activities, screen technology transfer agreements & provide intellectual property information.	No	Intellectual property	Yes	www.kipi.go.ke	

National gene bank	The National Genebank undertake ex-situ conservation of Kenya's plant genetic resource. Establishment of a GR network among existing research stations. Construction of a central genebank at Muguga.	yes	GR	yes	www.kari.go.ke	Over 60% of the accessions conserved are from Kenya, while the remaining ones are from more than 137 countries. A significant proportion of the collection consists of cultivated species although there is substantial amount of wild species of economic value such as medicinal plants (over 4000 accessions representing over 1000 species).
Thematic Working Group on the the Agribusiness , value addition and market Access programme in the Agricultural coordinating unit, Government of Kenya (ASCU).	Thematic Working Group on the the Agribusiness, value addition and market Access programme.	No	Biological resources for agribusiness	Yes	http://www.ascu.go.ke/twg.cfm	

Tegemeo Institute	Tegemeo Institute conducts policy research and analysis in the domain of agriculture, rural development, natural resources and the environment.	No	Socio-economic research on agriculture.	Yes	www.tegemeo.org/partners.asp	The Institute aims at addressing Micro and Macroeconomic policy issues bearing on farming, transportation, processing, marketing, and trade of agricultural products and inputs; sustainability of agricultural systems, natural resources as well as the environment; and commercialization, income growth and food security.
Kenya Marine and Fisheries Research Institute	Research on marine and fisheries resources.	Yes	Marine and fishery resource	yes	www.kmfri.co.ke	It undertake research on Marine life and carries out ex-situ marine and freshwater conservation.
Sasini (public company)	Focus on innovative, efficient business practices, quality products in tea, coffee and dairy.	Yes	Agriculture, dairy, horticulture and forestry	Yes	www.sasini.co.ke/about-us/history	-
Export Promotion Council	Promote export of Kenyan products	No	No	Yes	www.epckeny.org	
Horticultural Crops Development Authority (HCDA)	HCDA carries demonstrations and/or trials for different horticultural crops and technologies, mainly on new varieties of crops in the market and seeks to develop partnership with industry. It 's a state company.	Yes	Horticulture	Yes	http://www.hcda.or.ke	-

International Livestock Research Institute (ILRI)		Yes	Livestock	Yes	www.ilri.org	
World Agroforestry Center (ICRAF)		Yes	Agroforestry	Yes	www.worldagroforestry.org/country/kenya	
Public research institutions : universities						
Overview of universities.	Kenya has seven public universities	Yes	yes	Yes	See individual university websites	Universities such as Nairobi University, Moi University, Kenyatta University, JKUAT, Egerton University, Masinde Muliro University of Science and Technology and Maseno universities have established G32. These are used for exchange of biological material and also for learning process. Some of the Universities have micro scale depositories of microbials and cell lines.
University of Nairobi	Education and research.	Yes	Biodiversity	Yes	www.uonbi.ac.ke	The University of Nairobi has a large collection of biological specimens and cultures for research and training. Active research includes phytochemistry of useful compounds and screening of plants for herbal medicines, research on identification of game meat (species identification) and

						a postgraduate program on natural products, bioprospecting and value chain. Also there are researches on useful enzymes from extremophilic micro-organisms, biofertilizers, plant and animal genetic improvement.
Jomo Kenyatta University of Agriculture And Technology	Education and research.	Yes	Both agricultural and non agricultural insitu and ex-situ R&D	Yes	www.jkuat.ac.ke	The core research projects include tissue culture of horticultural and commercial plants, Oyster and button mushrooms, microbial bioprospecting and organic farming practices.
Kenyatta University	Education and research.	Yes	Biodiversity	Yes	www.ku.ac.ke	Kenyatta University bioprospecting research agenda aims to contribute to economic growth by focusing on developing technologies for; enhancing health in human and livestock, agricultural productivity, environmental management and adding value to industrial products and processes and environmental management. Some of the research programs highlighted include work in human and animal health, screening of bioactive products from plants, crop and animal resistance to pests and diseases. The School of Environmental management is developing technologies for the treatment of waste water from abattoirs and tanneries and organic waste and has encouraging results from microbial isolates from these areas with potential in cellulosic and xylanase

						activities. Collaborating institutions include local and international universities and research institutions. Their notable achievements include 2 joint patents with ICIPE with a 50-50 benefit-sharing plan.
Moi University	Education and research.	Yes	Biodiversity	Yes	www.mu.ac.ke	The major bioprospection projects include, a comparison of soil fertility management practices in Western Kenya, Bean germplasm evaluation, chick pea improvement, French variety development/ Snap bean improvement; Impact of consumptive utilization of wetland resources on ecological integrity and livelihood in selected areas of Lake Victoria basin.
Pwani University College	Education and research.	Yes	Biological resources	yes		
Egerton university - Temegeo insitute	Education and research.	Yes	Biodiversity	Yes	www.egerton.ac.ke/index.php/Faculties/faculty-of-agriculture.html	The bioprospecting initiatives include anti microbial and pesticidal substances, marker genes for high food yielding, for disease resistance and indigenous chicken genotypes and livestock improvement projects. In addition there are projects on Marker genes for heat stress tolerance, drought tolerance, water use efficiency and nutritional health properties. The university has MOUs and MTAs involving both local and international partners.

Egerton University, Faculty of Agriculture	Profesional training in agriculture	Yes	Agriculture	No	www.egerton.ac.ke/index.php/Faculties/faculty-of-agriculture.html	It has a botanical garden.
Actors of the support environment						
African Natural Products Company	It commercialise a range of products include agricultural input, tea, functional fund to cosmetics.	Yes, it has a partnert hship with a company (Nevax) to outsourc e R&D	Unclear	Yes	www.africanaturalproducts.org/	-
Agrochemic als association of Kenya (AAK)	The Agrochemicals Association of Kenya (AAK) is the national representative of the International Agrochem Industry represented worldwide by CroLife International (formerly GIFAP). It is the umbrella organization in Kenya for manufacturers, formulators, repackers, importers, distributors, farmers and users of pest control products (pesticides).	Yes	Agrochemical s	Yes	http://agrochem.co.ke/	
Agro-chemicals Association of Kenya	Members of the Agrochemicals Association of Kenya (AAK)	Unclear	Agrochemical s	Unclear	http://agrochem.co.ke/index.php?option=com_mmpportfolio&view=projects&Itemid=3	
Association of cereal growers	To bring all cereal farmers together for collective action to	No	Cereals	Yes	www.cga.co.ke cga@wananchi.com	-

	ensure sustained improvement to their farming enterprises.					
Fresh Produce Exporters Association of Kenya	Supports growers and exporters by providing technical and marketing information and training, act as an information centre, and run active lobbying and advocacy programmes to enhance the sector's competitiveness.	No	Agriculture	Yes	http://www.fpeak.org/ info@fpeak.org	
Horticultural Growers Association	Support horticultural growers	Unclear	Horticulture	Unclear	www.kenfap.org xtinewambu@yahoo.com producers@kenfap.org	
Kenya Business Council	Promote business development.	No	All	Unclear		-
Kenya Coffee Traders Association	To represent members engaged in coffee industry in export trade including promotion of Kenyan coffee in international market.	No	Coffee	Yes	www.kenyacoffee.or.ke	-
Kenya Coffee Producers and Traders Association	Run the auctioneering of coffee	No	Coffee	Yes	www.kcpta.co.ke	-
Kenya Cotton Growers Association	A a non-political non-profit making cotton growing representative body-representing cotton farmers interests.	No	Cotton	Yes		-
Kenya Flower Council	A common platform for representatin, promotion and	No	Horticulture	Yes	www.kenyaflowercouncil.org	

	compliance to international standards.					
Kenya Livestock Producers' Association	Promotion of livestock industry and production techniques.	No	Livestock	Yes	http://www.klpakenya.org	-
Kenya Mango Producers & Marketing Association	Promotion of mangoes growing in Kenya	Unclear	Mango	Unclear		-
Kenya Mushroom Growers Association	Advocacy for the mushroom farmers.	Collaborate with Musinde Muliro & Maseno Universities	Mushroom	Unclear	No website	-
The Kenya national chamber of commerce and industry	Promote business development.	No	All	Unclear	knccikirinyaga.org	Only regional websites with limited information available on website on sectors and companies.
Kenya National Federation of Agriculture Producers	Empowers its members farmers both large and small scale to make informed choices for improved sustainable livelihoods.	Unclear	Agriculture	No	www.kenfap.or.ke	It collaborates with KARI and Jomokenyatta University if Agriculture
Kenya Poultry Farmers Association	Training of farmers on poultry keeping	No	Poultry	Unclear	www.kenyapoultryfarmers.org	-

Kenya soya Beans Farmers Association	Educating farmers in growing of soya and and value addition	No	Soya	Not yet but have intention of exporting		-
Seed Trade Association of Kenya	Promote the development of formal seed trade and also to produce, process/and or market seed in Kenya	Yes	Agriculture, seed	Yes		-
Tea board of kenya	License tea manufacturing factories; carry out rresearch through the Tea Research Foundation of Kenya, register growers, buyers, brokers, packers and other persons dealing with tea	Yes	Tea	Yes	www.teaboard.or.ke	-
Kenya tea developmen t agency Ltd	Kenya Tea Development Agency Ltd is the Leading Management agency for the small scale tea farmers in Kenya.	No	Tea	Yes	www.ktdateas.com/index.php?option=com_content&view=article&id=84&Itemid=201	-
Kenya Tea Growers Association	Promote issues of common interests in cultivation, manufacturing and marketing of tea	No	Tea	Yes	No website.	-
Business Incubation Association of Kenya	A corporate membership organization advancing innovative entrepreneurship through business incubation and technology commercialization in Kenya.	Yes	All	no	www.biak-kenya.org/	
AAA Growers	Leading exporters of premium & prepared vegetables from Kenya and the largest commercial grower and exporter of chillies from Kenya.	No	Agriculture, horticulture	Yes	www.aagrowers.co.ke/	

Athi Harvest Ltd	Specialized in cut flower production.	No	Horticulture	Yes	www.harvestflowers.com	-
Honey care	Support farming families to grow out of poverty with honey production	No	Honey	Unclear	http://honeycarefrica.com/	-
Kenya Seed Company	Research, market seeds in agriculture and horticulture	Yes	Agriculture, horticulture	Yes	www.kenyaseed.com/	
Magana Flowers Kenya Ltd	Produce rose	No	Horticulture	Yes	www.maganaflowers.com/mission-statement.php	-
Mosi flowers	Mosi flowers grow fresh cut roses.	No	Horticulture	Yes	www.mosiflowers.com/	-
Mont Elgon	Grow roses	No	Horticulture	Yes	www.mtelgon.com/	-
Rea Vipingo	Sisal production.	No	Sisal	Yes	www.reavipingo.com/companyinfo.htm	Potentially, the largest producer in Africa.
Kenya International property (KIPI)	KIPI receives, examines and grants industrial property rights. It promote inventive activities, screen technology transfer agreements & provide intellectual property information.	No	Intellectual property	Yes	www.kipi.go.ke	
Kenya Copyright Board (KECOBO)	KECOBO administer and enforce copyrights and related rights in Kenya.	No	Intellectual property	Yes	www.copyright.go.ke	
Kenya Plant Health Inspector Services (KEPHIS)	KEPHIS is the agency in Kenya with mandate to protect Kenya's agriculture from pests and diseases that could impact upon the environment, economy and human health.	Unclear	Agriculture	Unclear	www.kephis.org/	Grants plant variety and phytosanitary certificate on export.

National Commission for Science, Technology and innovation (NACOSTI)	Advisory commission to the Government on matters of science, technology, innovation and research	No	Research	Yes	Oris.nacosti.go.ke	
Kenyan Bureau of Standard (KEBS)	Provide standardization solution for the assessment of the quality of goods and services.	NO	Regulation	Yes	www.kebs.org	
Customs (KRA)	Collect and account for import duty and VAT on imports as well as other taxes. It is also responsible for the facilitation of legitimate trade.	NO	Regulation	Yes	www.kra.ke	
NGOs						
ICRISAT-Kenya	Conducts agricultural research for development in Asia and sub-Saharan Africa	Yes.	Agriculture	www.icrisat.org/icrisat-globalpresence.htm	www.icrisat.org/icrisat-globalpresence.htm	Research program on biotechnology. http://www.icrisat.org/bt-leadersnote.htm = Has a genebank on millets (http://www.icrisat.org/genebank-home.htm)
ICIPE – African insect science for food and health	New activities on food and biodiversity and some products have been commercialised after internal research.	Yes	Insects	Yes	www.icipe.org	
List of companies in the agro-industry. www.commonwealthofnations.org/sectors-kenya/business/trade_associations_and_chambers_of_commerce/#						
List of actors related to health research. www.healthresearchweb.org/en/kenya/institution						
There are a number of community based organizations (CBOs) and NGOs that conduct ex-situ conservation activities. Other institutions such as KARI, KEMRI, KETRI, KEVAVAPI and Veterinary Laboratories' have kept various types of culture collections ranging from microbes, tissue and blood serum.						

Annex 4: List of the most relevant actors to R&D and the utilisation of genetic resources

Name of institution	Principal activity	R&D on GR	Focus of the R&D on biodiversity	Contact with foreign actors	Website	Other
Providers of GR						
Kenya Wildlife Service (KWS)	The main technical competent government authority on wildlife protection, conservation and management as per Wildlife Act 2013. Manages insitu biological resources. The main goal of Kenya Wildlife Service is to “Conserve, in perpetuity, Kenya’s rich diversity of species of microbes, plants and animals, habitats and ecosystems, in partnership and consultation with other government agencies and stakeholders for the well being of the Kenyan people and the global community.”	Yes	Insitu biological resources	Yes	www.kws.org	KWS has signed various memoranda of understanding with local and international institutions for bioprospecting activities . Some of the collaborating institutions include, International Centre of Insect Physiology and Ecology (ICIPE), Diversa, DuPont Corporations, Novozymes, Ministry of Education and Science-Germany on BIOTA project and Royal Botanic Garden (KEW) on Millennium Seed bank project.
Kenya Forest Service	The Kenya Forest Service manages a large expanse of indigenous or natural forest areas specifically for the conservation of forest and forest related biodiversity and for provision of ecosystem services such as water catchment function and carbon sequestration among others.	No	Forest	Yes	www.kenyaforestservice.org	Ex-situ conservation programme such as the National Arboretum for certain important indigenous tree species are being undertaken in addition to specially dedicated seed stands or plantations of high commercial value tree species such as Prunus africana, Juniperous

						procera, Podocarpus sp, Croton sp. and Vitex keniensis among others.
Public research institutions						
Government of Kenya - Ministry of Environment and Natural Resources (MEWNR)	Policy on Management of Natural resources, coordination function	No	N.A.	Yes	www.e-government.go.ke/	National Biodiversity Strategy Action plan. A bioprospecting strategy is hosted by KWS. This document is used in this list as a source to describe the bioprospection activities of some key players.
Natural Products Initiative Platform	This initiative is under creation.	yes	TK	Yes, initiating	No website	Developing policy on Natural product industry with main focus on traditional medicines
Kenya forestry research institute	Conduct research and provide information and technologies for sustainable development of forest and allied natural resources.	Yes. Genetic improvement of major plantation species.	Forest	Unclear	www.kefri.org/service.asp x	Some of these research programs include: work on screening of bioactive products from plants, resistance to pests and diseases, establishment of botanical gardens and the tree seed centre which serve as repositories for natural resources. The tree seed centre has wide range of indigenous tree seeds that have been collected from wide range of ecological zones in the country. The seeds are for

						commercial purpose as well as for research and exchange programs.
Kenya Animal GR centre	It has 2 main activities: a) establishment of a National Livestock Resources Genebank. B) serve as reference laboratory for certification, testing of semen, embryos, and related livestock reproductive materials, for purposes of exportation and importation	Yes	Animal	Yes	www.kagrc.co.ke	
Kenya Industrial Research and Development Institute (KIRDI)	A national research institute under the Ministry of Trade and Industry and mandated to undertake multidisciplinary research and development in industrial.	Yes	Food	Yes	www.kirdi.go.ke/	The major RTI divisions are: Engineering, Energy and Environment, ICT, Leather & Textiles, and Food Technology Divisions (reduce post-harvest food losses through process and product development)

Kenya Agricultural Research Laboratories (KARI)	KARI promotes agricultural research, technology generation and dissemination to ensure food security through improved productivity and environmental conservation.	Yes	Food, agriculture	Yes, International R&D partners	www.kari.org/	It has research programmes in food crops, horticultural and industrial crops, livestock and range management, land and water management, and socio-economics.
National Museums of Kenya	It collects, preserves, studies, documents and presents Kenya's cultural and natural heritage. It gaver around 20 museums.	Yes	Biodiversity	Yes	http://www.museums.or.ke/#	The NMK houses one of the largest biodiversity collections in the region, including indigenous knowledge . Biological collections comprise of zoological and botanical specimens. The NMK currently holds over 3 million biological specimens and is also the regional reference centre for botany and a national repository of botanical knowledge. There is an established Resource Centre comprising of a Library that covers all academic disciplines. NMK houses the East African Herbarium and the Nairobi Botanic Garden whose functions are the identification of specimens, verification of plant names and propagation and preservation of live plant specimens respectively. The herbarium has a comprehensive databank with over 1 million specimens.

National gene bank	The National Genebank undertake ex-situ conservation of Kenya's plant genetic resource. Establishment of a GR network among existing research stations. Construction of a central genebank at Muguga.	yes	GR	yes	www.kari.go.ke	Over 60% of the accessions conserved are from Kenya, while the remaining ones are from more than 137 countries. A significant proportion of the collection consists of cultivated species although there is substantial amount of wild species of economic value such as medicinal plants (over 4000 accessions representing over 1000 species).
Kenya Marine and Fisheries Research Institute	Research on marine and fisheries resources.	Yes	Marine and fishery resource	Unclear	www.kmfri.co.ke	It undertake research on Marine life and carries out ex-situ marine and freshwater conservation.
Horticultural Crops Development Authority(HCDA)	HCDA carries demonstrations and/or trials for different horticultural crops and technologies, mainly on new varieties of crops in the market and seeks to develop partnership with industry. It 's a state company.	Yes	Horticulture	Yes	http://www.hcda.or.ke	
International Livestock Research Institute (ILRI)		Yes	Livestock	Yes	www.ilri.org	

World Agroforestry Center (ICRAF)		Yes	Agroforestry	Yes	www.worldagroforestry.org/country/kenya	
Actors of the support environment						
Tegemeo Institute	Tegemeo Institute conducts policy research and analysis in the domain of agriculture, rural development, natural resources and the environment.	No	Socio-economic research on agriculture.	Yes	www.tegemeo.org/partners.asp	The Institute aims at addressing Micro and Macroeconomic policy issues bearing on farming, transportation, processing, marketing, and trade of agricultural products and inputs; sustainability of agricultural systems, natural resources as well as the environment; and commercialization, income growth and food security.
Export Promotion Council	Promote export of Kenyan products	No	No	Yes	www.epckkenya.org	

Agrochemicals association of Kenya (AAK)	The Agrochemicals Association of Kenya (AAK) is the national representative of the International Agrochem Industry represented worldwide by CropLife International (formerly GIFAP). It is the umbrella organization in Kenya for manufacturers, formulators, repackers, importers, distributors, farmers and users of pest control products (pesticides).	Yes	Agrochemicals	Yes	http://agrochem.co.ke/	
Fresh Produce Exporters Association of Kenya	Supports growers and exporters by providing technical and marketing information and training, act as an information centre, and run active lobbying and advocacy programmes to enhance the sector's competitiveness.	No	Agriculture	Yes	http://www.fpeak.org	
Horticultural Growers Association	Support horticultural growers	Unclear	Horticulture	Unclear	www.kenfap.org	
Kenya Flower Council	A common platform for representatin, promotion and compliance to international standards.	No	Horticulture	Yes	www.kenyaflowercouncil.org	-
The Kenya national chamber of commerce and industry	Promote business development.	No	All	Unclear	www.kenyachamber.org.ke	Only regional websites with limited information available on website on sectors and companies.

Seed Trade Association of Kenya	Promote the development of formal seed trade and also to produce, process/and or market seed in Kenya	Yes	Agriculture, seed	Yes	www.stak.org.ke	-
Business Incubation Association of Kenya	A corporate membership organization advancing innovative entrepreneurship through business incubation and technology commercialization in Kenya.	Yes	All	no	http://www.biak-kenya.org/	
AAA Growers	Leading exporters of premium & prepared vegetables from Kenya and the largest commercial grower and exporter of chillies from Kenya.	No	Agriculture, horticulture	Yes	http://www.aaagrowers.co.ke/	-
Kenya Seed Company	Research, market seeds in agriculture and horticulture	Yes	Agriculture, horticulture	Yes	http://www.kenyaseed.com/	
Kenya International property (KIPI)	KIPI receives, examines and grants industrial property rights. It promote inventive activities, screen technology transfer agreements & provide intellectual property information.	No	Intellectual property	Yes	www.kipi.go.ke	
Kenya Copyright Board (KECOBO)	KECOBO administer and enforce copyrights and related rights in Kenya.	No	Intellectual property	Yes	www.copyright.go.ke	
Kenya Plant Health Inspector Services (KEPHIS)	KEPHIS is the agency in Kenya with mandate to protect Kenya's agriculture from pests and	Unclear	Agriculture	Unclear	www.kephis.org/	Grants plant variety and phytosanitary certificate on export.

	diseases that could impact upon the environment, economy and human health.					
National Commission for Science, Technology and Innovation (NACOSTI)	Advisory commission to the Government on matters of science, technology, innovation and research	No	Research	Yes	Oris.nacosti.go.ke	
Kenyan Bureau of Standard (KEBS)	Provide standardization solution for the assessment of the quality of goods and services.	NO	Regulation	Yes	www.kebs.org	
Customs (KRA)	Collect and account for import duty and VAT on imports as well as other taxes. It is also responsible for the facilitation of legitimate trade.	NO	Regulation	Yes	www.kra.ke	
Universities						
Overview of universities.	Kenya has seven public universities	Yes	yes	Yes	See individual university websites	Universities such as Nairobi University, Moi University, Kenyatta University, JKUAT, Egerton University, Masinde Muliro University of Science and Technology and Maseno universities have established G32. These are used for exchange of biological material and also for learning process. Some of the Universities have micro scale depositories of microbials and cell lines.

University of Nairobi	Education and research.	Yes	Biodiversity	Yes	www.uonbi.ac.ke	The University of Nairobi has a large collection of biological specimens and cultures for research and training. Active research includes phytochemistry of useful compounds and screening of plants for herbal medicines, research on identification of game meat (species identification) and a postgraduate program on natural products, bioprospecting and value chain. Also there are researches on useful enzymes from extremophilic micro-organisms, biofertilizers, plant and animal genetic improvement.
Jomo Kenyatta University of Agriculture And Technology	Education and research	Yes	Agriculture	Yes	www.jkuat.ac.ke	The core research projects include tissue culture of horticultural and commercial plants, Oyster and button mushrooms, microbial bioprospecting and organic farming practices.

Kenyatta University	Education and research.	Yes	Biodiversity	Yes	www.ku.ac.ke	Some of the research programs highlighted include work in human and animal health, screening of bioactive products from plants, crop and animal resistance to pests and diseases. The School of Environmental management is developing technologies for the treatment of waste water from abattoirs and tanneries and organic waste and has encouraging results from microbial isolates from these areas with potential in cellulotic and xylanase activities. Collaborating institutions include local and international universities and research institutions. Their notable achievements include 2 joint patents with ICIPE with a 50-50 benefit-sharing plan.
Moi University	Education and research.	Yes	Biodiversity	Yes	www.mu.ac.ke	The major bioprospection projects includes : a comparison of soil fertility management practices in Western Kenya, Bean germplasm evaluation, chick pea improvement, French variety development/ Snap bean improvement, impact of consumptive utilization of wetland resources on ecological integrity and livelihood in selected areas of Lake Victoria basin.

Egerton university - Temegeo insitute	Education and research.	Yes	Biodiversity	Yes	www.egerton.ac.ke	The bioprospecting initiatives include anti microbial and pesticidal substances, marker genes for high food yielding, for disease resistance and indigenous chicken genotypes and livestock improvement projects. In addition there are projects on Marker genes for heat stress tolerance, drought tolerance, water use efficiency and nutritional health properties. The university has MOUs and MTAs involving both local and international partners.
Egerton University, Faculty of Agriculture	Profesional training in agriculture	Yes	Agriculture	No	http://www.egerton.ac.ke/index.php/Faculties/faculty-of-agriculture.html	It has a botanical garden.
NGO						
ICIPE – African insect science for food and health	New activities on food and biodiversity and some products have been commercialised after internal research.	Yes	Insects	Yes	www.icipe.org	
List of companies in the agro-industry. http://www.commonwealthofnations.org/sectors-kenya/business/trade_associations_and_chambers_of_commerce/#						
List of actors related to health research. www.healthresearchweb.org/en/kenya/institution						
There are a number of community based organizations (CBOs) and NGOs that conduct ex-situ conservation activities. Other institutions such as KARI, KEMRI, KETRI, KEVAVAPI and Veterinary Laboratories’ have kept various types of culture collections ranging from microbes, tissue and blood serum.						

Annex 5: List of patent documents examined for linking species with markets and value chains

[Click here to view annex 5.](#)