National Seed Policy and Action Plan

Ministry of Industry, Commerce, Agriculture & Fisheries

2019

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LIST OF ACRONYMS

AIC	Agro Investment Corporation
BSJ	Bureau of Standards Jamaica
CARDI	Caribbean Agricultural Research and Development Institute
CASE	College of Agriculture Science and Education
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza
CBD	Convention on Biodiversity
CIDCO	Coffee Industry Development Company Limited
CPC	Chief Parliamentary Counsel
CPGCA	Christiana Potato Growers Cooperative Association
DBJ	Development Bank of Jamaica
GDP	Gross Domestic Product
I.C.S	Imperial College Selections
ICT	Information Communication Technology
JCPA	Jamaica Citrus Protection Agency
JIPO	Jamaica Intellectual Property Organization
MDAs	Ministries, Departments and Agencies
MICAF	Ministry of Industry, Commerce, Agriculture & Fisheries
MOF	Ministry of Finance & the Public Service
NCU	Northern Caribbean University
NEPA	National Environment and Planning Agency
NLA	National Land Agency
NSC	National Seed Committee
PC Bank	People's Cooperative Bank

PEQF	Post Entry Quarantine Facility
PGRFA	Plant Genetic Resources for Food and Agriculture
R&D	Research & Development Division
RADA	Rural Agricultural Development Authority
RMS	Resource Mobilization Strategy
SIRI	Sugar Industry Research Institute
SRC	Scientific Research Council
TSH	Trinidad Select Hybrid
TYLCV	Tomato Yellow Leaf Curl Virus
UWI	University of the West Indies
VRC	Varietal Release Committee
WCR	World Coffee Research
WICSCBS	West Indies Central Sugar Cane Breeding Station

EXECUTIVE SUMMARY

The agricultural sector is important to the Jamaican economy, contributing approximately 6.6 percent to total Gross Domestic Product (GDP) and is the second largest employer of labour, accounting for 18 percent of the total labour force in 2014. Agricultural production has a multiplier effect on the economy given its linkages with other activities such as manufacturing, tourism, transportation and local commerce and is important to rural development, as the main economic activity. Crops of importance for exports are sugar, yams, coffee, ackees, citrus, cocoa, pimento, pumpkins, ginger, dasheen, sweet potato, papayas and bananas. The sector is also critical to local food and nutrition security as it generally supplies vegetables, legumes, fruits, roots, tubers and condiments for domestic consumption and agro-processing.

Importance of Seed

Seed is the basic input to crop production which has the greatest potential for increasing on farm productivity and food security. It sets the limits to the effectiveness of all other inputs such as fertilizer, agro-chemicals, water and even management. Seed quality is often considered to be one of the most important factors contributing to crop yields and the productivity of other agricultural inputs and cultural practices within the farming system. The use of improved seed has been one of the factors for modern agricultural development and the advancement of many developed and emerging economies. The Agriculture Sector Plan and Food and Nutrition Security Policy have underscored the need for improved seeds to meet the country's production, productivity and food security goals.

The Seed System

Jamaica's seed[1] system is a mixture of imported seeds (mainly vegetables), a few locally produced seeds (scotch bonnet pepper, sorrel, callaloo, coconut) and those obtained from existing plants (e.g. cocoa). The rest of plants are vegetatively propagated (e.g. banana, yam, ginger, turmeric, etc.). There is no commercial production of genetically engineered crops. Seeds are produced and distributed locally by several key players, namely, Government (including commodity organizations), research institutions, private nursery operators, commercial and subsistence producers and farmers organizations.

The primary actors in Jamaica's formal seed sector are Ministry of Industry, Commerce, Agriculture & Fisheries' Research & Development Division, Commodity Boards (Sugar Industry Research Institute, Cocoa Industry Board, Coffee Industry Board, Banana Board, Coconut Industry Board and Export Division), Scientific Research Council, Caribbean Agriculture

[1] Seed within the context of this policy means parts of agricultural, forestry and horticultural plants intended for sowing or planting purposes.

Research and Development Institute and the Forestry Agency. Farmers' organizations also play an integral role in the supply of planting material for their members.

The informal seed supply system consists of farmer-managed seed production activities and is based on indigenous knowledge and local diffusion mechanisms. It includes methods such as retaining seed on-farm from previous harvests to plant the following crop and farmer-to-farmer seed exchange networks.

Challenges

Jamaica's domestic seed industry is not well developed as most planting material is from farmer saved seeds or imported. Private sector involvement in certified seed production is limited for most crops, so the public sector is expected to meet the demand for locally produced planting material for key crops. The public sector seed programme is constrained by inadequate human resources for key skills (e.g. plant breeders, budders, seed technologists), lack of funding for production and distribution activities, limited production capacity and stealing of the crops used for seed production.

There is legislation impacting on the seed industry, plant genetic resources and the conservation and sustainable use of biodiversity. However, there is no comprehensive legislation that addresses key components of the seed sector, such as varietal development/improvement, release, multiplication, production, processing, storage, certification, marketing and distribution of seeds. There is currently no protection for plant breeders' rights for the development of new plant varieties, which serves as a disincentive for the private sector and other interested individuals investing heavily in plant breeding activities.

In order to meet the objectives of national agricultural and food security policies, the seed system needs to be improved to provide adequate, quality planting material to farmers on a timely basis. Significant investments in crop research and plant breeding will also be necessary to support current and future production expansion programmes. A national seed policy can be seen as a vehicle that justifies investment in crop research, since it makes it possible for producers to benefit from plant breeding initiatives.

Scope of the Policy

The policy focuses on the development of a seed system that ensures the availability of high quality seed which is accessible to end users. Seed within the context of this policy means parts of agricultural, forestry and horticultural plants intended for sowing or planting purposes. Both conventional and organic production systems fall under the scope of this policy. The areas of research, plant breeding, varietal evaluation, seed multiplication, processing, storage, quality control, marketing, promotion and protection of plant genetic resources for food and agriculture are addressed by the policy. Provision is made for the implementation of an appropriate

institutional framework, building of technical and institutional capacity, promulgation of seed legislation, financing strategy and a communications programme.

Vision and Goals

The vision of the policy is to establish a sustainable seed system that ensures a consistent and reliable supply of clean, affordable and accessible seed in support of agricultural production, productivity, food security and biodiversity.

The goals of the policy are to:

i. Facilitate development, evaluation and maintenance of pest resistant/ tolerant, high yielding varieties that are adaptive to given local agro-ecological zones and challenges posed by climate change.
ii. Increase availability and access to clean seed to meet production requirements.
iii. Improve regulation and monitoring of the seed industry to ensure adherence to quality standards.
iv. Improve the sustainable marketing and distribution of seeds.
v. Protect national plant genetic resources.

Elements of the Policy

i. Research, Variety Improvement, Evaluation and Release

Support for basic and adaptive research aimed at crop improvement will be emphasized and resources made available to the national research system to undertake these activities. The national research strategy for seed will be based on collaborative efforts with relevant international, regional and private sector research initiatives and will develop, adopt and adapt research techniques to achieve the desired goals. In that regard, plant breeding, evaluation trials, on-farm trials and validations will be very important components of research activities, as well as efforts to obtain for such trials, the most promising varietal lines from cooperating research institutions outside of Jamaica. Emphasis will be placed on the development of seed for varieties with desirable traits (such as yield, quality, disease resistance, etc.) for both conventional and organic production systems. Research will be aimed at ensuring the identification of varieties which will perform optimally in the areas where they are to be used.

The seed industry requires specialized expertise to propel the national research and supporting programmes. Government shall therefore seek to recruit appropriate personnel and build capacity within existing staff to acquire the necessary skills for its seed research programmes. The private

sector will also be encouraged to make investments in capacity building activities of its personnel.

An effective plant variety protection system is vital to encourage creativity and investment in private and public breeding. Therefore, plant variety protection legislation will be promulgated to grant and protect breeders' rights in development of new varieties.

ii. Seed Multiplication, Processing and Storage

In order to ensure increased production of commercial seed for agriculture and related sectors, Government will concentrate its efforts on the production of breeder and foundation seeds, while encouraging the private sector to produce commercial seeds for selected varieties in its seed programmes. Government shall create the framework for the establishment of seed multiplication programmes by the private sector using Certified Outgrower Schemes. Private seed producers will be assisted to develop the required infrastructure and expertise which will form an important basis for selection of qualified and organized producers and producer groups. In the interest of national food and nutrition security, Government will continue to have responsibility for maintaining breeder, foundation and commercial seeds for multiplication, processing and storage for strategic and priority crops which are not taken up by the private sector.

Government will ensure seed security in the event of disasters and crisis, which may disrupt normal seed production and supplies through appropriate preparedness and response methods. In this regard, seed system security assessments will be conducted to provide critical information to prepare for, and respond to disasters. Seed standards and protocols for gifts of seeds that meet minimum local and international standards to be followed by all donor agencies will be established to guide post-disaster relief efforts.

With respect to preparedness measures, Government will make arrangements for strategic seed stocks and nurseries, where appropriate, and give support to local level interventions such as on-farm seed conservation and community seed banks. Germplasm of important varieties will continue to be stored in regional and international gene banks. The importation and evaluation of adaptable varieties from other countries for multiplication will be explored in the event of a loss of local germplasm for varieties that are critical to food and nutrition security.

iii. Seed Quality Control

Given the sensitivity of seed as a key input to production, it is necessary to maintain high quality standards to fully derive the benefits of the use of certified seed. As such, Government shall:

- Promulgate national seed legislation to ensure reliable standards of seed quality, protect seed suppliers and users, and develop a quality-oriented seed industry;
- Develop a Seed Certification Scheme as part of the enabling regulations of the seed legislation; and

- Develop seed standards that conform to regional and international best practices, including gifts of seeds to the country.

iv. Marketing and Promotion

Recognizing the importance of the private sector in the seed trade, public/private partnerships will be encouraged for the marketing and promotion of seed produced by programmes operated by Government through established guidelines in order to ensure efficiency. Marketing will also remain a private sector activity for all commercialized seed programmes, bearing in mind intellectual property rights and licensing systems. The role of Government shall be focused on providing market intelligence, which will assist in demand forecasting and ensuring equitable supply of seeds to all production areas. Government will utilize the extension services in creating awareness among farmers of new crops, varieties and quality seed and to show how these factors contribute to increased production and productivity.

With respect to development of the seed value chain, Government shall seek to define the value chains for seed varieties agreed upon by stakeholders. Upgrading strategies to facilitate development of these chains will be promoted to build trust among value chain actors, encourage innovation and identify new product and market opportunities, including exports.

v. Protection of Plant Genetic Resources

Plant genetic resources for food and agriculture are indispensable for crop genetic improvement, whether by means of farmers' selection, classical plant breeding or modern biotechnologies, and are essential in adapting to unpredictable environmental changes and future human needs. In accordance with the national legislation for the Protection of Plant Genetic Resources for Food and Agriculture (2013) and the International Treaty on Plant Genetic Resources for Food and Agriculture, Government shall promote an integrated approach to the conservation, exploration, collection, characterization, evaluation, documentation and sustainable use of plant genetic resources for food and agriculture; right to equitably participate in sharing benefits arising from its benefits; and right to participate in making decisions at the national level, on matters related to its conservation and sustainable use.

Government shall build capacity in plant genetic resources for food and agriculture by:

- Strengthening programmes for scientific and technical education and training in conservation and sustainable use of plant genetic resources for food and agriculture;
- Developing and strengthening facilities for conservation and sustainable use of plant genetic resources for food and agriculture; and
- Carrying out scientific research in fields where it is needed.

Government shall co-operate with relevant international organizations in enhancing international activities to promote conservation, evaluation, documentation, genetic enhancement, plant breeding and seed multiplication; and sharing, providing access to, and exchanging plant genetic resources and appropriate information and technology.

National Seed Plan

The National Seed Plan outlines the framework of activities that will be critical in implementing the National Seed Policy and will cover a ten year period, from 2019 to 2029. It is underpinned by an Activity Matrix elaborated in Appendix I. The Activity Matrix is comprised of the strategies and actions that are linked to each policy goal. Additionally, the matrix ascribes timelines and indicators and details stakeholders responsible for each action.

The goals and strategies are outlined in the table below.

Goals	Strategies
Goal 1: Facilitate development, evaluation and maintenance of pest resistant/ tolerant, high yielding varieties that are adaptive to local agro-ecological zones and challenges posed by climate change.	1.1 Promote basic and adaptive research for local varietal development and improvement.
	1.2 Strengthen technical capacity of human resources to support the seed research programme.
	1.3 Strengthen the physical capacity of participating institutions to support seed research programmes.
	1.4 Test and evaluate imported seed varieties.
	1.5 Facilitate release of new and improved seed varieties.
Goal 2: Increase availability and access to clean seed to meet production requirements.	2.1 Strengthen breeder and foundation seed production programmes.
	2.2 Establish a Certified Outgrower Scheme for commercial seed production.
	2.3 Develop a seed security programme.
	2.4 Improve post disaster seed security programme.
Goal 3: Improve regulation and monitoring of the seed industry to ensure adherence to quality standards.	3.1 Create legislative framework for development of a seed industry.
	3.2 Develop a Seed Certification Scheme to ensure quality assurance of seeds produced and marketed.
Goal 4: Improve the sustainable marketing and distribution of seeds.	4.1 Provide market intelligence to improve efficiency in the seed distribution system.
	4.2 Increase awareness on the availability and use of quality seeds.
	4.3 Upgrade seed value chains.
Goal 5: Protect national plant genetic resources.	5.1 Promote on-farm and *in situ* conservation of plant genetic resource for food and agriculture.
	5.2 Strengthen national *ex situ* conservation systems.
	5.3 Enhance the use and management of plant genetic resources in gene banks.

Implementation Framework

The Seed Policy and Plan was developed within the wider context of the Agriculture Sector Plan, National Food and Nutrition Security Policy and Action Plan and other relevant policies and plans. In order to operationalize the Plan, there needs to be an emphasis on the coordination of actions, accountability of all stakeholders and efficient allocation of resources. Given that the Seed Plan will be implemented over a ten year period, from 2019-2029, actions will be streamlined in the Corporate, Operational Planning and budgetary processes of the Ministries, Departments and Agencies (MDAs) involved in its implementation.

The main implementing bodies will be:

i. A National Seed Committee (NSC), which will serve as an advisory body responsible for oversight and coordination of the Seed Policy and Plan.

ii. A Varietal Release Committee (VRC), which will be a sub-committee of the NSC to develop and implement a mechanism for orderly release of new varieties of crops, whether imported or locally developed.

iii. A Seed Certification Agency, which shall be established under the auspices of the National Plant Protection Organization and charged with the responsibility of conducting the necessary field inspections and laboratory tests aimed at providing the necessary quality checks and assistance to all facets of the seed industry.

iv. A Management Authority which is mandated to provide guidance on policy and legal measures that provide for the conservation and sustainable use of plant genetic resources and the equitable sharing of the benefits arising out of their use.

The implementation of the Seed Policy and Plan will require input from Government, private sector and civil society for the sustainability of the industry.

Legislative Framework

The implementation of the Seed Policy and Plan will require the promulgation of new legislation to support the seed industry and for the protection of plant breeders' rights. It will also require a review of existing legislation and regulations with a view to identifying the changes that may be required to complement the new legislation.

Communications Programme

A Communications Programme will be developed and implemented by the National Seed Committee to promote public awareness about the Seed Policy and Plan and other programmes/projects being implemented to support the seed sector.

Financing of the Seed Policy and Plan

The National Seed Policy and Plan will require significant resources over the ten year period of its implementation. The methodology for deriving the funding requirements for the Seed Policy and Plan takes into consideration that there are already existing resources committed by Government through its national budget for implementing activities under its regular programmes. The implementation of activities in the Seed Plan, for the most part, will rely upon existing resources of implementing partners in the public sector and also mobilize resources from private sector and civil society to minimize the impact of the policy and plan on the national budget.

However, there are some areas, namely, research, protection of plant genetic resources for food and agriculture, seed certification and seed security, which require additional investment to support Government's thrust towards food and nutrition security and agricultural development. Total funding requirements for the Policy and Plan is J$214.4 million over the 10 year period.

Monitoring and Evaluation

The monitoring and evaluation (M&E) of the National Seed Policy and Plan are important to facilitate effective management and oversight of its implementation. The Planning and Policy Division of the Ministry of Industry, Commerce, Agriculture & Fisheries will be responsible for implementing and managing a M&E system for the Seed Policy and Plan in collaboration with the National Seed Committee. The outcome of this process will be used to provide updates, recommendations and guidance for revision of policies and strategies to improve the seed system and management of plant genetic resources for food and agriculture.

1. BACKGROUND

The agricultural sector is important to the Jamaican economy, contributing approximately 6.6 percent to total Gross Domestic Product (GDP) and is the second largest employer of labour, accounting for 18 percent of the total labour force in 2014. Agricultural production has a multiplier effect on the economy given its linkages with other activities such as manufacturing, tourism, transportation and local commerce and is important to rural development as the main economic activity. Food exports accounted for 16.5 percent of total merchandise trade in 2014. Jamaica's agricultural activity is characterized by a small number of large scale producers of export crops and a large number of very small farmers producing mainly for the domestic market.

Crops of importance for exports are sugar, yams, coffee, ackees, citrus, cocoa, pimento, pumpkins, ginger, dasheen, sweet potato, papayas and bananas. The sector also is critical to local food and nutrition security, as it generally supplies vegetables, legumes, fruits, roots & tubers and condiments for domestic consumption and agro-processing. However, cereals and cereal preparations used in agroprocessing are normally imported for local consumption and feed. Seed supply systems are a mixture of imported seeds, a few locally produced seeds (scotch bonnet pepper, sorrel, callaloo, coconut) and those obtained from existing plants (e.g. cocoa). The rest of plants are vegetatively propagated (e.g. banana, yam, ginger and turmeric).

The Agricultural Census (2007) reported that there were 325,810 hectares of land in farms in 2007. Most of the land (45.6 percent) is dedicated to the production of export crops, while other crops accounted for 26.52 percent of land use. The data shows that there has been a 46 percent decline in the hectarage of land under agricultural production between 1968 and 2007. This has been attributed to several factors, mainly, population growth leading to increased demand of lands for housing, coupled with industrial and commercial expansion; declining investment in agriculture overtime; and a declining interest in agriculture as a business venture.

Agriculture's contribution to GDP increased by 27 percent over the past 10 years, from 5.2 percent in 2005 to 6.6 percent in 2014. Despite challenges with tropical storms and droughts, the agricultural production index increased by 10.6 percent, with export crops and other agricultural crops increasing by 10 percent and 14.7 percent, respectively. This trend represents a renewed emphasis by Government towards the agricultural sector as an engine for growth and development for the country.

Challenges confronting the sector include low productivity, high production costs, limited application of good agricultural practices, low application of technology to farming, lack of understanding of the importance of elite varieties to high yields, high post-harvest losses, small and uneconomic size of land holdings, limited access to credit due to onerous collateral

requirements, poor quality of feeder and farm roads, high incidence of praedial larceny, limited marketing intelligence and poor organization of producers due to weak producers' organizations.

The domestic agricultural sector has been adversely impacted climate change and climate related events such as droughts, floods tropical storms and hurricanes. The past decade has seen furious storms and hurricanes which have wreaked havoc on crops, livestock and fisheries production and agricultural infrastructure. These disasters and hazards have adversely impacted production and production systems and serve as a disinvestment to producers to reinvest in the sector. The impact of natural disasters on the sector was brought to light in 2004 when Hurricane Ivan costed the sector approximately 62 percent of its total earnings in 2004.

Given the impact of climate change on the sector, production systems will require crop varieties that are tolerant to heat stress and water logging. Also, as an adaptation measure, some production areas will need to diversify into other crops to counter the impact of climate change on production systems. Greater resources will need to be directed into plant breeding and varietal research for local crops, as well as the expansion of national/ regional seed banks for preservation of the country's genetic resources.

Public and private sector investments will also be critical in the continued development of the sector. Government's continuous work with producers, their organizations and other value chain actors will be critical in reducing the challenges facing the sector and its stakeholders and taking advantage of opportunities presented to Jamaican products in local and international markets.

2. INTRODUCTION

Seed[2] is the basic input to crop production which has the greatest potential for increasing on farm productivity and food security. It sets the limits to the effectiveness of all other inputs such as fertilizer, agro-chemicals, water and even management. Seed quality is often considered to be one of the most important factors contributing to crop yields and the productivity of other agricultural inputs and cultural practices within the farming system. The use of improved seed has been one of the factors for modern agricultural development and the advancement of many developed and emerging economies. Key national policies have underscored the need for improved seeds to meet the country's production, productivity and food security goals.

Under Vision 2030 Jamaica, the Agriculture Sector Plan lays out a clear roadmap to address the main factors that have limited the sector's progress and to increase its contribution to economic and social development and environmental sustainability. The Vision 2030 Jamaica Agriculture Sector Plan expresses the long term vision of the agriculture sector to be competitive, driven by private sector investment, knowledge-driven based on widespread use of appropriate technology and supported by relevant research and development, including improving the quality of planting material to the sector.

The National Food and Nutrition Security Policy also underscores Government's commitment to the food sector through the promotion of sustainable production of safe, affordable, nutritious, good quality Jamaican food commodities/products, with emphasis on legislation, the enabling environment and productivity gains. In recognition of the importance of high quality planting material to productivity, emphasis is placed on ensuring the production, conservation, importation, evaluation and distribution of high quality planting and genetic material, development of a seed and genetic material plan and an appropriate implementation mechanism for these activities.

The development of a National Seed Policy and Plan is important to ensure the supply of high quality seeds of improved varieties to meet the demands of producers. Interventions to improve the seed system should therefore focus on the following elements:

- Research, plant breeding, varietal evaluation and maintenance;
- Formal mechanisms for varietal release of imported and locally produced seeds;
- Seed multiplication, processing and storage;
- Seed security;

[2] Seed within the context of this policy means parts of agricultural, forestry and horticultural plants intended for sowing or planting purposes.

- Formal mechanisms for seed quality control and certification;
- Marketing and promotion to ensure adequate linkages between research, extension, seed suppliers and producers;
- Capacity building of human resources with appropriate skills; and
- Adequate financial resources to fund activities.

As the Government aims to have a well-developed agricultural sector, the National Seed Policy and Plan, with appropriate seed legislation should drive the national seed industry. The improvement of a national seed industry should be a cooperative effort between the public and private sectors. The roles of both sectors are important in this thrust, whereby the private sector should be encouraged to play a greater role in the production, marketing and distribution of commercially produced certified seeds. Government's main role is creating the enabling environment through policy, research, regulation and the provision of incentives to seed producers. A clearly defined seed industry will lead to its success and positively impact on the country's goals of increased agricultural production, productivity and food and nutrition security.

3. SITUATIONAL ANALYSIS

Jamaica's seed system is a mixture of imported seeds (mainly vegetables), a few locally produced seeds (scotch bonnet pepper, sorrel, callaloo, coconut) and those obtained from existing plants (e.g. cocoa). The rest of plants are vegetatively propagated (e.g. banana, yam, ginger, turmeric, etc.). There is no commercial production of genetically engineered crops. Seeds are produced and distributed locally by several key players, namely, Government (including commodity organizations), research institutions, private nursery operators, commercial and subsistence producers and farmers organizations.

3.1 Imported Seed

Certified vegetable seeds are mainly imported by major input supplies companies based on local demand and sold through distribution outlets throughout the country. These companies are very cognizant of the major diseases affecting plants in Jamaica and provide the latest bacteriocides, fungicides and other products to prevent disease and the plant varieties that produce a crop that Jamaicans will consume. There is no local certification process for imported seeds, but a phytosanitary certificate is obtained for the import of seeds from the Plant Quarantine/Produce Inspection Division of the Ministry of Industry, Commerce, Agriculture & Fisheries (MICAF).

In collaboration with MICAF's Research & Development Division (R&D), local field trials are conducted on various improved varieties, using pre-determined selection criteria such as plant vigour, insect/disease resistance or tolerance, yield, time to maturity and quality (texture, taste, colour, shelf life, etc.). Trials are usually conducted on selected farms in major agricultural areas for specific crops. In addition, samples are given to farmers for their field observations. On selection of suitable varieties for the local market, demonstration plots are usually established, field day/training days conducted and information bulletins issued on the varieties available. Seeds are then commercialized and follow-up is done to monitor crop performance through field visits. There are ongoing efforts by input supplies companies to offer and obtain improved varieties to producers.

3.2 Domestic Seed Production and Distribution

3.2.1 Formal Seed Sector

Formal seed production involves all the stages or classes of seed multiplication, from small quantities of early generation (breeder, foundation and registered) seeds to larger quantities of seed that is eventually sold to farmers (FAO, 2013). The objective of formal seed production is to deliver appropriate crop varieties to farmers through a systematic process of seed multiplication, in which the roles of various agencies (public, private, contract growers or civil society) at different stages are clearly defined and guidelines are provided on how the seed production activities should be carried out (FAO, 2013).

The primary actors in Jamaica's formal seed sector are MICAF's R&D Division, Commodity Boards (Sugar Industry Research Institute, Cocoa Industry Board, Coffee Industry Board, Banana Board and Coconut Industry Board and Export Division), Scientific Research Council (SRC), Caribbean Agriculture Research and Development Institute (CARDI) and Forestry Agency. These institutions utilize internal quality assurance systems in the production of seeds. However, most of breeding work for traditional crops is done outside the country by specialized research institutions in the Caribbean, Latin America or other locations in the world. It should be noted that with the exception of citrus, there is no certification system required by legislation for seed produced in, or imported to the country.

Farmers' organizations also play an integral role in the supply of planting material for their members. Planting material supplied are normally those which are within the mandate of the organization. These farmers' organizations do not conduct research or breeding activities, but undertake commercial multiplication of seedlings, primarily for their members or a particular sub-sector. Some organizations include the Jamaica Agricultural Society, Citrus Growers Association, Christiana Potato Growers Cooperative Association (CPGCA), among others.

3.2.1.1 Domestic Crops

Formal production of indigenous seeds is being undertaken by MICAF's R&D Division for pumpkin, sorrel, scotch bonnet pepper and corn using better seed production techniques and improved varieties in some cases.

There has been continuous work on the breeding and evaluation of resistant varieties of scotch bonnet pepper to viruses of economic importance such as *tobacco etch virus* and *potato virus Y*. Marker-assisted breeding has been introduced to reduce the breeding time and cost. Field

evaluations are done at the Bodles Research Station and on farmers' holdings. Seeds are also multiplied commercially by the R&D Division and contract growers. Marketing and distribution of seeds are done through the Division's field stations and farm stores across the country.

CARDI also carries out continuous breeding and evaluation of disease resistant varieties of scotch bonnet and West Indian Red peppers. The R&D Division does the multiplication and sale of West Indian Red on CARDI's behalf.

The R&D Division has also developed the Bodles Globe Pumpkin, which is a high-yielding cultivar of uniform round shape and size. Seeds are multiplied commercially by the Division and contract growers. Marketing and distribution of seeds are done through the Division's field stations. Plant breeding and evaluation work is now being carried out for a flat pumpkin variety.

A new sorrel cultivar that can grow all year round giving a crop every three months was developed by the R&D Division. Seeds are multiplied and produced commercially and sold to farmers. The MD2 variety of corn was also developed by the Division. It is multiplied and sold locally to farmers through R&D's field stations.

With respect to tomatoes, the R&D Division collaborated with the AMSA seed company to screen tomato seeds at Bodles. This led to the identification of several hybrids tolerant to tomato yellow leaf curl virus (TYLCV). These tolerant tomato seeds are being supplied to the local and international markets.

Root and tubers have also benefited from research work. Characterization of sweet potatoes and cassava is being carried out by R&D. In-vitro material for cassava has been imported, planted out and mass propagated to meet the needs of the sector. With respect to ginger, the focus has been on providing clean planting material through tissue culture, with the outcome of significantly increasing production in the short term to meet market demands. Several organizations such as the CPGCA and SRC have been using tissue culture to produce disease free planting material for ginger. CPGCA has a tissue culture laboratory which produces and sells ginger plantlets to its members and other producers.

The SRC in collaboration with MICAF has been working to develop irradiated tissue culture ginger plants that are resistant to ginger rhizome rot through a project funded by the International Atomic Energy Agency between 2007 and 2011. Work still continues as irradiated plants are presently being screened for resistance to the casual agents of ginger rhizome rot and yam anthracnose under greenhouse conditions.

3.2.1.2 Fruit Trees

MICAF partnered with the Rural Agricultural Development Authority (RADA) in the 2000s to implement a commercial fruit tree crop programme through the production and distribution of seedlings and the provision of extension support to interested farmers. Main crops included ackee, avocado, annonance, june plum, mango, guava, breadfruit, tamarind, West Indies cherry, the annonas sweetsop, soursop, custard apple, etc. Propagation was mainly done by using seeds and grafting. For the latter, budwood was obtained from mother plants which had desirable characteristics and were used to propagate new plants. Farmers were also asked to provide bud wood for further expansion when their crops were established. Evaluation activities were carried out for adaptability in various ecological zones, namely, Montpelier, Orange River, Bodles and on various farms which participated in the project. Propagation activities are still being undertaken by the Fruit Tree Crop Unit.

Multiplication of fruit trees is done at the R&D Division and sold at its research stations across the island. Private nurseries also produce and sell their own seedlings. Production of seedlings can be increased to meet industry demand, as R&D has been instrumental in training budders for the industry. Commercial farmers also tend to propagate their own seedlings for fruit trees.

3.2.1.3 Sugar Cane

The West Indies Central Sugar Cane Breeding Station (WICSCBS) located in Barbados is one of the oldest cane breeding stations in the world and responsible for sugar cane breeding for its Caribbean member countries. Jamaica's sugar industry collaborates with the WICSCBS for the development of new varieties. Cultivars can be developed through either an ongoing testing and selection programme conducted in Jamaica, or accessed from other cane-growing jurisdictions worldwide through the WICSCBS. Testing and selection are conducted to promote or discard varieties as necessary. These tests are conducted annually. Each set of accessions (called a Series) is tested over a 12 to 15 year period, which at the end-point, a new variety may be released. Feedback is provided to the WICSCBS based on the results of the tests. The data are used to incorporate the best parents in a breeding programme for Jamaica.

At the end of the field trials (Stage VI), select varieties undergo pre-commercial expansion in small plots. This would normally last for 1 or 2 years (i.e. years 12 to 15 of the testing programme). Regeneration time for seed material production is approximately 6-8 months; the canes are cut-back and regrown for the next harvest of seed material. Satisfactory quantities of seed are developed, then moved from experiment plots and propagated in primary, secondary and tertiary nurseries on selected estates and farmers' holdings. Large scale distribution of seed would begin thereafter for commercial establishment in the recommended locations.

The WICSCBS is the repository for sugar cane germplasm in the Caribbean and houses one of the largest collections in the world. The WICSCBS gathers stocks of sugar cane from around the world and distributes germplasm to countries outside of the Caribbean. Varieties distributed to Jamaica undergo testing and selection. In instances, some outstanding cultivars may be returned to the WICSCBS for further use in the Cane Breeding Programme. The germplasm is stored as standing cane at the WICSCBS and are retrieved from the fields during the Crossing Season. Funding for the WICSCBS is derived from contributions from Sugar Association of the Caribbean member countries, namely Jamaica, Guyana, Trinidad & Tobago, Barbados, St. Kitts and Belize.

3.2.1.4 Banana

The Banana Breeding Research Scheme began in Trinidad in 1922 and in Jamaica in 1924. Work in both programmes became linked in the 1930's with shared responsibilities. Trinidad was responsible for fundamental botanical studies and Jamaica for the development of new varieties. This arrangement led to the creation of the Breeding Research Scheme in 1947 and the establishment of the Bodles Banana Breeding Station to promote the development of new varieties of bananas. The Station was the foremost institution in conventional breeding of *Musa* for over 50 years.

At present, the Station is funded solely by the Jamaican Government. Work is restricted primarily to the maintenance of valuable germplasm, comprised of 130 varieties, which is opined to be one of the best in the world, and the multiplication and production of planting materials (seedlings) for the banana and plantain industry.

Bodles Banana Breeding station functions as the main certified nursery for production and distribution of planting materials to five other certified nurseries strategically located across the island. Four of these nurseries were constructed in November 2011 at strategic locations across the island (Orange River research station in St. Mary for the northern parishes, C.A.S.E, Portland, primarily for the eastern parishes, Knockalva Agricultural School, Hanover, for the western parishes). In July 2014, the nursery at Ebony Park Academy, Clarendon was constructed to supply central parishes. The varieties which are presently supplied by the nurseries include banana varieties, FHIA 17, 25 and Robusta and plantain varieties, FHIA 20 and Horse Plantain.

Multiplication and production of planting material is presently carried out by macropropagaton at Bodles. Peepers (tiny vegetative shoots on parent plants) are planted in seedling bags of mixed soil substrate. Propagation by this means is somewhat not adequate to meet the demand of the farmers, therefore the Banana Board has been utilizing tissue culture from local and regional institutional sources to meet some of the demand for FHIA 17, 25 and 20 seedlings.

Storage of planting material is done at the main nursery at Bodles Banana Breeding Station and at the other four nurseries across the island. Distribution of seedlings takes place from the five nurseries with Bodles Banana Breeding Station being the main source of distribution. Farmers who need planting material will contact the Banana Board Field Officer who in turn liaises with the main nursery for supply to the respective nurseries.

3.2.1.5 Coffee

Coffee seedlings from the *Coffea arabica* species, variety *Typica*, were imported to Jamaica as early as 1728. By 1958, there were at least two varieties being cultivated, that is, *Bourbon* and *Typica*. In 1978, hybrids varieties (*T 2722 Geisha, T 2308 Caturra, T 4387 Hibrido de Timor, T 5159, T 5175* and *Catuai*) were introduced from CATIE in Costa Rica, to evaluate results pertaining to yield, quality, rust resistance and response to copper fungicide application. Some of these varieties were already being cultivated in the country and this formed the basis for the importation of their hybrids.

Jamaica is currently part of the Multi-Location Variety Trial, which is one of the genetic improvement programmes. The country has received three varieties (*Columbia 1, Columbia 2, EC 16*) which are being evaluated locally. Additional plantlets are expected under the programme. This is being done as part of the programme with the World Coffee Research (WCR), where new varieties of coffee are developed *in vitro* in Mexico and are used in field trials around the world.

For the production of planting material, seeds are taken from the coffee bean, pulped and dried until they contain the required moisture level. Seeds are then sent to the nurseries where they are sown in seed beds / sand beds for germination. They are then transplanted in potted bags are made available to nurseries and farmers upon request through the Coffee Industry Board.

With respect to coffee germplasm, the coffee germplasm collection at CATIE is quite diverse and is considered to be the fourth largest collection in the world, containing a good part of the genetic diversity of *Coffea arabica.* CATIE has the most important collection of *Coffea arabica* on the continents of North and South America because of the number of introductions and the genetic diversity conserved.

3.2.1.6 Cocoa

The Cocoa Research Centre at the University of the West Indies in Trinidad & Tobago undertakes cocoa research and development and is the custodian of the International Cocoa Genebank, thereby possessing the most important cocoa varieties in the world. The Cocoa

Industry Board collaborates with the Cocoa Research Centre for varietal development and improvement, characterization and evaluation activities.

Jamaica benefits from the research and development work done by the Cocoa Research Centre through the introduction of improved varieties of *Trinitaro*, which produces fine or flavor cocoa beans. These were mainly the I.C.S (Imperial College Selections) and the TSH varieties (Trinidad Select Hybrid). Most of the seedlings produced by the Cocoa Industry Board are propagated from seed selected for their performance and disease resistance, which are mainly of the ICS clonal varieties (ICS, 1,3,95, 60).

The Cocoa Industry Board has existing facilities in place to propagate and distribute 600,000 seedlings annually, which is more than adequate to supply the industry's needs. There are a few private nursery operations that have an estimated capacity of 100,000 annually.

In Jamaica, cocoa germplasm is being maintained at the Orange River and Montpelier Research Stations, commercial plantations and in farmer's holdings. It is estimated that six accessions are being maintained at Orange River.

3.2.1.7 Citrus

In response to the threat of the Tristeza virus to the citrus industry, the Government established the Jamaica Citrus Protection Agency (JCPA) in 1999, which is responsible for implementation of a mandatory citrus certification programme. It involves the registration of nurseries, certification of seed source trees, scion trees, parent trees, testing of parent and certified scion trees for viruses and diseases. Budwood and certified seeds must be witnessed and certified by the JCPA before they can be distributed to farmers or growers. Only registered nurserymen can purchase both seed and budwood. Distribution of both seed and budwood is conducted by the JCPA.

Budwood are multiplied at three levels:

- From the parent trees, which are the highest quality but limited in quantity;
- From certified scion trees, second best quality also limited in quantity; and
  From quick multiplication block, lower quality but unlimited quantity.

As part of JCPA's certification programme, there has been the need to introduce new cultivars of citrus to the industry in a safe and transparent manner. This is facilitated by the Research and Development Division's Post Entry Quarantine Facility (PEQF). This provides the industry with new material and prevents the introduction of pests and diseases, which are prevalent in the citrus industry worldwide. The PEQF maintains uncompromised foundation citrus mother plants for the industry. This facility utilizes the shoot tip grafting technique to clean up local citrus

varieties and is a source of clean certified budwood material for private nurseries. With regards to seed for rootstock production, only seeds from California and Spain are allowed in the country. There have been six introductions from Spain and California under the programme. Cultivars are only released after all indexing, biological and serological results are found to be negative for all diseases. This process normally takes between two and three years and is done by PEQF.

The JCPA is working with the citrus industry to recover local cultivars for inclusion in their parent stock collection. However, these cultivars have to be evaluated to ensure that they are true to type.

Over 38 accessions are maintained in private nurseries (Citrus Growers Association) under the oversight of the Citrus Protection Agency.

3.2.1.8 Coconut

For the coconut industry in Jamaica, plant breeding has its main objective of development of varieties/ hybrids with optimum resistance/tolerance to lethal yellowing and other important diseases, having high, stable yields and generally well performing under local conditions. Breeding has mostly involved 'dwarf x tall' hybridization by the mass controlled pollination (MASCOPOL) method, in which the entire seed garden is isolated (planted in an area without significant coconut populations). Production of dwarf breeder seed is carried out by self-pollination and planting material by open pollination in homogenous fields followed by seednut selection.

Progeny of breeding is tested at formal field gene banks and selected farmers' holdings, prior to full release to farmers. Release to semi-commercial cultivation can be after seven years, with full release taking up to fourteen years. Maintenance is achieved by encouraging farmers to purchase planting material from the Coconut Industry Board, especially hybrids. Coconut seedlings are usually sold at a subsidized price, or supplied free of cost under respective Planting Programmes in force from time to time.

Germplasm is stored in field gene banks, otherwise known as Variety Collections. This involves respective parents of hybrids and introduced varieties. Additional gene banks are established from time to time, depending on suitable available sites and presence of additional material.

3.2.1.9 Transgenic Crops

There is no commercial production of transgenic crops in Jamaica. Legislation only permits importation of plants for experimental purposes. However, the Biotechnology Center at the University of the West Indies (UWI) continues to work on developing a transgenic variety of papaya that is resistant to the Papaya Ringspot Virus. Work is also being conducted to develop virus-resistant transgenic hot pepper and tomato cultivars (McGlashan, et al, 2008).

3.2.2 Informal Seed Sector

The informal seed supply system consists of farmer-managed seed production activities and is based on indigenous knowledge and local diffusion mechanisms. It includes methods such as retaining seed on-farm from previous harvests to plant the following crop and farmer-to-farmer seed exchange networks. Farmers normally save seeds from crops such as sorrel, okra, gungo peas, callaloo, pumpkin, peanut (informal multiplication of seeds). Vegetative propagation is also high among farmers for root crops, bananas, fruit trees, etc.

Nursery operators play an important role in supplying planting material to producers and householders. Some nurseries specialize in ornamental plants, fruit trees, vegetable seedlings, etc.

3.3 Plant Genetic Resources

Most of Jamaica's major crops for food and agriculture come from imported genetic resources[3]. However, a number of native and endemic plants are cultivated. The *in situ* state of diversity of crop varieties is unknown; where they are present they would be escapees[4]. Many of the wild relatives of our agricultural crops are escapees, as most of Jamaica's agricultural crops are introduced and these wild relatives are much fewer than those of the country's indigenous biodiversity[5].

There are various *ex situ* collections of plant races of many crop species throughout the country. Few farmers maintain varieties not presently in use, such as yam and old banana varieties. Given that nearly 79 percent of farms are under 1 hectare, most farmers use all of their land for their

[3] McGlashan, D. et. al (2008) Jamaica: Country Report on the State of Plant Genetic Resources for Food and Agriculture
[4] Ibid
[5] Ibid

present crop. Few farmers utilize their land for the production of planting material for sale or for germplasm conservation.

Ex situ germplasm collections are maintained throughout the country in botanical gardens, field banks, seed banks and *in vitro* collections[6]. Though not exclusively used for maintenance and conservation of germplasm, botanical gardens are sometimes used a transit facility for incoming and outgoing germplasm. The Hope Botanical Gardens have established horticultural, xerophytic and palm gene banks and a medicinal tree grove. Other public gardens have been used to collect seeds and bud woods of different species.

The R&D Division of MICAF has maintained field banks from early colonial times (including botanical gardens and private collections) and seed banks since 1990s[7]. McGlashan, et al (2008), highlight that throughout the country, various collections of plant races of many crop species have been initiated and are being maintained. The active field banks of the MICAF are maintained at the Bodles, Orange River, Montpelier and Top Mountain Research Stations. These *ex situ* field collections include pepper, pumpkin, sorrel, pigeon pea, cow peas, cassava, sweet potato, mango, star apples, Annonas spp., pomegranate, cashew, June plum (tall and dwarfs), breadfruit, ackee, oteheite apple, guavas, nutmeg, West Indian cherry, and exotics (miracle fruit, lychee, cherimoya, longan, mamey apple, camu camu, and cocona [Solanum sessiliflorum]).

Other active *ex situ* collections are being maintained by the Coconut Industry Board (coconut), Banana Board, UWI (medicinal plant collection), CARDI (hot peppers, sweet potato), private nurseries such as Citrus Growers Association (citrus). There are *in vitro* collections maintained by the Scientific Research Council and Biotechnology Centre, UWI.

SRC maintains an *in vitro* gene bank that hosts plants of economical, medicinal, cultural importance and those endemic to Jamaica. This *in vitro* gene bank has approximately 135 different species of plants, which gives a total of more than 4000 plants in tubes and jars. These plants ranges from food crops (yams, bananas, cassava, ginger, sugarcane, jackfruit, pineapple, Irish potato etc.), ornamental plants (roses, orchids, *Anthurium*, African violet, Kalanchoe, Petunia, Caladium etc.) and medicinal, cultural and endemic plants (Guinea hen weed, turmeric, *Turnera camapaniflora* etc).

The Biotechnology Centre at UWI has an active tissue culture collection of mainly medicinal plants. Plant species presently *in vitro* include: aloe (Aloe vera), ackee, arrowroot (Maranta arundinacea), bottle brush (Callistemon viminalis), cerassee (Momordica charantia), chainy root (Smilax balbisiana), ginger, fever grass (Cymbopogon citratus), medina (Alysicarpus vaginalis),

[6] Ibid
[7] Ibid

neem (Azadirachta indica), pepper elder (Piper amalgo), pineapple, sarsaparilla (Smilax regelii), scotch bonnet pepper, spirit weed (Eryngium foetidum), strong back, tuna (Opuntia cochenillifera), turmeric, wicker (Philodendron sp.) and yam[8].

3.3.1 Challenges

Seed System

Jamaica's domestic seed industry is not well developed as most planting material is farmer saved seeds or imported. The attempt of a commercial seed programme at the Thetford Seed Farm was terminated in 1984 and no other national seed programme has attempted to replicate this model. Anecdotal reports suggest that production of seed from public sector providers is not sufficient to meet the demand of farmers on a timely basis. For example, the Banana Board notes that although tissue cultured plants can be obtained readily from suppliers abroad, Jamaica needs to be able to produce: (a) the local Robusta variety (not available abroad) which is a hardy Cavendish variety and more suited to local rain-fed production systems; (b) the new high-yielding FHIA varieties for domestic use (also not produced commercially abroad); (c) other high yielding varieties for irrigated production systems; and (d) all of the above in adequate quantities, on a timely basis and rigorously screened for diseases of quarantine importance. All of these are needed to meet the requirements of the farmers. Presently the country does not have a local supplier which can supply required commercial quantities on a timely basis.

Private sector involvement in certified seed production is limited for most crops, so the public sector is expected to meet the demand for locally produced planting material for key crops. The public sector seed programme is constrained by inadequate human resources for key skills (e.g. plant breeders, budders, seed technologists), lack of funding for production and distribution activities, limited production capacity and stealing of the crops used for seed production.

Outside of citrus, there is no regulatory system for seed certification, which is critical to the development of a reputable seed industry. Varietal evaluation and release systems for both imported and locally produced seeds are also absent. Seed quality control standards and protocols for multiplication of seeds by commercial actors are not in place for most crops. Therefore, practices by breeders and commercial producers of seed are based on their knowledge and the processes of their respective organizations.

Private sector involvement in commercial seed production is limited, but necessary for meeting increased demand for seeds by producers. Market intelligence is lacking, as data on supply and

[8] Ibid

demand are not readily available or accessible to stakeholders. Additionally, without proper systems of certification, access to land, credit and skilled personnel, few advances can be made in building a commercial seed industry.

Plant Genetic Resources for Food and Agriculture

The present state of Jamaica's plant diversity is not extensively assessed or documented. Surveys and inventories tend to be fragmented, as there is no one place where all such studies can be found. There is a lack of attention to plant varieties and knowledge of the importance of distinct varieties which are compounded by the absence of varietal protection in national legislation. McGlashan, et al (2008) identify the constraints to improving inventories and surveys of plant genetic resources, crop associated biodiversity and wild plants for food production. These include: a lack of knowledge; non-inclusion in work programmes; mismatch between training programmes (tend to be environmental) and training needs (such as parataxonomy, plant inventory and field gene bank and seed bank management); and a lack of policy and programme support.

Not enough farmers are trained in, or have knowledge in the conservation, management and improvement of on-farm plant genetic resources. Any on-farm improvements of plant genetic resources are normally the initiatives of individual farmers. There are also very few on-farm participatory plant breeding programmes or activities, or support for local or small scale seed production. National and regional fora for stakeholders involved with on-farm conservation are also limited.

There is a limited emphasis on plant breeding across the public sector and research institutions. Given financial and human resource constraints, plant breeding programmes are limited in scope and only cover a few crop varieties. Outside of some major crops, there are very low levels of characterization and evaluation, few core collections for which access has been provided and low levels of documentation of varietal ancestry (only for sugar). Notably, there are very few plant breeders, propagators and an inadequate use of trained molecular biologists. Limited knowledge of demands for pre-breeding and breeding activities amongst research groups and policy makers, insufficient infrastructure, lack of integration and coordination amongst conservation and utilization programmes, researchers, breeders, gene bank managers and farmers are significant challenges towards improving the use of our plant genetic resources.

Many of the crops grown in Jamaica are not optimized to local conditions (McGlashan, 2008). Given that these crops are not native, wild varieties or related species are scarce. For such crops, lines need to be collected and varieties optimized by selection and/or plant breeding (assisted with such molecular techniques as marker-assisted breeding) and protected as a variety.

There is no clear distinction between improved and traditional varieties in Jamaica (McGlashan, 2008). Varieties developed from local breeding efforts by MICAF are given names, but there is

no systematic naming system. For most crops, there is an absence of a proper system for tracking the location and performance of varieties distributed to farmers.

Since there is no plant variety protection, locally bred varieties are usually interbred with other varieties within a short time span (McGlashan, 2008). On-farm plant propagation is not a specialist activity and normally done by individual farmers. However, a few farmers specialize in the production of hot pepper and callaloo seeds.

At present, there is no plant variety protection that provides patent-like rights to breeders and developers of plant varieties. The protection of the rights of plant breeders is an important stimulus for the development of better plant varieties. The possibility to claim intellectual property rights on a variety, gives a breeder the exclusive rights to exploit it and to prevent others from doing so illegally.

The maintenance of *ex situ* genetic resource collections have also been challenged by a lack of funding, human resources, infrastructure, suitable documentation systems and sustainable programmatic interventions. Other challenges also include praedial larceny, hurricanes, natural disasters and hazards. McGlashan, et al (2008), also outlined the constraints that are being experienced with the main collections. These are:

- Botanical gardens: Plant species have been lost from botanical gardens as priorities change over the years, or as a result of neglect, disease or old age.
- Field collections: Plant genetic resources have been lost from field collections due to praedial larceny, lack-of-use (cocoa), loss of field labels and field notes, abandonment of field stations, lack of long-term commitment and insufficient on-going work programmes.
- Seed collection: The seed collection is properly maintained and regenerated on an on-going basis. However, there is no stand-by generator in case of a power outage.
- *In vitro* collections: These are normally costly to maintain. Several species have been lost from *in vitro* collections because of change of staff, no dedicated staff to maintain the collections, change of priority plants, ending of project funding, lack of adequate growth-room space and low levels of on-going funding.

In order to address these challenges, significant investments will be needed to improve the seed system, conserve and sustainably use plant genetic resources for food and agriculture. Careful planning, effective organization, coordination and cooperation among public sector, private sector, producers and civil society will be required to overcome these challenges and achieve national goals of agricultural development and food and nutrition security.

3.4 Institutional Framework

The seed industry is comprised mainly of public and private stakeholders that are involved in research, varietal development, improvement and evaluation, multiplication and distribution of seed and storage of germplasm. There are other public sector institutions that perform a regulatory function for seed industry with respect to quarantine and certification.

Table 1 shows the main institutions involved in the seed industry and their roles.

Table 1: Functions of Institutions Involved in the Seed Industry

Institutions	Roles
	Ministries and Agencies
Crop Research Unit- Research & Development Division-Ministry of Industry, Commerce, Agriculture & Fisheries	• Plant breeding, varietal development and improvement, characterization and evaluation • Importation of planting material for breeding programmes. • Multiplication and distribution of seed • Germplasm conservation
Plant Protection Unit- Research and Development Division of the Ministry of Industry, Commerce, Agriculture & Fisheries	• Provides improved and relevant pest and disease diagnostic capabilities to stakeholders • Supports the activities of Plant Quarantine by maintaining an updated pest register and determines status for plant quarantine purposes
Post Entry Quarantine Unit- Research and Development Division of the Ministry of Industry, Commerce, Agriculture & Fisheries	• Provides rigorous monitoring of imported planting material and validation of phytosanitary clearances issued by exporting countries for plant and plant parts • Conducts local field trials on imported varieties • Provides serological testing and bio-indexing of citrus bud wood material as a part of the Citrus certification programme
Plant Quarantine/Produce Inspection Unit- Ministry of Industry, Commerce, Agriculture & Fisheries	• Ensures that the pest free produce and planting material is imported or exported into/from Jamaica • Issues phytosanitary certificate for GMO plants imported for experimental purposes
Jamaica Citrus Protection Agency- Ministry of Industry, Commerce, Agriculture & Fisheries	• Implements mandatory citrus certification programme • Ensures that farmers and the general public get clean citrus material • Evaluates imported varieties of citrus
Rural Agricultural Development Authority (RADA)- Ministry of Industry, Commerce, Agriculture & Fisheries	• Assists in the marketing and distribution of seeds produced by MICAF • Provides advice to farmers in seed selection of imported varieties
Forestry Agency- Ministry of Economic Growth and Job Creation	• Management and conservation of the country's forest resources • Propagates and sells/distributes seedlings • Ensures reforestation of forests • Implements Private Tree Planting Programme
Scientific Research Council- Ministry of Energy , Science and Technology	• Production, multiplication and distribution of disease fee planting material through tissue culture • Storage of germplasm

Institutions	Roles
Jamaica Bureau of Standards- Ministry of Industry, Commerce, Agriculture & Fisheries	• Development and enforcement of Standards Specification for Labelling of Agricultural Seed Packages
Commodity Boards	
Sugar Industry Research Institute- Ministry of Industry, Commerce, Agriculture & Fisheries	• Importation, evaluation of varieties, multiplication and distribution of sugar cane varieties
Coffee Industry Board- Ministry of Industry, Commerce, Agriculture & Fisheries	• Importation, evaluation of varieties, multiplication and distribution of coffee varieties
Cocoa Industry Board-Ministry of Industry, Commerce, Agriculture & Fisheries	• Importation, evaluation of varieties, multiplication and distribution of cocoa varieties
Banana Board- Ministry of Industry, Commerce, Agriculture & Fisheries	• Importation, evaluation of varieties, multiplication and distribution of bananas and plantains • Collaboration with regional and international banana and plantain breeding programmes (IBP Cuba, CIRAD France, FHIA Honduras and EMBRAPA Brazil) • Suspended programme of conventional crosses for breeding research to develop new varieties • Storage of germplasm
Coconut Industry Board- Ministry of Industry, Commerce, Agriculture & Fisheries	• Breeding, evaluation of varieties, multiplication and distribution • Storage of germplasm
Export Division- Ministry of Industry, Commerce, Agriculture & Fisheries	• Multiplication and distribution of ginger and pimento varieties
Academic Institutions	
UWI/Biotechnology Centre, Mona Campus, Jamaica	• Training and capacity building • Characterization and evaluation of varieties • Storage of germplasm • Development of transgenic crops for pest and disease resistance
College of Agriculture, Science and Education	• Training and capacity building • Characterization and evaluation of varieties • Storage of germplasm
Northern Caribbean University	• Training and capacity building • Characterization and evaluation of varieties • Storage of germplasm
Regional Organizations	
Caribbean Agricultural Research and Development Institute	• Plant breeding, varietal development and improvement, characterization and evaluation • Germplasm conservation • Supplies germplasm to international collections
West Indies Central Sugar Cane Breeding Station	• Plant breeding, varietal development and improvement, characterization and evaluation • Germplasm conservation
Cocoa Research Centre, UWI Trinidad & Tobago	• Plant breeding, varietal development and improvement, characterization and evaluation • Germplasm conservation

Institutions	Roles
Non-Government Organizations	
Christiana Potato Growers	• Multiplication and distribution of disease free ginger and Irish potato varieties
Jamaica Agricultural Society	• Multiplication and distribution of seedlings
Citrus Growers Association	• Multiplication and distribution of seedlings • Storage of germplasm

3.5 Legal Framework

There is legislation impacting on plant genetic resources and the conservation and sustainable use of biodiversity. However, there is no comprehensive legislation that addresses key components of the seed sector, such as varietal development/improvement, release, multiplication, production, processing, storage, certification, marking and distribution of seeds. There is currently no protection for plant breeders' rights in the development of new varieties or improvement of existing ones.

With the exception of importing plants for experimental purposes, Jamaica's legislation also does not address the procedures or conditions for the deregulation and commercialization of genetically modified seeds/planting material. However, biosafety legislation is being developed and drafting instructions state that the Biosafety Act is intended to bring the Jamaican legal system into closer alignment with international standards.

The main pieces of legislation impacting on the seed industry and plant genetic resources are:

i. The Protection of Plant Genetic Resources for Food and Agriculture Act, 2013

The objectives of the Act are to facilitate Jamaica's compliance with its obligations under International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA) and otherwise to:

- Further the conservation and sustainable use of plant genetic resources;
- Facilitate access to, and use of plant genetic resources; and
- Promote the equitable sharing of benefits arising out of the use of plant genetic resources.

The Act speaks to the establishment of a Management Authority which aims to advise the Minister on matters of policy and legal measures that provide for the conservation and sustainable use of plant genetic resources and the equitable sharing of the benefits arising out of their use. The Management Authority is tasked with the establishment and maintenance of a register of plant genetic resources, where the details of plant genetic resources donated to the

gene banks kept by any agency or department of Government or any statutory body or Government company is entered.

The Act permits for access to any listed plant genetic resource for utilization or conservation for the purpose of research, breeding, or training for food and agriculture to be obtained by the entities specified in the Regulation, in accordance with the terms and conditions of a standard material transfer agreement between that entity and the owner of the plant genetic resource.

A Plant Resources Fund is also established by the Act, which provides for all monies arising from standard material transfer agreements be paid to the Fund and then remitted to the respective stakeholders.

ii. The Plant Quarantine Act (1993) and Regulations

The Act makes provision for the effective control of the importation of plants, plant products and articles which pose a threat of introduction to Jamaica, any injurious plant pest, as well as the course of action to be taken when these are discovered within the island. "Plants" is defined as, "all species and types of plants, either living or dead and includes stems, branches, tubers, corns, stocks, budwood, cuttings, slips, layers, suckers, roots, leaves, flowers, seeds and seedlings." The Act contains three regulations, namely, The Plant (Importation) Control Regulations, 1997, the Plants (Importation) Control (Amendment) Regulations, 2005 and Citrus Plant (Certification) Regulation (1999).

The 2005 Regulations are to be construed and used as one with the 1997 Regulations. The 1997 Regulations governs the importation of plants, seeds, cuttings and slips to the island, where a plant is defined as a plant that has been genetically modified and imported into Jamaica for the purpose of experimentation under controlled conditions. These items are subject to inspection and quarantine, where necessary, according to the provisions of the Regulation. The methods for importing plants, seeds, cuttings and slips are also stated.

Specifically, regulations require that all importers of plants, seeds, cuttings and slips must apply to the National Biosafety Committee for permission to import such products, and upon approval, the application is submitted to the Plant Quarantine Division for granting of a permit by the Chief Plant Quarantine Officer. In determining whether to grant approval to the application, the National Biosafety Committee considers the applicant's ability to enforce adequate procedures and safeguards to ensure that no contamination, by or release of the plant, seed, cutting, or other plant parts, which is detrimental to the health or safety of any human, animal or other living organism will occur at the port of entry or in the country.

The 2005 Regulations lay out the procedures on the processes involved in acquiring an import permit, fines for breaches and the conditions attached to the importation of fresh fruits and

vegetables and planting material (including genetically modified plants). It outlines items that require an import permit, namely:

- Fresh fruits, vegetables, citrus fruits, plants and budwood;
- Fruits, suckers, plants or plant parts;
- Coconut/palm family- seeds;
- Coffee-berries and plants;
- Anthurium plants-tissue cultured; and
- Other plants and plants for planting.

The Citrus Plant (Certification) Regulation 1999 establishes the Jamaica Citrus Protection Agency which is responsible for responsible for implementation of the mandatory citrus certification programme. The Regulation requires that all nurseries be registered with the Agency according to requirements stated in the Regulations. The certificate of registration is valid for a period of one year from the first day of July in any year and can be cancelled if the nursery breaches the regulation. The certification of seed source trees, scion trees, parent trees, testing of parent and certified scion trees for viruses and diseases, propagation for quick multiplication blocks, production of certified trees and varietal block trees are covered by the Regulation.

iii. The Forest Act, 1996

The Act addresses the sustainable management of forests on lands in the possession of the Crown and vests management responsibility in the Conservator of Forests. It provides for the establishment of forests reserves, the establishment of protected areas, the promotion of forestry research areas, reforestation initiatives and the preparation of forestry management plans.

The Forestry Agency is required to make an assessment of forestry lands to determine their potential for maintaining and enhancing biodiversity. Provisions have been made in the Act for the controlled utilization of forest resources in a rational manner. Jamaica has over 100 gazetted forest reserves. Under the Act, private lands may be acquired for declaration as forest reserves. One of the purposes of forest reserves is to protect and conserve endemic flora and fauna.

iv. Endangered Species (Protection, Conservation and Regulation of Trade) Act, 2000

The Endangered Species Act provides for the conservation, protection and regulation of trade in endangered species. The Act was prepared to allow the Government of Jamaica to fulfill its obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

v. Natural Resource Conservation Act (1991)

The Natural Resources Conservation Authority Act 1991 provides for the management, conservation and protection of the natural resources of Jamaica through the National Environment and Planning Agency (NEPA) whose responsibilities include the effective management of the physical environment of Jamaica and the management of marine parks and protected areas. The Natural Resources Conservation (Permits and Licences) Regulations, 1996, require a permit for the introduction of any species of fauna, flora and genetic material into the island.

3.6 International Treaties & Conventions

Jamaica is party to key treaties and conventions that impact on the conservation and use of its plant genetic resources, biodiversity and biosafety and agreements that impact on property rights protection. However, Jamaica is not party to the International Convention for the Protection of New Varieties of Plants due to the absence of national legislation that protects plant breeder rights.

i. International Treaty on Plant Genetic Resources for Food and Agriculture

The objectives of this Treaty are the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security. The cornerstone of the Treaty is a 'multilateral system for access and benefit-sharing' through Standard Material Transfer Agreements, which for certain categories of plant genetic resources for food and agriculture guarantees facilitated access in return for benefit-sharing. However, in respect of traditional knowledge, the key provision of the Treaty is its recognition of 'farmers' rights' subject to national laws for the:

- Protection of traditional knowledge relevant to plant genetic resources for food and agriculture;
- Right to equitably participate in sharing benefits arising from the utilisation of plant genetic resources for food and agriculture; and
- Right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture.

Article 14 recognizes the importance to the Treaty of the Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture and requires Parties to promote its effective implementation including through national actions and, as appropriate, international cooperation to provide a coherent framework, inter alia, for capacity building, technology transfer and exchange of information.

Jamaica is a contracting party to this Treaty.

ii. Convention on Biological Diversity

The Convention on Biological Diversity **(**CBD) is the foremost international convention obliging its contracting parties to take action on invasive alien species and was adopted in 1992. The convention speaks to the conservation and sustainable use of biological diversity and the fair and equitable sharing of benefits arising out of the utilization of genetic resources. Article (8h) of the CBD requires contracting parties to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or systems.

In order to assist Governments in meeting their obligations, two protocols have been established under the CBD, namely, the *Cartagena Protocol on Biosafety* and the Guiding Principles for the Prevention, Introduction and Mitigation of Impacts of Alien Species.

Jamaica is a signatory to the CBD.

iii. Cartagena Protocol on Biosafety

The *Cartagena Protocol on Biosafety to the Convention on Biological Diversity* is an international treaty governing the movements of living modified organisms (LMOs) resulting from modern biotechnology from one country to another. It was adopted on 29 January 2000 as a supplementary agreement to the Convention on Biological Diversity and entered into force on 11 September 2003. Jamaica is a Party to the Protocol.

iv. World Trade Organization- Trade-Related Aspects of Intellectual Property Rights (TRIPS)

The TRIPS Agreement has been in force since 1995 and is to date the most comprehensive multilateral agreement on intellectual property. The TRIPS Agreement introduced global minimum standards for protecting and enforcing nearly all forms of intellectual property rights. The TRIPS Agreement now requires all WTO members, with few exceptions, to adapt their laws to the minimum standards of intellectual property rights protection. Copyright protection for new plant varieties are covered by TRIPS.

Jamaica is a signatory to this Agreement.

4. RATIONALE FOR POLICY

Seed is one of the most important inputs to production. The ready availability of adaptable varieties of high quality seeds is one of the steps in improving production and productivity. Increased farm productivity is largely based on the yield of seed acting together with other farm inputs. One of the serious problems in crop production is the inability of farmers to know how their planting material will perform before committing their resources into crop establishment. The guarantee is made possible by the industry-wide quality oversight and the availability of information to enable the producer to enhance his production planning and confidently utilize his resources in production.

Policy Context

The Vision 2030 Agriculture Sector Plan and the National Food & Nutrition Security Policy recognize the need for increased production and productivity to meet the country's food security needs, import substitution and exports to generate foreign exchange and reduce the trade deficit. The Agriculture Sector Plan expresses the long term vision of the agriculture sector to be competitive, driven by private sector investment, knowledge-driven based on widespread use of appropriate technology and supported by relevant research and development, including improving the quality of planting material to the sector. The National Food and Nutrition Security Policy recognizes the importance of high quality planting material to productivity. Emphasis is placed on ensuring the production, conservation, importation, evaluation and distribution of high quality planting and genetic material, development of a seed and genetic material plan and an appropriate implementation mechanism for these activities.

In line with these policies, Government's agricultural and food security programmes and projects are also targeted towards improving production of critical crops, for which the availability of locally produced planting material are inadequate and have negatively impacted on the rapid expansion of these programmes. This situation has hampered the efforts of Government to adequately tackle the high food import bill, increase export earnings from the agricultural sector and increase the income of producers and other stakeholders along the value chain. In order to meet the objectives of national agricultural and food security policies, the seed system needs to be significantly improved to provide adequate, quality planting material to farmers on a timely basis.

Roles of Public and Private Sector

Public sector institutions do not have the productive capacity to respond to the demand of farmers for planting material for any one crop. The private sector and growers associations also lack the capacity to produce sufficient planting material for the sector. This is a serious challenge for the sector which must be addressed speedily.

In order to create stimulus for private sector to undertake commercial seed production, there needs to be a redefinition of the roles of public and private sector actors. Private sector actors should be provided with an enabling environment to facilitate the production and marketing of commercially certified seeds for sale to producers, such as access to credit, land and market intelligence. Ideally, the public sector should focus on activities in which it has a comparative advantage such as research, production of foundation and breeder seed, regulation and the setting of standards. The promulgation of national seed legislation which addresses key components of the seed sector such as varietal development/improvement, release, multiplication, production, processing, storage, certification, marketing and distribution of seeds, is necessary for maintaining high quality standards in the industry.

Capacity Building

A national seed policy can be seen as a vehicle that justifies investment in crop research, since it makes it possible for producers to benefit from plant breeding initiatives. However, the capacity and resources available to the public sector must be increased to support research and varietal development, improvement and maintenance. Human resource development is also a key component of building capacity in the sector, as the availability of persons with relevant skills (e.g. plant breeders, seed technologists, etc.) are currently limited, with some persons not willing to work in the public sector. Acquisition and upgrading of equipment and provision of infrastructure will be necessary to enhance research work.

Protection of Plant Breeders Rights

Investment in plant breeding is also an important activity for the private sector. At present, there is no plant variety protection legislation that provides patent-like rights to breeders and developers of plant varieties. The protection of the rights of plant breeders is an important stimulus for the development of new plant varieties. The possibility to claim intellectual property rights on a variety gives a breeder the exclusive rights to exploit it and prevents others from doing so illegally. The protection of intellectual property rights is also important to protect investment for development of new varieties.

Climate Change

Climate change provides particular challenges to the farmers' seed systems. When the changes are concentrated in ecological zones, farmers will quickly learn to use varieties in neighbouring zones. However, if the changes stem from an increase in the occurrence and severity of extreme weather, then the genetic diversity in the available landraces is not likely to be wide enough to adapt to these changes quickly enough. External assistance in plant breeding will have to be sought to mitigate against the impact of climate change on the seed system.

Climate change also has great implications for the use of genetic diversity. In the face of climatic instability, with greater extremes in temperature and rainfall, farmers are likely to pursue yield stability rather than maximum yield, and since diversity is one of the mechanisms contributing to yield stability, breeders will need to venture into the development of genetically diverse varieties. Climate change may also further increase the need for emergency seed provision, given the extremity of natural disasters.

Seed distribution has many negative side effects, including the distribution of poor quality seed and non-adapted varieties, distortion of seed markets and undermining both local seed enterprises and the resilience of farmers. In light of the potential negative impacts of climate change on the seed system, emphasis needs to be placed on seed security, given national goals of food and nutrition security and agricultural production and productivity.

A national seed policy and plan is therefore needed to create the framework to guide development and direction of the seed industry by addressing gaps in the current system and by taking advantage of opportunities to increase domestic seed production.

5. SEED POLICY

5.1 Scope of the Policy

The policy focuses on the development of a seed system that ensures the availability of high quality seed which is accessible to end users. Seed within the context of this policy means parts of agricultural, forestry and horticultural plants intended for sowing or planting purposes. Both conventional and organic production systems fall under the scope of this policy. The areas of research, plant breeding, varietal evaluation, seed multiplication, processing, storage, quality control, marketing, promotion and protection of plant genetic resources for food and agriculture are addressed by the policy. Provision is made for the implementation of an appropriate institutional framework, building of technical and institutional capacity, promulgation of seed legislation, financing strategy and a communications programme.

5.2 Vision

The vision of the policy is to establish a sustainable seed system that ensures a consistent and reliable supply of clean, affordable and accessible seed in support of agricultural production, productivity, food security and biodiversity.

5.3 Goals

The goals of the policy are to:

i. Facilitate development, evaluation and maintenance of pest resistant/ tolerant, high yielding varieties that are adaptive to given local agro-ecological zones and challenges posed by climate change.
ii. Increase availability and access to clean seed to meet production requirements.
iii. Improve regulation and monitoring of the seed industry to ensure adherence to quality standards.
iv. Improve the sustainable marketing and distribution of seeds.
v. Protect national plant genetic resources.

5.4 Guiding Principles

The guiding principles of the policy are:

- Food and Nutrition Security
- Environmental Sustainability and Biodiversity
- Protection of Plant Genetic Resources for Food and Agriculture
- Promotion and Protection of Indigenous Seed Systems
- Quality Assurance of Seed Systems
- Promotion and Protection of Innovation
- Coordination and Partnership Building
- Private Sector Participation with Government Providing the Enabling Environment

5.5 Elements of the Policy

5.5.1 Research, Variety Improvement, Evaluation and Release

Government recognizes that research, plant breeding and evaluation constitute the foundation of a viable and sustainable seed industry and are important to the thrust of improving production and productivity in the agricultural sector. Government also recognizes that the national agricultural research system is pivotal to supporting varietal development, improvement and evaluation for local and imported seeds. In this regard, support for basic and adaptive research aimed at crop improvement will be emphasized and resources made available to the national research system to undertake these activities.

The national research strategy for seed will be based on collaborative efforts with relevant international, regional and private sector research initiatives and will develop, adopt and adapt research techniques to achieve the desired goals. In that regard plant breeding, evaluation trials, on-farm trials and validations will be very important components of research activities, as well as efforts to obtain for such trials, the most promising varietal lines from cooperating research institutions outside of Jamaica. Emphasis will be placed on the development of seed for varieties with desirable traits (such as yield, quality, disease resistance, etc.) for both conventional and organic production systems.

Research Focus

Research will be aimed at ensuring the identification of varieties which will perform optimally in the areas where they are to be used. Selection criteria will be based on:

- Food and nutrition security;
- Food safety;

- MICAF's list of priority crops;
- Importance of the crop in local food consumption and utilization;
- Potential export earnings and/or foreign exchange savings;
- Seed and crop quality requirements; and
- Biodiversity/conservation.

Such efforts will be extended to cover imported seed for new varieties for which locally conducted trials will form the basis of importation, as well as for extension advice to producers.

Government shall promote private/public partnerships for genetic improvement of varieties that are important for local production systems and food and nutrition security. Private sector involvement in research will be encouraged, subject to its conformity with pre-developed and published protocols, priorities and linkages.

In the medium to long term, collaboration with regional and international institutions will be strengthened so as to make better use of resources and maintain strong linkages with key stakeholders, such as seed multiplication entities, seed distributors, extension services and farmers.

In view of trends of genetic erosion, research shall be encouraged to safeguard local biodiversity by cooperating with national germplasm conservation agencies. As far as possible, research shall incorporate indigenous germplasm into the breeding programme to ensure maintenance of a wide genetic base for all the important crops in order to enhance adaptation of new varieties. The Government recognizes the effort of traditional farmers in the conservation of local cultivars and will encourage their efforts by assisting them in on-farm seed production in order to ensure continuation of germplasm conservation.

Human Resources

Government recognizes that the seed industry requires specialized expertise to propel the national research and supporting programmes. Government shall therefore seek to recruit appropriate personnel and build capacity within existing staff to acquire the necessary skills for its seed research programmes. The private sector will also be encouraged to make investments in capacity building activities of its personnel.

In order to achieve optimum benefits from training programmes, Government will seek to ensure that staff are deployed for their proper utilization and advancement. Government will also seek to assist the private sector by providing technical support for private or joint ventures in the seed industry under reasonable terms.

Variety Release

Government shall establish a process to register new or improved varieties for release under the oversight of a Variety Release Committee comprising:

- Representatives of the Ministry responsible for agriculture;
- A representative from a Regional Agricultural Research Institution;
- A representative from Academia;
- A representative from an Organization with Responsibility for Commodities;
- A representative from a Seed Distribution Company;
- A representative from a Farmers Organization; and
- Coopted Specialized Members as Required.

Intellectual Property

Government recognizes that an effective plant variety protection system is vital to encourage creativity and investment in private and public breeding. This system provides breeders with a legal framework and administrative structure for controlling reproduction of their varieties and thereby recovering their investment. Government shall therefore promulgate plant variety protection legislation to grant and protect breeders' rights in development of new varieties.

5.5.2 Seed Multiplication, Processing and Storage

Government shall ensure that the agriculture and related sectors are seed secure, whereby, producers have access to seed of acceptable quality, at affordable prices, in adequate quantities and in time for planting. At present, Government is involved in the production of breeder, foundation and commercial seeds for some varieties and in some instances, is unable to supply required quantities of commercial seed to producers. In order to ensure increased production of commercial seed for agriculture and related sectors, Government will concentrate its efforts on the production of breeder and foundation seeds, while encouraging the private sector to produce commercial seeds for selected varieties in its seed programmes.

Certified Outgrower Schemes

Government shall create the framework for the establishment of seed multiplication programmes by the private sector using Certified Outgrower Schemes. In this regard, protocols shall be provided for multiplication of seeds by private seed producers and technology transfer facilitated to assist in the production of high quality seeds. Private seed producers will be assisted to develop the required infrastructure and expertise which will form an important basis for selection of qualified and organized producers and producer groups. Additionally, Government shall

facilitate access to credit and land for private sector investment in seed multiplication programmes.

In the interest of national food and nutrition security, Government will continue to have responsibility for maintaining breeder, foundation and commercial seeds for multiplication, processing and storage for strategic and priority crops which are not taken up by the private sector. Continuous capacity building will be emphasized to ensure that the national research system possesses the requisite expertise and technology needed to support the seed industry.

Informal Seed Sector

Government recognizes that the informal seed sector is the most important source of seed for producers, especially for varieties that are not supplied by the formal sector. Since this is likely to remain the case for the foreseeable future, Government will continue to support the informal seed sector through its extension services to build capacity in seed production and good agricultural practices.

Seed Security

Government will ensure seed security in the event of disasters and crisis, which may disrupt normal seed production and supplies. In this regard, seed system security assessments will be conducted to provide critical information to prepare for, and respond to disasters. Seed standards and protocols for gifts of seeds that meet minimum local and international standards to be followed by all donor agencies will be established to guide post-disaster relief efforts.

With respect to preparedness measures, Government will make arrangements for strategic seed stocks and nurseries, where appropriate, to include contractual arrangements with commercial entities in the seed industry. Support shall be given to local level interventions such as on-farm seed conservation and community seed banks. Germplasm of important varieties will continue to be stored in regional and international gene banks. The importation and evaluation of adaptable varieties from other countries for multiplication will be explored in the event of a loss of local germplasm for varieties that are critical to food and nutrition security.

5.5.3 Seed Quality Control

Given the sensitivity of seed as a key input to production, it is necessary to maintain high quality standards to fully derive the benefits of the use of certified seed. As such, Government shall:

- Promulgate national seed legislation to ensure reliable standards of seed quality, protect seed suppliers and users, and develop a quality-oriented seed industry;

- Develop a Seed Certification Scheme as part of the enabling regulations of the seed legislation; and

- Develop seed standards that conform to regional and international best practices, including gifts of seeds to the country.

Government shall mandate the National Plant Protection Organization (NPPO) as the Relevant Authority for maintaining the integrity of the Seed Certification Scheme, that is, field inspection, laboratory testing and licensing of private sector seed inspectors and seed analysts to carry out certification work as deemed necessary. Such participation by private seed inspectors and seed analysts shall be subject to general monitoring and periodic checks by the seed certification body.

5.5.4 Marketing and Promotion

Marketing and Promotion

At present marketing and promotion of seed is done by both the public and private sectors. However, the private sector seldom participates in the marketing of seeds produced by the public sector. Recognizing the importance of the private sector in the seed trade, public/private partnerships will be encouraged for the marketing and promotion of seed produced by programmes operated by Government through established guidelines in order to ensure efficiency. Marketing will also remain a private sector activity for all commercialized seed programmes, bearing in mind intellectual property rights and licensing systems. The private sector will also be encouraged to continue their own marketing and promotion activities for seed varieties sold to producers.

Notably, the role of Government shall be focused on providing market intelligence, which will assist in demand forecasting and ensuring equitable supply of seeds to all production areas. Government shall therefore promote greater integration of distributors, retailers, farmers, farmer groups/associations, commodity boards and other relevant organizations in the provision of base data to improve seed demand forecasting.

Extension

Government recognizes that extension is pivotal in creating awareness among farmers of new crops, varieties and quality seed and to show how these factors contribute to increased production and productivity. Government, through its extension services shall:

- Stimulate demand for quality seed of improved varieties and disseminate technical information on good agricultural practices and improved production technologies;

- Utilize extension approaches, including Farmer Field School, to demonstrate, exchange experiences and teach producers about new and improved varieties and related best practices; and
- In collaboration with seed producers and distributors, use different extension strategies to promote varieties and seeds, including field days, demonstrations, displays at agricultural shows, posters, radio and television broadcasts.

Value Chain Development

The value chain approach is recognized as an important part of modern agriculture business strategy. It involves a series of actors participating in the creation of differentiated products that increase agricultural systems efficiency and create more rewarding positions in the market place for products. In order to promote development of the seed value chain, Government shall seek to define the value chains for seed varieties agreed upon by stakeholders. Upgrading strategies to facilitate development of these chains will be promoted to build trust among value chain actors, encourage innovation and identify new product and market opportunities, including exports.

5.5.5 Protection of Plant Genetic Resources for Food and Agriculture

Conservation of Plant Genetic Resources

Plant genetic resources for food and agriculture are indispensable for crop genetic improvement, whether by means of farmers' selection, classical plant breeding or modern biotechnologies, and are essential in adapting to unpredictable environmental changes and future human needs.

In accordance with the national legislation for the Protection of Plant Genetic Resources for Food and Agriculture (2013) and the International Treaty on Plant Genetic Resources for Food and Agriculture, Government shall promote an integrated approach to the conservation, exploration, collection, characterization, evaluation and documentation of plant genetic resources for food and agriculture. In particular, Government shall:

- Survey and inventory plant genetic resources for food and agriculture, taking into account the status and degree of variation in existing populations, including those that are of potential use and, as feasible, assess any threats to them;
- Promote the collection of plant genetic resources for food and agriculture and relevant associated information on those plant genetic resources that are under threat, or are of potential use for food and agriculture;
- Promote and support, as appropriate, producers and local communities efforts to manage and conserve on-farm, their plant genetic resources for food and agriculture;

- Promote *in situ* conservation of wild crop relatives and wild plants for food production, including in protected areas, by supporting, inter alia, the efforts of local communities;
- Promote the development of an efficient and sustainable system of *ex situ* conservation, giving due attention to the need for adequate documentation, characterization, regeneration and evaluation, and the development and transfer of appropriate technologies for this purpose, with a view to improving the sustainable use of plant genetic resources for food and agriculture; and
- Monitor the maintenance of the viability, degree of variation, and the genetic integrity of collections of plant genetic resources for food and agriculture.

Sustainable Use of Plant Genetic Resources

Gene bank collections are useful in helping users respond to new challenges and opportunities to improve crop productivity, enhance sustainability, respond to threats such as climate change and pest resistance and meet human needs related to plant genetic resources for food and agriculture. In accordance with the national legislation for the Protection of Plant Genetic Resources for Food and Agriculture (2013) and the International Treaty on Plant Genetic Resources for Food and Agriculture, Government shall promote the sustainable use of plant genetic resources for food and agriculture through:

- Pursuing fair agricultural policies that promote, as appropriate, the development and maintenance of diverse farming systems that enhance the sustainable use of agricultural biological diversity and other natural resources;
- Strengthening research which enhances and conserves biological diversity by maximizing intra- specific[9] and inter-specific[10] variation for the benefit of farmers, especially those who generate and use their own varieties and apply ecological principles in maintaining soil fertility and in combating diseases, weeds and pests;
- Promoting, plant breeding efforts which, with the participation of farmers, particularly in developing countries, strengthen the capacity to develop varieties particularly adapted to social, economic and ecological conditions, including in marginal areas;
- Broadening the genetic base of crops and increasing the range of genetic diversity available to farmers;
- Promoting, as appropriate, the expanded use of local and locally adapted crops, varieties and underutilized species;
- Supporting, as appropriate, the wider use of diversity of varieties and species in on-farm management, conservation and sustainable use of crops and creating strong links to plant

[9] Intra-specific variation-occurring within a species or involving members of one species
[10] Inter-specific variation- Arising or occurring between species.

breeding and agricultural development in order to reduce crop vulnerability and genetic erosion; and

- Reviewing, and, as appropriate, adjusting breeding strategies and developing regulations concerning variety release and seed distribution.

Farmers' Rights

Government shall develop measures to protect and promote Farmers' Rights, including:

- Protection of traditional knowledge relevant to plant genetic resources for food and agriculture;
- Protection of the right to equitably participate in sharing benefits arising from the utilization of plant genetic resources for food and agriculture; and
- Protection of the right to participate in making decisions at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture.

Capacity Building

Government shall build capacity in plant genetic resources for food and agriculture by:

- Strengthening programmes for scientific and technical education and training in conservation and sustainable use of plant genetic resources for food and agriculture;
- Developing and strengthening facilities for conservation and sustainable use of plant genetic resources for food and agriculture; and
- Carrying out scientific research in fields where it is needed.

Establishment of Management Authority

Government shall ensure the integration of activities under the Treaty on Plant Genetic Resources for Food and Agriculture into its relevant agricultural and food and nutrition security policies and programmes. In this regard, a Management Authority shall be established under the Protection of Plant Genetic Resources for Food and Agriculture Act (2013) to provide guidance on policy and legal measures that provide for the conservation and sustainable use of plant genetic resources and the equitable sharing of the benefits arising out of their use.

Cooperation with International Organizations

Government shall co-operate with relevant international organizations in enhancing international activities to promote:

- Conservation, evaluation, documentation, genetic enhancement, plant breeding and seed multiplication; and

- Sharing, providing access to, and exchanging plant genetic resources and appropriate information and technology relating thereto, within the context of national legislation for the Protection of Plant Genetic Resources for Food and Agriculture and the International Treaty on Plant Genetic Resources for Food and Agriculture.

6. SEED PLAN

The National Seed Plan outlines the framework of activities that will be critical in implementing the National Seed Policy and will cover a ten year period, from 2019 to 2029. It is underpinned by an Activity Matrix elaborated in Appendix I. The Activity Matrix is comprised of the strategies and actions that are linked to each policy goal. Additionally, the matrix ascribes timelines and indicators and details stakeholders responsible for each action.

This chapter outlines the goals, strategies and actions which are aligned to each element of the policy.

6.1 Research, Variety Improvement, Evaluation and Release

- **Goal 1: Facilitate development, evaluation and maintenance of pest resistant/ tolerant, high yielding varieties that are adaptive to local agro-ecological zones and challenges posed by climate change.**

  - **Strategies and Actions**

    - ***Promote basic and adaptive research for local varietal development and improvement.***
      - Identify strategic and priority crops.
      - Conduct breeding research trials, on-farm demonstrations and validations within the context of agro-ecological zones and climate change.
      - Incorporate indigenous germplasm into the breeding programme.
      - Collaborate with producers for germplasm conservation and classification for indigenous varieties.
      - Collaborate with research institutions at the international, regional and local levels for seed technology transfer.
      - Disseminate research findings through appropriate media.

    - ***Strengthen technical capacity of human resources to support the seed research programme.***
      - Identify manpower requirements for seed programmes.
      - Recruit staff in identified disciplines to support seed programmes.
      - Train existing staff in improved technologies for varietal research and production.

- Collaborate with research and other institutions at the international, regional and national levels for capacity building.
- Collaborate with tertiary and other training institutions to include courses for seed production in curricula.

- ***Strengthen the physical capacity of participating institutions to support seed research programmes.***
  - Conduct a needs assessment of existing seed research programmes.
  - Identify physical gaps among participating institutions.
  - Develop funding strategy to address gaps.
  - Encourage collaborative use of available equipment.

- ***Test and evaluate imported seed varieties.***
  - Collaborate with seed importers and distributors to identify and evaluate new imported varieties.
  - Conduct local trials of imported new and improved varieties.
  - Disseminate results through existing channels.

- ***Facilitate release of new and improved seed varieties.***
  - Promulgate plant variety protection legislation.
  - Establish a Variety Release Committee.
  - Develop procedures/protocols for registration and release of new varieties and improvement of existing varieties (local and imported).

6.2 Seed Multiplication Processing and Storage

Goal 2: Increase availability and access to clean seed to meet production requirements.

❖ **Strategies and Actions**

- ***Strengthen breeder and foundation seed production programmes.***
  - Establish criteria and identify varieties for programme.
  - Conduct needs assessment on existing facilities and equipment.
  - Develop programmes to improve seed conditioning and storage facilities and seed processing equipment in key institutions.

- Develop where necessary, protocols for multiplication, conditioning and storage of seed.
- Enhance and sustain capacity of staff involved in seed multiplication programmes.
- Initiate technical cooperation for improvement in local breeder and foundation seed programmes.
- Provide extension support to producers in the production of their own seeds.

- ***Establish a Certified Outgrower Scheme for commercial seed production.***
  - Identify seed producers for commercial seed production.
  - Develop protocols for multiplication of commercial seeds by private seed producers.
  - Build capacity of private seed producers for production of commercial seeds.
  - Collaborate with credit institutions to provide window of financing for commercial seed producers.
  - Liaise with NLA/AIC to designate suitable land for commercial seed production for lease.

- ***Develop a seed security programme.***
  - Identify critical crop varieties, wild types and indigenous varieties for seed security programme.
  - Collaborate with institutions at the national, regional and international levels and selected producers to establish buffer stock of selected seed.
  - Maintain food and tree crop nurseries across the island.
  - Provide support to on-farm seed conservation or community seed banks.
  - Expand programme to import and evaluate adaptable varieties from other countries with potential for commercial multiplication.
  - Collaborate with national, regional and international institutions to expand gene bank for local germplasm.

- ***Improve post disaster seed security programmes.***
  - Conduct seed system security assessment for strategic varieties.
  - Build capacity to assess and establish seed security post disaster, including helping producers to access locally adapted plant genetic resources for food and agriculture.
  - Establish institutional responsibilities and mechanisms to identify, acquire, multiply and deliver appropriate seeds post disaster.

- Establish seed standards and protocols for gifts of seeds that meet minimum local and international standards, including a pre-test phase.

6.3 Seed Quality Control

Goal 3: Improve regulation and monitoring of the seed industry to ensure adherence to quality standards.

❖ **Strategies and Actions**

- ***Create legislative framework for development of a seed industry.***
  - Conduct stakeholder consultations towards national seed legislation.
  - Prepare drafting instructions for national seed legislation.
  - Promulgate national seed legislation.

- ***Develop a Seed Certification Scheme to ensure quality assurance of seeds produced and marketed.***
  - Establish seed certification entity to administer Seed Certification Scheme.
  - Build capacity of seed certification entity to implement the Seed Certification Scheme.
  - Establish formal arrangements with certified laboratories to test efficacy of seeds.
  - Develop programme to train and certify private seed inspectors and seed analysts.
  - Establish seed standards that conform to regional and international best practices.
  - Establish seed standards and protocols for gifts of seeds that meet minimum local and international standards, including a pre-test phase.
  - Enforce labelling according to standards specification for agricultural seed packages.
  - Implement public education programme.

6.4 Marketing and Promotion

Goal 4: Improve the sustainable marketing and distribution of seeds.

❖ **Strategies and Actions**

- ***Provide market intelligence to improve efficiency in the seed distribution system.***
  - Establish seed forecasting system for local seeds.
  - Include accurate and up-to-date data on seed prices in existing Agricultural Marketing Information System.
  - Disseminate data on seed prices and suppliers through established channels.

- ***Increase awareness on the availability and use of quality seeds.***
  - Utilize extension methodologies to teach producers about new and improved varieties.
  - Continue to provide capacity building on good agricultural practices and improved technologies.
  - Collaborate with seed producers and distributors to host field days, demonstrations, displays at agricultural shows, posters, radio and television broadcasts.
  - Design public awareness programme to promote use of quality seeds.

- ***Upgrade seed value chains***
  - Conduct value chain analysis on selected seed value chains.
  - Develop and implement upgrading strategies for selected value chains using participatory approaches.

6.5 Protection of Plant Genetic Resources for Food and Agriculture

Goal 5: Protect national plant genetic resources.

❖ **Strategies and Actions**

- ***Promote on-farm and in situ conservation of PGRFA***

- Conduct a baseline of the state of conservation and use of cultivated and wildcrafted plant genetic resources and wild relatives and of the knowledge and traditional practices associated with them.
- Develop national research programme for *in situ* management of PGRFA.
- Explore incentive framework for farmers, farmers associations and communities to contribute to *in situ* conservation and use of PGRFA.
- Establish and/or enhance community gene banks.
- Establish programme (including capacity building) and networks to strengthen on-farm management and conservation of farmers' varieties/landraces and crop wild relatives.
- Document and disseminate best practices on knowledge, innovations and traditional practices associated with conservation and sustainable use of PGRFA in communities.

- ***Strengthen national ex situ conservation systems***
  - Conduct inventory of status of existing *ex situ* collections.
  - Identify priorities for targeted collecting in terms of missing diversity, potential usefulness and threatened environments.
  - Develop a standardized national documentation system for updates and maintenance of *ex situ* collections.
  - Develop protocols and standards to improve the characterization, evaluation and regeneration of germplasm conserved in institutional gene banks.
  - Develop standardized system for collection and recording of landraces and wild relatives of crop species.
  - Expand collection of cultivated and wild crafted plants of economic importance to include collections of wild relatives.
  - Improve conditions of *ex situ* conservation in institutional gene banks for regenerating, evaluating, multiplying and distributing germplasm.
  - Establish and/or strengthen community gene banks for *ex situ* conservation.
  - Develop mechanisms for emergency collecting of PGRFA, in particular endangered crop wild relatives.
  - Develop/Adopt low cost conservation technologies for PGRFA.
  - Conduct capacity building in scientific collecting, characterization and evaluation methods for PGRFA.
  - Develop system for replication and safe storage of *ex situ* materials not currently safely duplicated.
  - Coordinate with regional and international partners to provide linkages with certain *ex situ* collections, gap-filling and regeneration efforts.

- Expand linkages with regional and crop networks and with the users of PGRFA (breeders, researchers and farmers) in order to inform, direct and prioritize the entire conservation process, including surveying, inventorying and collecting.

- ***Enhance the use and management of plant genetic resources in gene banks.***
  - Establish baseline characterization and evaluation data for varieties of economic importance and underutilized species.
  - Develop innovative, crop-specific characterization and evaluation activities, with participatory approaches as appropriate.
  - Increase the use of advanced methods (e.g. molecular) in the characterization and evaluation processes.
  - Standardize characterization and evaluation processes for all PGRFA.
  - Improve information systems for recording, maintenance and retrieval of data.
  - Strengthen systems for exchange of characterization and evaluation information, including through networking gene bank databases.
  - Build institutional capacity to utilize improved methods for characterization and evaluation.
  - Develop a public awareness programme to highlight the importance of PGRFA.

7. IMPLEMENTATION

The Seed Policy and Plan was developed within the wider context of the Agriculture Sector Plan, National Food and Nutrition Security Policy and Action Plan, and other relevant policies and plans impacting areas such as plant health, organic production, forestry, biodiversity, biosafety and climate change (see Chapter 9 - Linkages to Other Policies). In order to operationalize the Plan, there needs to be an emphasis on the coordination of actions, accountability of all stakeholders and efficient allocation of resources. Given that the Seed Plan will be implemented over a ten year period, from 2019-2029, actions will be streamlined in the Corporate, Operational Planning and budgetary processes of the Ministries, Departments and Agencies (MDAs) involved in its implementation.

Specifically, steps will be taken to ensure:

- Alignment of the 3-year corporate/strategic business plans and 1-year Operational Plans of relevant MDAs with the relevant actions of the Seed Plan, taking into consideration the timelines;
- Alignment of programmes and projects of relevant MDAs with actions of the Seed Plan; and
- Development, strengthening and utilization of effective resource allocation mechanisms by relevant MDAs and non-state actors.

In order to achieve this level of integration within the regular planning processes in MDAs, sensitization and enhanced coordination among corporate planners, policy analysts, project managers and budget and finance officers across MDAs will be required. In addition, relevant private sector entities and producer organizations will also be encouraged to include relevant elements of the Seed Plan into their annual plans or work programmes.

7.1 Institutional Framework

7.1.1 National Seed Committee

The Government shall establish a National Seed Committee (NSC), which will serve as an advisory body responsible for oversight and coordination of the Seed Policy and Plan. The main functions of the NSC include, *inter alia*:

- Coordinate the activities for implementation of the Seed Policy and Plan;
- Ensure collaboration among all stakeholders in the implementation of the Seed Policy and Plan;

- Guide development of legislation and quality standards for the seed industry;
- Provide input for the establishment of a national seed certification agency;
- Give advice to plant breeding organizations on market and farmers' requirements;
- Establish relevant sub-committees to support its work;
- Advocate for resources to be committed to the Seed Policy and Plan;
- Provide half yearly reports on the progress of implementation of the Seed Policy and Plan to the Planning & Policy Division of the MICAF;
- Provide input to continuous revision of the Seed Policy and Plan; and
- Develop and implement communication programme for the Seed Policy and Plan.

The NSC shall be chaired by the Ministry responsible for agriculture and its membership comprised as follows:

- Three representatives of the Ministry responsible for agriculture (Research & Development, Plant Quarantine and Planning & Policy);
- A representative of the Rural Agricultural Development Authority;
- A representative from seed multiplication agencies;
- A representative from a seed distribution company;
- A representative from the Jamaica Citrus Protection Agency;
- A representative from the Ministry responsible for the environment;
- A representative from the Scientific Research Council;
- A representative from the Bureau of Standards Jamaica;
- A representative from Academia;
- A representative from a regional agricultural research institution;
- A representative from an organization with responsibility for commodities;
- Chairperson of the Varietal Release Committee; and
- A representative from a producers' organization.

The NSC may co-opt such other persons as it deems necessary for the efficient and timely execution of its mandate.

The NSC will meet quarterly in the first two years of its establishment, to ensure the building of the momentum for the implementation of the Seed Policy and Plan. The Committee can then meet at intervals which it deems necessary to carry out its work. The Ministry of Industry, Commerce, Agriculture & Fisheries shall provide secretariat and logistical support to the work of the NSC.

7.1.2 Varietal Release Committee

A Varietal Release Committee (VRC) shall be formed as a sub-committee of the NSC to develop and implement a mechanism for orderly release of new varieties of crops, whether imported or locally developed. The functions of the VRC include, *inter alia*:

- Approval of new varieties;
- Revision and maintenance of the national variety list;
- Revision of the history and performance records of selected varieties;
- Establishment of standards of varieties eligible for seed certification;
- Approval of variety release and entry into the seed multiplication programme;
- Making recommendations on obsolete varieties;
- Determining the varieties to be released, rejected, or deferred; and
- Provision of half-yearly reports to the National Seed Committee.

The VRC shall be chaired by the Ministry responsible for agriculture and be comprised of:

- Representatives from the Ministry responsible for agriculture;
- A representative from a Regional Agricultural Research Institution;
- A representative from Academia;
- A representative from an Organization with Responsibility for Commodities;
- A representative from a Seed Distribution Company;
- A representative from a Farmers Organization; and
- Coopted specialized members as required.

The VRC may co-opt such other persons as it deems necessary for the efficient and timely execution of its mandate. The VRC shall meet half-yearly or as deems necessary. The Ministry responsible for agriculture shall provide secretariat and logistical support to the work of the VRC.

7.1.3 Seed Certification

The Plant Quarantine/Produce Inspection Branch of the Ministry will be charged with the responsibility of seed certification. Seed certification duties will include conducting the necessary field inspections and laboratory tests aimed at providing the required quality checks and assistance to all facets of the seed industry. It shall also be responsible for the licensing of private sector inspectors and seed analysts to support its certification and quality control work. The proposed seed legislation will provide the legal basis for certification.

7.1.4 Management Authority

The Protection of Plant Genetic Resources for Food and Agriculture Act (2013) establishes a Management Authority to implement Jamaica's obligations under the International Treaty on Plant Genetic Resources for Food and Agriculture. This Authority is being established within the MICAF's, R&D Division. Specifically, the Management Authority is mandated to provide guidance on policy and legal measures that provide for the conservation and sustainable use of plant genetic resources and the equitable sharing of the benefits arising out of their use.

The legislation states that the Management Authority shall be comprised of no less than eleven nor more than thirteen members appointed by the Minister as follows:

- One member shall be a representative of the Ministry responsible for agriculture;
- One member shall be a representative of the Ministry responsible for environment;
- One member shall be a representative of the National Environment and Planning Agency;
- One member shall be a representative of the Scientific Research Council;
- Two members shall be representatives, each from a tertiary institution;
- One member shall be a representative of the Institute of Jamaica;
- One member shall be an attorney-at-law;
- One member shall be qualified in the area of accounting and finance; and
- At least two persons appointed from among such other persons who are suitably qualified in the area of botany, or to represent the interests of farmers and plant breeders.

The Chairman and Vice-Chairman shall be appointed from among the membership of the Management Authority.

7.1.5 Roles of Government, Private Sector & Civil Society

The implementation of the Seed Policy and Plan will require input from Government, private sector and civil society for the sustainability of the industry.

7.1.5.1 Role of Government

The role of Government in the implementation of this Policy and Plan is the:

- Provision of leadership in policy, planning and programme development;
- Appropriate regulation of the seed industry;
- Creation of an enabling environment for private sector involvement in the national seed programme;

- Provision of services such as certification, quality control, seed testing, marketing intelligence and seed statistics;
- Synchronization of the Seed Policy and Plan with national agriculture, food and nutrition security, plant health, organic, forestry, biosafety, climate change, biodiversity and related policies;
- Conducting research in the development of superior varieties, improvements of cultural practices and cropping patterns and determination of optimal input levels for production;
- Education through demonstration of improved production practices, including use of improved seed;
- Maintenance of breeder seed stocks of publicly developed varieties;
- Control of production and allocation of foundation seed stock of publicly developed and introduced varieties; and
- Provision of technical assistance to the private sector involved in the seed programme.

7.1.5.2 Role of the Private Sector

The role of private sector in the implementation of this Policy and Plan is the:

- Production, distribution and marketing of commercial and/or certified seed of publicly developed varieties and hybrids planted by cultivators;
- Development of varieties and hybrids, or introduction of new and adapted varieties; and
- Production, marketing and promotion of privately developed varieties subject to certain standards of quality, performance capability and ethics, as established by government regulations.

7.1.5.3 Role of Civil Society

The participation of civil society is integral to the implementation of the Seed Policy and Plan. In this regard, civil society will be allowed to inform and influence the decision making process and be involved in its implementation. The role of civil society in this Policy and Plan includes:

- Building of partnerships with actors in the national seed system to strengthen research, multiplication and quality control programmes;
- Assist in efforts to protect, maintain and conserve PGRFA;
- Participate in, and technically contribute to the National Seed Committee and sub-committees;
- Participate in capacity building of actors in the national seed system;

- Participate in the design and implementation of public education and awareness programmes;
- Advocacy for issues relating to the seed system and PGRFA; and
- Assist in efforts to bolster seed security programmes at the community and national levels.

7.2 Legislative Framework

The implementation of the Seed Policy and Plan will require the promulgation of new legislation to support the seed industry and protect plant breeders' rights. It will also require a review of existing legislation and regulations with a view to identifying the changes that may be required to complement the new seed legislation and protection of the rights of breeders of new varieties of plants legislation.

7.2.1 Seed Legislation

There is need for an appropriate legal framework to support the regulation of the seed industry. It is being proposed that national seed legislation be promulgated to ensure reliable standards of seed quality, protect seed suppliers and users and develop a quality-oriented seed industry.

Key areas of focus for the seed legislation shall include:

- Varietal development;
- Plant variety protection;
- Seed production, including registration and classification of seed producers and processing units;
- Seed certification;
- Quality assurance, including seed analysis, seed testing and packaging/labelling;
- Regulation of the sale of seed;
- Seed distribution and marketing;
- Transgenic plant varieties;
- Import of seeds and planting materials; and
- Seed exports.

7.2.2 Plant Variety Protection Legislation

Plant variety protection legislation will be enacted to protect the rights of breeders of new varieties. This legislation will encompass, *inter alia*:

- Conditions for the grant of breeders' rights;
- Application for the grant of breeders' rights;
- The rights of the breeder;
- Variety denomination;
- Nullity and cancellation of breeders' rights;
- Enforcement of breeders' rights;
- Publication of applications for and grants of breeders' rights; and
- Supervisory authority for implementation of the legislation.

7.3 Communications Programme

A Communications Programme will be developed and implemented by the National Seed Committee to promote public awareness about the Seed Policy and Plan and other programmes/projects being implemented to support the seed sector. The objectives of the Communication Programme are to:

- Ensure accountability and transparency in the implementation of the Seed Policy and Plan;
- Update stakeholders and the general public about the progress of implementation of the Seed Policy and Plan; and
- Raise awareness of producers about the benefits of the use of quality seed and issues dealing with conservation and maintenance of PGRFA.

Private sector's and civil society's involvement in the Communications Programme will be encouraged as it is critical to its success. A diverse media strategy, using both ICT and traditional methods will be adopted to increase the impact of the Communications Programme.

8. Financing of the Seed Policy and Plan

8.1 Funding Requirements

The National Seed Policy and Plan will require significant resources over the ten year period of its implementation. The methodology for deriving the funding requirements for the Seed Policy and Plan takes into consideration that there are already existing resources committed by Government through its national budget for implementing activities under its regular programmes. The implementation of activities in the Seed Plan, for the most part, will rely upon existing resources of implementing partners in the public sector and also mobilize resources from private sector and civil society to minimize the impact of the policy and plan on the national budget.

However, there are some areas, namely, research, protection of plant genetic resources for food and agriculture, seed certification and seed security, which require additional investment to support Government's thrust towards food and nutrition security and agricultural development.

Table 2 outlines the funding requirements for each goal of the Policy and Plan, which totals J$214.4 million over the 10 year period.

Table 2: Funding Requirements for Implementation of the Seed Policy and Plan

Goals	J$
Goal 1: Facilitate development, evaluation and maintenance of pest resistant/ tolerant, high yielding varieties that are adaptive to local agro-ecological zones and challenges posed by climate change.	**73,900,000**
Goal 2: Increase availability and access to clean seed to meet production requirements.	**58,500,000**
Goal 3: Improve regulation and monitoring of the seed industry to ensure adherence to quality standards.	**31,500,000**
Goal 4: Improve the sustainable marketing and distribution of seeds.	**2,500,000**
Goal 5: Protect national plant genetic resources.	**40,000,000**
Monitoring and Evaluation	**6,000,000**
Communications Programme	**2,000,000**
Total	**214,400,000**

This amount represents additional resources that Government will have to identify to achieve the goals of the policy and plan.

8.2 Financing Strategy

The Seed Policy and Plan will be financed by Government of Jamaica budgetary resources and resources from the private sector and civil society, where appropriate. A Resource Mobilization Strategy (RMS) will be developed to identify possible sources of funding for activities in the Plan. Specifically, the RMS should be spearheaded by the Ministry of Industry, Commerce, Agriculture & Fisheries and involve:

- Mapping of potential partners to action areas;
- Packaging of projects to attract funding; and
- Engaging partners at the highest level to secure their support.

Collaboration with the private sector, producer organizations and other civil society interests, will also be critical in the programming of non-government resources towards the Policy and Plan. Partnerships with traditional and non-traditional stakeholders who can support the implementation of the Policy and Plan will also be explored.

It is recognized that technical cooperation programmes will be necessary to achieve some of the actions, as greater capacity building from countries with more advanced systems are needed. South-South Cooperation in this area will also be critical for facilitating capacity building and technology transfer.

9. MONITORING & EVALUATION FRAMEWORK

The monitoring and evaluation (M&E) of the National Seed Policy and Plan are important to facilitate effective management and oversight of its implementation. The Planning and Policy Division of the Ministry of Industry, Commerce, Agriculture & Fisheries will be responsible for implementing and managing a M&E system for the Seed Policy and Plan in collaboration with the National Seed Committee. The outcome of this process will be used to provide updates, recommendations and guidance for revision of policies and strategies to improve the seed system and management of PGRFA.

9.1 Monitoring Process

The monitoring framework consists of impact and output indicators that are SMART[11]. At a higher level, the impact indicators are aligned to the vision and goals of the Action Plan. The output indicators are found in the activity matrix and are linked to actions, which are each aligned to a strategy. Performance monitoring will be closely tied to the activity matrix. By continuous monitoring of the implementation process, information will be generated on the progress of implementation and remedial actions to be taken, if necessary.

In implementing the monitoring framework, an incremental approach will be used, that is, in the first phase, a minimum set of core indicators will be defined, guided by the assessment of information availability. The set of indicators can be adjusted, if it is deemed necessary, as it becomes clear where to invest to fill information gaps and enhance monitoring capacities.

An Annual Progress Report will be compiled each year by the Planning and Policy Division with support from the National Seed Committee. The Annual Progress Report will be submitted to Cabinet and tabled in Parliament. Thereafter, it will be posted on the website of the Ministry of Agriculture & Fisheries to ensure transparency and accountability.

9.2 Indicator Framework

The Seed Policy and Plan is underpinned by a results based activity matrix which establishes lower level output indicators for activities undertaken at the institutional level. The higher level indicators have been established to track overall progress at the national level, which are linked to the vision and goals of the Policy and Plan. These indicators are a subset of a broader framework of indicators for monitoring the implementation of the Second Global Plan of Action

[11] **S**pecific, **M**easurable, **A**chievable, **R**eliable and **T**ime-bound

for Plant Genetic Resources within the context of the International Treaty of Plant Genetic Resources for Food and Agriculture. These indicators are described below.

- **Supporting seed production and distribution**
  - ***Indicators:***
    i. Number of new varieties released.
    ii. Number of formal/registered seed enterprises.

- **Supporting plant breeding, genetic enhancement and base-broadening efforts.**
  - ***Indicators:***

    i. Number of crops with active public pre-breeding and breeding programmes.
    ii. Number of crops with active private pre-breeding and breeding programmes.
    iii. Number of active public crop breeders.

- **Surveying and inventorying plant genetic resources for food and agriculture**
  - ***Indicators:***
    i. Number of *in situ* (including on farm) surveys/inventories of PGRFA carried out.
    ii. Number of PGRFA surveyed/inventoried.

- **Supporting on-farm management and improvement of plant genetic resources for food and agriculture.**
  - ***Indicators:***
    i. Number of farming communities involved in on-farm PGRFA management and improvement activities.

- **Assisting farmers in disaster situations to restore crop systems.**
  - ***Indicators:***
    i. Existence of disaster risk management policies for restoring crop systems that include seed security provisions.

- **Promoting *in situ* conservation and management of crop wild relatives and wild food plants.**
  - ***Indicators:***
    i. Percentage of national *in situ* conservation sites with management plans addressing crop wild relatives and wild food plants.
    ii. Number of crop wild relatives and wild food plant species actively conserved *in situ*.

- **Supporting targeted collecting of plant genetic resources for food and agriculture.**
  - ***Indicators:***
    i. Existence of a strategy for identification of gaps in national gene bank holdings and for targeted collecting missions to fill identified gaps.
    ii. Number of crops conserved in the national gene bank(s) that require targeted collecting.

- **Sustaining and expanding *ex situ* conservation of germplasm.**
  - ***Indicators:***
    i. Number of crops conserved *ex situ* under medium or long-term conditions.
    ii. Number of species conserved *ex situ* under medium or long-term conditions.

- **Regenerating and multiplying ex situ accessions.**
  - ***Indicators:***
    i. Number of *ex situ* accessions regenerated and/or multiplied.
    ii. Percentage of *ex situ* accessions in need of regeneration.

- **Promoting diversification of crop production and broadening crop diversity for sustainable agriculture.**
  - ***Indicators:***

    i. Number of new crops and/or wild species introduced into cultivation.

- **Promoting development and commercialization of all varieties, primarily farmers' varieties/landraces and underutilized species.**
  - ***Indicators:***

    i. Number of farmers' varieties/landraces and underutilized species with potential for commercialization identified

Given the absence of official data for the indicators, a baseline will be established to inform the targets for the ten year period and assist with the country's reporting obligations under the Second Global Plan of Action.

9.3 Evaluation of the Seed Policy and Plan

An evaluation of the Seed Policy and Plan will be conducted after the first five years of its implementation, preferably, by an independent evaluator. The Policy and Plan will then be reviewed and updated based on the outcome of the evaluation.

The evaluation will cover *inter alia* the:

- Level of achievement of the vision, goals, strategies and actions;
- The level of achievement of the targets according to the timelines specified;
- Effectiveness of the policy and plan in accomplishing the vision, goals, strategies and actions;
- Status of the progress of implementation of the Policy and Plan;
- Adequacy of resources for achievement of targets; and
- Recommendations for changing of actions and timelines based on the assessment.

A final evaluation will be conducted at the end of the ten year period designated for implementation of the Policy and Plan. The final evaluation will focus on the achievement of the vision, goals, policies and strategies, the impact of policy and programme initiatives for the seed industry and PGRFA and recommendations for the design and implementation of future policies and plans.

10. LINKAGES TO OTHER POLICIES AND PLANS

The Seed Policy and Plan is linked to several policies and action plans at the national level. These are summarized below.

10.1 Vision 2030 Jamaica National Development Plan

The Vision 2030- National Development Plan aims to put Jamaica in a position to achieve developed country status by 2030. The Plan aims to transform the country from a middle income developing country to one which affords its citizens a high quality of life and world-class standards in critical areas including education, health care, nutrition, basic amenities, access to environmental goods and services, civility and social order. Vision 2030 Jamaica is built on four strategic goals and sixteen national outcomes for the country's development. These are:

- **Goal 1: Jamaicans are empowered to achieve their fullest potential**

National Outcomes:

- ✓ A Healthy and Stable Population
- ✓ World-Class Education and Training
- ✓ Effective Social Protection
- ✓ Authentic and Innovative Culture

- **Goal 2: Jamaica's society is cohesive and just**

National Outcomes:

- ✓ Security and Safety
- ✓ Effective Governance

- **Goal 3: Jamaica's economy is prosperous**

National Outcomes:

- ✓ A Stable Macro-Economy
- ✓ Enabling Business Environment
- ✓ Strong Economic Infrastructure
- ✓ Energy Security and Efficiency
- ✓ A Technology-Driven Society
- ✓ Internationally Competitive Industry Structures

- **Goal 4: Jamaica has a healthy natural environment**

National Outcomes:

- ✓ Sustainable Use and Management of Environmental and Natural Resources
- ✓ Hazard Risk Reduction and Adaptation to Climate Change
- ✓ Sustainable Urban and Rural Development

The Vision 2030 National Development Plan is complemented by 32 sector plans.

10.2 Vision 2030- Agriculture Sector Plan

The Agriculture Sector Plan seeks to increase the competitiveness and productivity of agricultural output, including: increasing the application of capital equipment, small tools and mechanization; developing economies of scale through clustering of activities and facilities; strengthening the use of modern farming systems and best practices; diversifying into higher value-added production; and strengthening the application of technology, innovation, research and development to agricultural production, including improving quality of planting material to the sector. The plan includes specific strategies for the development of key agricultural sub-sectors, including traditional and non-traditional crops.

The drive for increased productivity is complemented by measures to enhance the marketing of agricultural products locally and internationally. The plan also seeks systematically to improve the most important aspects of the supporting environment for agriculture in Jamaica and has an explicit goal towards improving food security.

10.3 National Food and Nutrition Security Policy

The Food and Nutrition Security Policy (FNSP) was approved by Cabinet and tabled in Parliament in May 2013. The vision of the FNSP is that "all Jamaicans and residents of Jamaica at all times have universal physical, social and economic access to sufficient, safe and nutritious food to meet their dietary and food preferences for an active and healthy life".

More specifically, the policy seeks to:

- Ensure that a sufficient quantity of nutritious food of appropriate quality is available to all people in Jamaica, through increased domestic production and a sustainable level of imports, with special emphasis on a structured food import replacement programme (Food Availability);
- Ensure that all individuals in Jamaica have access to adequate resources to acquire appropriate foods for a nutritious diet (Food Access);
- Ensure that all individuals in Jamaica reach a state of nutritional well-being through food choices and consumption that reflect Recommended Dietary Allowances (RDAs) (Food Utilization); and
- Ensure that all people in Jamaica have access to adequate, safe and nutritious food at all times, are not at risk of losing access to it due to external economic shocks and natural hazards, and consume/utilize foods that reflect physiological needs (Stability of Food Supply).

In recognition of the importance of high quality planting material to productivity, emphasis is placed on ensuring the production, conservation, importation, evaluation and distribution of high quality planting and genetic material, development of a seed and genetic material plan and an appropriate implementation mechanism for these activities.

10.4 National Food and Nutrition Security Action Plan

The National Food and Nutrition Security Action Plan (NFNSAP) outlines the framework of activities that will be critical in implementing the National Food and Nutrition Security Policy and will cover a ten year period, from 2013 to 2022.

The goals of the NFNSAP are to:

- Promote the sustainable production of safe, affordable, nutritious, good quality Jamaican food commodities/products;
- Ensure access of households and individuals to sufficient, nutritious affordable food at all times;
- Promote nutritionally adequate, safe, affordable dietary intakes and other positive lifestyle behaviours throughout the life course; and
- Improve the food and nutrition security resilience of the national community to natural and socio-economic shocks and climate change.

The strategy that informs the NFNSAP is based on lessons learned and on-going initiatives and recognizes the critical role of both public and private sector investments, as well as the need for a revitalized rural sector, emphasizing a value chain approach for the development of a large number of agricultural, forestry, and fishery activities.

10.5 Draft National Organic Policy

The draft National Organic Policy seeks to promote the development of a sustainable, locally and internationally competitive and compliant organic sub-sector that protects the environment, biodiversity, human and animal health and welfare, contributes to national food and nutrition security, job creation, economic growth and social equity.

Its goals are to:

- Create an enabling environment for the development of the organic sector;
- Increase production, productivity and trade of value added products;
- Reduce environmental degradation and support enhancement of ecological services;

- Contribute to social equity, food security and improved health of the nation;
- Increase stakeholder awareness about the importance and benefits of organic production systems; and
- Promote consumption of locally produced organic food/products;

The policy speaks to the establishment of a National Organic Seed Bank by Government in collaboration with relevant stakeholders. Priority will be given to the main crops cultivated by organic farmers and other selected crops that have market potential. Technical assistance will be provided to individual organic farmers or groups of farmers to establish small seed banks.

10.6 Draft National Forest Policy (2012-2024)

The Forest Policy addresses both national priorities for forests, including conservation, protection and reforestation of forest ecosystems, as well as the need for forests to be supportive of rural livelihoods and uses. It outlines eight principles recognized by the Government as being critical to the sustainable management of Jamaica's forests, which include transparency and accountability, the utilization of sustainable development and inter-generational considerations, best science and participatory and collaborative approaches in forest management planning and implementation processes. The Policy also establishes three overarching goals which cover ten objectives. The three Goals are related to Governance, Forest Ecological System Conservation and Socio-Economic Considerations.

The Forest Policy provides the basis on which necessary changes to the legislative and management framework can be instituted. The expansion of the Agency's jurisdiction will also include the establishment of a land trust to hold the approximately eight per cent of remaining closed broad leaf forest in trust for the people of Jamaica. The Policy also addresses the activities that are deemed crucial to the maintenance of a vibrant forestry sector. These include, but is not limited to the need for the development of forest management plans; mechanisms governing forest management data collection; the demarcation of jurisdictional boundaries; and the regulation of activities on Crown and privately owned lands, the forest sector and forest-based industries.

10.7 Draft National Biosafety Policy

The National Biosafety Policy sets out objectives, strategies and implementation procedures for a range of state-led activities, which together create the framework for a national biosafety regime. It addresses the safe use, transportation, storage and handling of Genetically Modified Organisms (including requirements for transboundary movement) and sets a policy framework for supporting research and public education on modern biotechnology. The policy is designed to

meet not only international obligations, specifically those set out in the Cartagena Protocol on Biosafety, but also the peculiar needs and requirements of Jamaica, as it seeks to benefit from the advantages of the technology.

10.8 Jamaica's National Biodiversity Strategy and Action Plan

The National Biodiversity Strategy and Action Plan aims to conserve and protect Jamaica's biodiversity through sustainable use and fair and equitable sharing of the benefits derived from its biodiversity.

The goals of the policy are:

i. Conserve Jamaica's biodiversity.
ii. Promote sustainable use of biological resources.
iii. Facilitate access to biological resources to promote developments in biotechnology and to ensure benefit sharing.
iv. Ensure safe transfer, handling and use of Living Modified Organisms (LMOs).
v. Enhance resource management capacity.
vi. Promote public awareness and education and community empowerment.
vii. Promote regional and international co-operation and collaboration in support of the implementation of the Convention on Biodiversity.

Under Goal 1, the strategy speaks to use of an integrated management approach in the conservation of Jamaica's biodiversity. It outlines conservation measures for *in-situ* and *ex-situ* conservation.

With respect to *in situ* conservation, the strategy seeks to:

- Establish and Manage Protected Areas
- Rehabilitate Degraded Ecosystems and Promote Recovery of Threatened Species
- Manage and Maintain Wild Species and Their Habitat
- Control and/or Eradicate Invasive Introduced Species

With respect to *ex situ* conservation, the strategy seeks to:

- Conduct research to identify, inventory and document the genetic resources of Jamaica and store this information in a national database.
- Prepare a national *ex-situ* conservation plan involving Government agencies, *ex-situ* experts, representatives of conservation organizations, private sector groups, researchers and other stakeholders to identify priorities, resource requirements and opportunities for national and regional collaboration and action, taking into account the need for various types of gene banks and rescue centres.

- As part of the national *ex-situ* conservation plan, determine national requirements for *ex-situ* facilities, and identify financial resources for the management of existing facilities and the development of new facilities.
- Ensure the inclusion of *ex-situ* conservation experts in the development of recovery plans for endangered species where appropriate, and in the preparation of biodiversity policies and programmes.
- Provide, develop and use appropriate incentives as a means of promoting cultivation of local varieties of food crops and locally adapted breeds of livestock and undertake artificial propagation and captive breeding of threatened species.

The Action Plan outlines project concepts to support each Goal of the Strategy.

10.9 National Plant Health Policy

The policy seeks to address the gaps and failures in the current plant health system in light of requirements of international treaties and agreements and food safety and phytosanitary standards of the country's major trading partners. The policy identifies issues faced by Government that hinder the development of an efficient plant health system. The policy makes provision for the revision of existing legislation, building of institutional capacity, scientific systems, quarantine capacity, surveillance systems, emergency response for pest outbreaks and increased public awareness.

10.10 Food Safety Policy

The Food Safety Policy was crafted in response to the need to improve the food safety system, especially as it relates to the regulatory and institutional framework. In addition, emphasis is now being placed on the ability of all stakeholders in the food chain to be able to demonstrate adequate traceability of all food sources, especially in the global trading arena.

The Food Safety Policy covers all aspects of national, regional, and international practices, principles, guidelines, standards and agreements governing food safety systems. The policy addresses issues such as legislative gaps and overlaps in the regulation of the food safety system, coordination of the food safety function, traceability, risk analysis, research, surveillance/epidemiology, locally accredited laboratories for food safety analysis, monitoring of food production and distribution systems, national food safety emergency response systems and public awareness and education.

The policy is underpinned by a national food control strategy; strengthening of infrastructure and institutional framework; compliance policies which establish specific or general limits to which products, processes and practices must comply, and accompanied by effective and efficient food control systems and legislation.

10.11 Vision 2030- Natural Resources and Environmental Management & Hazard Risk Reduction and Climate Change Sector Plan

The plan identifies four areas for priority attention, namely, biodiversity and ecosystem management, natural resource management, environmental governance and natural hazard mitigation and climate change. It specifically addresses risk mitigation and climate change by seeking to:

- Develop mechanisms that integrate disaster risk reduction in development planning;
- Build awareness of natural hazards among all stakeholders;
- Implement best practices for hazard risk management;
- Support community based approach to hazard risk reduction;
- Create mechanisms to enable all government policies and plans to fully consider the implementation of climate change;
- Identify strategic priorities for climate change; and
- Adopt best practices for climate change adaptation.

10.12 Climate Change Policy Framework and Action Plan (Green Paper)

The Climate Change Policy Framework and Action Plan is primarily intended to support the goals of Vision 2030 by reducing the risks posed by climate change to all of Jamaica's sectors and development goals. It outlines the strategies that the country will employ in order to effectively respond to the impacts and challenges of climate change, through measures which are appropriate for varying scales and magnitudes of climate change impacts. A number of Flagship Programmes from new and existing initiatives have been identified for early implementation.

The general objective of the Policy Framework is to create a sustainable institutional mechanism to facilitate the development, coordination and implementation of policies, sectoral plans,

programmes, strategies, policies and legislation to address the impacts of climate change. These sectors may include, but are not limited to water, energy, agriculture, fisheries, forestry, coastal and marine resources, health, mining, tourism, transportation, solid waste management, planning and disaster risk reduction and response management.

It is expected that on the basis of this policy framework, the relevant sectors will develop or update, as appropriate, plans addressing climate change adaptation and/or mitigation.

10.13 National Land Policy (1997)

The goals and objectives of this Policy are to ensure the sustainable, productive and equitable development, use and management of the country's natural resources.

The Policy also aims to compliment socioeconomic development initiatives of the country. It challenges and seeks to remove inefficient, onerous and outdated legal, administrative, management and other barriers that affect the planning, use, control, development, protection and conservation of Jamaica's physical resources.

10.14 National Security Policy

The National Security Policy (NSP) cohesively integrates the country's major security policies, goals, responsibilities and actions into an overall master strategy for the fulfillment of the vision for national security for Jamaica. The NSP outlines the combined use of the political, economic, social, informational and security instruments of national power and influence, including the military. It clarifies the institutional framework within which the armed forces and civil institutions of the State will coordinate their activities to create an integrated and cohesive national security network to safeguard national interests. It also prescribes the complementary roles and responsibilities of the public and private sectors, as well as civil society, in supporting national security.

The NSP has identified eight Strategic Security Goals to effectively address the challenges currently facing the nation. The goals are to:

- Reduce violent crime and dismantle organised criminal networks;
- Strengthen the justice system and promote respect for the rule of law;
- Protect Jamaica from terrorism;
- Protect and control Jamaica's territory;
- Strengthen the integrity of the institutions of democratic government;
- Increase Jamaica's contribution to regional and international security initiatives;

- Provide the environment for a stable economy and an effective delivery of social services; and
- Protect Jamaica's natural resources and reduce the risks of disasters.

Matters relating to the effective analysis and use of intelligence and the enhancement of public education and awareness are also identified as important cross-cutting issues. The NSP aims to transform attitudes, processes and practices in order to achieve national security goals.

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APPENDIX I- ACTIVITY MATRIX

SUMMARY MATRIX

Goals	Strategies
Goal 1: Facilitate development, evaluation and maintenance of pest resistant/ tolerant, high yielding varieties that are adaptive to local agro-ecological zones and challenges posed by climate change.	1.1 Promote basic and adaptive research for local varietal development and improvement.
	1.2 Strengthen technical capacity of human resources to support the seed research programme.
	1.3 Strengthen the physical capacity of participating institutions to support seed research programmes.
	1.4 Test and evaluate imported seed varieties.
	1.5 Facilitate release of new and improved seed varieties.
Goal 2: Increase availability and access to clean seed to meet production requirements.	2.1 Strengthen breeder and foundation seed production programmes.
	2.2 Establish a Certified Outgrower Scheme for commercial seed production.
	2.3 Develop a seed security programme.
	2.4 Improve post disaster seed security programme.
Goal 3: Improve regulation and monitoring of the seed industry to ensure adherence to quality standards.	3.1 Create legislative framework for development of a seed industry.
	3.2 Develop a Seed Certification Scheme to ensure quality assurance of seeds produced and marketed.
Goal 4: Improve the sustainable marketing and distribution of seeds.	4.1 Provide market intelligence to improve efficiency in the seed distribution system.
	4.2 Increase awareness on the availability and use of quality seeds.
	4.3 Upgrade seed value chains.
Goal 5: Protect national plant genetic resources.	5.1 Promote on-farm and *in situ* conservation of plant genetic resource for food and agriculture.
	5.2 Strengthen national *ex situ* conservation systems.
	5.3 Enhance the use and management of plant genetic resources in gene banks.

ACTIVITY MATRIX

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
Goal 1: Facilitate development, evaluation and maintenance of pest resistant/ tolerant, high yielding varieties that are adaptive to local agro-ecological zones and challenges posed by climate change.					
1.1 Promote basic and adaptive research for local varietal development and improvement.	1.1.1 Identify strategic and priority crops.	1.1.1.1 Strategic and priority crops identified.	Strategic and priority crops identified by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Academia, SRC, Producer Groups/Associations, JOAM	Years 1-2
	1.1.2 Conduct breeding research trials, on-farm demonstrations and validations within the context of agro-ecological zones and climate change.	1.1.2.1 Breeding research trials, on-farm demonstrations and validations conducted.	At least four (4) breeding research trials, on-farm demonstrations and validations conducted each year.	MICAF, RADA, Commodity Boards, Academia, CARDI, Producer Groups/Associations, JOAM	Ongoing
	1.1.3 Incorporate indigenous germplasm into the breeding programme.	1.1.3.1 Indigenous germplasm incorporated into the breeding programme.	At least two (2) varietal improvement programmes incorporate indigenous germplasm.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, Academia, Producer Groups/Associations, JOAM	Ongoing
	1.1.4 Collaborate with producers for germplasm conservation and classification for indigenous varieties.	1.1.4.1 Collaboration forged with producers for germplasm conservation and classification for indigenous varieties.	At least one (1) collaborative effort forged each year.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, Academia, Producer Groups/ Associations, Producers,	Ongoing

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
				JOAM	
	1.1.5 Collaborate with research institutions at the international, regional and local levels for seed technology transfer.	1.1.5.1 Partnerships forged with research institutions at the international, regional and local levels for seed technology transfer.	At least three (3) partnerships forged over a 5 year period.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, regional and international organizations	Ongoing
	1.1.6 Disseminate research findings through appropriate media.	1.1.6.1 Research findings disseminated.	At least one (1) information bulletin/publication per year disseminated through ICT.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, Academia	Ongoing
1.2 Strengthen technical capacity of human resources to support the seed research programme.	1.2.1 Identify manpower requirements for seed programmes.	1.2.1.1 Manpower requirements for seed programme identified.	Manpower requirements identified by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, Academia	Years 1-2
	1.2.2 Recruit staff in identified disciplines to support seed programmes.	1.2.2.1 Staff in identified disciplines recruited.	At least three (3) staff members recruited by Year 5.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, Academia	Years 1-5
	1.2.3 Train existing staff in improved technologies for varietal research and production.	1.2.3.1 Existing staff trained in improved technologies for varietal research and production.	At least two (2) staff members trained each year in at least one area.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, Academia	Ongoing
	1.2.4 Collaborate with research and other institutions at the international, regional and national levels for capacity building.	1.2.4.1 Collaboration forged with research and other institutions at the international, regional and national levels for capacity building.	At least three (3) partnerships forged over a 5 year period.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, regional and international organizations	Years 1-5

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	1.2.5 Collaborate with tertiary and other training institutions to include courses for seed production in curricula.	1.2.5.1 Collaboration forged with tertiary and other training institutions to include courses for seed production in curricula.	At least three (3) partnerships forged over a 5 year period.	MICAF, RADA, Commodity Boards, CARDI, Forestry Agency, Academia	Years 1-5
1.3 Strengthen the physical capacity of participating institutions to support seed research programmes.	1.3.1 Conduct a needs assessment of existing seed research programmes.	1.3.1.1 Needs assessment of existing seed research programmes conducted.	Needs assessment of existing seed research programmes conducted by Year 3.	MICAF, RADA, Commodity Boards, CARDI, SRC, Forestry Agency, Academia	Years 1-3
	1.3.2 Identify physical gaps among participating institutions.	1.3.2.1 Physical gaps among participating institutions identified.	Physical gaps identified by Year 3.	MICAF, RADA, Commodity Boards, CARDI, SRC, Forestry Agency, Academia	Years 1-3
	1.3.3 Develop funding strategy to address gaps.	1.3.3.1 Funding strategy to address gaps developed.	Funding strategy developed by Year 4.	MICAF, RADA, Commodity Boards, CARDI, SRC, Forestry Agency, Academia	Years 1- 4
	1.3.4 Encourage collaborative use of available equipment.	1.3.4.1 Collaborative use of available equipment encouraged.	MOUs developed by Year 2.	MICAF, RADA, Commodity Boards, CARDI,SRC, Forestry Agency, Academia	Years 1-2
1.4 Test and evaluate imported seed varieties.	1.4.1 Collaborate with seed importers and distributors to identify and evaluate new imported varieties.	1.4.1.1 New imported varieties identified and evaluated.	At least 75 percent of imported new varieties evaluated.	MICAF, RADA, Commodity Boards, Seed importers and distributors, Producer Groups/ Associations, JOAM	Ongoing
	1.4.2 Conduct local trials of imported new and improved varieties.	1.4.2.1 Local trials for imported new and improved varieties conducted.	Local trials conducted for at least 75 percent of new and improved	MICAF, RADA, Commodity Boards, Producer Groups/ Associations, JOAM,	Ongoing

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
			varieties.	seed importers and distributors, Forestry Agency, Academia	
	1.4.3 Disseminate results through existing channels.	1.4.3.1 Results disseminated through existing channels.	At least one (1) information bulletin/ publication disseminated each year.	MICAF, RADA, Commodity Boards, Producer Groups/ Associations, seed importers and distributors, Forestry Agency, Academia	Ongoing
1.5 Facilitate release of new and improved seed varieties.	1.5.1 Promulgate plant variety protection legislation.	1.5.1.1 Plant variety protection legislation promulgated.	Plant variety protection legislation promulgated by Year 5.	JIPO, MICAF, CPC	Years 1-5
	1.5.2 Establish a Variety Release Committee within the context of seed legislation.	1.5.2.1 Variety Release Committee established.	Variety Release Committee established by Year 6.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, seed importers and distributors, Forestry Agency, Academia	Year 6- onwards
	1.5.3 Develop procedures/ protocols for registration and release of new varieties and improvement of existing varieties (local and imported).	1.5.3.1 Procedures/ protocols for registration and release of new varieties and improvement of existing varieties developed.	Procedures/ protocols developed by Year 6.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, seed importers and distributors, Forestry Agency, Academia	Year 6- onwards

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
Goal 2: Increase availability and access to clean seed to meet production requirements.					
2.1 Strengthen breeder and foundation seed production programmes.	2.1.1 Establish criteria and identify crop varieties for programme.	2.1.1.1 Criteria established for programmes. 2.1.1.2 Crop varieties identified.	i. Criteria establish for programmes by Year 1. ii. Crop varieties identified by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia	Years 1-2
	2.1.2 Conduct needs assessment on existing facilities and equipment.	2.1.2.1 Needs assessment on existing facilities and equipment conducted.	Needs assessment conducted by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, Forestry Agency, Academia	Years 1-2
	2.1.3 Develop programmes to improve seed conditioning and storage facilities and seed processing equipment in key institutions.	2.1.3.1 Programmes to improve seed conditioning and storage facilities and seed processing equipment in key institutions developed.	Programmes to improve seed conditioning and storage facilities and seed processing equipment in key institutions developed by Year 3.	MICAF, RADA, Commodity Boards, Producer Groups/ Associations, CARDI, SRC, JOAM, Forestry Agency, Academia	Years 1-3
	2.1.4 Develop where necessary, protocols for multiplication, conditioning and storage of seed.	2.1.4.1 Protocols for multiplication, conditioning and storage of seed developed.	Protocols for multiplication, conditioning and storage of seed developed by Year 3.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia	Years 1-3
	2.1.5 Enhance and sustain capacity of staff involved in seed multiplication	2.1.5.1 Capacity of staff involved in seed multiplication programmes enhanced	i. Capacity building programmes for staff commence in Year 2. ii. At least one (1)	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations,	Year 2- onwards

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	programmes.	and sustained.	capacity building activity executed each year.	SRC, Forestry Agency, Academia, training institutions	
	2.1.6 Initiate technical cooperation for improvement in local breeder and foundation seed programmes.	2.1.6.1 Technical cooperation for improvement in local breeder and foundation seed programmes initiated.	Technical cooperation for improvement in local breeder and foundation seed programme initiated by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia	Year 2- onwards
	2.1.7 Provide extension support to producers in the production of their own seeds.	2.1.7.1 Extension support provided to producers in production of their own seeds.	Extension support provided to producers in production of their own seeds by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, Forestry Agency, Academia	Year 2- onwards
2.2 Establish a Certified Outgrower Scheme for commercial seed production.	2.2.1 Identify seed producers for commercial seed production.	2.2.1.1 Producers for commercial seed production identified.	Producers for commercial seed production identified by Year 3.	MICAF, RADA, Commodity Boards, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia	Year 3- onwards
	2.2.2 Develop protocols for multiplication of commercial seeds by private seed producers.	2.2.2.1 Protocols for multiplication of commercial seeds by private seed producers developed.	Protocols for multiplication of commercial seeds by private seed producers developed by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia	Years 1-2
	2.2.3 Build capacity of private seed producers for production of commercial seeds.	2.2.3.1 Capacity of private seed producers for production of commercial seeds built.	i. Capacity building initiatives commence in Year 3. ii. At least one (1)	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations,	Year 3- onwards

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
			capacity building activity executed each year.	SRC, JOAM, Forestry Agency, Academia	
	2.2.4 Collaborate with credit institutions to provide window of financing for commercial seed producers.	2.2.4.1 Collaboration forged with credit institutions to provide window of financing for commercial seed producers	Window of financing for commercial seed producers provided by Year 3.	MICAF, DBJ, PC Bank, Financial Institutions, RADA, Commodity Boards, Producer Groups/ Associations, JOAM, Forestry Agency, Academia	Year 3- onwards
	2.2.5 Liaise with NLA/AIC to designate suitable land for commercial seed production for lease.	2.2.5.1 Suitable land for commercial seed production for lease identified.	Suitable land for commercial seed production for lease identified by Year 3.	MICAF, NLA, AIC, RADA, Commodity Boards, Producer Groups/ Associations, JOAM, Forestry Agency, Academia	Year 3- onwards
2.3 Develop a seed security programme.	2.3.1 Identify critical crop varieties, wild types and indigenous varieties for seed security programme.	2.3.1.1 Critical crop varieties, wild types and indigenous varieties for seed security programme identified.	Critical crop varieties, wild types and indigenous varieties for seed security programme identified by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia	Years 1-2
	2.3.2 Collaborate with institutions at the national, regional and international levels and selected producers to establish buffer stock of selected seed.	2.3.2.1 Collaboration forged with institutions at the national, regional and international levels and selected producers to establish buffer stock of selected seed.	Efforts at collaboration with institutions at the national, regional and international levels and selected producers commence by Year 3.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, producers, JOAM, SRC, Forestry Agency, Academia, regional and international organizations.	Years 1-3

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	2.3.3 Maintain food, and tree crop nurseries across the island.	2.3.3.1 Food and tree crop nurseries maintained across the island.	Food and tree crop nurseries in operation.	MICAF, RADA, Commodity Boards, Producer Groups/ Associations, JOAM, Forestry Agency, Academia	Ongoing
	2.3.4 Provide support to on-farm seed conservation or community seed banks.	2.3.4.1 Support provided to on-farm seed conservation or community seed banks.	At least two (2) on-farm seed conservation or community seed banks established each year, from Year 3.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia	Year 3- onwards
	2.3.5 Expand programme to import and evaluate adaptable varieties from other countries with potential for commercial multiplication.	2.3.5.1 Programme to import and evaluate adaptable varieties from other countries with potential for commercial multiplication expanded.	Programme to import and evaluate adaptable varieties from other countries with potential for commercial multiplication commence in Year 3	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, Forestry Agency, Academia	Year 3- onwards
	2.3.6 Collaborate with national, regional and international institutions to expand gene bank for local germplasm.	2.3.6.1 Collaboration forged with national, regional and international institutions to expand gene bank for local germplasm.	Collaboration forged with national, regional and international institutions to expand gene bank for local germplasm by Year 3.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia, regional and international organizations	Year 1- onwards
2.4 Improve post disaster seed security	2.4.1 Conduct seed system security assessment for	2.4.1.1 Seed system security assessment	Seed system security assessment conducted	MICAF, RADA, Commodity Boards,	Years 1-3

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
programmes.	strategic varieties.	conducted for strategic varieties.	for strategic varieties by Year 3.	CARDI, Producer Groups/ Associations, JOAM, Forestry Agency, NGOs, Academia, regional and international organizations	
	2.4.2 Build capacity to assess and establish seed security post disaster, including helping producers to access locally adapted PGRFA.	2.4.2.1 Capacity to assess and establish seed security post disaster, including helping producers to access locally adapted PGRFA built.	Capacity building activities to assess and establish seed security post disaster, including helping producers to access locally adapted PGRFA commence by Year 3.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, Academia, NGOs, other national, regional and international organizations	Years 1-3
	2.4.3 Establish institutional responsibilities and mechanisms to identify, acquire, multiply and deliver appropriate seeds post disaster.	2.4.3.1 Institutional responsibilities and mechanisms to identify, acquire, multiply and deliver appropriate seeds post disaster established.	Institutional responsibilities and mechanisms to identify, acquire, multiply and deliver appropriate seeds post disaster established by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, SRC, JOAM, Forestry Agency, NGOs, Academia, other national, regional and international organizations	Years 1-2
	2.4.4 Establish seed standards and protocols for gifts of seeds that meet minimum local and international standards,	2.4.4.1 Seed standards and protocols for gifts of seeds that meet minimum local and international standards, including a	Seed standards and protocols for gifts of seeds that meet minimum local and international	MICAF, RADA, Commodity Boards, Producer Groups/ Associations, JOAM, Forestry Agency,	Years 1- 3

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	including a pre-test phase.	pre-test phase established.	standards, including a pre-test phase established by Year 3.	Academia, NGOs, regional and international organizations	
Goal 3: Improve regulation and monitoring of the seed industry to ensure adherence to quality standards					
3.1 Create legislative framework for development of a seed industry.	3.1.1 Conduct stakeholder consultations towards national seed legislation.	3.1.1.1 Stakeholder consultations towards national seed legislation conducted	Stakeholder consultations towards national seed legislation conducted by Year 2.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, Forestry Agency, SRC, Academia, NGOs, CPC	Years 1-2
	3.1.2 Prepare drafting instructions for national seed legislation.	3.1.2.1 Drafting instructions for national seed legislation prepared.	Drafting instructions for national seed legislation prepared by Year 3.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, Forestry Agency, SRC, Academia, NGOs, CPC	Years 1-3
	3.1.3 Promulgate national seed legislation.	3.1.3.1 National seed legislation promulgated.	National seed legislation promulgated by Year 5.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, Forestry Agency, SRC, Academia, NGOs, CPC	Years 1-5
3.2 Develop a Seed Certification Scheme to ensure quality	3.2.1 Establish seed certification entity to administer Seed	3.2.1.1 Seed certification entity to administer Seed Certification Scheme	Seed certification entity to administer Seed Certification	MICAF, MOF, Cabinet Office	Years 6-onwards

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
assurance of seeds produced and marketed.	Certification Scheme.	established.	Scheme established by Year 6.		
	3.2.2 Build capacity of seed certification entity to implement the Seed Certification Scheme.	3.2.2.1 Capacity of seed certification entity to implement the Seed Certification Scheme built.	Capacity building for seed certification entity to implement the Seed Certification Scheme undertaken by Year 6.	MICAF, Seed Certification Entity, academia, regional and international organizations.	Year 6- onwards
	3.2.3 Establish formal arrangements with certified laboratories to test efficacy of seeds.	3.2.3.1 Formal arrangements with certified laboratories to test efficacy of seeds established.	Formal arrangements with certified laboratories to test efficacy of seeds established by Year 6.	MICAF, Seed Certification Entity, Private laboratories	Year 6- onwards
	3.2.4 Develop programme to train and certify private seed inspectors and seed analysts.	3.2.4.1 Programme to train and certify private seed inspectors and seed analysts developed.	Programme to train and certify private seed inspectors and seed analysts developed by Year 6.	MICAF, Seed Certification Entity, Academia, Training institutions	Year 6- onwards
	3.2.5 Establish seed standards that conform to regional and international best practices.	3.2.5.1 Seed standards that conform to regional and international best practices established.	Seed standards that conform to regional and international best practices established by Year 5.	MICAF, Seed Certification Entity, BSJ	Years 1-5
	3.2.6 Establish seed standards and protocols for gifts of seeds that meet minimum local and international standards, including a pre-test phase.	3.2.6.1 Seed standards and protocols for gifts of seeds that meet minimum local and international standards, including a pre-test phase established.	Seed standards and protocols for gifts of seeds that meet minimum local and international standards, including a pre-test phase established by Year	MICAF, BSJ	Years 1-3

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
			3.		
	3.2.7 Enforce labelling according to standards specification for agricultural seed packages.	3.2.7.1 Labelling according to standards specification for agricultural seed packages enforced.	All domestically produced seed packages labelled appropriately by Year 3.	MICAF, BSJ	Years 3-onwards
	3.2.8 Implement public education programme.	3.2.8.1 Public education programme implemented.	Public education programme implemented by Year 6.	MICAF, Seed Certification Entity, BSJ	Year 6-onwards
Goal 4: Improve the sustainable marketing and distribution of seeds					
4.1 Provide market intelligence to improve efficiency in the seed distribution system.	4.1.1 Establish seed forecasting system for local seeds.	4.1.1.1 Seed forecasting system for local seeds established.	Seed forecasting system for local seeds established by Year 6.	MICAF, Seed Certification Entity, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, Forestry Agency, SRC, Academia, NGOs	Year 6- onwards
	4.1.2 Include accurate and up-to-date data on seed prices in existing Agricultural Marketing Information System.	4.1.2.1 Up-to-date data on seed prices included in existing Agricultural Marketing Information System.	Up-to-date data on seed prices included in existing Agricultural Marketing Information System included by Year 3.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, seed distributors, JOAM, Forestry Agency, SRC, Academia, NGOs	Year 3- onwards
	4.1.3 Disseminate data on seed prices and suppliers through established	4.1.3.1 Data on seed prices and suppliers disseminated through	Data on seed prices and suppliers disseminated by Year	MICAF, RADA, Commodity Boards, CARDI, Producer	Year 3- onwards

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	channels.	established channels.	3.	Groups/ Associations, Seed producers, seed distributors, JOAM, Forestry Agency, SRC, Academia, NGOs	
4.2 Increase awareness on the availability and use of quality seeds.	4.2.1 Utilize extension methodologies to teach producers about new and improved varieties.	4.2.1.1 Extension methodologies to teach producers about new and improved varieties utilized.	At least 5 percent of producers in each extension area taught about new and improved varieties each year.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, seed distributors, JOAM, Forestry Agency, Academia, NGOs	Ongoing
	4.2.2 Continue to provide capacity building on good agricultural practices and improved technologies.	4.2.2.1 Capacity building on good agricultural practices and improved technologies continuously provided to producers.	Capacity building on good agricultural practices and improved technologies provided to at least 10 percent of producers in each extension area each year.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, seed distributors, JOAM, Forestry Agency, Academia, NGOs	Ongoing
	4.2.3 Collaborate with seed producers and distributors to host field days, demonstrations, displays at agricultural shows, posters, radio and television broadcasts.	4.2.3.1 Collaboration forged with seed producers and distributors to host field days, demonstrations, displays at agricultural shows, posters, radio and television broadcasts.	At least ten (10) extension activities carried out each year to teach producers about new and improved varieties.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, seed distributors, JOAM, Forestry Agency, Academia, NGOs	Ongoing

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	4.2.4 Design and implement public awareness programme to promote use of quality seeds.	4.2.4.1 Public awareness programme to promote use of quality seeds designed and implemented.	Public awareness programme to promote use of quality seeds designed and implemented by Year 3.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, seed distributors, JOAM, Forestry Agency, Academia, NGOs	Year 3- onwards
4.3 Upgrade seed value chains	4.3.1 Conduct value chain analysis on selected seed value chains.	4.3.1.1 Value chain analysis on selected seed value chains conducted.	At least one (1) Value chain analysis on a selected seed value chain conducted each year.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, Forestry Agency, SRC, Academia, NGOs	Year 2- onwards
	4.3.2 Develop and implement upgrading strategies for selected value chains using participatory approaches.	4.3.2.1 Upgrading strategies for selected value chains using participatory approaches developed and implemented.	At least two (2) upgrading strategies implemented by Year 5.	MICAF, RADA, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, Forestry Agency, SRC, Academia, NGOs	Years 1-5
Goal 5: Protect national plant genetic resources					
5.1 Promote on-farm and *in situ* conservation of PGRFA	5.1.1 Conduct a baseline of the state of conservation and use of cultivated plant genetic resources and wild relatives, and of the	5.1.1.1 Baseline of the state of conservation and use of cultivated plant genetic resources and wild relatives, and of the	Baseline of the state of conservation and use of cultivated plant genetic resources and wild	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed	Year 3

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	knowledge and traditional practices associated with them.	knowledge and traditional practices associated with them conducted.	relatives, and of the knowledge and traditional practices associated with them conducted by Year 3.	distributors, JOAM, Forestry Agency, NEPA, Academia, NGOs	
	5.1.2 Develop national research programme for *in situ* management of PGRFA.	5.1.2.1 National research programme for *in situ* management of PGRFA developed.	National research programme for *in situ* management of PGRFA developed by Year 2.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, Forestry Agency, NEPA, Academia, NGOs	Year 2
	5.1.3 Explore incentive framework for farmers, farmers associations and communities to contribute to *in situ* conservation and use of PGRFA.	5.1.3.1 Incentive framework for farmers, farmers associations and communities to contribute to *in situ* conservation and use of PGRFA explored.	Incentive framework for farmers, farmers associations and communities to contribute to *in situ* conservation and use of PGRFA explored by Year 3	MICAF, MOF, regional and international institutions, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, Forestry Agency, NEPA, Academia, NGOs	Year 3
	5.1.4 Establish and/or enhance community gene banks.	5.1.4.1 Community gene banks established and enhanced.	A least one (1) community gene banks established or enhanced each year.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, Forestry Agency,	Year 3-onwards

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
				Academia, NGOs	
	5.1.5 Establish programme (including capacity building) and networks to strengthen on-farm management and conservation of farmers' varieties/landraces and crop wild relatives.	5.1.5.1 Programme (including capacity building) and networks to strengthen on-farm management and conservation of farmers' varieties/landraces and crop wild relatives established.	Programme (including capacity building) and networks to strengthen on-farm management and conservation of farmers' varieties/landraces and crop wild relatives established by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, Forestry Agency, Academia, NGOs	Year 3-onwards
	5.1.6 Document and disseminate best practices on knowledge, innovations and traditional practices associated with conservation and sustainable use of PGRFA in communities.	5.1.6.1 Best practices on knowledge, innovations and traditional practices associated with conservation and sustainable use of PGRFA in communities documented and disseminated.	At least one (1) documentation of best practices on knowledge, innovations and traditional practices associated with conservation and sustainable use of PGRFA in communities documented and disseminated each year.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, Forestry Agency, Academia, NGOs	Year 3- onwards
5.2 Strengthen national *ex situ* conservation systems.	5.2.1 Conduct inventory of status of existing *ex situ* collections.	5.2.1.1 Inventory of status of existing *ex situ* collections conducted.	Inventory of status of existing *ex situ* collections conducted by Year 2.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed	Year 1-2

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
				producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs	
	5.2.2 Identify priorities for targeted collecting in terms of missing diversity, potential usefulness and threatened environments.	5.2.2.1 Priorities for targeted collecting in terms of missing diversity, potential usefulness and threatened environments identified.	Priorities for targeted collecting in terms of missing diversity, potential usefulness and threatened environments identified by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, NEPA, Forestry Agency, Academia, NGOs	Years 2-3
	5.2.3 Develop a standardized national documentation system for updates and maintenance of *ex situ* collections.	5.2.3.1 Standardized national documentation system for updates and maintenance of *ex situ* collections developed.	Standardized national documentation system for updates and maintenance of *ex situ* collections developed by Year 4.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs	Years 3-4
	5.2.4 Develop protocols and standards to improve the characterization, evaluation and regeneration of germplasm conserved in institutional gene banks.	5.2.4.1 Protocols and standards to improve the characterization, evaluation and regeneration of germplasm conserved in institutional gene banks developed.	Protocols and standards to improve the characterization, evaluation and regeneration of germplasm conserved in institutional gene banks developed by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs	Year 3

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	5.2.5 Develop standardized system for collection and recording of land-races and wild relatives of crop species.	5.2.5.1 Standardized system for collection and recording of land-races and wild relatives of crop species developed.	Standardized system for collection and recording of land-races and wild relatives of crop species developed by Year 5.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs	Year 5- onwards
	5.2.6 Expand collection of cultivated and wild crafted plants of economic importance to include collections of wild relatives.	5.2.6.1 Collection of cultivated and wild crafted plants of economic importance to include collections of wild relatives expanded.	Collection of cultivated and wild crafted plants of economic importance to include collections of wild relatives expanded by Year 8.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs	Years 1-8
	5.2.7 Improve conditions of *ex situ* conservation in institutional gene banks for regenerating, evaluating, multiplying and distributing germplasm.	5.2.7.1 Conditions of *ex situ* conservation in institutional gene banks for regenerating, evaluating, multiplying and distributing germplasm improved.	Conditions of *ex situ* conservation in institutional gene banks for regenerating, evaluating, multiplying and distributing germplasm improved by Year 5.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs	Year 5
	5.2.8 Establish and/or strengthen community gene banks for *ex situ* conservation	5.2.8.1 Community gene banks for *ex situ* conservation established and/or strengthened.	At least one (1) community gene banks for *ex situ* conservation established and/or strengthened each	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM,	Ongoing

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
			year.	SRC, Forestry Agency, Academia, NGOs	
	5.2.9 Develop mechanisms for emergency collecting of PGRFA, in particular endangered crop wild relatives.	5.2.9.1 Mechanisms for emergency collecting of PGRFA, in particular endangered crop wild relatives developed.	Mechanisms for emergency collecting of PGRFA, in particular endangered crop wild relatives developed by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs, regional and international institutions	Years 1-3
	5.2.10 Develop/Adopt low cost conservation technologies for PGRFA.	5.2.10.1 Low cost conservation technologies for PGRFA developed/ adopted.	Low cost conservation technologies for PGRFA developed/adopted by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs, regional and international institutions	Years 1-3
	5.2.11 Conduct capacity building in scientific collecting, characterization and evaluation methods for PGRFA.	5.2.11.1 Capacity building in scientific collecting, characterization and evaluation methods for PGRFA conducted.	At least 20 percent of relevant staff benefit from capacity building in scientific collecting, characterization and evaluation methods for PGRFA each year.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs, regional and international institutions	Ongoing

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
	5.2.12 Develop system for replication and safe storage of materials not currently safely duplicated.	5.2.12.1 System for replication and safe storage of materials not currently safely duplicated developed.	System developed by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs, regional and international institutions	Year 3
	5.2.13 Coordinate with regional and international partners to provide linkages with certain *ex situ* collections, gap-filling and regeneration efforts.	5.2.13.1 Linkages with certain *ex situ* collections, gap-filling and regeneration efforts forged through coordination with regional and international partners.	Linkages with regional and international partners established by Year 4.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs, regional and international institutions.	Year 4- onwards
	5.2.14 Expand linkages with regional and crop networks and with the users of PGRFA (breeders, researchers and farmers) in order to inform, direct and prioritize the entire conservation process, including surveying, inventorying and collecting.	5.2.14.1 Linkages with regional and crop networks and with the users of PGRFA expanded.	Linkages with regional and crop networks and with users of PGRFA increased by 20 percent by Year 5.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, Seed producers, Seed distributors, JOAM, SRC, Forestry Agency, Academia, NGOs, regional and international institutions.	Ongoing

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
5.3 Enhance the use and management of plant genetic resources in gene banks.	5.3.1 Establish baseline characterization and evaluation data for varieties of economic importance and underutilized species.	5.3.1.1 Baseline characterization and evaluation data for varieties of economic importance and underutilized species established.	Baseline characterization and evaluation data for varieties of economic importance and underutilized species established by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, Forestry Agency, Academia, NGOs	Year 3
	5.3.2 Develop innovative, crop-specific characterization and evaluation activities, with participatory approaches as appropriate.	5.3.2.1 Innovative, crop-specific characterization and evaluation activities, with participatory approaches developed.	At least two (2) varieties characterized and evaluated each year.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, Forestry Agency, Academia, NGOs	Ongoing
	5.3.3 Increase the use of advanced methods (e.g. molecular) in the characterization and evaluation processes.	5.3.3.1 Use of advanced methods (e.g. molecular) in the characterization and evaluation processes increased.	Advanced methods utilized by Year 4.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, Forestry Agency, Academia, NGOs	Year 4- onwards
	5.3.4 Standardize characterization and evaluation processes for all PGRFA.	5.3.4.1 Characterization and evaluation processes for all PGRFA standardized.	Characterization and evaluation processes for all PGRFA standardized by Year 6.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, Forestry Agency, Academia, NGOs	Years 1-6
	5.3.5 Improve information systems for recording, maintenance and retrieval of data.	5.3.5.1 Information systems for recording, maintenance and retrieval of data improved.	Information systems for recording, maintenance and retrieval of data improved by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, Forestry Agency,	Years 1-3

STRATEGIES	ACTIONS	OUTPUTS	INDICATORS OF ACHIEVEMENT	RESPONSIBLE AGENCIES AND STAKEHOLDERS	TIMEFRAME
				Academia, NGOs	
	5.3.6 Strengthen systems for exchange of characterization and evaluation information, including through networking gene bank databases.	5.3.6.1 Systems for exchange of characterization and evaluation information, including through networking gene bank databases strengthened.	Systems for exchange of characterization and evaluation information, including through networking gene bank databases strengthened by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, Forestry Agency, Academia, NGOs	Years 1-3
	5.3.7 Build institutional capacity to utilize improved methods for characterization and evaluation.	5.3.7.1 Institutional capacity to utilize improved methods for characterization and evaluation built.	At least 20 percent of staff participates in capacity building activities each year.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, Forestry Agency, Academia, NGOs	Year 2- onwards
	5.3.8 Develop a public awareness programme to highlight the importance of PGRFA.	5.3.8.1 Public awareness programme to highlight the importance of PGRFA developed.	Public awareness programme to highlight the importance of PGRFA developed by Year 3.	MICAF, Commodity Boards, CARDI, Producer Groups/ Associations, JOAM, SRC, Forestry Agency, Academia, NGOs	Years 1-3

GLOSSARY

Accession	A distinct, uniquely identifiable sample of seeds representing a cultivar, breeding line or a population, which is maintained in storage for conservation and use.
Biosafety	Efforts to reduce and eliminate the potential risks resulting from biotechnology and its products on plant, animal, or human health, genetic resources or the environment.
Biotechnology	Any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for a specific use.
Breeder seed	Breeder seed is seed directly controlled by the originating or sponsoring plant breeding institution, or person, or designee thereof. As applied to certified seed, breeder's seed is the source for the production of seed of the other classes of certified seed.
Certified seed	Certified seed is the progeny of Breeder and Foundation seed so handled as to maintain satisfactory genetic purity and identity, and which has been acceptable to the certifying agency. Certified tree seed is defined as seed from trees produced so as to assure genetic identity.
Characterization	The recording of highly heritable characters that can be easily seen and are expressed in all environments.
Collection	A group of germplasm accessions maintained for a specific purpose under defined conditions.
Commercial seed	Any seed which is not grown under a certification programme but may enter the market in case of certified seed shortage and meets the same seed testing standards as certified seed.
Conditioning	The mechanical handling of seed from harvest until marketing.
Crop wild relatives	Wild plant species that are genetically related to cultivated crops. These wild cousins of crops are vital to food security because they contain greater amounts of genetic diversity, making them more resilient in the face of climate change, pests and diseases and other new threats.
Escape	A non-native plant that is cultivated and then becomes established in the wild.

Evaluation	The recording of those characteristics whose expression is often influenced by environmental factors.
Ex situ	A collection of plant genetic resources for food and agriculture maintained outside their natural habitat.
Ex situ conservation	Conservation of plant genetic resources for food and agriculture outside their natural habitat.
Foundation seed	Foundation seed is seed which is the progeny of breeder or foundation seed produced under control of the originator or sponsoring plant breeding institution, or person, or designee thereof. As applied to certified seed, foundation seed is a class of certified seed which is produced under procedures established by the certifying agency for the purpose of maintaining genetic purity and identity.
Gene bank	A centre for conserving genetic resources under suitable conditions to prolong their lives.
Genetic diversity	The variety of genetic traits that result in differing characteristics.
Genetic erosion	Genetic Erosion in Agricultural biodiversity and livestock biodiversity is the loss of genetic diversity, including the loss of individual genes, and the loss of particular combinants of genes (or gene complexes) such as those manifested in locally adapted landraces.
Genetic material	Material of plant origin, including reproductive and vegetative propagating material, containing functional units of heredity.
Genetically modified organisms	Organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination.
Genotype	The genetic constitution of an individual plant or organism.
Germplasm	The genetic material that forms the physical basis of heredity and that is transmitted from one generation to the next by germ cells.
Horticulture	The science and art of growing fruits, vegetables, flowers, or ornamental plants.

In situ conservation	Conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings and, in the case of domesticated or cultivated plant species, in the surroundings where they have developed their distinctive properties.
Informal sector	Seed supply system consists of farmer-managed seed production activities and is based on indigenous knowledge and local diffusion mechanisms.
Landrace	A crop cultivar that has evolved through many years of farmer-directed selection and that is specifically adapted to local conditions; landraces are usually genetically heterogeneous.
Living modified organisms	Any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology.
Long-term conservation	The storage of germplasm for a long period, such as in base collections and duplicate collections. The period of storage before seeds need to be regenerated varies, but is at least several decades and possibly a century or more. Long-term conservation takes place at sub-zero temperatures.
Material transfer agreements	Contractual documents used for the acquisition of various biological and research materials, and occasionally, data, developed by nonprofit, government and private industry.
Medium-term conservation	The storage of germplasm in the medium-term such as in active and working collections; it is generally assumed that little loss of viability will occur for approximately ten years. Medium-term conservation takes place at temperatures between 0 °C and 10°C.
Multiplication	The representative sample of an accession grown to multiply the quantity of conserved material for distribution.
On-farm conservation	*In situ* conservation of cultivated plants.
Plant breeder	Person or organization actively engaged in the breeding and maintenance of varieties of plants.
Plant genetic resources for food and agriculture	Any genetic material of plant origin of actual or potential value for food and agriculture.

Plant variety rights	Rights granted to the breeder of a new variety of plant that give the breeder exclusive control over the propagating material (including seed, cuttings, divisions, tissue culture) and harvested material (cut flowers, fruit, foliage) of a new variety for a number of years.
Quality seed	Quality seed is defined as varietally pure with a high germination percentage, free from disease and disease organisms, and with a proper moisture content and weight. Quality seed insures good germination, rapid emergence, and vigorous growth.
Regeneration	Grow-out of a seed accession to obtain a fresh sample with high viability and numerous seeds.
Registered seed	Registered seed is the progeny of Breeder or Foundation seed handled under procedures acceptable to the certifying agency to maintain satisfactory genetic purity and identity.
Seed (botanical definition)	A mature fertilized plant ovule, consisting of an embryo and its food store surrounded by a protective seed coat.
Seed (for the purpose of this policy)	Parts of agricultural, forestry and horticultural plants intended for sowing or planting purposes.
Seed value chain	The seed value chain includes raw seed production by contract growers; purchase of raw seed, processing and storage by seed enterprises; and marketing through dealers and other retail networks.
Transgenic	Relating to, or denoting an organism that contains genetic material into which DNA from an unrelated organism has been artificially introduced.
Upgrading (value chain)	Relates both to the achievement of new product and process development, and in the functional reconfiguration of who does what in the value chain as a whole.
Value chain	The full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use.

Value chain upgrading strategy	Describes how industries and firms within industries will take advantage of opportunities and resolve key constraints to enhance their competitiveness. The goal of an upgrading plan is to create an action path that actors in the value chain follow to collectively address constraints to competitiveness over time.
Variety	A recognized division of a species, next in rank below subspecies; it is distinguishable by characteristics such as flower colour, leaf colour and size of mature plant.