THE REPUBLIC OF UGANDA

NATIONAL BIOTECHNOLOGY AND BIOSAFETY POLICY

Ministry of Finance, Planning and Economic Development
P.O. Box 8147 Kampala

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FOREWORD

Through a country wide consultative process, Ugandans agreed on a national Vision 2025, as a "*prosperous people, harmonious nation and beautiful country".* In line with this Vision, and key national development objectives highlighted in the Poverty Eradication Action Plan (PEAP) and Plan for Modernisation of Agriculture (PMA), the National Biotechnology and Biosafety Policy provides a framework for safe application of biotechnology in order to contribute to Uganda's economic growth and transformation.

Biotechnology is applied in many fields of science and technology and as such cuts across several of the national economy sectors. Broadly, biotechnology encompasses scientific and engineering principles and techniques used in processing materials derived from living organisms. The key aspects of biotechnology include tissue and cell culture, medical diagnostics, industrial microbiology, bio-chemical engineering and genetic transformations.

The science of Biotechnology is not new and has been used for thousands of years in wine and beer processing, cheese and yoghurt production and in leavening of bread. Several industrial processes, such as extraction of cobalt in Western Uganda, apply Biotechnological techniques. However, aspects of Biotechnology applied in genetic engineering that involve transferring useful genes, e.g. those that confer disease resistance or tolerance to drought, across species resulting in genetically modified organisms (GMOs) are relatively new. This new aspect of biotechnology creates enormous opportunities for agricultural modernization, industrial production and environmental protection. Application of modern biotechnology can therefore, be very instrumental in realising Uganda's development potential especially in agriculture, health and environment management.

Accordingly, the proposed National Biotechnology and Biosafety Policy is in line with the aspirations of the various stakeholders in Uganda and is consistent with the principles laid out in the National Environment Act, as well as the Catargena Protocol on Biosafety that commits parties to put in

place measures for ensuring the safe transfer, handling and use of GMOs, and to which Uganda is a Party.

The Process of formulating this Policy begun in the year 2000 and involved wide consultations with both Government and Non-Governmental institutions. The Uganda National Council for Science and Technology, which is responsible for coordinating the formulation of science and technology policies and their integration in national development processes, coordinated the national consultative process in order to raise public awareness and build consensus on the various issues highlighted in the Policy. This Policy, therefore, is based on stakeholder consensus on a comprehensive framework for development and safe application of biotechnology in Uganda.

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Minister of Finance, Planning and Economic Development

ACRONYMS

AGT	Agro-genetic Technologies
CBD	Convention on Biological Diversity
CBOs	Community Based Organisations
CORI	Coffee Research Institute
DNA	Deoxyribo Nucleic Acid
FOSRI	Food Science and Technology Research Institute
GEF	Global Environment Facility
GM	Genetically modified or Genetic modification
GMOs	Genetically modified organisms
HIV	Human Immunodeficiency Virus
IK	Indigenous Knowledge
JCRC	Joint Clinical Research Centre
KARI	Kawanda Agricultural Research Institute
LDC	Least Developed Countries
LGs	Local Governments
LIRI	Livestock research Institute
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MBL	Med-Biotech Laboratories
MFPED	Ministry of Finance, Planning and Economic Development
MGLSD	Ministry of Gender, Labour and Social Development
MoES	Ministry of Education and Sports
MoFA	Ministry of Foreign Affairs
MoH	Ministry of Health
MTTI	Ministry of Tourism, Trade and Industry
MWE	Ministry of Environment
NAARI	Namulonge Agricultural and Animal Production Research Institute
NABC	National Agricultural Biotechnology Centre
NARO	National Agricultural Research Organisation
NBC	National Biosafety Committee
NCA	National Competent Authority
NCHE	National Council for Higher Education
NCRL	Natural Chemotherapeutic Research Laboratory
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NFP	National Focal Point

NIMES	National Integrated Monitoring and Evaluation System
PEAP	Poverty Eradication Action Plan
PMA	Plan for Modernisation of Agriculture
R&D	Research and development
RDCs	Resident District Commissioners
RDIs	Research and Development Institutions
rDNA	Recombinant DNA
S&T	Science and Technology
STI	Science, Technology and Innovation
UBOS	Uganda Bureau of Statistics
UCPA	Consumer Protection Agency
UGKIS	Uganda Indigenous Knowledge and Information Society
UIRI	Uganda Industrial Research Institute
UNBS	Uganda National Bureau of Standards
UNCST	Uganda National Council for Science and Technology
UNEP	United Nations Environment Program
UNRHO	Uganda National Health Research Organisation
URA	Uganda Revenue Authority
UVRI	Uganda Virus Research Institute
UWA	Uganda Wildlife Authority

GLOSSARY

Biosafety: The safe development, transfer application and utilisation of biotechnology and its products.

Biotechnology: Any technique that uses living organisms or substances there from to make or modify a product, improve plant or animal breeds, or microorganisms for specific uses.

Cell Culture: Growing of cells under laboratory conditions.

Competent Authority: The institution legally designated by Government to carry out policy implementation oversight functions specified in this Policy.

Contained Use of Genetically Modified Organisms (GMOs): Any activity in which genetically modified organisms are cultured, stored, transported, disposed of or used in any other way and for which physical, chemical or biological barriers, or any combination of such barriers, are used to limit their contact with humans and the environment.

Deoxyribonucleic Acid (DNA): A molecule found in cells of organisms where genetic information is stored.

Environment: Land, air, water and living organisms surrounding human life, including physical, biological or chemical elements of any of the above.

***Ex-situ**:* Existence of an organism outside the natural environment in which the organism normally thrives, such as is the case with conserving plants and/or animals away from their original natural environments.

Gene: Part of DNA that determines an organism's specific inherited characteristics.

Genetic Engineering: The selective and deliberate alteration of genes by humans.

Genetic Modification: The process whereby genes are inserted into DNA 7 living organisms to give them useful and desired characteristics. Over the centuries, humans have learned to accelerate this process through classical plant breeding and selection, and more recently through application of modern biotechnology techniques involving artificial gene isolation and transfer.

Genetically Modified Organism (GMO): An organism in which a gene or genes has/have been artificially inserted.

Genome: The entire hereditary material in a cell.

Recombinant DNA (rDNA) Techniques: Refers to genetic engineering techniques involving gene isolation and transfer from one organism to another.

Risk associated with GMOs: A function of the probability of harm to humans or the environment and the severity of that harm, consequential to the transportation, handling or use of a GMO.

Traits: Inheritable Genetic characteristics such as size, shape, taste, colour, increased yield, or disease resistance.

Trans-boundary Movement (Exports/Imports) of GMOs: The movement of a GMO from the territorial jurisdiction of one country to the territorial jurisdiction of another country.

Transgene: A gene that has been artificially inserted into an organism.

1.0 BACKGROUND TO THE BIOTECHNOLOGY AND BIOSAFETY POLICY

1.1 Rationale for the Biotechnology and Biosafety Policy

1.1.1 Current Policy Environment

Uganda actively participated in the negotiation and subsequently ratified the Cartagena protocol on Biosafety in 2001. One of the key obligations to the implementation of the protocol was to review existing policy and legal environment and determine their adequacy in regulation of modern biotechnology by the parties. The policy and legal review process revealed inadequacy of existing policies and laws to harness the potential benefits while at the same time addressing the perceived risks associated with Biotechnology. The consensus from this review process, therefore, was that there is a strong need to put in place an explicit policy on Biotechnology and Biosafety.

1.1.2 Contribution of Biotechnology to National Development Initiatives

Evidence from international experience indicates that application of biotechnology will augment government efforts to develop and modernize the economy in line with Uganda's national planning framework as spelt out in the Poverty Eradication and Action Plan (PEAP), the Plan for Modernisation of Agriculture (PMA), the Industrial Sector Development Strategy, the Medium Term Competitive Strategy, the Strategic Framework for S&T Development and other national development strategies. A strong biotechnology base however, requires that Government establishes an enabling policy environment for safe development and application of modern Biotechnology.

1.1.3. Regional and International Commitments

At the East African Community level, efforts are already underway to put in place an East African Regional Policy on Biotechnology and Biosafety. This would require harmonisation of the policies of member states. In the absence of a national biotechnology policy, it will be difficult for Uganda to effectively take part and benefit from regional policy harmonisation.

At the African continent level, the African Union (AU) has put in place the African Model Law on Biotechnology and Biosafety. It has also instituted a Panel of Experts in Biotechnology which is charged with the responsibility of

advising the AU on matters regarding safe application of Biotechnology in development efforts. Uganda, being a member of the AU is expected to adopt the recommendation of the AU and also domesticate the African Model law on Biosafety.

The country has already ratified several international treaties and conventions relating to Biotechnology development, which are currently not fully operationalised at the national level. In 1993, Uganda ratified the Convention on Biological Diversity (CBD), which *inter alia,* promotes biotechnology transfer and the conservation of biodiversity.

Box I: Uganda's International Obligations

- Article 16 of the CBD requires each contracting party to as far as possible and as appropriate establish or maintain means to regulate, manage or control the risks associated with the use and release of Living Modified Organisms (LMOs) resulting from modern biotechnology.
- Article 2 of the CPB requires each party State to take necessary and appropriate legal, administrative and other measures to implement its obligations under the protocol.
- The CPB require parties to ensure the safe transfer, handling the GMOs. Uganda has partly addressed this requirement by combining Biotechnology and Biosafety issues in this policy.

The Coming into force of the Convention on Biological Diversity necessitated the formulation of an international agreement that would regulate biosafety in the transboundary movement of Genetically Modified Organisms (GMOs). Subsequently, the Cartagena Protocol on Biosafety (CPB) was adopted in January 2000 as the first legally binding instrument on issues of GMOs. Uganda signed this protocol in May 2000 and ratified it in November 2001. The articles of relevance in both the CBD and CPB that commit Uganda to implement its international obligations with regard to Biotechnology and Biosafety are summarised in Box I.

1.1.4 Importance of Biotechnology to Development

Modern biotechnology, offers robust options for addressing current challenges to sustainable development, especially in regard to agriculture, environment, industry and other sectors. It is envisaged that biotechnology will be a means to ensuring sustainable food security for the growing population, play a vital role in the development and manufacture of pharmaceuticals, and

Box II: Benefits of Biotechnology

- Improved agricultural yields and more nutritious varieties
- Tolerance of agricultural crops to poor environmental conditions, pests and diseases.
- Application in industrial processes e.g. brewing, mining, bio fuel production, etc.
- Health services e.g. manufacture of vaccines, drugs, addressing malnutrition, bio fortification of food crops with essential nutrients e.g. Vitamin A.
- Environmental Health e.g. use in bioremediation in wastewater treatment and deactivation of oil spills.
- Reduced agriculture inputs, reduced pesticide use, and production of Biofuels.

create a conducive environment for the effective utilisation of bio-resources.

In the face of the current trends of high energy costs, it also is anticipated that the production of Biofuels from indigenous crops such as cassava, Jatropa, simsim, castor oil seeds, will go a long way in solving our energy problems. The use of Biofuels has been demonstrated elsewhere in the world to be a viable option to fossil fuel and will impact positively on the environment. These developments will ultimately lead to more sustainable socio-economic development of Uganda. A summary of some of the potential benefits of modern biotechnology is given in Box II.

1.1.5 Biotechnology and Biosafety Stakeholders

The Government recognizes the multiplicity and diversity of Biotechnology and Biosafety stakeholders. These include the central government, SETIs, local government, private sector, NGOs and CBOs, academia, researchers, science and technology professionals, policy makers and implementers, development partners, farmers, artisans, consumers of products of Biotechnology and the general public.

1.1.6 Policy Formulation Process

The government of Uganda has developed the national biotechnology and biosafety policy in line with principles and objectives of other related policies that provide for promotion of research, development and application of science and technology for national development.

The Uganda National Council for Science and Technology (UNCST), as the lead national co-ordinating agency for science and technology development in the country initiated the Biotechnology and Biosafety policy formulation process in the year 2002. This has involved working in close collaboration with stakeholders involved in a scientific research and development issues, at local universities, government ministries and other institutions and organizations in both the public and the private sectors.

Several fora, including stakeholder and independent expert consultations were organised to raise public awareness on several aspects of biotechnology and to build consensus on the major national issues about biotechnology. These consultations *inter alia* laid the foundation for the process of developing a biotechnology and biosafety policy for Uganda.

Through these consultations, a number of issues that required policy intervention were identified and they constitute the major areas of focus for this policy.

1.2 Current Status, Opportunities and Challenges of Biotechnology Development

1.2.1 Global Status of Biotechnology Development

The first genetically modified crop to be commercialised was BT maize in 1996 in the U.S.A. Since then, several other countries have commercialised genetically modified crops including some developing countries such as India, China, South Africa, and Brazil among others. As a matter of fact, by 2006, the number of countries planting biotech crops increased to 25 with the EU country Slovakia, planting BT maize for the first time and bringing the total number of countries planting biotech crops in the EU to six out of the 25. Spain continued to be the lead country in Europe planting 60,000 hectares in 2006 whereas the U.S. continues to be the world leader followed by Canada. Importantly, the collective BT maize hectareage in the other five EU countries (France, Czech Republic, Portugal, Germany, and Slovakia) increased over 5-fold from approximately 1,500 hectares in 2005 to approximately 8,500 hectares, albeit on small hectarages, and growth in these five countries is expected to continue. This is a reflection of the general increase in the hectareages of genetically modified crop planting world-wide as illustrated in Figures 1 below:

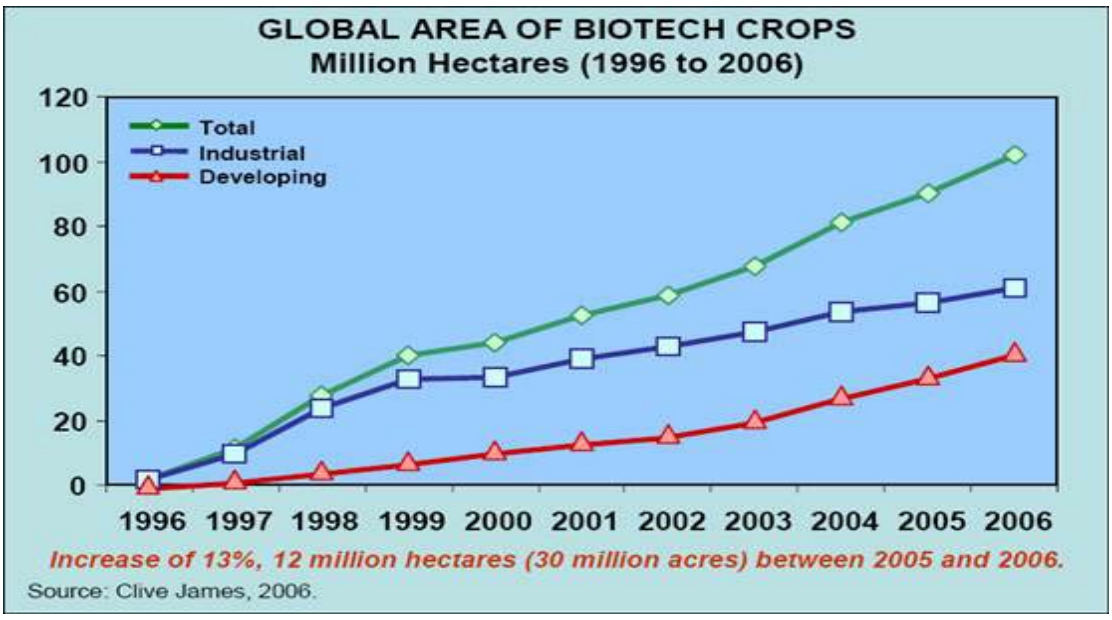

Figure 1: Trends in global adoption of Genetically Modified Crops (Source: ISAAA Report 35)

1.2.2 Regional Status of Biotechnology Development

In the East African region, Kenya is leading the way in the development and application of modern biotechnology. A number of crops including GM cotton, maize, sweet potatoes and cassava have been developed and tested in confined field trials. In addition, Kenya developed and approved the National Biotechnology Development Policy in 2006. Other countries which have embarked on testing GM crops include Cameroon, Mali, and Egypt while South Africa has already commercialised GM cotton and maize and has enacted an explicit law for Biosafety.

1.2.3 National Status of Biotechnology Development

1.2.3.1 Biotechnology infrastructure

Currently, there are 27 universities but only Makerere University offers biotechnology related courses within a wide scope of other biology-based disciplines. At Makerere University, there are five moderately equipped laboratories for biotechnology research and development in the departments of Crop Science in the Faculty of Agriculture, and Department of Biochemistry in the Faculty of Science, as well the faculties of Veterinary Medicine and Human Medicine and in the Institute of Environment and Natural Resources. NARO hosts the most advanced Biotechnology centre at Kawanda but with other biotechnology facilities of lesser capacity at its various research institutes such as NaLIRRI, NaCRRI and Kabale ZARI, Kachwekano. There are two private laboratories with capacity for Biotechnology research and commercialisation and these are AGT and MedBiotech Laboratories.

1.2.3.2 Research and development Initiatives

Uganda has made a modest start in agricultural biotechnology and molecular biology in general, and there are a number of biotechnology activities initiated by Ugandan individual scientists and institutions especially under the aegis of the National Agricultural Research Organization (NARO), its associated institutions and Makerere University.

a) ***National Agricultural Resources Laboratories Institute (Kawanda) and National Crop Resources Research Institute (Namulonge)***

The main areas of research at these NARO institutes include: gene identification for various useful traits of crops, genetic markers for Maize Streak (MSV), angular leaf spot disease in beans, quality traits and acyanogenesis identification in cassava, sweet potato and for Quality protein in maize. Other research activities include molecular characterisation for crop genetic diversity, molecular diagnostics for crop diseases, genetic modification to improve resistance to viruses in cassava, resistance to black sigatoka and bacterial wilt diseases in banana and plant tissue culture techniques for disease-free multiplication of banana, coffee, cassava and sweet potatoes.

Figure 2 below shows the process by which genetically modified bananas for resistance to banana bacterial wilt disease is conducted at the National Agricultural Biotechnology centre at Kawanda.

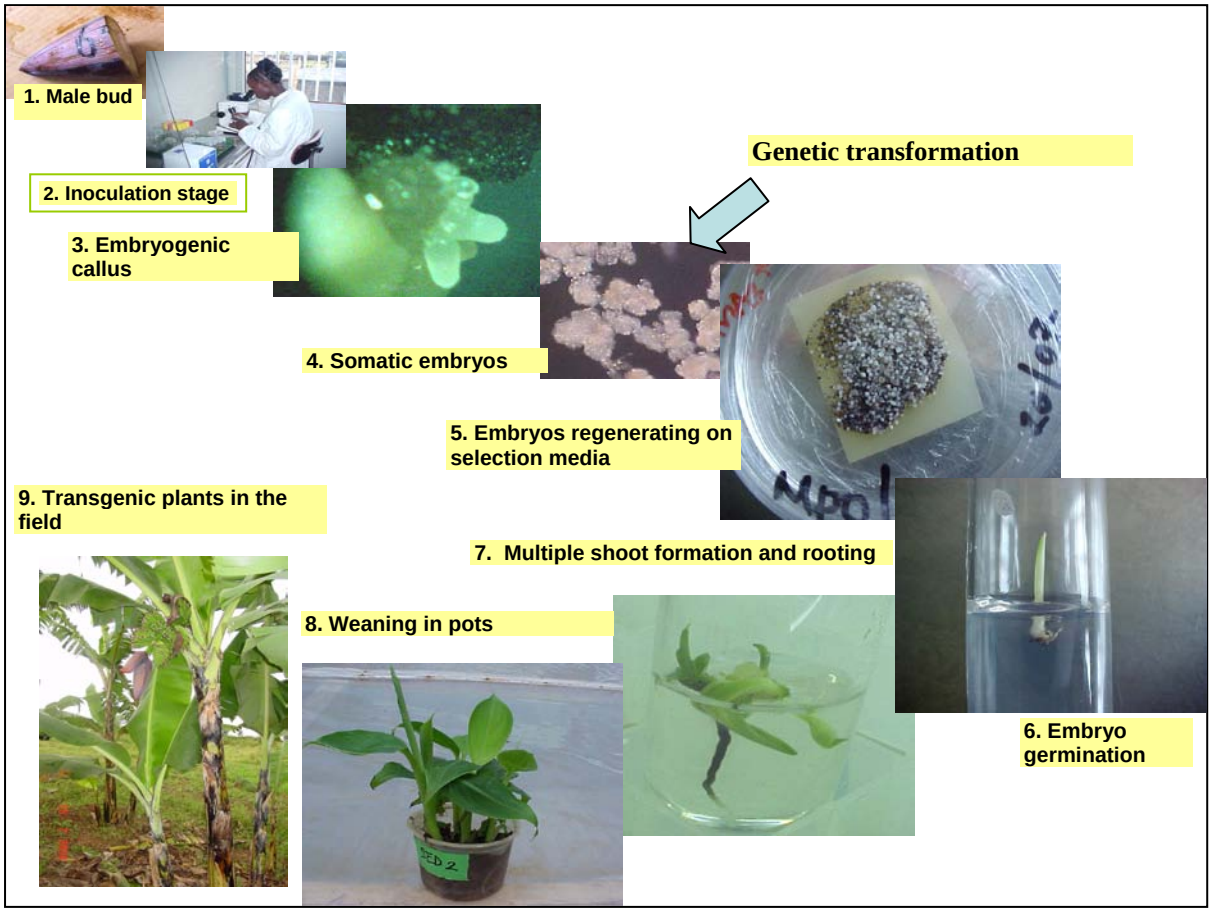

Figure 2: Banana Biotechnology Research at the National Agricultural Biotechnology Centre, Kawanda

b) National Livestock Resources Research Institute (NaLIRRI)

The areas of research at this institute include cloning and sequencing of genes in trypanosomes that confer resistance to currently used drugs, development of diagnostics for the detection of contagious bovine *Pleuropneumonia*, using hybridoma technology, development of an

improved vaccine against this disease, development of a suitable delivery medium for thermostable vaccine against Newcastle Disease and Improvement of the currently used vaccines against East Coast Fever.

c) Makerere University

At Makerere University, the Department of Crop Science is involved in the improvement of banana (*Musa acuminata*) for disease resistance and tolerance to abiotic stress such as drought, molecular characterization of sweet potato (*Ipomoea batatas*) viruses and fungal pathogens; the Department of Biochemistry is involved in screening of extremophilic bacteria (from hot springs in Uganda), to identify species possessing genes encoding enzymes that might be of industrial value. The Department of Animal Science on the other hand, is researching on the improvement of feeds through micro organisms and animal breeding by attempting to find DNA markers linked to useful traits in local cattle breeds.

The scientists in the Department of Veterinary Parasitology and Microbiology are using molecular methods as a tool in epidemiology and diagnostics and vaccine development for livestock and wildlife. Makerere University's medical school is investigating the use of a live recombinant human immunodeficiency virus (HIV) vaccine. Its current focus is on determining the vaccine's safety (toxicology and immunogenicity) through clinical trials. The Institute of Environment and Natural Resources is involved in the use of Microsatellites and mitochondrial DNA sequences to study the population genetics of elephants (*Loxodonta africana*), hippopotamuses (*Hippopotamus amphibious*), buffalo (*Syncerus caffer*), and various fish species. This information will aid conservation decision-making, and forensics (determining identity and source of seized illegal animal products).

d) Health Research

Several research efforts to use biotechnology in health research are underway under the different institutions in Uganda. These include the production of medicines, hormones, vaccines and other bio-engineered products such as the ALVAC-HIV vaccine whose trials on human subjects (phase 1) was completed in 2000 and the recombinant DNA vaccine is currently undergoing trials (phase 1) in the country. At the fore front of this landmark research efforts are scientists from Makerere University Medical School, Joint Clinical Research Centre (JCRC) and the Uganda Virus Research Institute (UVRI).

1.2.3.3 Human resource and Infrastructure development

In their survey conducted in 2000, Braunschweig and Sengooba (2001) identified 38 researchers and 31 technicians and support staff conducting research in all disciplines of biotechnology. The researchers were comprised of 15 Ph.D.-level, 17 M.Sc.-level, and 6 B.Sc.-level scientists.

Braunschweig and Sengooba (2001) documented the status of laboratory facilities in Uganda. The authors found that 30% of the laboratories surveyed were deficient in resources. At present, laboratory facilities in molecular biology at the Department of Crop Sciences and Institute of Environment and Natural Resources at Makerere University and NARO at KARI serve a key role for biotechnology in the country. A survey of biotechnology institutions showed that none of the people interviewed mentioned a severe need for personal computers, telephones, or fax machines. Therefore, the needs of the research community appeared to be adequately served by the present supply of these machines.

Table 1: The Human and Infrastructure Biotechnology Capacity in Uganda in Comparison to the East African Region as a Whole

	Human Resource*		Infrastructure Resource (Laboratories)	
Technology	**National**	**Regional(E.A)**	**National**	**Regional (E.A)**
Tissue Culture	10	66	6	29
Molecular Markers	13	18	4	10
Recombinant tech.	5	45	1	10
Bio fertilizer			1	4
Bio pesticides			1	3
Fermentation			0	3
Total	**28**	**129**	**13**	**56**

Source: J. Wekundah, 2003

***Human Resource – Ph.D and MSc. degrees the different biotechnology disciplines**

1.2.3.4 Investments in Biotechnology

There is still low level of private investments in commercial biotechnology possibly due to lack of awareness of the potential Biotechnology in generating highly competitive products and services. However, a few entrepreneurs have recently started to take in interest in this field. These include the followings: Agrogenetic technologies which is using biotechnology to produce disease-free planting materials of different crops such as bananas, coffee, pineapples and Aloe Vera; MedBiotech is engaged in Malaria vaccine research and other aspects of medical biotechnology and SiRIM/BERHAD which is a Malaysian company that showed interest in production of Biofuel in Uganda.

On its part, Government has made modest contribution to kick start biotechnology developments in Uganda. The funding of the National Agricultural Biotechnology Centre at Kawanda is a demonstration of government's commitment to biotechnological developments in the wide scope of the PMA. These investments in high level research are geared towards commercial agriculture, value addition and enhancement of competitiveness of Uganda's Agricultural products.

1.2.3.5 Legal and Regulatory Framework

In the absence of an explicit government policy on Biotechnology and Biosafety, efforts were made to provide for specific aspects of Biotechnology and Biosafety in the Uganda Biosafety Framework within which the various institutions and agencies involved in biotechnology research were defined and could operate. This was developed on the basis of the UNCST Act Cap. 209 that mandates UNCST to oversee research and development in all fields of science and technology. Basing on this act, guidelines for conducting research involving genetic modification both at laboratory and confined field trial level have been developed: Confined field trial Guidelines (2006) and Guidelines for Containment with Genetically modified organisms and microbes (2007). During the policy and legal status review process that preceded the drafting of this policy, it was noted that though the UNCST Act can in the interim be used to regulate aspects of biotechnology research and development, it was inadequate to regulate the overall development of biotechnology and commercialization of its products hence the need for an explicit policy and law for biotechnology and biosafety.

1.2.3.6 Institutional framework

The Cartagena Protocol on Biosafety requires parties to establish National Focal Points to liaise with the CBD Secretariat on matters regarding the implementation of the Protocol. Currently the Ministry responsible for environment is the National Focal Point. The Protocol also provides for the designation of a National Competent Authority. Currently the Uganda National Council for Science and Technology is the Competent Authority and by virtue of its statutory mandate, provides the overall policy framework within which biotechnology research and applications are promoted in Uganda. In 1996, the UNCST established the National Biosafety Committee which is still functional to date.

However, the UNCST's capacity to coordinate biotechnology development has been constrained by inadequate financial and infrastructural provisions coupled with a lack of clear definition of roles of the various stakeholder institutions. There is, therefore, need for Government to decide on institutional mechanisms for biotechnology development that should be provided for under the national policy on Biotechnology and Biosafety.

1.2.4 Challenges facing Biotechnology and Biosafety Development

1.2.4.1 Low Public Awareness and Participation

There is limited public awareness and participation in Biotechnology research and development and a lot of misinformation with respect to the techniques, basic applications, opportunities, utility and safety of the new and emerging technologies. Access to knowledge of biotechnology and its application for development is still restricted to a few advanced level researchers in biological sciences. This constrains optimal attainment of a national level of awareness and consensus on biotechnology and its potential contribution to national development.

1.2.4.2 Biotechnology Financing

The limited national awareness on biotechnology and biosafety and the apparent absence of a national programme and strategic plan for harnessing the potential of modern biotechnology development in Uganda, has led to inadequate funding for biotechnology innovation and development. Funding for biotechnology has remained within the confines of the already below average funding levels for science and technology. The little available

funding is mainly from foreign sources, with research agendas that may not necessarily reflect national priorities for development. The public-private sector partnerships such as joint investment ventures and franchises in biotechnology are also currently weak or non-existent as a result of limited awareness of investment opportunities in Biotechnology and lack of an appropriate policy and regulatory framework.

1.2.4.3 Policy and Legal Environment

The Ugandan legal framework is inadequate with respect to biotechnology regulation. Legislation on the Ugandan statute books today does not explicitly and exhaustively cover issues pertaining to modern biotechnology and biosafety. Furthermore, legally binding instruments to regulate the application of biotechnology for the conservation and utilisation of genetic resources in Uganda are scattered in provisions of several sectoral laws relating to such broad areas as natural resources conservation and utilisation, industrial development and environmental protection whose management is entrusted to various statutory bodies with no clear demarcation of areas of jurisdiction.

1.2.4.4 Industrial Application and Commercialisation

The weak industry-research linkages and the low levels of utilisation of research results in Uganda, has meant that biotechnology has not yet found its rightful position as a key mover of industrial development. In addition, a deliberate policy to promote foreign investment in industrial biotechnology is lacking. This *inter alia* calls for the establishment and strengthening of inter and intra-institutional collaboration and forging strategic partnerships in research, development and commercialisation of biotechnology products.

1.2.4.5 Bioethics and Biosafety

There is an apparent lack of a code of ethics in biotechnology research in Uganda. Ethical considerations in biotechnology research therefore, do not exist save for certain aspects that are addressed by the more general national guidelines on research ethics (National Guidelines for Research Involving humans as Research participants, UNCST, 2007). The code of bio-ethics should enable the development and exploitation of Biotechnology in accordance with acceptable societal norms. This is a key factor in shaping public attitude and consumer acceptance of products of biotechnology.

1.2.4.6 Biotechnology Regulation

The issue of biosafety has emerged as a critical factor in the effort to deploy modern biotechnology in both industrialised and developing countries. This issue is mainly about how to avoid or control potential risks of biotechnology on human health, the environment, as well as the socio-economic impacts of such risks.

Uganda has taken significant steps to ensure safety in biotechnology applications. In 1996, the UNCST established the National Biosafety Committee (NBC) as its national administrative arm on matters concerning biosafety. The main function of the committee is to provide technical advice on biosafety issues to government particularly with respect to the assessment of benefits and risks associated with biotechnology applications and processes. Institutional Biosafety Committees (IBCs) have also been established in some institutions engaged in Biotechnology R&D such as NARO. However, the guidelines for the set-up and operation of these regulatory organs appear to be ad hoc without the required support that is provided by a national policy framework thus, justifying the need for a holistic policy to provide for a broader context for strengthening the regulatory instruments for Biotechnology application.

1.2.4.7 Biodiversity Conservation and Utilisation

Uganda faces the challenge of rapid loss of her genetic resources due to high population growth rates, encroachment on protected areas and climatic changes. This continues steadily despite the fact that Uganda is a biodiversity-rich country. The deployment of Biotechnology tools such as DNA bar coding will play a big role in identification, characterisation and conservation of this genetic diversity in gene banks, genetic databases and other forms of conservation of genetic information. In addition, this

immense variety of genes will provide immense returns for a vibrant biotechnology-based industry.

1.3 Coordination, Linkages and Partnerships

1.3.1 National Stakeholder Coordination

Currently, there is no clear demarcation of stakeholder and sectoral roles in the development and application of modern biotechnology. The efforts in research and development are fragmented and in the interest of individual funders. The definition of government agencies that are supposed to address the concerns of the stakeholders and the public in the development and application of modern Biotechnology is not clear. Inter and intra institutional linkages in the areas of biotechnology training, research, product development and commercialisation in Uganda are currently weak. This policy therefore, provides an implementation framework that defines responsibilities of different agencies at the national level.

1.3.2 International Collaboration and Partnerships

The development of biotechnology thrives on the formation of strategic partnerships amongst stakeholders. The existing linkages are mainly informal and not entirely reflective of institutional collaboration beyond professional association among individual researchers in the country with their international counterparts. The bi-lateral and multi-lateral collaboration is mainly uncoordinated and largely based on the interests of the support granting partners. This calls for systematic development and strengthening of mutually beneficial partnerships in all aspects of Biotechnology that address national development priorities.

2.0. GUIDING PRINCIPLES

2.1 Consistency with National Objectives: The Policy shall at all times be consistent with the National aims and objectives guiding sustainable development as articulated in the Constitution, PEAP and Vision 2025.

2.2 Addressing national Development Challenges: The policy shall seek to address national development challenges in food security, healthcare, biodiversity conservation and industrialization.

2.3 Capacity Building: The policy shall build human resources and infrastructural capacity so as to enhance research, development and innovation.

2.4 Partnerships in Governance: The policy shall encourage strong institutional relationships so as to enhance efficiency, transparency, accountability, and confidence in all Biotechnology and Biosafety Stakeholders.

2.5 Self-Sustainability: This policy is not expected to impose significant burden to the national treasury but rather has potential to, in the long term, attract investment in this country both through the Biotechnology companies as well as through the civil society thereby sustaining its implementation and contribute to self-sustainability of the national economy.

2.6 Safe Development and Application of Biotechnology: The policy provides for both development and regulation of Biotechnology hence the concept of Biosafety which ensures safety in the development of biotechnology products from the laboratory to the marketplace.

3.0 GOAL AND OBJECTIVES

3.1 Goal

The goal of the policy is to contribute to the national goals of poverty eradication, improved healthcare, food security, industrialisation and the protection of the environment through the safe application of biotechnology.

3.2 Objectives

The objectives of the policy are to:

i. build and strengthen national capacity in biotechnology research, development and application;
ii. promote the utilisation of biotechnology products and processes as tools for national development;
iii. provide a regulatory and institutional framework for safe and sustainable biotechnology development and applications;
iv. Promote ethical standards in biotechnology research and development.

4.0 POLICY STATEMENTS AND STRATEGIC ACTIONS

In consideration of the strategic role and potential benefits of biotechnology in development, the Government of Uganda hereby undertakes to promote and facilitate the safe development and sustainable application of biotechnology in addressing challenges to national development through a Biotechnology and Biosafety policy framework. Strategic actions for implementation of the Policy will be guided by the principles outlined in Section 2. Strategic actions for addressing specific policy areas will be undertaken as outlined below:

4.1 Human Resource Capacity Development

> **Policy Statement 1:** ***Mechanisms will be put in place for continuous human resource development, deployment and retention to ensure that Biotechnology research and development is conducted by competent personnel for the benefit of society.***

Safe research and development of biotechnology is based on sustainable national human resources development with adequate provision of quality infrastructure for the immediate and long-term development of the nation. Human resources development shall therefore, focus on appropriate curricular schemes and practical skills development at all levels of training in order to produce adequate and high quality personnel for all biotechnological activities.

Strategies for implementation of the above statement will include the following actions:

i. Provide training opportunities of a technical and academic nature for Ugandans at both local and foreign institutions.

ii. Encourage and promote partnerships and networking among Government, Universities, research institutions and the private sector, in human resources development.
iii. Promote appropriate curricular development in biotechnology and biosafety training at all levels.
iv. Initiate and encourage participation of academic and other staff in refresher courses in advanced biotechnology.
v. Provide fellowships in biotechnology for capable but financially unable personnel.
vi. Put in place mechanisms of attracting Biotechnology scientists in the Diaspora to either return home or make their contributions to Biotechnology research and development from their countries of residence.

4.2 Infrastructure Development

> ***Policy Statement 2: Priority attention will be given to the provision of adequate and state-of-the-art infrastructure facilities to facilitate rapid development of biotechnology and biosafety in the country.***

Meaningful research and development in Biotechnology cannot be conducted with obsolete laboratory equipment. Though some modest efforts have been made by Government to put in place infrastructure for Biotechnology research and development such as establishment of the National Agricultural Biotechnology Centre at Kawanda, more investment needs to be made in equipping teaching and research laboratories in Universities and Research institutions with modern equipment.

Strategies for implementation of the above statement will include the following actions:

i. Ensure that adequate and reliable R&D infrastructure facilities are installed in all major research centres so that Ugandans have access to safe and profitable biotechnology products and services.
ii. Implement strategies for technology transfer and adoption to supplement indigenous technology development.
iii. Promote public-private partnerships in biotechnology endeavours for sustainable development.
iv. Facilitate establishment of centres of excellence for biotechnology research and develop and strengthen those already in existence so as to

build capacity in the implementation of strategic national programmes in biotechnology.

4.3 Research and Development

> **Policy Statement 3:** ***A strong emphasis will be placed on biotechnology and biosafety R&D in priority areas of food and agriculture, health, industry, environment and natural resources development.***

Currently, there is already Biotechnology research going on in research institutions and universities such as molecular characterisation of some local crop plants such as bananas, plant tissue culture, marker assisted selection breeding of some indigenous crops, livestock improvement and vaccine research among others. There is however limited financial, human and infrastructure capacities to engage in better Biotechnology research as well as in the regulation of this research Biotechnology. Government therefore, needs to augment these efforts that have been predominantly supported through development partners and the international research community. Government also needs to initiate and promote programmes that will engender acceptable development and deployment of imported and indigenous technologies.

Strategies for implementation of the above statement will include the following actions:

i. Provide the appropriate enabling environment for development of strong biotechnology and biosafety R&D.
ii. Undertake a national biotechnology assessment studies to determine biotechnology research priorities in the agricultural, health, industrial, environmental and other strategic sectors.
iii. Establish mechanisms for continuous dialogue among researchers, policy makers, industrialists and other stakeholders to elaborate on national priorities in biotechnology and biosafety.
iv. Install efficient information and communications technology facilities to enable R&D communities have access, as well as network and exchange global and local information on their areas of interest in biotechnology and biosafety.
v. Enforce compliance with biosafety regulations by institutions and companies engaged in biotechnology research activities so as to promote biosafety standards.

4.4 Public Awareness and Participation

Policy Statement 4: ***Strategies will be put in place to increase public understanding and participation in Biotechnology and Biosafety Development.***

In Uganda, Biotechnology is widely perceived as a new technology and Biosafety as a new concept which actually is not the case. Government shall launch a public awareness campaign to educate and sensitise the general public about the application, potential benefits and risks of biotechnology in the national efforts on industrialization, modernization of agriculture and eradication of poverty. It will also sensitise the public about the role of Biosafety in the development and application of Biotechnology in different sectors.

Strategies for implementation of the above statement will include the following actions:

i. Support national biotechnology and biosafety awareness campaigns through *inter alia* participatory approaches on matters concerning the safe transfer, handling and use of products of Biotechnology.
ii. Establish national documentation and dissemination systems for biotechnology and biosafety information.
iii. Strengthen civil society involvement in advocating for and promoting safe biotechnology development.

4.5 Industrial Application and Commercialisation

Policy Statement 5: ***A conducive environment and appropriate initiatives will be created for wider application and commercialisation of biotechnology in the relevant sectors of the economy.***

The application of Biotechnology in a wide range of industrial processes and products was long acknowledged. The development of the world's most widely applied pharmaceuticals and industrial products is through Biotechnology. There is limited public and private investment in the development and commercialisation of Biological technologies in Uganda. This therefore means that the Government needs to create an enabling

environment as incentives for the both public and private sector investment in Biotechnology development and commercialisation.

Strategies for implementation of the above statement will include the following actions:

i. Initiate and promote programmes that will engender profitable development and utilisation of biotechnology products and services.
ii. Encourage free enterprise, establishment of local and international franchises, and foster collaboration between public and private enterprises in biotechnology.
iii. Provide appropriate investment incentives for development of the biotechnology industry.
iv. Ensure persons involved in industrial application and commercialisation comply with biosafety standards while developing, producing, transferring and moving biotechnology products.

4.6 Bioethics and Biosafety

> **Policy Statement 6: M*echanisms will be put in place to develop and apply Biotechnology in accordance with acceptable societal morals and national and international norms and standards.***

In the course of executing scientific and technical work in various sectors, unethical issues and practices are likely to intentionally and unintentionally arise. There is therefore need to put in place a system for streamlining and regulating Biotechnology development and its application as per the international ethics in scientific research and Ugandan morals and standards.

Strategies for implementation of the above statement will include the following actions:

i. Establish acceptable national ethical standards or code of ethics for undertaking biotechnological research and applications.
ii. Ensure, through a national competent authority that GMOs and their products sold in or imported into or through Uganda are labelled according to national and international regulations.
iii. Establish effective mechanisms for enforcing ethical conduct in biotechnology R&D.
iv. Integrating bio-ethics in all training programmes on biotechnology so as to build a national culture of ethics in biotechnology applications.

v. Establishing a mechanism and procedures for decision making in Biotechnology development and commercialisation.

4.7 Indigenous Knowledge and Practices

Policy Statement 7: ***Indigenous knowledge will be integrated in the development and application of modern Biotechnology.***

Indigenous knowledge (IK) has the potential of being continuously integrated in the emerging technologies and can ensure that mechanisms are in place to harmonise IK practices with applications of biotechnology for mutual application.

Strategies for implementation of the above statement will include the following actions:

i. Create awareness for IK to take advantage of biotechnology applications.
ii. Promote integration of IK with modern Biotechnology.
iii. Promote equitable benefit and access sharing of Indigenous Knowledge.

4.8 Gender Considerations and Equity

Policy Statement 8: ***Gender issues will be given utmost consideration in the process of development and application of Biotechnology***

Biotechnology is a technology that has a big potential of reducing the burden of manual labour. For instance, improved varieties of crops are produced that require less frequency of weeding, effectively use water reserves and are more convenient to harvest, this will reduce on the time spent by the women the children (who form the majority) on the farms. The technologies will also contribute significantly to improvement of nutrition and general health of the pregnant mothers and the children since Biotechnology can be used to produce different forms of food nutrients, vaccines and pharmaceuticals products.

Strategies for implementation of the above statement will include the following actions:

i. Ensure that the biotechnologies that are adopted are those that will not put a burden on the women and children but rather reduce the already existing burden and contribute to improving their health and livelihoods.
ii. Promote participation of disadvantaged groups in the development of biotechnology and biosafety programmes.
iii. Provide entrepreneurship to disadvantaged groups to enhance their ability to utilise and commercialise biotechnology.

4.9 Linkages and Partnerships

Policy Statement 9: ***Strategic partnerships will be put in place for fostering synergistic linkages among public and private research institutions, the civil society, as well as the international community in the implementation of this policy.***

Uganda has signed a number of international agreements that relate to Biotechnology development and its application. These include among others the Convention on Biological Diversity (CBD) and the Cartagena Protocol on Biosafety. The development and application of Biotechnology shall therefore entail forging of strategic partnerships among public and private sector research institutions, development partners and civil society at both local and international levels.

Strategies for implementation of the above statement will include the following actions:

i. Encourage national, regional and international collaboration and networking in biotechnology development and biosafety matters.
ii. Create mechanisms for functional linkages and partnerships between public and private sector R&D institutions.
iii. Initiate collaborative programmes among local and international public and private institutions with the aim of commercialising biotechnology products and services.
iv. Facilitate the formation of strategic and mutually beneficial alliances among multi-national companies and local entrepreneurs in biotechnology development.

4.10 Biodiversity Conservation and Utilisation

Policy Statement 10: ***Well-regulated conservation and***

sustainable utilisation of Uganda's natural resources will be enhanced through judicious application of Biotechnology.

Uganda's rich biodiversity forms a key part of future economic growth. The country's bio-resources shall be sustainably exploited through regulated bio-prospecting of these natural resources for use in agriculture, health and industry, through the following activities:

Strategies for implementation of the above statement will include the following actions:

i. Use biotechnology to characterise indigenous plants and animals so as to evaluate their economic potentials for biotechnological applications.
ii. Use biotechnology in *in-situ* and *ex-situ* genetic resources conservation.
iii. Develop well-equipped laboratories for the sustainable exploration and exploitation of bio-resources.
iv. Apply information technology to bio-resources development.
v. Strengthen the legal and institutional arrangements for adherence to the legislation on biodiversity conservation.

5.0 POLICY IMPLEMENTATION

The Government shall, establish and where already in existence, strengthen well-coordinated and sustainable mechanisms and structures for effective implementation, monitoring and periodic review of this policy. The structure shall comprise of a National Focal Point on matters related to the CBD, a National Competent Authority on all issues of Biotechnology and Biosafety, which and shall under this policy continue to be the UNCST, and which shall house the National Biosafety Committee (NBC).

5.1 Institutional Framework

5.1.1 The National Focal Point

Government shall enhance the capacity of the National Focal Point (NFP) for Biosafety in the Ministry responsible for Environment to take greater responsibility on behalf of Uganda in liasing with the CBD Secretariat in coordinating information flow and exchange. The competent authority shall seek to strengthen the working relationship with the National Focal Point.

5.1.2 The National Competent Authority

Government shall strengthen the UNCST as the National Competent Authority to supervise and coordinate implementation of this policy. The powers and duties of the Competent Authority shall be spelt out in the requisite legislation. The Competent Authority shall house the Secretariat of the National Biosafety Committee as provided for hereunder.

5.1.3 National Biosafety Committee

Government shall establish a NBC within the Competent Authority. The NBC shall review and approve all Biotechnology research and development activities in the country. The NBC Secretariat within the Competent Authority shall provide administrative support to the National Biosafety Committee. The NBC shall comprise of experts with competence to review and evaluate risks and benefits of biotechnology research and development activities.

5.1.4 Other Lead Agencies

These agencies are sector based and have the mandate of conducting research, product development and various aspects of innovation in Biotechnology. The lead agencies comprise institutions within the National Agricultural Research System, National Industrial Research System, National Health Research System; National Environment Research System, Universities and other Institutions of Higher Learning, Private Sector Institutions and organisations having a portfolio of Biotechnology research and product development. The Ministry responsible for crop protection will specifically oversee inspection for compliance with the Phytosanitary and other terms and conditions of approval of activities involving agricultural biotechnology. The Ministry responsible for health will handle the safety of development and application of all biotechnologies involving pharmaceuticals, nutrition products and related issues whereas the Ministry responsible for environment will handle issues regarding biodiversity and liaison with the CBD secretariat. The Ministry responsible for trade will handle issues of commercialisation and trade in the products involving recombinant DNA technology. The Ministry responsible for labour and social development will handle occupational health and safety of workers involved in biotechnology activities. The Ministry responsible for information and communication technology will handle the development of appropriate

communication infrastructure and services. All these lead agencies will operate in consultation with the Competent Authority.

5.2 Financing

Implementation of the Biotechnology and Biosafety policy will build on current GoU commitments for national science and technology development although more funding commitments in the short-, medium-, and long-term perspective are envisaged. While the bulk of the resources can be obtained from the current sector allocations, new funding sources for long-term development of biotechnology are required to build on the already committed resource allocations for research and development during the period 2007/08 – 1010/11. The lead implementing institutions indicated in Annex 1 will therefore budget for and directly access funds through their sectoral budgeting processes.

In addition to current financial commitments to research and development through support to institutions such as Uganda Industrial Research Institute, NARO, health research institutions and Universities, Government will continue to explore mechanisms for increasing both foreign and local investment in biotechnology by fostering private-private and public-private sector partnerships.

5.3 Legal and Regulatory Framework

For the purposes of implementing this Policy, an Act for safe development and application of Biotechnology will be enacted to regulate Biotechnology applications. The Act will provide for the establishment of the institutional arrangements provided for under this policy. It will also clearly spell out the institutional mandates, functions and administrative roles for effective and safe application of biotechnology in national development.

6.0 MONITORING AND EVALUATION

6.1 Monitoring and Evaluation Framework

The Government will, within the provisions of this Policy, establish a Monitoring and Evaluation Framework for Biotechnology and Biosafety development to continuously monitor and assess both the sector and system performance on basis of measurable performance parameters as provided for within the national Biotechnology and Biosafety Plan and the National Integrated Monitoring and Evaluation System (NIMES) framework. Government will establish a national monitoring and evaluation framework for Biotechnology and Biosafety policy management that will provide the macro guidelines for evaluation of implementation of the policy.

6.2 Monitoring and Evaluation Strategy

The government will regularly evaluate the impact of the strategic actions and institutional framework developed for the implementation of this policy. A well-defined information system will be established, with reliable data on agreed performance indicators. The performance indicators will be used to gauge progress and effectiveness of the various implementation strategies put forward in this Policy.

ANNEX 1

BIOTECHNOLOGY AND BIOSAFETY POLICY IMPLEMENTATION FRAMEWORK 2007/08 – 2011/12

Policy Issue	Policy Statement	Policy Action	Targeted Results/ Outputs	Responsible Institutions
1. Human Resource Capacity Development	Mechanisms will be put in place for continuous human resource development, deployment and retention to ensure that Biotechnology research and development is conducted by competent personnel for the benefit of society.	Provide training opportunities of a technical and academic nature for Ugandans at both local and foreign institutions. Encourage and promote partnerships and networking among Government, universities, research institutions and the private sector, in human resources development. Promote appropriate curricular development in biotechnology and biosafety training at all levels. Initiate and encourage participation of academic and other staff in refresher courses in advanced biotechnology. Provide fellowships in biotechnology for capable but financially unable personnel.	Increased technical capacity in Biotechnology and Biosafety improved coordination and effective utilisation of human resources Biotechnology and Biosafety integrated in the school syllabi Personnel up to date with developments in Biotechnolo	MoES (NCHE, ESA, NCDC; Universities, Technical Colleges), and UNCST.

Policy Issue	Policy Statement	Policy Action	Targeted Results/ Outputs	Responsible Institutions
		Put in place mechanisms of attracting Biotechnology scientists in the Diaspora to either return home or make their contributions to Biotechnology research and development from their countries of residence.	gy & Biosafety Increased human resource capacity in biotechnology and biosafety Increased quality research in Biotechnology and biosafety	
2. Infrastructural Development	Priority attention will be given to the provision of adequate and state-of-the-art infrastructure and other facilities for biotechnology in order to facilitate rapid development of biotechnology and biosafety in the country.	Ensure that adequate and reliable R&D infrastructure facilities are installed in all major research centres to ensure that Ugandans have access to safe and profitable biotech products and services. Implement technology adoption strategies such as purchase of technologies and other forms of technology transfer to supplement indigenous technology development. Promote public/private partnerships in biotechnology endeavours for sustainable development. Facilitate establishment of centres of excellence for biotechnology research and develop and strengthen those already in existence so as to build capacity in the implementation of strategic national programmes in biotechnology	High quality and well equipped research centres for Biotechnology Biotechnology Product development process hastened Improved public-private collaboration in Biotechnology High quality and well equipped centres of excellence in biotechnology	MoH (UNHRO, NCRL, JCRC, UVRI), MTTI (UNBS, UIRI, UWA) MFPED (UNCST, UBOS), MICT, MAAIF (Crop Production/Protection; Animal Protection/Production), MWE (NEMA, NFA), RDIs, Universities, Private Sector, Donors.

Policy Issue	Policy Statement	Policy Action	Targeted Results/ Outputs	Responsible Institutions
3. Research and Development	A strong emphasis will be placed on biotechnology and biosafety R&D in priority areas of food and agriculture, health, industry, environment and natural resources development	Provide the appropriate enabling environment for development of strong biotechnology and biosafety R&D. Undertake a national biotechnology assessment studies to determine biotechnology research priorities in the agricultural, health, industrial, environmental and other strategic sectors. Establish mechanisms for continuous dialogue among researchers, policy makers, industrialists and other stakeholders to elaborate on national priorities in biotechnology and biosafety. Install efficient information and communications technology facilities to enable R&D communities have access, as well as network and exchange global and local information on their areas of interest in biotechnology and biosafety. Enforce compliance with biosafety regulations by institutions and companies engaged in biotechnology research activities so as to promote biosafety standards.	Biotechnology policy and law enacted Policy and status studies in Biotechnology and biosafety undertaken National priorities in Biotechnology and Biosafety established Improved access to information Improved adherence to biosafety standards	MoH (UNHRO, NCRL, JCRC, UVRI), MTTI (UNBS, UIRI, UWA) MFPED (UNCST, UBOS), MAAIF (NARO, Crop Production/Protection; Animal Protection/Production), MWE (NEMA, NFA), RDIs, Universities, Private Sector, Donors, NGOs, CBOs, MICT.
4. Public Awareness and Participation	Strategies will be put in place to increase public understanding of, and participation in, Biotechnology and Biosafety.	Support national biotechnology and biosafety awareness campaigns *inter alia* through education in a participatory approach especially on matters concerning the safe transfer, handling and use of living modified organisms in relation to the conservation and sustainable use of biological diversity.	Improved awareness on issues of biotechnology and biosafety Improved	UNCST, NAADS, PMA Secretariat, UNHRC, NARO Parliament, The Media, Civil Society, Local Governments (LGs), RDCs, Cultural

Policy Issue	Policy Statement	Policy Action	Targeted Results/ Outputs	Responsible Institutions
		Establish national documentation and dissemination systems for biotechnology and biosafety information. Strengthen civil society involvement in advocating for and promoting safe biotechnology development.	system of communication of biotechnology findings and news Active participation of CBOs and NGOs	Institutions, MICT
5. Industrial Application and Commercialisation		Initiate and promote programmes that will engender profitable development and utilisation of biotechnology products and services. Encourage enterprise, establishment of local and international franchises, and foster collaboration between public and private enterprises in biotechnology. Provide appropriate investment incentives for development of the biotechnology industry. Ensure persons involved in industrial application and commercialisation comply with biosafety standards while developing, producing, transferring and moving biotechnology products.	Improved utilisation of Biotechnology products Enhanced Public-Private partnerships and entrepreneurship Improve policy environment Adherence to Biosafety standards	MTTI (UIRI, UIA), Private Sector, Technology Incubation Centres, UNCST, Universities, Enterprise Uganda, Private Sector Foundation, Donors.
6. Bioethics and Biosafety	Mechanisms will be put in place to develop and apply Biotechnology in accordance with acceptable societal morals and national and international norms and standards.	Establish acceptable national ethical standards for undertaking biotechnological research and applications. Ensure GMOs and their products sold in or imported into or through Uganda are labelled according to national and international regulations. Establish effective mechanisms for enforcing ethical conduct in biotechnology R&D. Integrating bio-ethics in all training programmes on	Ethical code of conduct Adherence to National and International regulations Ethical code of conduct enforced	UNCST, RDCs, LGs, RDIs, Universities, NARO, MWE, NEMA, MAAIF (Crop Protection, Animal Protection), UWA, URA, MoH (JCRC, UNHRO, NCRL, UVRI) UCPA.MGLSD

Policy Issue	Policy Statement	Policy Action	Targeted Results/ Outputs	Responsible Institutions
		biotechnology so as to build a national culture of ethics in biotechnology applications. Establishing a mechanism for evidence-based decision making in Biotechnology development and commercialisation.	Increased Bioethics content in curricula High quality evaluation of Biotechnology	
7. Indigenous Knowledge and Practices	Indigenous knowledge will be effectively integrated in the development and application of modern Biotechnology.	Promote integration of IK with modern Biotechnology. Promote equitable benefit sharing and access to Indigenous Knowledge	Enhanced of IK with elements of Biotechnology Increased Information access	UNCST (UGKIS, Traditional Health Practioners, Conservationists, UWA, NEMA, NARO, Universities, LGs, Communities, Cultural Institutions.
8. Gender Considerations and Equity	Gender issues will be given utmost consideration in the process of development and application of Biotechnology	Ensure that the biotechnologies that are adopted are those that will not put a burden on the women and children but rather reduce the already existing burden and contribute to improving their health and livelihoods Promote participation of disadvantaged groups in the development of biotechnology and biosafety programmes Provide entrepreneurship to disadvantaged groups to enhance their ability to utilise and commercialise biotechnology	Appropriate biotechnologies Improved gender balance in biotechnology activities Recognition of special needs persons and perspectives in biotechnology activities	MGLSD, UNCST, MoES, NUDIPU, UNISE, NGOs, CBOs, Donors.
9. Linkages and Partn	Strategic partnerships will be put in place for fostering synergistic linkages among public and	Encourage national, regional and international collaboration and networking in biotechnology development and biosafety	Functional institutional collaboration	MoFA, UNCST, Universities, RDIs, Regional Blocks,

Policy Issue	Policy Statement	Policy Action	Targeted Results/ Outputs	Responsible Institutions
erships	private research institutions, the civil society, as well as the international community in the implementation of this policy	matters. Create mechanisms for functional linkages and partnerships between public and private sector R&D institutions. Initiate collaborative programmes among local and international public and private institutions with the aim of commercialising biotechnology products and services Facilitate the formation of strategic and mutually beneficial alliances among multi-national companies and local entrepreneurs in biotechnology development.	frameworks Functional regional and international programmes	Government ministries, Government Institutions, Donors.
10. Biodiversity Conservation and Utilisation	Well-regulated conservation and sustainable utilisation of Uganda's natural resources will be enhanced through judicious application of Biotechnology.	Use biotechnology to characterise indigenous plants and animals so as to evaluate their economic potentials for biotechnological applications. Use biotechnology in *in-situ* and *ex-situ* genetic resources conservation. Develop well-equipped laboratories for the sustainable exploration and exploitation of bio-resources. Apply information technology to bio-resources development. Strengthen the legal and institutional arrangements for adherence to the legislation on biodiversity conservation.	Standardized taxonomic databases Gene banks, genetic databases Well equipped laboratories Stronger legal regimes for biodiversity conservation	MWE, NEMA, UNCST, UWA, Civil Society, CBOs, Local Communities, Universities, RDIs, Civil Society, Donors.