



Strategic Plan
(2016 - 2020)
For
The Food Crop, Livestock and
Forestry Sectors

January 2016

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ACRONYMS

ACP	African-Caribbean-Pacific
AFD	Agence Française de Développement
AI	Artificial Insemination
AnGR	Animal Genetic Resources
AMB	Agricultural Marketing Board
APD	Animal Production Division
APMIS	Agricultural Production & Market Information System
AS	Agricultural Services
AU-IBAR	African Union Inter-African Bureau for Animal Resources
CAADP	Comprehensive Africa Agriculture Development Programme
CBD	Convention on Biological Diversity
CCU	Co-operative Credit Unions
CIF	Cost Insurance Freight
CIRAD	Centre de Coopération Internationale en Recherche Agronomique pour le Développement
CITES	Convention on International Trade of Endangered Species
COLEACP	Europe-Africa Caribbean-Pacific Liaison Committee
COMESA	Common Market for Eastern and Southern Africa
COP	Code of Practices
CSO	Civil Society Organisation
DCCB	Dangerous Chemicals Control Board
DUS	Distinctness, Uniformity and Stability
DVS	Division of Veterinary Services
EDF	European Development Fund
ESA	Environmentally Sensitive Area
EU	European Union
FAO	Food and Agriculture Organization
FAREI	Food and Agricultural Research and Extension Institute
FOB	Free On Board
FORIP	Field Operations, Regrouping and Irrigation Project
FSFSP	Food Security Fund Strategic Plan
GAP	Good Agricultural Practice
GDP	Gross Domestic Product
GEF-SGP	Global Environment Facility-Small Grants Programme
GHG	Green House Gases
GI	Glycemic Index
GIS	Geographic Information System
GMO	Genetically Modified Organism
GoM	Government of Mauritius
HBS	Household Budget Survey
IA	Irrigation Authority
IAEA	International Atomic Energy Agency
IAS	Invasive Alien Species
ICT	Information & Communication Technology
IDPM	Integrated Disease & Pest Management

IFAD	International Fund for Agricultural Development
INDC	Intended Nationally Determined Contributions
IOC	Indian Ocean Commission
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
IPNS	Integrated Plant Nutrient System
IPR	Intellectual Property Rights
IRS	Integrated Resort Scheme
ISO	International Organisation for Standardisation
IUCN	International Union for Conservation of Nature
MAIFS	Ministry of Agro-Industry and Food Security
MDF	Model Dairy Farm
MDG	Millennium Development Goals
MoESDDBM	Ministry of Environment, Sustainable Development, and Disaster and Beach Management
MID	Maurice Ile Durable
MITD	Mauritius Institute of Training & Development
MMA	Mauritius Meat Authority
MSB	Mauritius Standards Bureau
MQA	Mauritius Qualifications Authority
MSAW	Mauritius Society for Animal Welfare
MUR	Mauritian Rupee
MWF	Mauritian Wildlife Foundation
NAPRO	National Agricultural Products Regulatory Office
NBSAP	National Biodiversity Strategy and Action Plan
NCD	Non Communicable Disease
NEPAD	New Partnership for Africa's Development
NFIDC	Net-Food Importing Developing Country
NGO	Non Government Organisation
NPCS	National Parks and Conservation Service
NPIP	Northern Plains Irrigation Project
NPPO	National Plant Protection Office
NPVSO	National Plant Varieties and Seeds Office
NSA	Non-State Actor
NTC	National Trade Certificate
OAU	Organisation of African Unity
ODL	Open Distance Learning
OIE	Office International des Epizooties
PAN	Protected Area Network
PCM	Project Cycle Management
PGRFA	Plant Genetic Resources for Food and Agriculture
PPP	Private Public Partnership
QDS	Quality Declared Seed
R&D	Research & Development
RBM	Results Based Management
RTREBS	Rivulet Terre Rouge Estuary Bird Sanctuary

SADC	Southern Africa Development Community
SFWF	Small Farmers Welfare Fund
SIDS	Small Island Developing State
SME	Small and Medium Enterprise
SWOT	Strengths-Weaknesses-Opportunities-Threats
TCP	Technical Cooperation Programme
TIDS	Technology Innovation & Diffusion Scheme
UNCCD	UN Convention to Combat Desertification
UNDP	United Nations Development Programme
UNFCCC	UN Framework Convention on Climate Change
UNFF	UN Forum on Forests
UoM	University of Mauritius
VCA	Value Chain Approach
VCU	Value for Cultivation and Use
VRS	Voluntary Retirement Scheme
WIPO	World Intellectual Property Organisation
WTO	World Trade Organisation

FOREWORD



The Strategic Plan 2016-2020 for the Food Crop, Livestock and Forestry Sectors, which I have the honour to present, sets out the goals and objectives to be attained over the next five years to improve the level of food security and food safety and promote a more sustainable agriculture.

The challenges facing most countries in the world today, especially Small Islands Developing States are how to ensure access to nutritious food at affordable costs to their population whilst at the same time eliminating food wastage and minimizing post-harvest losses. These challenges are becoming more formidable in the context of the global climate change and the rapid urbanization process which are having adverse effect on agriculture.

Our main objectives are two-fold, namely increasing production of high quality strategic crops, vegetables and meat to satisfy local demand and promoting the development of the agri-business sector to enhance import substitution in order to reduce dependency on imports. Necessary incentives will, to that effect, be given to the farmers, especially the youth and women, to encourage them to engage in agri-business activities.

I wish to express my personal appreciation to the farming community for their valuable contribution to the development of agriculture over the years despite numerous difficulties and constraints. The delivery of key services to farmers will be greatly improved to respond better to their priority needs. All necessary assistance and technical options will be provided to them to ensure a smooth transition to bio-farming and sustainable agriculture in line with the Government Programme.

I am also thankful to all the stakeholders for their participation in the different workshops on food crops, livestock and forestry and for their valuable suggestions and recommendations for the elaboration of this Strategic Plan.

I am confident that, with the collaboration of one and all, the objectives set in this Strategic Plan will be successfully attained.

Honourable Mahen Kumar SEERUTTUN
Minister of Agro-Industry and Food Security

EXECUTIVE SUMMARY

Agriculture plays an important role in the national economy. Although no more the largest contributor to national production and wealth, the sector still makes a stable contribution to the economy.

Traditionally, the non-sugar sector has contributed particularly to food production and has ensured some measure of food security. Its forestry and biodiversity components are now playing vital roles in the management of natural resources, and are recognised as significant contributors to sustainable development and to the mitigation of climate change impacts. Hence, improvement of this sub-sector is even more beneficial for the country.

Building on the achievements of past strategic plans and based on lessons learned, the Ministry of Agro-Industry and Food Security has developed its new strategy for the period 2016-2020 using a participatory approach. The Plan is inspired broadly by the Government Programme 2015-2019, and has been formulated to take Mauritius to a higher level of food security whilst respecting the need for safe food and better nutrition of the population. It takes on board the need for sustainable agricultural development in a climate-friendly mode as well as safeguarding farmers livelihoods.

The Strategy identifies MAIFS's mission as:

"to enable and facilitate the advancement of agriculture and the agri-business sector for improved food security and safety in line with requirements for sustainable development, with support from national service providers and regional stakeholders."

and sets its vision as :

"An integrated development to build vibrant non-sugar agriculture and agri-business sectors that utilise natural resources sustainably, contribute significantly to national food security and safety, empower producers to higher productivity, and enhance the welfare of the farming community."

The overall goal is to raise the national food security level by maintaining self-sufficiency in those agricultural products where it is possible and by generating a significant, concomitant increase in local production of others. This should be achieved through a shift to sustainable agricultural practices and using methods of production and protection that are eco-friendly but conducive to safer and better human nutrition.

In line with Government's vision for bio-food, bio-farming including permaculture and other variants will be promoted. This would require a drastic change in farmers' mindset vis-à-vis agro-chemicals. The following measures are proposed:

- Sensitisation of the public on the importance of consuming bio-food, and valuing the difference;
- Development of bio-production protocols;
- Establishment of dedicated bio-farming zones, and the relevant conditions to be imposed on land use and crop management;
- Training of farmers in production of bio-food production;
- Introduction of a bio-farming certificate /label to encourage bio-food production.

Non-sugar crops

The non-sugar crops sub-sector covers foodcrops, fruits and ornamentals and is driven mainly by 8,000 small growers and 375 hydroponic producers. Close to 100% self-sufficiency is achieved for fresh vegetables and tropical fruits, except for off-season imports of selected vegetables such as potato, onion and garlic.

For foodcrop production, the shift towards bio-farming will ensure the production of safe and quality food, with standards and norms defined.

- Incentives will encourage the adoption of sustainable practices; clustering of farms; exploitation of abandoned land; agri-business ventures in processing food for local and export market; cross-border investment;
- R&D in new technologies to increase land productivity and sustainable production and ensure food and nutrition security; biotechnology and biological inputs in production systems; tools to address labour shortage, improve post-harvest life and minimise food wastage; addressing climate change mitigation and adaptation;
- Technology exchange, capacity building and effective information and communication management; support to agro-entrepreneurs through training to identify potential agri-business and its feasibility; educating farmers about climate change and coping strategies;
- Strengthening of marketing and market information services to the farming community;
- Promotion of value chain approach, with participation of private sector and governance by public body; and
- Capacity building for adaptation to Climate Change.

Tea is attracting renewed interest. Fresh tea plantations will be supported through release of State Lands, nursery space for plantlets, and extension support to growers. A contract-growing scheme will connect growers, processors and promoters.

Production of flowers and ornamentals meet local requirements, with anthurium and orchids also for export. Demand is growing for cut roses, anthurium, gerbera, chrysanthemum and gladiolus. Growers will be encouraged to start production on abandoned sugarcane lands, with facilities to set up nurseries, greenhouses and shadehouses, and for the purchase of tissue-cultured plantlets.

Fruit production consists of pineapple, banana, papaya, passion-fruit and the seasonal litchi and mango. Pineapple, litchi and passion-fruit hold potential for export and processing for value addition. Some fruits are also imported, consisting mainly of temperate fruits to meet consumer preferences. In support of fruit production:

- the anti-bird net scheme will be maintained to prevent fruit damage by bats and birds;
- fiscal incentives will promote the export of fresh litchi to non-traditional and emerging markets (Dubai, East Europe, Russia, China, India); and
- growers who are adopting self-assessment guides will be assisted to upgrade their production system for Global GAP certification.

Besides, the fruit production base will be diversified with encouragement to produce pitaya, breadfruit, emerging fruits (Lemon, Avocado, Longan and Atemoya) and those under-utilised and lesser-known local fruit species.

Medicinal plants have now grown beyond backyards, and offer new opportunities for commercial production, processing and marketing. Some production is already on-going, but there is still room for growth.

With regard to marketing of fruits and vegetables, MAIFS will set up a National Wholesale Market to improve market efficiency and ensure better transparency. The National Wholesale Market will be managed by AMB.

To facilitate access to planting materials, agro-entrepreneurs and the corporate sector will be encouraged to undertake the production of Quality Declared Seeds and planting materials for orchard and ornamental crops.

In support of agro-processing and value-addition, an Agro-processing Park will be set up with the required facilities (buildings, equipment, mentoring, advisory services, financial services).

Livestock

The Livestock sub-sector has made little progress in recent years, mainly because of high costs of production, limited access to land and breeding animals, lack of an organised market structure, and difficulties to comply with environmental regulations. Emerging issues relate to competition from

cheap imports, high cost of quality inputs and the increasing consumer concern over food safety and animal welfare.

Nevertheless, production levels for poultry, goat/mutton, pork and rabbit reflect a satisfactory measure of self-sufficiency. More effort is needed to raise self-sufficiency for milk and beef. The high start-up cost can be a deterrent. Raising of small stock (duck, turkey, rabbit..) will thus be encouraged. In that context, turkey will present an opportunity for diversification once the teething problems of crossing parent stock is resolved. Opportunities also exist for agro-processing and value addition.

To achieve better efficiency and effectiveness in serving the small breeders, support services will be brought together for research, extension, training and veterinary health care. To relieve pressure on the veterinary services, para-veterinary services will be introduced and farmers will be trained in basic veterinary care and first-aid for livestock. They will also be sensitised over climate change issues in livestock rearing, and introduced to adaptation, mitigation and coping strategies,

Access to feed, fodder and breeding animals will be facilitated, and additional livestock zones set up for farmers operating in clusters.

For marketing, a new slaughterhouse will be set up. A Trade and Marketing Bureau will encourage farmers to choose formal marketing channels, and thereby help combat illegal slaughter. For local stock, a match-making service will be run by FAREI to link sellers to buyers and save productive animals from slaughter. A Livestock Fair will be organised annually. The Bureau will advocate for the services of a livestock carrier and associated logistics to facilitate the import of live animals for slaughter as well as weaner cattle.

With regard to biosafety, good hygiene practices, eco-friendly approaches and safety measures will be enforced by a 'Police Agricole', and a programme for certification introduced. A package will be developed to advance bio-farming, complete with local standards, incentives for producers and education of consumers over the merits of bio-products.

Forestry

Our forests are invaluable assets harbouring a rich biodiversity, and they protect our watersheds and environmentally sensitive areas. They need to be protected from degradation, conserved and further enhanced. Given their new roles in mitigating climate change impacts, management will aim at increasing our tree cover, and will favour non-consumptive uses and those activities that are sustainable, less destructive and more rewarding in the long term.

Thus, a tree planting programme is scheduled to increase tree cover throughout the island; existing legislation and policies will be reviewed to increase tree and forest protection; special care will be taken of environmentally-sensitive areas such as watershed and steep slopes; biodiversity and ecosystem services will be enhanced; and the general public will be educated on the importance and value of the trees and forests.

Biodiversity

Invasive alien species are a major cause of bio-diversity loss. A comprehensive programme will therefore be implemented for their control. In addition, a revised National Biodiversity Strategy and Action Plan (NBSAP) will be prepared for biodiversity conservation and sustainable use, which will include mainstreaming its implementation in development frameworks and the valuation of ecosystem services.

Agro-biodiversity has special significance for the enhancement of productivity in crops and livestock and as a source of natural resistance to pests and diseases. As such, it can support the drive for bio-farming and food security, more so under threat of climate change. Adequate resources will be devoted to advance on-going conservation efforts for both plant and livestock genetic resources.

Climate change

Agriculture is highly vulnerable to climate extremes and climate variability, which results in lower productivity, crop loss or crop failure. These affect production, prices and farmers' livelihoods adversely, and will eventually accentuate our food insecurity. However, agriculture has also the potential to adapt and mitigate climate change impacts via the practice of Climate-Smart Agriculture.

Accordingly, a Climate Change Working Group will be set at FAREI for concerted actions and to interface with other agencies responsible for Climate Change. Its first task will be to undertake a detailed survey of climate impacts, vulnerabilities and coping measures as well as ways to improve usage of climate information and forecasts.

Information

The Agricultural Production & Market Information System (APMIS) will be upgraded to capitalise on novel communication tools, namely with data capture at field level using mobile devices and developing decision-support tools for field officers to advise farmers and entrepreneurs. Besides, it will be adapted to fit with the forthcoming National Wholesale Market.

There is no estimate of post-harvest losses or food wastage in our agricultural value chains. Similarly, little information is available on the socio-economic status, income, household food security and welfare of small farmers. These new information needs will henceforth be addressed.

A long overdue Census of Agriculture was run in 2014 following the previous one in 1940, and will provide a useful baseline to measure progress. A consolidated report will be available early in 2016. It would be useful to compare its data with those from current statistics derived largely from administrative reports. The next one should follow systematically in ten years, and an update should be run in between.

Land Management

Unutilised lands represent a waste of valuable resources and a missed potential for novel initiatives. To assist the conservation and optimal utilisation of our limited fertile lands, a Land Bank will be organised to monitor land use and land use changes. It will also assist MAIFS to manage more effectively land settlements and other leased areas to ensure compliance with the provisions of lease agreements. For these, effective use will be made of facilities available for Remote Sensing and GIS once they are set in working order.

Research

The investment in crop and livestock research must be maintained. Research will now have to consider sustainability issues, climate-smart practices and higher food safety standards when deciding its priorities and later when evaluating options for the solution of field problems. Biofarming will require special attention along all its dimensions.

It is imperative also that the Animal Health research sections at FAREI be fully staffed.

Advisory services

Small-holder farmers and agro-entrepreneurs require advisory services on a regular basis to progress and stay competitive. FAREI's extension services, model farms and Training School are deployed to that effect. However, the 'one size fits all' approach must now make way for customised advisory services, which suit innovative and business-oriented farmers better. Training will extend beyond the traditional themes into entrepreneurship, climate-smart practices, traceability, food safety and quality, post-harvest management, MauriGAP and global GAP certification amongst others. The Open and Distance Learning (ODL) tools recently mastered will be deployed for the benefit of crop and livestock farmers.

FAREI's efforts to enlist more women and youth in agriculture have been consistent over the years, with agro-processing for women and backyard gardening and rearing of small livestock for youth. These programmes will now be refined to motivate women and youth into real business operations.

Institutional reforms

At institutional level, major changes are anticipated with the conversion of the Agricultural Services into a Directorate which will focus on policy formulation, control and regulatory functions. The transition will be overseen by a Re-organisation Committee of key stakeholders to ensure no disruption in the supply of essential services and inputs to the farming community.

The AMB will continue with its mission but will broaden the scope of its product range, diversify its sources of supply and extend its outlets across the country. It will in addition manage the facilities at the forthcoming National Wholesale Market.

More generally, in order to improve management of institutions, this Plan suggests a Service Improvement Plan for key services to farmers and the public. A consolidated database of farmers and service-users is also proposed to facilitate access to information between institutions.

In addition, it suggests the adoption of Results-Based Management with pre-defined Monitoring and Evaluation Plans to make service providers more focused on priorities and more accountable for results.

Legislation

To provide an up-to-date and effective legal framework in support of development, concerns over food safety and bio-safety, the new roles of forests and the drive for more sustainable farming, the legal framework needs to be refreshed.

Priority ones include:

- a review of the NAPRO Act 2013 to enable new tea producers to operate and trade on the local market and consider licensing of producers in speciality areas;
- a review of the Chemical Fertilisers Control Act 1980 to extend control to new forms of fertilizers, composts, inoculants and growth promoters;
- a proposal to extend the Dangerous Chemicals Control Act 2004 to cover the import, trade and usage of alternative pest control products such as bio-pesticides, sprout inhibitors and ripeners, and to provide for enforcement;
- new legislation for Organic Agriculture /bio-farming so as to build the institutional framework and the appropriate inspection systems;
- revision of the Animal Diseases Act 1925 in the light of a gap analysis by the OIE and to cover production in addition to health aspects;
- revision of the Artificial Insemination of Animals (Control) Act 1946 for extending the practice of artificial insemination to other species and its delivery by private sector entrepreneurs;
- changes to the Veterinary Council Act 1991 to allow the delivery of basic animal care by para-veterinarians and livestock producers; and
- amendment to Forests and Reserves Act and Shooting and Fishing Lease Act to improve oversight of private forest land; stiffen penalties for offences on Reserves and State forest land; and protect wetlands and biodiversity-rich areas.

Collaborative links

Agriculture-Mauritius has international and regional partners. These links will be strengthened to advance a number of schemes among which the Seeds Regulations and the development of Mauritius as a Seed Hub in the region (FAO and IFAD, SADC); the development of an Action Plan for conservation of freshwater biodiversity (IOC/EU); the improvement of veterinary services (OIE); improving the quality and availability of surveillance and other animal resources information in the country (AU-IBAR); the drafting of the CAADP Compact to reduce poverty and enhance food and nutrition (CAADP); and with (EDES-COLEACP) to enhance food safety via an efficient sanitary and phytosanitary control system.

Finally, this document describes a framework for implementation of the Plan, including a high-level Steering Committee to be established under the MAIFS to review progress and evaluation reports, and provide guidance to MAIFS accordingly.

1. INTRODUCTION

1.1 Overview of Agriculture

Over the years, the agricultural sector has played a pivotal, economic role and served as a driver in the development of Mauritius. Since the early 1970s however, the contribution of agricultural production to Gross Domestic Product (GDP) has been declining steadily from around 30% to only 3.4% in 2013, largely as a result of the successful diversification of the economy into the manufacturing and services sectors. Out of these 3.4%, some 2.2% are generated by the sugar sub-sector. Nonetheless, the sector still plays a vital, multi-functional role within the economy. It contributes significantly to GDP in absolute terms, and has significant economic, social and environmental impacts. In addition, agriculture provides direct employment to some 44,200 persons.

Because of its geographic location and the variety of micro-climates, Mauritius can produce a wide range of crops and livestock although its agriculture is dominated by sugar-cane cultivation. Thus, nearly 54,000 ha of agricultural land were devoted to sugar cane production in 2013, with about 8,200 ha under food crops and some 700 ha under tea. Incidentally, 2 ha of tobacco were also produced, but this commodity has now been phased out completely. But Mauritius is a net food importer, with imports close to 77% of its food requirements. Indeed, imported agricultural products were valued at MUR 36.4 billion compared just over MUR 23.6 billion for exports. Main items imported include wheat, rice, oil, fresh fruits, meat and milk. Over the last 5 years, this gap has been rising, indicating an increasing dependency on imported food.

Agricultural production activities are undertaken mainly by the corporate sector and a large number of small producers. Some 8,000 small farmers operate in the crop sector cultivating food-crops on holdings averaging 0.25 ha, and a small number are now growing fruits and flowers for export markets. Some have embarked on vertical integration into food processing to add value to their produce. Around 5,000 are active in the livestock sector producing milk and meat. While the corporate sector is heavily involved in the sugar sector, it has diversified its portfolio to cover food crops, venison, poultry, animal feed and processed milk products. It is also estimated that around 50% of agricultural production comes from the corporate sector.

Government of Mauritius and all the stakeholders in the agriculture sector have identified key areas needing urgent attention in order to boost the sector. These factors include but are not limited to the following:

- Increase investment in modern and innovative agricultural practices;
- Promote sustainable agricultural growth;
- Improve agricultural diversification and productivity to ensure further food security;
- Empower individuals further, particularly the youth and women, to undertake agricultural activities; and
- Strengthen agricultural exports, research and development, and capacity building.

1.2 Non-sugar crop sub-sector

1.2.1 Food crops

Food crop production is dominated by small scale farming and covers a wide range of crops including potatoes, onion, tomatoes, chillies, crucifers, cucurbits, leafy vegetables, garlic and ginger which are cultivated on commercial scale whereas fruits mainly come from backyard production. Although there are a few irrigated networks, food-crop production continues to be largely rain-fed resulting in surplus vegetable production during the winter months and a shortage in the summer months. Over the last decade, production of selected crops namely tomato, green pepper and cucumber have started under soil-less, protected structures. There is also growing interest for mushroom production.

Generally, some 8,000 small producers cultivating about 8,200 hectares of land produce on average some 110,000 tonnes of food crops annually, and there is no shortage of fresh vegetables as such on the local market. Except in cases of drought, cyclones and heavy rains, production amply satisfies the local consumption.

However, Mauritius imports all its requirement for its main staples, namely some 166,000 tonnes of wheat and 66,000 tonnes of rice. A limited quantity of rice is now produced for the niche market of low-glycemic-index rice for local market and export, while wheat production is still at pilot project stage.

1.2.2 Fruit crops

Fruit production which consists of mainly banana, pineapple, and seasonal fruits such as litchi and mangoes is estimated at 42,660 tonnes annually, over an equivalent of 3,065 ha of land. Fruits are produced mainly in backyards. Moreover, there is some corporate sector involvement in the production of pitaya, litchi, jujube and citrus.

Among the backyard fruits, litchi has achieved some prominence. Exports draw heavily on backyard production and some existing or newly-established orchards. Potential exists for other under exploited local fruits such as papaya, passion-fruit, star-fruit and guava for the fresh market or for processing.

1.2.3 Ornamentals

The ornamental sector now regroups around 100 producers, nursery operators and landscape designers exploiting 90 to 100 ha of agricultural land, with some 30 engaged in anthurium production. The main ornamentals currently being grown are anthurium, rose, gerbera, chrysanthemum and orchids. Anthurium dominates the production followed by rose and gerbera. Chrysanthemum and orchids are being produced in small quantities. In recent years, producers have been diversifying towards cut roses for the local market.

1.2.4 Tea

Since the 1990's the area under production has wound down from 3,028 ha due to lack of competitiveness and quality for the export market, to reach 672 ha for season 2013/2014. Additional reasons for the decline in tea cultivation are the ageing workforce and climatic factors; old tea plantations and lack of seedlings for their maintenance. There were around 1,338 registered tea growers in 2013 and 3 major tea factories in the country. Although some tea is imported to satisfy consumer demand, most of the tea consumed is produced locally. However, some niche export markets have emerged for the local black tea in countries such as Australia, France, Japan, Mayotte, Reunion, South Africa, Switzerland and United Kingdom.

1.3 Livestock sub-sector

Livestock production is undertaken by some 5,000 farmers mainly in cattle, goat, sheep, pig, deer, and poultry farming. Milk and dairy products are also an important component of this sub-sector. The livestock population was estimated in 2014 to comprise of 6,000 cattle, 26,500 goats, 2,000 sheep, 65,000 deer, 17,500 pigs and 2,000 rabbits. These are produced under a variety of systems ranging from backyards to semi-intensive, commercial intensive, open range and intensive feedlots. There is also a small component in the livestock sector comprising of apiculture, i.e. honey production of some 35 tonnes annually from about 240 bee-keepers.

1.3.1 Cattle

The cattle population is estimated to around 6,000 heads. Local production in 2014 stood at 89.9 tonnes of meat and 5 million litres of milk. Mauritius has its own indigenous breed known as Creole breed, also known as Vache Creole, characterised by white colour, absence of hump and its polledness; and best categorised as dual-purpose, used for milk and meat production. But the current cattle population is made up mostly of cross-breds between the indigenous Creole and exotic breeds such as Friesian and the recently introduced Jersey.

1.3.1.1 Dairying

The local dairy sector produces mainly fresh milk for direct consumption. Fresh milk production is quite limited, with annual production at about 5 million litres. This represents merely 4% of the overall country's needs for milk and milk by-products.

Most farms are small (up to 20 heads) with animals reared in the backyard, in total confinement and stall-fed system under the cut-and-carry system whereby fodder is collected by roadsides, forests or

marginal lands. The system is a low-input-low-output system of production. Small-holder dairy farmers sell their milk mostly at farm gate directly to consumers and intermediaries. A few sell their milk to private companies, who then pasteurise the milk and sell it in milk pouches to shops and supermarkets.

However, two large intensive farms have started since 2009 with over 100 heads, operating with modern, technical management. Milk is either sold to a processing plant or sold as pasteurized milk, fresh cream and ice cream.

One company recently tried marketing UHT-treated milk in tetra-pack, but the project has not taken off.

1.3.1.2 Beef

The beef sector may be categorised as fattening of calves from dairy farms or fattening of imported animals or from beef-type breeding farms. Beef meat is either from local animals (mainly Friesian and Creole, Brahford or crosses) or imported Zebu types from Rodrigues, South Africa, Kenya and Australia. Beef is consumed by about 48% of the local population and is marketed as fresh, chilled, frozen or processed meat. Fresh beef meat is from both local and imported animals and processed bovine meat (including buffalo) are purchased mainly from Australia, South Africa and India.

1.3.2 Goat & Sheep

Around 29,500 goats and sheep are reared for meat. Based solely on animals slaughtered at the abattoir, production in 2014 was estimated at 28.1 tonnes. This is mainly a part-time activity, with a wide range of farm sizes, the rearing system and management levels practiced on the farms. While a few farms carry more than 100 heads, most are small with less than 20 heads. In the common rearing system, practiced mostly by the small to medium farms, the animals are raised in backyards, in total confinement and stall-fed. The system is characterized by the cut-and-carry system whereby fodder is collected by roadsides, forests or marginal lands. On medium to large farms, animals are a semi-confined system with grazing in marginal lands as well as stall-feeding and feed supplementation. Goat meat is consumed by all ethnical groups, and demand peaks during the end of year festivities and other celebrations.

1.3.3 Pig

A total of some 17,500 heads are raised by 450 primary producers in the pork industry, with more than 90% of them engaged in both fattening and breeding, 8% in fattening only and 2% in breeding only. Most primary producers operate a low external input system mainly in backyard in the rural and coastal regions. For health and environmental reasons, many had to be relocated to specialised zones, namely at St Martin & Bassin Requin. The Census of 2008 reported that 75% operate on a full-time basis. A few large breeders operate on an intensive, professional basis. Following an outbreak of the African Swine Fever in 2007, various initiatives were taken to boost this sector, more farmers operating sub-urban areas were relocated in these zones, fresh animals introduced, infrastructure upgraded and some farmers were encouraged to specialise in pig reproduction farms.

The pig sector production mainly pork as fresh meat. About 8500 pigs with a total carcass weight of 557 tonnes were slaughtered at the Central Abattoir in 2014, and the country is practically self-sufficient in fresh pork. Around 25% of the local production is used for processing. Nonetheless, in 2013 about 850 tonnes of choice cuts were imported for processing as well as 1,200 tonnes of pre-processed pork.

1.3.4 Poultry and eggs

1.3.4.1 Poultry

The livestock sector in Mauritius is dominated by poultry (broiler chicken and eggs) for which self-sufficiency has been reached since a few decades. Poultry (meat) production stands at 47,000 tonnes annually, with 65% being sold as frozen (whole carcasses and cuts) and the difference as fresh produce. About 85% of the poultry meat is presently produced by four industrial farms, 10% by small commercial farms, and around 5% by family (backyard) producers. There is now a flourishing broiler production industry along with a relatively insignificant traditional, backyard production of indigenous chicken. Lately, production has started for 'poulet fermier' under range systems.

1.3.4.2 Eggs

Egg production is undertaken by some 250 operators rearing around 950,000 layers and producing around 145 million eggs. The small scale farmers rearing less than 5,000 layers account for around 15% of the total eggs produced. One vertically integrated company supplies more than 40% of the eggs produced and is also supplying liquid eggs.

1.3.5 Venison

Deer farming has established itself as a full-fledged economic activity and a major contributor to the livestock sector. Venison has become the source of red meat with the decline of local cattle production. Most of the venison comes from around 58 chassés, and the total land area occupied by the deer sector amounts to 25,000 ha of which 15,000 ha are privately-owned land with a population of 35,000 heads and 10,000 ha on leased State forest land carrying 20,000 heads. Some 10,000 heads are also reared in intensive farms on 1,000 ha. The total production of venison is marketed without problems on the local market with a per capita consumption standing at 0.5 kg/annum for 2014. Most of the deer meat is put on the market exclusively during hunting season, which runs from June to September. About 15 tonnes of good quality meat are produced during the closed season from intensive farms, with carcasses being processed at the Central Abattoir and marketed by a private marketing company on behalf of Mauritius Deer Farming Cooperative Society.

1.4 Agro-Processing

Agro-processing addresses the seasonal nature and the variability of local vegetable and fruit production as well as their perishability. It stimulates demand for primary agricultural products to be processed. It adds value by vertically integrating primary production and minimises post-harvest losses and food wastage; reduces marketing risks; and impacts positively on farm incomes, employment and foreign exchange earnings. Agro-processing provides a business opportunity that contributes to improving human nutrition; generating employment and mainstreaming women in the agricultural sector. There exist a certain number of agro-processing activities in both crops and livestock sub-sectors.

1.4.1 Crop sub-sector

- Pickles (fruits and vegetables) in oil and spices; pickle in brine; sweet and sour; paste (e.g. chilli paste, fruit and chilli paste, garlic paste, etc); sauces and chutney.
- Sugar-based products: crystallised fruits and vegetables, candied fruits, jam and jelly, marmalade; fruit paste/fruit leather; juice; cordial and syrup.
- Canning: fruit in syrup; puree and canned vegetables.
- Deep-fried products: chips (banana, potato, cassava, taro, etc.)
- Flour: breadfruit, banana, etc.
- Dehydrated products/powder: spices and herbs; fruits/vegetables.
- Frozen: Frozen fruits and vegetables; Frozen snacks & Frozen herbs
- Minimal processing: minimally processed fruits and vegetables (whole/ diced/sliced) using different types of packaging e.g. cling film, punnets, vacuum packed)

1.4.2 Livestock sub-sector

- Dairy products: Sago milk; 'fenousse'; paneer; yogurt; cheese (includes feta, mozzarella); pasteurised milk and ice-cream.
- Meat products: sausages/ burgers, polony, ham, salami, nuggets, sticks, poultry/pig marinated cuts.

1.4.3 Opportunities in Agro-Processing

There is a need to identify markets where Mauritius has comparative advantage such as niche markets for ethnic /exotic foods to capitalise on the wide variety of exotic primary commodities available, many of which are amenable to agro-processing. The process of making jams, jellies, fruit

nectars and other beverages is well established but now requires up-scaling, innovation and improvement in packaging and marketing to tap new markets.

The tourism industry represents an interesting market perspective where tourists are exposed to local processed products and can publicise them once at home.

- Algae-based processed product /local small onion are niche markets that can be exploited with the proper investment/support.
- The banana tree and fruit have potential for added-value in handicraft besides chips and other processed products.
- The local onion 'toupie' variety has promising potential as processed product.
- Dehydrated tropical fruits have good potential both for the local and export sectors. In the local market it can address nutritional problem of low consumption of fruits among our youth.

1.4.4 Agro-Processing Resource Center

In line with the Ministry's thrust towards agro industry development, FAREI has developed a R&D programme dedicated to agro-processing. Recognising the need for small entrepreneurs to test their ideas/products before investing heavily in production equipment, FAREI has set up a fully-equipped resource center to service the needs of entrepreneurs interested in the agro processing and value addition sector. The center is also used for conducted tours and serves as a model agro-processing unit. It is operational since July 2009.

1.5 Forestry and Biodiversity

1.5.1 Forestry

The total extent of forest cover in Mauritius was estimated at 47,103 ha representing about 25% of the total land area in 2014. Our forests have suffered from indiscriminate clearing for agriculture, timber production, sugar cane plantation, human settlement and other infrastructures. The native forests which originally covered most of the island have almost completely disappeared except for a few inaccessible areas, which have been spared the onslaught of deforestation. These areas have now been converted to national parks, nature reserves or other protected areas. Large areas of degraded, upland native forests have since been re-afforested with fast growing exotics that form the bulk of the forest plantations. The upland plantations produce limited timber but have a vital role in soil conservation and for water conservation both for agriculture and domestic purposes. Their roles in mitigating the effects of climate change are now being realised.

There are only two types of forest ownership in Mauritius: public and private. Around 22,103 ha are state-owned and 25,000 ha are on private lands, out of which 6,540 ha are legally protected as Mountain and River Reserves. There are thus more forests under private ownership but the growing stock is more in the state-owned forest plantations than in the privately-owned forests.

With regard to forests products, Mauritius imports most of its hardwood requirements. In 2014, Mauritius imports of forestry and logging products represented MUR 150 million. Local forests supplied only 5-10% of local demand for utility timber. Besides wood, there were non-wood products consisting mainly of venison, feral monkeys, fruits, fibres and medicinal plants. Due to limited land resources, timber exploitation in Mauritius is set to be phased out, and the focus shifted to conservation, non-consumptive uses and sustainable forest management.

1.5.2 Biodiversity

Mauritius has a rich biodiversity in its flora and fauna. It has an equally rich coastal zone of wetlands and mangroves, lagoon corals and fringing coral reefs; and its rivers and streams, several man-made reservoirs, natural lakes and marshy areas. However, Mauritius has one of the most threatened floras in the world.

It has a diverse marine environment with its different reef types and species of corals, species of fish among which many are of economic importance, shrimps, octopus, mussels, oysters, barnacles and clams, marine algae, marine mammals and some dolphins. Biodiversity is here under pressure, and fishing reserves and marine parks have been established for conservation purposes. Biodiversity is

under threat in Mauritius and its offshore islets, but the marine eco-system around St Brandon is still virtually intact.

Wetlands provide many ecosystem services but they also are subject to pressure from development projects, and are thus closely monitored.

1.5.3 Agro-biodiversity

Agro-biodiversity is linked to production and food security. But emphasis on high-yielding varieties and breeds has narrowed the genetic base and may pose serious threat to long-term food security, more so under climatic change. Therefore since 1995 the Plant Genetic Resources Unit of the Agricultural Services started the collection and conservation of local germplasm for food and agriculture, local fruits, medicinal plants and ornamentals, and wild relatives of cultivated crops in its seed-bank and field gene-bank. By way of animal genetic resources, FAREI holds only a small herd of Creole cattle.

1.5.4 Recent developments in the non-sugar sector

With regard to the non-sugar sector, the Food Security Strategic Plan 2013-2015 was prepared as a continuation to the previous strategic plans to improve the level of national self-sufficiency in various commodities, promote exports and create new opportunities for farmers, entrepreneurs and rural families to increase farm income and productivity, to provide safe, sufficient and nutritious food while conserving the natural biodiversity and mindful of the environment. The expected outcome was increased local production of all non-sugar crops [food crops, vegetables, fruits] by 1% to 2 % annually to meet increasing demand from Mauritian consumers and visiting tourists. For livestock, the aim was to increased local production of meat, milk and derived products by up to 5 % annually.

1.5.4.1 Non-sugar crops

A number of schemes were implemented for the non-sugar crop sector as follows :

- 1. Rain Water Harvesting Scheme**

This scheme encouraged crop/livestock farmers to harvest rainwater to optimize use of water resources. It provided partial funding as grant for the acquisition of appropriate equipment to collect, store and supply rainwater on-farm for agricultural production solely, and light structures for collection of rain-water.

- 2. Sheltered Farming Scheme**

It encouraged farmers to shift from traditional open-field cultivation to sheltered farming so as to help them mitigate the effect of adverse climatic conditions as well as to improve their production capacity as well as the quality of farm produce.

- 3. Crop Nursery (Curing Scheme)**

This scheme aimed at assisting vegetable growers to improve their capacity for production of planting materials and to enhance the quality of harvested produce by providing partial funding as grant for the construction of nursery-cum-curing units.

- 4. Purchase of Agricultural/ Processing Equipment**

The Purchase of Agricultural/ Processing Equipment encouraged planters to acquire farm machinery/ equipment to mechanise their production systems and also to venture in food-processing or other activities for value-addition.

- 5. Seed Potato/ Onion/Garlic Purchase Scheme**

The seed purchase scheme was meant for small planters to help them meet the significant, high financial cost involved in the purchase of seeds for potato, onion and garlic.

- 6. Agricultural Calamities Solidarity Scheme (ACASS)**

This scheme ensured the sustainability of small farmers by mitigating the effects of crop losses/death of animals caused due to natural calamities

7. **Compost Subsidy Scheme**

The objective of this scheme was to assist farmers in reducing production costs and the use of chemical fertilizers with a view to simultaneously improving the quality of their land, and hence promote sustainable agriculture. Locally-produced organic compost (about one tonne/arpent/year) was granted free-of-charge to registered planters under this scheme.

8. **Freight Rebate Scheme**

The objective was to promote the export of various agricultural products grown in Mauritius and increase local production of specific fruits, vegetables and flowers.

9. **Fruit Protection Scheme**

This scheme aims at addressing the bat problem and to ensure adequate protection of harvests for seasonal fruits.

10. **Family Farming Micro-Project Scheme**

This scheme was to encourage families/households to develop and sustain production of vegetable, fruit and other horticultural products with minimal processing. However, due to administrative issues early during its implementation, the scheme was abandoned.

Outcome :

- Total Food crop Production in year 2014: 117, 000 tonnes
- Self-sufficient in all the major fresh vegetables and local fruits.
- Self-sufficiency in onion has been around 40% in 2014
- Potato self-sufficiency has reached 88% in 2014
- Garlic self-sufficiency is at 18% in 2014

Despite these schemes, some constraints still prevailed, namely the unavailability of agricultural land, high input prices, labour scarcity and the high cost of production. To go around these problems and move forward, the proposals were to release land for agricultural development; to implement the incentive schemes under the Food Security Programme; to promote good agricultural practices (GAP) and the adoption of new technology packages to ensure quality of produce; and to promote of value-addition through agro-processing.

1.5.4.2 Livestock

Among the schemes set out to boost the livestock sector and ensure a better measure of self-sufficiency were the following:

1. **Cattle Breeding Scheme** to help livestock breeders to purchase heifer, pregnant heifer or cows of genetically improved breeds.
2. **Goat Multiplier Farms Scheme** to enable breeders to purchase goats/sheep of improved breeds.
3. **Bee keeping Scheme:** delivery of training to interested parties in bee-keeping, complemented with the provision of starter kits including queen bees.
4. **Pasture Development Scheme** to encourages the production of good quality fodder for proper feeding of livestock.
5. **Upgrading of Livestock Farm** to assist breeders in upgrading of livestock farms and pig sites.
6. **Scheme for Purchase of Equipment**, meant to help breeders acquire farm equipment including agro-processing equipment to modernise their production system.
7. **Family Farming Micro-Project Scheme**

This scheme was meant to encourage families/households to develop and sustain production of small farm animals. However, due to administrative issues early during its implementation, the scheme was abandoned.

8. Pre-Market Test & Certification Scheme

Under this scheme, 100% subsidy is granted to registered agro-processing enterprises for the conduct of the Pre-Market Test and Certification of their products at the Government Analyst Division. The aim was to assist agro-processing enterprises in tapping additional and more profitable market for their products, as well as ensuring the delivery of safe food to customers.

Outcome:

- Dairy: an estimated annual milk production of 5.9 Million litres, up from 3.3 M in 2008.
- Beef: Production increased from 27 tonnes in 2008 to 180 tonnes in 2012.
- Poultry meat increased from 42,000 tonnes in 2008 to 47,500, and exporting.
- Goat meat production from 18.7 tonnes to 36 tonnes.
- Pork went up from 330 to 652 tonnes in 2012.

Here again, some constraints persisted, namely a decreasing livestock population, limited access to costly inputs, poor animal husbandry practices; and an ageing and diminishing labour force.

Work-arounds to move forward included:

- Developing more effective technologies and farming practices through applied and adaptive research in nutrition, breeding, reproduction, fodder/pasture and animal waste management to increase productivity;
- Empowering farmers to carry out production, value-addition and marketing of their own products as a profitable venture; and
- Promoting the production of better quality and safer products for consumers.

2. STRATEGIC PLAN MAIFS FOR 2016 - 2020

2.1 Preamble

This Plan follows earlier planning efforts, and has benefited from the experience gained and lessons learned from previous Non-Sugar Sector Strategic Plans for 2003-2007 and 2008-2015, the Food Security Fund Strategic Plans for 2008-2011 and 2013-2015, the Mauritius CAADP Stocktaking Report (2015) and the Government Programme 2015-2019.

Initially, at the request of the MAIFS, key institutions under its mandate in the non-sugar sector were invited to prepare strategic plans for their respective sector with the participation of stakeholders. Meetings were thus held and discussions at this first stage led eventually to the drafting of four comprehensive documents for the sectors of Crop Production, Livestock Production, Forestry and Biodiversity.

In a second stage, the available documents were examined to analyse for strengths, weaknesses, opportunities and threats in these key sectors. Commodities were reviewed with regard to their current production level as well as their potential to ensure better food security and meet the demand for safe food. Priorities and key issues were flagged. Gaps in coverage were also identified and cross-cutting issues singled out for further information and analysis. Cross-cutting issues are indeed essential to achieve commodity priorities and targets.

As a last step, the Strategic Plan was concluded with the integration of all these elements. This was followed by setting a general policy orientation for agriculture, and working out the definition of the mission and vision of the MAIFS, and summarising the key issues to be addressed, and detailing a number of areas for intervention. These are embedded in strategies highlighted for each sub-sector in the following chapters.

The Plan is inspired broadly by the Government Programme 2015-2019, and therefore borrows its general orientations, calling for:

- Re-engineering of the agricultural sector into an Agro Industry with a view to (a) increasing the efficiency and profitability of the sector, (b) rendering it more attractive for young entrepreneurs (c) increasing its contribution to Economic Growth (d) developing it as an engine for jobs and wealth creation hence ensuring its sustainability and improving livelihoods;
- Developing Eco-tourism as a new economic pillar for job creation and wealth generation;
- Promoting the development of sustainable agriculture and organic farming through environment-friendly production techniques and efficient management of natural resources;
- Boosting up food production including via cross-border initiatives to ensure food security and improve livelihood of farmers;
- Establishing an Agricultural Risk Management Framework to increase the resilience of farmers to address their vulnerability to climate changes;
- Encouraging value addition of agricultural products for domestic, regional and international markets;
- Ensuring continuous capacity-building programs across the sector;
- Strengthening the position of women, youth and vulnerable groups in the value-chains; and
- Integrating nutrition in agricultural investment plans.

The Plan has been formulated to take Mauritius to a higher level of food security whilst respecting the need for safe food and better nutrition of the population. It takes on board the need for sustainable agricultural development in a climate-friendly mode as well as safeguarding farmers livelihoods. However, the various sub-sector strategies proposed will need to be operationalised as early as possible to enable prompt implementation and to allow ample time for achieving the 2020 targets. The relevant implementing agencies will need to develop a corresponding work plan covering the duration of the Plan which will be complemented with detailed work programmes on an annual basis as the Plan unfolds.

In view of the wide range of agricultural commodities covered and their specifics, this Strategic Plan will present each subsector in detail separately in the following chapters and thereafter cover cross-cutting issues such as institutional arrangements and reforms, climate change issues, gender and youth.

2.2 Overall policy

The general policy orientation may be defined as follows:

“Strengthening food security and sustainable agricultural development through improvements in productivity, provision of safe food, increased contribution of agriculture in the economy, more awareness and interest for agriculture for business and employment, and sustainable use of natural and genetic resources.”

2.3 Vision and Mission of MAIFS

The vision of the MAIFS is :

“An integrated development to build vibrant non-sugar agriculture and agri-business sectors that utilise natural resources sustainably, contribute significantly to national food security and safety, empower producers to higher productivity, and enhance the welfare of the farming community”

The mission is:

“to enable and facilitate the advancement of agriculture and the agri-business sector for improved food security and safety in line with requirements for sustainable development, with support from national service providers and regional stakeholders”.

2.4 Overall Goal

The overall agricultural development goal is to raise the national food security level by maintaining self-sufficiency in those agricultural products whenever possible and by generating a significant, concomitant increase in local production of others. This should be achieved through a shift to sustainable agricultural practices and eco-friendly methods of production and protection conducive to safer and better human nutrition.

Besides providing a regulatory framework and creating an enabling policy for the practice of bio-farming, institutions will need to uplift their methods and tools to support the producers and help them through this transformation away from high-external-input production systems. This will require appropriate technologies and sound management practices for both production, processing and marketing to make them competitive.

Specific objectives shall be :

- i. To improve the level of food security in the country
- ii. To provide safe and quality food for the local population and for export;
- iii. To improve the contribution of agriculture to national economic and social development;
- iv. To promote the sustainable management of land, water and other natural resources;
- v. To build capacity for enabling farmers to face climate change and move on to ‘climate-smart agriculture’.
- vi. To implement institutional reforms for service delivery and to empower farmers towards entrepreneurship and professionalism.

These will be adapted and developed further for each sub-sector in coming chapters.

2.5 Expected results to be achieved

The Ministry of Agro-Industry and Food Security expects to contribute to a number of results through the implementation of the Strategic Plan, namely:

- Reduce the annual deficit in the trade balance between exports and imports of agricultural and food products;

- Increase in the number of legislative provisions related to Good Agricultural Practices, and the sustainable management of natural resources;
- Increase administrative and legislative provisions for application of the Value Chain Approach; traceability of farm produce; marketing of fresh produce; certification for bio-farming; at least 3 value chains fully operational.
- Ensure at least 50% of farm production proceeds from bio-farming;
- A comprehensive GHG Inventory completed in the agricultural sector;
- A Climate Change Working Group in place and operational at FAREI;
- Climate Change adaptation and mitigation strategies developed;
- Number of individual farmers switching to IPM;
- Number of area-wide IPM cases implemented;
- The socio-economic living conditions of farmers is documented;
- A framework for risk management at farmer level is developed;
- An increase in food exports volume but without returns due to non-compliance to safety and quality norms;
- An increase in forest area (tree cover) by at least 5%.

2.6 Some principles to guide the plan forward

On the basis of submissions for the different sub-sectors, certain common conditions have emerged that would be necessary in order to overcome challenges and respond to crises that may arise.

- Recognition of the essential responsibilities of the public sector such as for policy and strategy formulation; the creation of an enabling environment for the farming community (including the corporate sector) to flourish; ensuring all-stakeholder partnerships (including community participation); monitoring, evaluation and feedback; preparation of relevant plans for certification, regulation and the maintenance of standards.
- An insistence on sound environmental practices, promotion of bio-diversity and sustainable use of natural resources to ensure the livelihoods of future generations of farmers; and in particular to deploy innovative tools such as Geographic Information System (GIS) and Remote Sensing for effective land use and management.
- An enhanced role for entrepreneurs in agri-business via the provision of agricultural inputs, technical advice, information and marketing services, with public sector responsibility for oversight, control and regulation.
- Recognition of the need for restructuring supporting institutions and their working methods to be more responsive and farmer-friendly, so that the Ministry achieves its goals.
- Recognition that all the key agencies under MAIFS work for a common goal, and hence the need for enhanced cooperation of all to achieve this goal.
- The necessity to develop the capacity of institutions and increase their readiness for partnerships and collaboration among all relevant stakeholders.
- The need to re-consider the approach to knowledge and technology transfer in order to reflect the specificities of business-oriented agricultural entrepreneurs as opposed to the traditional producer, and to capitalise on internet and mobile technologies. A value-chain approach with due facilitation and governance is highly desirable.
- Need for better and more timely agricultural statistics not limited to historical data, but providing current and forecast information for decision-making by both farmers and policy-makers, and extending beyond into food and nutrition balance sheets. Socio-economic status, poverty and welfare of farmers are significant information gaps to be filled.

- A genuine effort to be made to re-visit farmers organisations and their operation, and re-engineer them into professionally-run, productive and efficient entities.

Should the necessary effort and commitment be put in by implementing institutions and stakeholders, there is no doubt that the Plan will deliver to expectations by 2020.

3. NON- SUGAR CROPS

3.1 Introduction

The physical area under food crops is estimated at around 4,300 ha with an overall production cropped area of 8,200 ha as a result of multiple-cropping. Mauritius has always been a net food importing country being heavily reliant on imports of staple food – rice, wheat flour, edible oil, milk and meat, temperate fruits. The total imports of agricultural and food products amounted to MUR 36.4 billion in 2013, up 5.3% as compared to 2012.

Since the 1990's considerable effort has been made to produce selected food crops to meet our requirements and ensure some measure of self-sufficiency using an import-substitution strategy. The main crops cultivated are potato, tomato, onion, chilli, crucifers, cucurbits, green vegetables, fruits such as litchi, banana and pineapple averaging 112,800 tonnes of fresh vegetables and fruits annually. Close to 100% self-sufficiency in fresh vegetables and tropical fruits has thus been achieved. Nonetheless, seasonal imports of some vegetables including potato and onion are required to meet local consumption during the off-season and following calamities. Thus, self-sufficiency in potato is around 76%, onion is 40% and Garlic at 18%. Along with 100% imports for staples, these add to our food insecurity. With climate change scenarios envisaged in coming decades, adverse climatic events are more likely and will eventually pose additional risks for local production.

In Mauritius, the food crop sector has been meeting the food consumption requirements of the population with an overall self-sufficiency of 23%. The small-holder food crops sector involves around 8,000 growers holding plots of 0.2-1 ha, while the corporate sector operates larger areas of 20-25 ha. There are in addition some 375 hydroponic farmers with a production area of 27.3 ha.

Fruit production consists mainly of pineapple, banana, papaya, passion fruit and seasonal fruits such as litchi and mangoes. There is potential for production of pineapple, litchi and passion-fruit for the local market as well as for export and processing for value addition. Imports are nonetheless high for fresh fruits of temperate origin to meet consumer preferences.

Flowers and ornamentals production meets local requirements. Anthurium blooms and orchids also contributed to export of about 12.58 M blooms annually. Diversification towards cut/stem rose, gerbera, chrysanthemum and gladiolus for the local market is growing. The annual value of ornamental production is estimated at MUR 231 M.

3.2 A SWOT of the Non-Sugar crops sub-sector

This sub-sector provides opportunities for income generation, job creation, economic development, household food security and poverty alleviation. However, its sustainable expansion and intensification has met with a growing number of challenges. This calls for a comprehensive approach to address technological, environmental, input supply and natural resource challenges. The bio-farming approach to production, consumption, processing, storage, recycling and use of biological resources holds good potential.

The present analysis provides an insight in terms of its strength, weaknesses, opportunities and likely threats.

Strengths

1. Government initiatives to enable development through agri-business promotion and SME development; setting up of a national wholesale market; and a wide array of supporting institutions.
2. A high level of self-sufficiency in fresh vegetable production based on an experienced farming community and interest of the private sector; and
3. An island-wide coverage for research and extension, manned by qualified professionals as well as an operational Agricultural Production and Market Information System (APMIS).

Weaknesses

1. Limited land availability; small size of land holdings debar from economies of scale for mechanisation; and the absence of Specialised Agricultural Production Areas dedicated to organic or agro-processing;
2. Relatively low farm productivity associated with limited uptake of modern management techniques; an over-reliance on manual methods and agro-chemicals; low level of investment, and unwillingness to take risks; farmers' resistance to cluster to gain on economies of scale and productivity; no entrepreneurial aptitudes for vertical integration up the value chain;
3. High cost of labour and agricultural inputs; weak supply chains in terms of lack of planting material, storage infrastructure and agri-service support; shortage of skilled and unskilled labour;
4. Unprepared to face Climate Change;
5. Unstructured marketing; absence of norms and standards, and enforcement thereof;
6. Weak co-ordination and linkage between institutions, farmers and other stakeholders;
7. Inadequate investment in research, intensive technologies and capacity development;
8. Unattractive to youth, and an ageing farming community.

Opportunities

1. Useful option for diversification on abandoned sugarcane lands;
2. Emergence of investors in the agro-industrial sector; and agri-business opportunities developing out of economic integration and free trade areas in the region e.g. SADC, IOC, AU and COMESA;
3. Growing awareness for eco-friendly agriculture, Green Agriculture and Natural/ Bio-Farming; possibilities under fair-trade label and other niche markets;
4. Growing demand for variety in diets, nutritious food out of health concerns; innovative and convenience products to match modern lifestyle of the population; and a growing tourism industry;
5. Potential for clustering to benefit from economies of scale.

Threats

1. Ageing farming community and the new generation unwilling to embark in agriculture;
2. Inheritance issues and ever-decreasing size of land holdings; and conversion for urban development;
3. Dominance of market intermediaries;
4. Competition from cheaper imports from large-scale producing countries;
5. Adverse agro-climatic conditions, climate change risks and natural disasters; increasing threats from introduction of new pests and diseases; and lack of insurance;
6. Competition for resources (human, land and water) from other economic sectors.

3.3 Key strategic orientations

Based on the analysis above, some key orientations emerge for the food crop sector as follows:

1. A shift towards bio-farming for safe and quality food, with standards and norms; preferably in Clusters /Special Agricultural Production Areas;
2. Provision of incentives for the adoption of sustainable production practices; clustering; exploitation of abandoned land; agri-business ventures in processing food for local and export market; cross-border investment;
3. R&D in new technologies to increase land productivity and sustainable production and ensure food and nutrition security; biotechnology and biological inputs in production systems; tools to

address labour shortage, improve post-harvest life and minimise food wastage; addressing climate change mitigation and adaptation;

4. Technology exchange, capacity building and effective information and communication management; support to agro-entrepreneurs through training to identify potential agri-business and its feasibility; educating farmers about climate change and coping strategies;
5. Strengthening of marketing and market information services to the farming community;
6. Promotion of value chain approach, with participation of private sector and governance by public body;
7. Need to build capacity for adaptation to Climate Change.

3.4 Strategies and Intervention Areas

The objective is to provide a strategic direction to stakeholders, taking into account the demand for quality and safe food, implications of climate change, depleting resources and the need for sustainability among others. These warrant a fresh and innovative approach towards growth in agricultural production and food security so that this sub-sector continues to contribute to the economy, the economic empowerment of the farming community and poverty reduction. Thus the specific objective of this plan is to enhance the role of Agriculture by:

- Improving standards of living of the population and meeting the increasing demand for better quality and safer food products and bio-food;
- Enhancing the level of self-sufficiency in a number of selected agricultural products;
- Developing a modern agricultural sector with a radical change towards a bio-economy with the emphasis towards promoting green growth;
- Empowering the agricultural community economically and technically especially the younger, skilled generation by providing opportunities and appropriate support to enable them to emerge as agricultural entrepreneurs;
- Building capacity for adaptation to Climate Change;
- Sharpening our export potential with quality and diversified products taking into account the trade liberalisation, globalisation and cross-border initiatives;
- Seizing opportunities in the region to develop Mauritius into an agro-business hub;
- Promoting intensive agricultural production within a sustainable framework;
- Providing technical, market information and advisory services;
- Promoting value addition of primary farm produce; and
- Promoting commodity value chain and agribusiness development.

Opportunities have therefore to be created for farmers, entrepreneurs and rural families to generate revenue in new ways while providing safe and nutritious food and conserving the natural biodiversity. The strategic plan addresses priority food crops, vegetables, and fruits along their value chain and aligns institutions and stakeholders with the government policies in the following areas:

- Development of sustainable production systems;
- Professional development of producers and the youth;
- Improvement in efficient use of resources;
- Development of service providers for the farming community;
- Value chain and agri-business development; and
- Institutional strengthening/re-organization/networking.
- Institutions building capacity to promote bio-farming and relevant certification.

Based on the above, the following strategic interventions have been retained in priority:

Intervention 1: Enhancing food and nutrition security

The recent food crisis highlighted the country's vulnerability and the need for a renewed impetus to meet the challenges of food and nutrition security. The main actions identified to realise this intervention are:

- i. Institutional strengthening for R&D;
- ii. Enhancing self-sufficiency in selected agricultural products;
- iii. Optimal land resource allocation; and
- iv. Diversification away from sugarcane .

Intervention 2: Improving competitiveness

To realise food security objectives, productivity will have to be improved. Actions proposed are:

- i. Introduction and transfer of innovative and relevant technologies;
- ii. Promoting agri-business for service provision to the farming community;
- iii. Capacity building of farmers towards a knowledge-based agriculture;
- iv. Exploiting novel Information Communication Technology (ICT) to enhance agricultural extension outreach/training/information; and
- v. Modernisation of the sector (including farm mechanization).

Intervention 3: Promoting food safety and efficient and sustainable production practices/system

To meet the Government's vision of a green economy and ensuring safe food within a sustainable context, the following actions are proposed:

- i. Motivating farmers to shift towards sustainable production systems;
- ii. R&D in biotechnology and renewable biological alternatives to agro chemicals;
- iii. Improving efficiency in natural resource use;
- iv. Creating specific Special Agricultural Production Areas (zoning) for bio-farming;
- v. Implementing certification scheme for Green Agriculture/ Bio-Farming; and
- vi. Implementing a Food Safety Framework with appropriate regulatory system and enforcement.

In that context, Good Agricultural Practices (GAP) are being promoted. Meeting the GLOBALGAP criteria can be a daunting task for local producers. Thus, MauriGAP has been introduced with its Level 1 (Basic) and Level 2 (Advanced) to serve as steps towards Level 3 which corresponds to GLOBALGAP certification.

The Mauritius Standard Bureau has published in October 2015 a Mauritian Standard on 'Specification for Good Agricultural Practices for Crop Production – MauriGAP – Part 1 – Basic requirements'. It establishes basic requirements for sustainable crop production, focusing on Good Agricultural Practices for food safety, environmental stewardship and farmer / worker welfare. It applies to open and protected field cultivation as well as to hydroponics. It will be used for inspection and certification purposes of the crop production process.

Research is under way in collaboration with CIRAD and international research organisations. A sensitisation campaign has already been initiated. Further work is needed to develop the legal framework and a certification scheme. Technical assistance is being sought from FAO.

Intervention 4: Promoting strong value chains

A Value Chain Analysis (VCA) gives an indication of proposals for intervention along the crop filière. For example, strategic interventions may be required for seed production, mechanization to reduce cost of production and labour shortages; minimise loss and food wastage; pre- and post-harvest practices to improve quality, marketing and value addition. Thus, local seed production under the Quality Declared Seed scheme will be encouraged to meet the demand for vegetable seeds

and reduce our dependence on imports. Similarly, VCA's for pineapple, litchi and ornamentals are potential applications. Strong value chains can enhance the collaboration of the producers, private sector and service-providers. Their smooth functioning needs initially to be facilitated, with provision of governance of the value chain assured by public bodies.

Actions proposed are:

- i. Promoting value chain approach;
- ii. Adding value to primary produce;
- iii. Creating dedicated agro processing parks;
- iv. Minimising wastage along the value chain;
- v. Promoting emergence of agri-business networks / clusters;
- vi. Setting up of a regulatory framework e.g. for seeds; and
- vii. Strengthening of the Agricultural Production and Market Information Service.

Intervention 5: Developing resilience to Climate Change

As a SIDS, the country's agricultural sector is particularly vulnerable to climate change (CC), variability and its impacts. Small farmers who are already resource-poor are especially vulnerable. There is a need to strengthen resilience, enhance adaptation capacity and provide coping strategies. Actions proposed are:

- i. Institutional adaptation in terms of the setting up of a focal point for climate change and sustainable agricultural research and development at FAREI;
- ii. Implementing the national climate change adaptation policy;
- iii. Development of practices aimed at increasing the resilience of agricultural systems to climate change;
- iv. Data and information collection, early warning and dissemination; and
- v. Evaluating alternative land use options harnessing biomass / solar energy.

Intervention 6: Exploiting agri-business potentials of international, regional markets and free trade areas

With the country's limited land area, small population and market, the growth of the agricultural sector will depend on its capacity to harness agri-business potential abroad. This will imply:

- i. Sharpening our competitive edge on the export front with quality and diversified products;
- ii. Developing/promoting initiatives for export of agricultural produce; and
- iii. Providing an enabling environment for quality production.

Intervention 7: Promoting the emergence of agro-entrepreneurs

The Government Program 2015-2019 lays emphasis on structuring innovation and growth of the economy through Small and Medium Enterprise (SMEs) and in its Budget 2015-2016, Government set its goal to make the SME sector the backbone of our economy. In line with this goal, the following actions are envisaged:

- i. Supporting agro-entrepreneurship, in particular among the youth and women;
- ii. Providing start-up incentives to youth embarking in agri-business;
- iii. Providing training, incubation facilities and mentoring support for start-ups; and
- iv. Raising the status of agricultural jobs and activities through formal award courses.

Intervention 8: Creating an enabling environment and options for risk management

Agricultural activity is subject to a wide range of risks among which market price volatility, vagaries of weather, and theft. The realisation of these risks leads to reduced farm incomes, constrains future investment and growth of existing farm businesses, and can deter newcomers in the sector. To

achieve the objectives and targets set under the Plan, it is important to establish an enabling environment that is conducive to farmers' engagement.

To that effect, the following actions are proposed:

- i. Enhancing farmers' quality of life through better welfare programmes: pension, crop insurance scheme, health insurance;
- ii. Providing a full-fledged plan to support existing farmers and attract new entrants/workers and investors in the sector through financial incentives (part funding schemes), fiscal measures like tax holiday, discounted rates for land preparation at the SPMPC, enlarging the product base for VAT refund, access to leasing facilities to acquire equipment;
- iii. Promoting overseas exchange programs between farmers to accelerate adoption of new techniques and technologies; and
- iv. Working out a strategy to reduce theft in farmers' fields.

Intervention 9: Facilitating the emergence of Agri-Business Clusters

This new idea involves facilitating the setting-up and operation of Agri-Business Clusters to group farmers, traders, processors, import dealers and business development service providers. Training and mentoring services. It implies agribusiness support (business plan, feasibility, marketing), value addition; market links; and contracting services. The support package will comprise of:

- i. Motivation and canvassing potential candidates;
- ii. Defining codes of practice for the cluster;
- iii. Facilitating the linkages between actors within the cluster;
- iv. Ensuring good governance in its operation.

Such approach will also enable access to fair-trade initiatives which can provide additional revenue and new market opportunities to small producers. It also helps to professionalise the small producers through enhanced capacity development programmes. The above approach fits major commodities identified for our agri-food sector. This will lead farming towards agri-business attitudes and encourage them to invest in production, post-harvest, storage, processing and marketing.

Intervention 10: Research and Development

Research and Development is the driving force for innovation and for addressing new challenges to meet the current demands of farmers and consumers. It aims at improving sustainable food crop production through the development of cost effective production and protection methods. New technologies and capacity building are essential for sustaining production in a fast-changing environment, but must now fulfil conditions for compatibility with health, safety and environment norms. Besides, research needs to coordinate with extensionists and farmers so as to optimise on resources, avoid duplication and receive feedback on farmers' response to proposed technologies.

The R&D programme will focus on the following:

- i. Introduction / evaluation of new germplasm (for increased yield and quality, better adaptability, extension of season, resistance to pests and diseases);
- ii. Development of better performing novel varieties;
- iii. Productivity and quality improvement (through hydroponics, sheltered farming, novel technologies, mechanisation);
- iv. Pre- and post-harvest management and agro-processing;
- v. Minimisation of food waste along the chain.
- vi. Optimal resources use (land, water, seeds);
- vii. Sustainable agriculture and bio-farming;
- viii. Sustainable pest and disease management;
- ix. Climate change resilience; and

- x. Agricultural biotechnology.

3.5 Commodities

The situation is described in detail below for main food crop commodities, rice and tea, fruit crops and ornamentals with respect to their potential to maintain and where possible to improve our food self-sufficiency. The basis idea is to consolidate production for those crops where we are already self-sufficient, and extend their production to meet the increasing demand if resources allow. Where imports are significant, effort will be made to increase production as long as local producers are competitive. There will be some crops, however, where we do not have comparative advantage for technical and/or cost reasons such as our staples and pulses.

Several speciality crops raised under hydroponics or protected cultivation such as Salad Tomato, English Cucumber, Sweet Pepper, Melon and salad crops also offer room for growth.

Table 1 summarises some realistic but nonetheless challenging targets for 2020.

Table 1: 2020 targets for selected crops with potential for increased production

Crop	unit	from	to	% increase	% increased self-sufficiency
Crucifers	tonnes	6,625	8,645	30.5%	
Carrot	tonnes	4,952	6,500	31.3%	
Chillies	tonnes	1,488	1,900	27.7%	
Cucurbits	tonnes	28,263	31,734	12.3%	
Garlic	tonnes	62	300	383.9%	from 9 to 15%
Mushroom	tonnes	22	60	172.7%	
Onion	tonnes	7,000	8,500	21.4%	from 38 to 50%**
Potato	tonnes	19,000	21,600	13.7%	from 76 to 80%**
Tomato	tonnes	11,200	15,000	33.9%	
Crops under Hydroponics					
Salad Tomato	tonnes	3,750	4,267	13.8%	
Sweet Pepper	tonnes	580	658	13.4%	
Melon	tonnes	102	116	13.7%	
English Cucumber	M units	2.6	3	15.4%	
Lettuce	M heads	0.9	1	11.1%	

** These targets are realistic in view of seasonality and limits on storage life of these perishable products. Higher targets are realisable only if opportunities open up for export or processing.

3.5.1 Potato

Potato is a seasonal crop with 2 season plantations during a year. During 2010-2014, production averaged to 19,000 tonnes representing a self-sufficiency of 76% and the demand for ware potato averaged to 25,000 tonnes and is expected to reach 27,000 tonnes by 2020. From 2009 to 2014, imports of processed potato have increased by 77% indicating a shift in consumption pattern towards value-added products mainly in the form of frozen French fries and potato chips. This is expected to increase with the development of the fast food and tourism industry. However, the current demand of seed potato for the local seed industry is only 2,500 tonnes, and the rest (75%) is imported for MUR 60 million.

To attain a self-sufficiency ratio of 80% representing around 21,600 tonnes by year 2020, the following accompanying measures are proposed:

- i. Maintain the Potato Boost up Scheme to assist planters in purchasing seed potatoes;
- ii. Provide financial incentives for the purchase of machinery to mechanise field operations at planting, ridging and harvesting to reduce cost of production;

- iii. Maintain seed quality testing until its replacement by a certification scheme under the Seed Act;
- iv. Train entrepreneurs in agro-processing;
- v. Provide additional storage facility at AMB;
- vi. Encourage and improve seed and ware potato production efficiency;
- vii. Introduce and promote varieties with better yields due to increasing cost of production and varieties suitable for new markets such as chips and baby potato;
- viii. Make use of abandoned sugar cane lands for potato cultivation;
- ix. Additional 200 ha of land to be made available during the 2nd season plantation; and
- x. Develop new varieties which can be cultivated late in the 2nd season for extended production.

3.5.2 Garlic

Garlic is widely used in the local cuisine but is also valued for its anti-cholesterol effect and is used in traditional medicine. Over the last three decades, the average annual production has decreased from around 200 tonnes during the 1980s' to only 24 tonnes in 2010.

With the decision to revamp the sector, a Garlic Seed Purchase Scheme was introduced in 2011. The area under garlic rose to 27 ha in 2014 with a production of 162 tonnes representing a self-sufficiency of around 9%. Around 1,683 tonnes of garlic for a value of about MUR 75 M was imported mainly from China in 2014. Garlic has thus a good potential for import substitution.

To achieve a production of 300 tonnes (representing around 15% self-sufficiency) by 2020, the following support measures are proposed:

- i. Improve support measures via the Garlic Seed Purchase Scheme, Garlic Seed Scheme and the guaranteed price of table garlic;
- ii. Provide financial facilities for the purchase of machinery for land preparation, planting;
- iii. Train entrepreneurs in agro-processing;
- iv. Develop market for value-added products such as garlic pickles, flakes, paste and powder;
- v. Provide additional and better adapted storage facilities;
- vi. Improve extension support from plantation to storage through information and regular pest control;
- vii. Develop a protocol for the plantation of different varieties of garlic adapted to various regions;
- viii. Construct better stores for garlic seeds;
- ix. Provide incentives to specialised growers for larger production scale and efficiency; and
- x. Increase land under garlic so as to attain the targeted 15% self-sufficiency in year 2020.

3.5.3 Onion

Over the last five years, the annual production of onion ranged from 5,200 to 7,700 tonnes on 230 – 350 ha of land. Such a production represents a self-sufficiency of around 38%. The area under onion production is at present around 282 ha. The annual consumption turns around 17,000 tonnes with a per capita consumption of around 13 kg while the import bill amounted to MUR 201 M in 2014.

To achieve a production of 8,500 tonnes representing around 50% self-sufficiency by 2020, the following support measures are proposed:

- i. Provision of financial incentives to planters for the purchase of machinery for land preparation, sowing, harvesting and irrigation;
- ii. Maintain support measures in terms of the Onion Booster Scheme to encourage production;

- iii. Develop market opportunities for high value-added products such as onion pickles, flakes, and powder;
- iv. Provide additional storage facilities at AMB based on targeted production;
- v. Additional 125 ha of land to be released so as to attain 50% self-sufficiency in year 2020; and
- vi. Encourage seed production locally, and improve production efficiency on a larger scale through a specialised entity or dedicated entrepreneurs.

3.5.4 Legumes and pulses

During 2010-2014, the average annual production of snap beans and cowpeas (fresh) was 1,500 tonnes and 1,400 tonnes respectively. Pea production has significantly declined from 20 tonnes in 2007 to only 2 in 2013 due to its being highly labour-intensive.

Around 14,000 tonnes of pulses for a value of MUR 412 M was imported in 2014 and which consisted of lentils (3,500 tonnes), split peas (3,400 tonnes) and lima beans (3,000 tonnes).

Production of fresh mature/ripe pods has better prospects than pulses as it fetches better market price, consumer preference and acceptability. Pulse production is also not competitive given low price of imported pulse. Four bush lima bean varieties were released in 2013 and 4 pole lima bean varieties in 2015. The area under lima bean production was expected to reach 1.5 ha in 2015 with an estimated yield of 15 tonnes. Two promising bean varieties namely Rosa and Red Pearl were released in 2013 and a production of 8-10 tonnes over an area of one ha was expected in 2015. The promotion of leguminous crops (high in protein) is desirable in the context of nutrition security.

To maintain and increase legume/pulse production, the following support measures are proposed:

- i. Promote large scale production of newly-released pulse varieties;
- ii. Develop market and agro-processing opportunities; and
- iii. Provide support schemes for seed purchase and seed storage.

3.5.5 Tomato

During 2010-2014, the annual production of tomato varied from 11,000-12,000 tonnes. For same period, the importation of processed tomato (mainly for ketchup/purée) increased from 4,422 to 8,320 tonnes for a CIF value of MUR 278 M in 2014. Local tomato production for the agro-processing industry has so far been found not to be competitive due to an unstable supply to the markets.

In 2013, around 11,200 tonnes of tomato was produced over an area of 816 ha. To cater for fresh market and raw material for processing at cottage level, a production target of 15,000 tonnes is set by 2020.

The following measures are proposed:

- i. Train small entrepreneurs in agro-processing;
- ii. Provide support measures to household to set up small scale agro-processing unit to reduce losses, ensure price stabilisation and cater for shortages due to adverse climatic conditions;
- iii. Financial incentives for the purchase of plastic crates;
- iv. Training in pre and post-harvest practices to minimise post-harvest losses; and
- v. Training and campaign on the use of lures/ traps against pests.

3.5.6 Chillies

Over the last 5 years, the average production of chillies was 1,378 tonnes. An additional 495 tonnes was imported in the form of dried, powdered and processed chilli sauce. On the other hand, locally processed chilli in the form of pickles, sauce and preserved in brine is currently exported to niche market. This points to the potential for transformation and value addition of chilli both for the local and export market.

In 2013, about 1,488 tonnes of chilli was produced over an area of 275 ha. A production target up to 1,900 tonnes is set by 2020 and the following measures are proposed:

- i. Train local entrepreneurs in agro processing; and
- ii. Provide support measures in terms of schemes for entrepreneurs to set up small scale agro-processing units.

3.5.7 Carrot

About 4,952 tonnes of carrot were produced in 2013. It is consumed fresh or in semi processed form, which is imported frozen. The area under carrot cultivation over the years has more or less stagnated. Fresh carrot is imported during drought, cyclone or flooding when production is affected and supply to the market is low. In 2014, 74 tonnes of fresh or chilled carrots was imported for a CIF value of MUR 2.7 M.

A target production of 6,500 tonnes is set for 2020 and the following measures are proposed:

- i. Mechanisation of bed formation and sowing activities;
- ii. Improvement of pre- and post-harvest practices to extend shelf life; and
- iii. Financial incentives for the purchase of bed-formers and sowing machines.

3.5.8 Crucifers

The main crucifers comprises of cauliflower, cabbage and broccoli with average annual production of 4,700 tonnes of cabbage, 1,700 tonnes of cauliflower and 225 tonnes of broccoli over the last 5 years. The country is self-sufficient in cruciferous crops, except during periods of cyclones when importation is required to cater for the demand. In 2014, the total importation of crucifers was 68 tonnes.

Over the last 5 years, the area under cabbage has been stable while for broccoli there is an increase of 14 ha and 55 ha for cauliflower. The production of all these crucifers is expected to rise by 2020 to 5,770 tonnes for cabbage, 2,580 tonnes for cauliflower and 365 tonnes for broccoli. To achieve these targets, the following measures are proposed:

- i. Promoting cultivation of cauliflower and broccoli for off-season production; and
- ii. Introduction of pre- and post-harvest practices to increase the shelf life.

3.5.9 Cucurbits

Cucurbits constitute of the following cultivated species such as pumpkin, cucumber, squash, chayote (chouchou), calabash, zucchini, ridge gourd, bitter gourd and snake gourd. Production of these cucurbits for 2014 amounted to 28,263 tonnes from an area of 2,294 ha.

Being self-sufficient in most of the species, only a small volume of squash, cucumber and zucchini is imported to cater primarily for the hotel industry.

The production of these cucurbits is estimated to reach 31,734 tonnes by 2020. To that effect, the following measures are proposed:

- i. Improving cultural practices (trellising);
- ii. Promoting of pre and post-harvest practices to increase the shelf life; and
- iii. Promoting protected cultivation.

3.5.10 Mushroom

There is an increasing demand for fresh mushroom and processed products such as mushroom pickles, spreads, ketch-up and pre-cooked products such as mushroom burgers and meat balls. About 1,446 tonnes of mushrooms (fresh/chilled or processed) were imported in 2013.

Mushroom production (*Pleurotus*) is estimated to be around 22 tonnes in 2013. A production target of 60 tonnes is set for 2020, and the following measures proposed:

- i. Provision of incentives to growers for the purchase of equipment for mushroom production;

- ii. Promotion of alternative substrates to bagasse for mushroom production; and
- iii. Diversification of mushroom production by promoting shitake.

3.5.11 Crops under Hydroponics

Following the introduction of the Biotechnology Loan Scheme in 1999, the number of promoters has increased from 6 exploiting 25 hydroponics units to around 365 now operating 615 units over an area of 26.7 ha in 2014 for the production of vegetables and ornamentals. The estimated production is 3,750 tonnes of salad tomato, 580 tonnes of sweet pepper, 2.6 M units of green cucumber, 102 tonnes of melon and 0.9 M units of lettuce heads.

This production technique has enabled the supply of quality products and a decrease in their importation. It also demonstrates the high rate of return when investing in this technology. The area under hydroponic cultivation is expected to increase by 0.5 ha each year. The annual projected production will reach around 4,267 tonnes of salad tomato, 658 tonnes of sweet pepper, 116 tonnes of melon, 3 M units of English cucumber, and 1 M heads of lettuce by 2020.

The following measures are proposed:

- i. Maintaining financial incentives to growers for setting up hydroponic units;
- ii. Clustering of producers for improved marketing;
- iii. Training of skilled workers for this sector; and
- iv. Development of low-cost structures using bamboo.

3.5.12 Tea

The tea sector in 2013 consisted of a total of 672 ha under cultivation, compared to 713 ha in 2009. Some 442 ha are cultivated by small-holders (with less than 1 ha) whilst three estates (Bois Chéri, Corson and Chartreuse) occupy a total area of 180 ha. The small-holders comprised of some 1,340 planters (450 metayers, 6 co-operative societies under one federation, and 600 individual planters). Though there is a decrease of 5.7% in the area over last four years, an increase of 4% is noted in the production of green leaves (7,663 tonnes in 2009 compared to 7,981 tonnes in 2013).

The following measures are proposed to support the traditional tea sector:

- i. Training of planters for the setting up of nurseries to raise plantlets for in-filling of fields;
- ii. Support to re-habilitate abandoned tea plantations (drainage system, pruning, termite control); and
- iii. Provision of advisory services for the tea sector (following the closure of the Tea Board).

It must be noted here that tea is currently subject of renewed interest by foreign investors. This presents opportunities to bring back into operation those same tea factories that were closed down in the 90's, thereby generating employment for out-growers and factory operators alike.

However, several strategic issues need to be addressed and steps taken to assist this re-vitalisation of the tea industry and its long term sustainability, as follows:

- i. Increasing production of green tea leaf, notably by enabling new tea producers to operate and trade on the local market, and provision of an estimated 125 hectares of State Lands to establish fresh plantations.
- ii. Establishment of a nursery to produce tea plantlets for in-filling, replacement of old plantations and starting fresh ones.
- iii. Current tea manufacturing technologies must be reviewed, and new technologies developed to improve quality of made tea. Technical expertise will need to be out-sourced or solicited from development partners or through bi-lateral cooperation.
- iv. Extension support to leaf producers for the adoption of sound husbandry practices so they can achieve higher yields and better leaf quality.

- v. A joint venture should be considered with the MAIFS, local tea producers and manufacturers as parties. This is essential on account of the high investment involved in establishing new plantations and nurturing them to profitable production stage. Alternatively, a contract-growing scheme could be put in place linking local tea producers and manufacturers, and overseen by MAIFS to ensure compliance with agreed arrangements and fair terms of trade for all parties.
- vi. By way of encouragement, a special financial support scheme for new tea growers, to assist them with land preparation; procurement of inputs; and subsistence during the early years before their plantation reaches maturity.

3.5.13 Rice

The country has recently started production of rice and rice seeds for commercial purposes. This project initiated by a private promoter concerns the cultivation of hybrid rice varieties. These varieties are high-yielding and high ratooning ability. They carry beneficial traits such as low glycemic index (GI) and have found a niche as health food on the US market. The company aims at scaling up production, but will keep developing rice seeds of high nutritional values meant both for the local and the export markets.

3.5.14 Ornamental sector

Ornamentals grown are anthurium, rose, gerbera, chrysanthemum, orchids, foliage, tropical exotics, gladiolus and liliun. Total acreage cultivated is around 67 ha with anthurium, rose and gerbera being the main crops. Some 10 nurseries are in operation. The anthurium production is geared mainly towards export although there is export potential for foliage and tropical exotics like hanging lobster, strelitzia, ginger torch and alpinia. Flower production can further be expanded with the development of the tourism industry and changes in lifestyle of locals.

To maintain/increase flower production, the following measures are proposed:

- i. Encouraging potential agro-entrepreneurs moving out of sugarcane to embark in commercial flower production;
- ii. Introduction and evaluation of new varieties from certified sources;
- iii. Provision of financial facilities to set up nurseries, greenhouse, shade-house and purchase of planting materials including tissue cultured plantlets;
- iv. Revival of the production of anthurium;
- v. Promotion and training of growers in orchid culture; and
- vi. Facilitating the application for import/export permits (on-line).

3.5.15 Fruits

Lands formerly under sugarcane but now abandoned represents a unique opportunity for the fruit sector to become a new focus for agricultural development, targeting the local and export markets. It represents a diversification opportunity for the sugarcane planters, and can contribute towards the country's food and nutrition security. Fruit production on abandoned sugarcane land will also address environmental issues and assist with soil carbon sequestration.

Fruit production has the potential to be commercially viable without recourse to chemicals and therefore bio-production should be a reasonable aim. Such a development should be encouraged by:

- i. Incentive schemes for new start-ups;
- ii. Allocation of resources for the establishment and management of orchards;
- iii. Stepping up the production of planting materials
- iv. Fine-tuning pre- / post-harvest and agro-processing technologies;
- v. Enhancement of export services (market information, certification, freight facility); and
- vi. Sensitisation of consumers of the value of locally-produced fruits.

3.5.15.1 Pineapple

The area under pineapple cultivation has doubled during the last five years reaching 600 ha in 2013 with a production of 16,000 tonnes. Export peaked to 1,800 tonnes in 2014 for a FOB value of MUR 122.7 M. Abandoned land under sugarcane in Flacq and Pamplemousses districts are increasingly being brought under pineapple cultivation. New markets are emerging in Dubai, East Europe and China to complement the traditional European market. Some farmers and exporters have significantly improved their production and post-harvest practices and are now Global GAP certified. However, cases have been reported of residue levels above MRL for ethephon used for de-greening fruits exported to EU.

The low productivity per unit area (27 tonnes/ha), and an increase to 50 tonnes/ha is realisable through systematic land rotation and the adoption of sustainable practices. To increase production and exports eventually, the following measures are proposed:

- i. Supporting planters adopting self-assessment guides to upgrade their production system for Global GAP certification;
- ii. Discourage de-greening of pine apple in the field so as to maintain the premium nature of locally produced variety, Victoria;
- iii. Creation of pineapple villages in Camp de Masque and Les Mariannes among others, to promote agro-tourism;
- iv. Promotion of green businesses (agro-processing, handicrafts, 'colis cadeau') to create employment for women and youth;
- v. Support measures to farmers moving into organic production in Specialised Zones; and
- vi. Training on flower induction and sensitisation of growers and associated workers on dangers associated with indiscriminate use of ethephon.

3.5.15.2 Litchi

For more than 25 years, Mauritian litchi has been a reference on the European market. Export has for several years been dependent on sulphured litchi from backyard production to target the early season (November) when the price is significantly more remunerative.

During the last ten years, the number of backyard trees has decreased by nearly 50% (40,000 down to 24,000 trees). In contrast, litchi orchards have been established throughout the island. Some 346 planters are now growing litchi trees commercially over an area of 423 ha.

To compete with countries like Madagascar which have economies of scale and low cost of production, Mauritius has diversified from export of sulphured litchi to fresh branched litchi. This has enabled Mauritian litchi to remain competitive until end-December. The export market fluctuates between 250 tonnes and 300 tonnes annually.

For the development of the sector, the following measures are proposed:

- i. Production of planting materials to meet the demand for orchard development initiatives (e.g. new promising variety Yook Ho Pow);
- ii. Maintaining schemes for the purchase of equipment to encourage recycling/composting leaves in commercial orchards;
- iii. Review and maintain the anti-bird net scheme to encourage use of nets to prevent fruit damage by bats and birds;
- iv. Strengthening of Post-Harvest facilities;
- v. Support to planters in adopting self-assessment guides to upgrade their production system for Global GAP certification;
- vi. Fiscal incentives to promote export of fresh litchi to non-traditional and emerging markets (Dubai, East Europe, Russia, China, India); and
- vii. Promoting bio-farming in litchi production.

3.5.15.3 Banana

The area under banana (500 ha) and annual production (10,000 tonnes) has been stable during the last five years. The main challenges are to increase the area under production and productivity to meet increased demand (fresh and processed product for domestic and tourist markets). Furthermore, the issue of fruit quality and safety needs to be addressed urgently, particularly the indiscriminate application of ethephon for ripening of banana.

The following measures are proposed:

- i. Increasing propagation of clean banana planting materials through tissue culture;
- ii. Integration of banana cultivation to fruit orchards to reduce mono crop plantation on marginal lands as a strategy to minimise spread of diseases;
- iii. Provision of schemes to promote the export of Gingely and Mammoul banana to niche markets (fair trade, organic);
- iv. Provision of fiscal incentives for ripening of banana under controlled temperature using ethylene gas to gradually replace ripening using ethephon;
- v. Encouraging entrepreneurs in supply of quality ripened banana as an agri-business; and
- vi. Investigating into banana fibre production for added value.

3.5.15.4 Passion fruit

The cultivation of passion fruit, mainly the purple variety, has increased significantly during the past years to reach 8.36 ha. The crop is well adapted to all agro-climatic zones, and provides an early return on investment. There is a potential for significantly increasing the acreage for the export market in particular.

The following measures are proposed:

- i. Propagation of planting materials for distribution to planters;
- ii. Setting up of scheme for the establishment of plots to offset the costly trellising system;
- iii. Promotion of production clusters to increase export of quality fruits; and
- iv. Integration of passion fruit cultivation in fruit tree orchards to minimise cyclone damage.

3.5.15.5 Papaya

Papaya is a fruit species grown on around 19 ha. It is adapted to local conditions, requires low investment and provides a relatively short payback period. It is proposed that papaya cultivation be integrated in interlines of orchards established in the low-lands.

The following measures are proposed to boost production:

- i. Developing pre- and post-harvest management practices for improved marketability;
- ii. Encourage value addition through processing (small scale enterprises); and
- iii. Step up the rearing of parasitoids and promotion of bio-control for papaya mealy bugs in orchards.

3.5.15.6 Pitaya

Pitaya is a new fruit species recently introduced and its production area is estimated to be 2.73 ha. It adapts well on marginal land, requires low input and has a relatively short pay-back period compared to the majority of perennial fruit species. Its fruit fetches a high price on the local market and there is potential for its export due to its good post-harvest handling characteristics. In support, the following measures are proposed:

- i. Promotion of organic production of pitaya as it can be successfully grown without agro-chemicals;
- ii. Production of pitaya on marginal lands unsuitable for other crops; and

- iii. Release of self-pollinated pitaya to encourage and facilitate its production.

3.5.15.7 Breadfruit

Breadfruit for export has slowly but consistently increased during the last five years to reach 4.67 ha in 2014. A niche market in UK is gradually developing and has the potential to increase further. Actually, breadfruit can be grown with minimum inputs, and production starts as from the third year after planting. Unavailability of planting materials is no more a limiting factor. Breadfruit has the further advantage that it can be grown in an agro-forestry system. Moreover, its high perishability and its seasonality can be addressed through agro processing.

The following measures are proposed:

- i. Sensitising owners of abandoned sugarcane land on potential of breadfruit;
- ii. Value addition to produce gluten free flour for both the local and export niche market;
- iii. Planting in agro-forestry system to boost the supply chain; and
- iv. Provision of schemes to promote bio-production and processing.

3.5.15.8 Mango

Mango, although grown throughout the island, is better adapted to the west and north coasts of Mauritius. There are many varieties with good sensory attributes which have not been exploited commercially. Some have the potential for a niche export markets.

The following measures are proposed:

- i. Encouraging orchard development on abandoned sugarcane lands (west and north coasts);
- ii. Stepping up the supply of planting materials for orchard development;
- iii. Maintaining anti-bird net scheme to prevent fruit damage by bats;
- iv. Develop value addition through processing;
- v. Encouraging rejuvenation of old mango trees for easy management; and
- vi. Stepping up fruit fly control to increase production of quality fruits.

3.5.15.9 Strawberry

Strawberry is a high-value crop, appropriate for production on the central plateau. It is currently grown on 5.0 ha with a potential production of 40 tonnes annually. A day-neutral variety, Agathe, has been established successfully for more than 15 years now.

In support, the following measures are proposed:

- i. Maintaining the importation of cold-stored runners as per demand;
- ii. Promotion of integrated pest and disease management packages to minimise application of pesticides;
- iii. Scheme to support sustainable pest management and improve marketability; and
- iv. Extending financial incentives and anti-bird net schemes for open-field strawberry producers.

3.5.15.10 Emerging fruit species

Lemon, Avocado, Longan and Atemoya are fruits which used to be grown for household consumption but are gradually gaining economic importance as a result of growing demand from the local market and the tourist industry.

The following two measures are proposed:

- i. Increase availability of planting materials for prompt establishment of orchards; and
- ii. Development of pre and post-harvest packages to promote marketability.

3.5.15.11 Underutilised fruit species

There is a wide range of fruit species presently grown in the backyards. These species [jackfruit, grapefruit, sour orange, mulberry, acerola, jambolan (jambelon), starfruit (carambola), bilimbi, rose apple (jamrosat), jambos, water apple (jamalac), guava, sugar apple (ate), bullock's heart (coeur de boeuf), corrosol (sour sop), hog plum (fruit de cythere), loquat (bibasse), eggfruit (lucuma), jujube, surinam cherry (roussaille), tamarind, local prune] can indeed be exploited for the local and the tourist markets.

The above referred fruits can usefully be integrated in an agro-forestry system and can be helpful to reduce erosion, promote bio-diversity and contribute to carbon credits through carbon sequestration. However, they are little known, and would require an information campaign (including schools) to promote their nutritive value, consumption (fresh and processed) and eventually up-scale their production.

3.5.15.12 Medicinal plants

Mauritius has a rich pool of medicinal plants. Unfortunately, it has been under-utilised by the general public and knowledge of their traditional uses is gradually disappearing. However, in recent years they have received research attention which has generated ample documentation on their botany and economic value.

Recent trends show that people are increasingly going back to natural cures, which opens a new avenue for diversification and value addition. Indeed, some herbal tea and medicinal plants are now on produced and processed locally, and commercialised even abroad. Potential thus exists for their exploitation on commercial scale. The preservation of this component of our biodiversity is also necessary.

3.6 Agro-processing

Mauritius has the unique advantage of blending Indian, Chinese, European and African cuisines, which has given rise to commercial products, namely pickles, sweet and sour and sugar-based products such as jam, jelly and marmalade. However, it has to contend with competition from imported products. Locally, there is opportunity for further expansion with the range of fruits and vegetables grown in Mauritius which can be dehydrated, frozen or processed into innovative convenience food. Starchy crops (breadfruit, cassava, sweet potato, taro) can also be converted into flour and sold in speciality/health shops (gluten-free flour).

The sector has potential to create employment and business opportunities for young entrepreneurs and women. This sector can expand the market for primary agricultural produce, and contribute to value addition, and help minimise post-harvest losses and food wastage. It can also contribute to import substitution and increases export earnings.

In that regard, the implementation of the value chain approach can assist the emergence of new agro-entrepreneurs and for the development of innovative products. This new breed of agro-entrepreneurs should nonetheless show professionalism and commitment towards the environment and consumers through adoption of GAP and/or other norms and standards.

Agro-entrepreneurs should be guided towards emerging opportunities and technologies through awareness and sensitisation. Information on new avenues should be more readily accessible by common means (media and internet). However, the biggest challenge faced by agro processing entrepreneurs is their inability to meet the required norms.

The following measures are proposed:

- i. Creation of an Agro-processing Park, complete with buildings, equipment, mentoring, advisory services and financial services, and including incubator facilities to support budding agro-processors;
- ii. Encouraging grouping of operators into clusters to reduce cost of production, improve economies of scale and take advantage of market opportunities including access to new markets. This can improve access to Fair Trade markets while reducing their cost of production and improving economy of scale;

- iii. Support to clusters of entrepreneurs willing to engage in commercial production of convenience food (fresh cuts, minimally processed vegetables and fruits);
- iv. Providing incentive schemes to operators to upgrade their agro-processing operations;
- v. Promoting success stories through reviving the Farmers Excellence Award;
- vi. Support to agro-entrepreneurs through capacity building and incubation facility;
- vii. Providing marketing support for sale of produce; and
- viii. Improving market access through compliance to certification schemes and bar coding.

3.7 Sustainable Agriculture

Food crop production locally heavily relies on the use of agro-chemicals particularly pesticides and fertilisers. Sustainable agriculture is an alternative approach that maximises the reliance on natural, renewable on-farm inputs while ensuring long-term environment protection, health benefits and economic viability.

The Ministry of Agro Industry and Food Security has made provision for a Green Certification Scheme of growers' production through a local standard called MAURIGAP. It is a minimum quality assurance programme that focuses on food safety while ensuring sustainable production practices.

In this context, research is focusing on:

- i. Development of sustainable practices based on resource conservation technologies and meant to optimise use of natural resources (land, water, organic matter);
- ii. Introduction and testing of eco-friendly alternatives to agro-chemicals;
- iii. Integrated Pest and Disease Management including bio-control;
- iv. Development of Integrated Plant Nutrition Systems;
- v. Use of appropriate crop varieties;
- vi. Improved or sustained crop productivity;
- vii. Protecting the natural environment;
- viii. Climate change adaptation and coping strategies; and
- ix. Research on agro-forestry and alternative land-use options such as biomass production for energy.

However, technical solutions are not enough. Farmers will have to be motivated to shift towards sustainable production systems. All the agencies supporting the implementation of the National Climate Change Adaptation policy must be assisted in their endeavour to improve the resilience of small-scale farmers. An enabling environment must therefore be created for institutions and farmers alike. To that effect, the following support measures are proposed:

- i. Maintaining the schemes for the purchase of efficient irrigation system/fertigation equipment/ Rain water harvesting;
- ii. Capacity building and sensitisation of farmers on sustainable agriculture;
- iii. Encouraging the maintenance of long-term soil fertility via improvement in soil microbial life, soil organic carbon, nutrient recycling by making use of bio-fertilisers;
- iv. Conservation and use of local agro-biodiversity/local seed production/plant propagation;
- v. Evaluating alternative land use options such as biomass production for energy; and
- vi. Introducing new techniques such as pollinators in production systems.

3.8 Bio-farming

With the growing concern of consumers over the negative impact of agro chemicals, there is an increasing demand for safe fruits and vegetables. The Government's policy for bio-food production

encourages farmers to avoid recourse to synthetic agro-chemicals and shift to eco-friendly crop production and protection approaches viz. pesticide-free production, bio-farming, zero budget/natural farming and permaculture. In Budget 2015, Government set a target of 50% of local food to be produced according to bio-norms within 5 years. The Government plans to place 100 ha of land at the disposal of planters to establish model bio-farms. This will require a re-orientation of production practices; a drastic change in farmers' mindset vis-à-vis agro-chemicals; and a willingness to act responsibly for the community's benefit.

Since 2014, a national project funded by UNDP is being implemented and 4 workshops have been organised to sensitise farmers on zero-budget/natural farming. Demonstration plots have also been set to demonstrate the use of locally-prepared soil enricher, organic mulch, mixed cropping, use of companion and trap crops, crop rotation and plant-based insecticides/ fungicides in vegetables production.

Furthermore since January 2014, an experiment station of FAREI at Pamplemousses has been converted as a model to showcase production of fruits and vegetables without agro-chemical inputs.

To meet the Government's vision, the following measures are proposed:

- i. Sensitisation of the public on the importance of consuming bio-food, and valuing the difference;
- ii. Development of bio-production protocols.
- iii. Establishment of dedicated bio-farming zones, and the relevant conditions to be imposed on land use and crop management;
- iv. Training of farmers in production of bio-food production;
- v. Provision of support schemes for the purchase of inputs/equipment for bio-farming;
- vi. Promoting markets for produce from fields in the process of conversion to organic;
- vii. Introduction of a bio-farming certificate to encourage bio-food production;
- viii. Review of Dangerous Chemicals Control Act to regulate the import and use of bio-pesticides;
- ix. Review of Chemical Fertilizers Act to regulate the import and use bio-fertilisers and other organic fertilisers, growth promoters and additives such as dyes and colorants; and
- x. Harmonising and standardising procedures for the evaluation of plant protection products, and soil conditioners for use in bio-farming.

3.9 Permaculture

Permaculture is quite prominent among the various forms of sustainable farming. It applies integrated farming practices that are based on principles learned from the study of natural ecosystems. Its key objectives are to bring food production closer to consumers, to restore soil fertility, and to cultivate land in ways that maximise long term productivity, while minimising artificial inputs and effort.

It relies on small-scale, land and energy-efficient, multi-cropping systems, and thereby avoids and reverses the problems caused by modern, intensive agriculture. Permaculture favours the cooperative approach, and build communities around food production. It encourages healthy and sustainable food habits.

In open farming, it favours complex ecosystems of plants and organisms that are virtually self-sustaining. It builds on Nature's adaptability via biodiversity, and relies on mixed cropping and recycling of plant nutrients through composting. Permaculture also embraces closed farming approaches such as planting in containers and using soil-less techniques (hydro and aeroponics).

While it is more complicated to implement, it is relatively easy to manage once established. It requires however an intimate understanding of the eco-system, and small commercial farmers would be faced with a prolonged learning period they can hardly afford. A gradual phase-in may be needed.

3.10 Plant Protection

Agricultural pests and diseases constitute a major constraint to agricultural production under local climatic conditions. Globalisation, increasing tourist traffic and a trend towards open-market access are placing additional pressures on our border control and quarantine services. During the last ten years, 30 new plant pests (14 insect pests and 16 disease organisms) have been detected, and many of them are causing significant losses in horticultural crops namely tomato, banana, papaya and chilli. Furthermore, pest dynamics evolve as a result of climate change, and several outbreaks of existing pests and diseases have been recorded. This has sadly led planters to rely more on chemical pesticides.

To counter these new threats, a surveillance system was established in 2005 for early detection of new pests and diseases, and outbreaks of existing ones for timely intervention by planters. Packages developed for Integrated Pest & Disease Management (IPDM) were disseminated and brought about significant reductions in pesticide use in the cultivation of several horticultural crops, namely cabbage, cucurbits, strawberry and papaya. To assist with rapid plant disease diagnosis, molecular techniques are now being used at FAREI's Plant Pathology Laboratory.

Similarly, biological control was successfully implemented for the control of the papaya mealy bug, an invasive pest detected in 2013. Earlier, bio-control agents were successfully reared in the laboratory and released in farmers' fields for the control of *Plutella* sp. in crucifers and for red spider mites.

Under these circumstances, plant protection is a real challenge. The difficulty is to develop and disseminate effective IPDM packages in a timely manner to reduce farmers' dependence on chemical pesticides in pest and disease management. To that end, the following measures are therefore proposed:

- i. Upgrading FAREI's Entomology Laboratory to increase its capacity for mass production of bio-control agents; and for accreditation to ISO 17025;
- ii. Setting up a Multipurpose Containment Facility (MCF) for containment of genetically modified organisms; investigation of high-risk quarantine materials and pathogen; and speedy introduction, testing, breeding and multiplication of biological control agents.
- iii. Strengthening the surveillance system for timely detection of new pests and diseases, reporting of outbreaks of existing ones; and institutional network for information exchange;
- iv. Application of ICT for rapid communication in pest and disease diagnosis; and maintaining the flash SMS Alert for pest and disease outbreaks;
- v. Maintaining an island-wide integrated fruit fly management programme in cucurbits using eco-friendly techniques (application of protein bait sprays, mass trapping of males and release of sterile flies);
- vi. Capacity building for technical staff on taxonomy of pests and diseases;
- vii. Training planters in pest and disease identification and protection technologies including IPDM packages; and
- viii. Providing support schemes for adoption of eco-friendly technologies and inputs.

3.11 Agricultural Biotechnology

Agricultural biotechnology is an important tool that is already being used for the improvement of crops; rapid disease screening and tissue culture for mass multiplication of disease-free plant materials. Laboratories involved in agricultural biotechnology have been upgraded through the National Agricultural Biotech Laboratory Consortium/Network.

Protocols for *in-vitro* propagation have been developed for crops such as breadfruit, potato, colocasia, ornamentals, fodder and bio-fuel plant. During 2010-2014, about 126,000 in-vitro plants of breadfruit, banana and anthurium were supplied to growers by FAREI's Tissue Culture Laboratory as well as 56,000 plantlets of orchids, banana and anthurium.

Beyond propagation of plants, biotechnology should now be oriented to support sustainable systems through the production of renewable biological resources as agricultural inputs (bio-fertilizer, bio-pesticides, bio-enzymes and compost activators).

To support the development of the sector and meet the increasing demand for new varieties and clean in-vitro plantlets and biological resources, the following measures are proposed:

- i. Increase multiplication and supply of *in-vitro* propagated plants and clean planting materials;
- ii. Application of molecular techniques for rapid pest and disease screening thus enabling better control;
- iii. Breeding programmes for novel varieties;
- iv. Establishment of a legal framework for promoting innovation and product protection with the introduction of Intellectual Property Rights (IPR); and
- v. Appropriate infrastructure and capacity for production of biological resources for use as agricultural inputs.

3.12 Irrigation

The Government of Mauritius through the Irrigation Authority has invested around one billion rupees in the development of irrigation schemes over the past 30 years for boosting sugar cane production in irrigated areas like the Northern Plains and promoting intensive food crop production at Small Scale Irrigation Project at Belle Mare, Plaisance, Palma and Rivière du Rempart.

Over the past 3 years, the irrigated area has remained unchanged. However, more sugar cane land is being converted for food crop cultivation. Some 17,183 ha (out of the total irrigable area of 28,000 ha of land) are being irrigated of which 1,739 ha are under vegetable and fruit cultivation. The total area falling under the jurisdiction of the Irrigation Authority (IA) is 4,000ha, occupied by 5,200 small planters. Around 20% of the area (800 ha) is under food crop cultivation and some 10% (400 ha) are abandoned.

The presence of abandoned lands within irrigation projects is a major limiting factor to the optimum use of irrigation systems. Abandoned lands cause wastage of water especially under centre-pivot irrigation schemes and thus, a loss of earning for the IA. There is a need to encourage farmers to diversify to high income crops and increase their profitability and reduce the extent of abandoned lands within irrigation projects. Rehabilitation of these abandoned lands offers the scope for production of vegetable and fruit crops.

The following measures are proposed:

- i. Rehabilitation and consolidation of existing irrigation networks and schemes for a more judicious and efficient use of available water resources;
- ii. Replacement of old and worn irrigation equipment and logistic to ensure optimization of water use in irrigated agriculture;
- iii. Promotion of the use of water efficient irrigation system;
- iv. Capacity building of trainers and farmers in efficient irrigation water management;
- v. Review of the price of water in view to encourage planters in efficient use of irrigation water;
- vi. Development of new irrigation schemes in areas where main pipe networks have already been laid (A5 pipeline for Blocks 4, 5, 6 & 7 of NPIP Phase 2) and implementation of Stage 2 of Midlands Dam for mobilization of additional water resource;
- vii. Funds for conversion of irrigation systems originally meant for sugar cane (low frequency, high precipitation) to systems adaptable to vegetables and food crops (high frequency, low precipitation); and
- viii. Introduction of appropriate technologies for the design, operation and maintenance of different types of irrigation systems.

3.13 Marketing

Fresh produce is traditionally marketed by small growers through an auction system and the produce moves on to municipal markets and village fairs. The conditions obtaining the auction system are ill-adapted and unacceptable from the sanitary viewpoint, especially in Port Louis. In fairs especially, there is some direct sales by retailers to consumers, and sometimes by farmers themselves to consumers much like in a farmer's market. Now that more supermarkets and hypermarkets are in operation, these are fast becoming an alternative channel for consumers. Present marketing conditions at the national level of fruits and vegetables are considered as unsatisfactory by almost all operators of the production and marketing chain.

Some controlled products, notably onions, potatoes, garlic are marketed through the Agricultural Marketing Board (AMB) which offers other services among which marketing and price stabilization.

Accordingly, MAIFS will set up a National Wholesale Market (NWM) with the objective of reorganizing the wholesale marketing for fruits and vegetables at national level, and thereby creating a concentrated volume in a single place. This should bring market efficiency, synergies and cost-sharing between operators, better transparency, modern and adequate premises to the whole fruits and vegetable system. The National Wholesale Market will managed by AMB.

Elsewhere, bio-farmers are showing an increasing interest for alternative marketing channels such as direct (one-on-one) marketing, earth market, roadside stalls, farmers' market, 'community supported gardens' and food hubs. Consumers have increasing concerns about food safety issues and wish for more control over their food supply, and they are willing to pay a premium price for it. Here in Mauritius, roadside stalls exist and some farmers do market their own produce, but these channels are not well structured. Earth markets are now being launched, and attracting some attention.

3.14 Supply of planting materials

The adequate and timely availability of quality seeds and planting materials is a pre-requisite for achieving the targets set for food security. The annual national seed requirement is estimated around 16 tonnes (excluding bean and potato seeds). However, there is increasing difficulty to meet the requirements for quality planting materials due to the marked increase in demand for food crops and fruits.

The Agricultural Services plays a key role in the production and supply of seeds of vegetable crops as well as seedlings, grafts and layers of fruit trees. In 2014, about 1,154 tonnes of seeds of more than 20 vegetable crops were produced. Under the Quality Declared Seeds (QDS) Scheme, about 1,150 kg of seeds [cucurbits (700 kg); bean (300 kg); onion (139 kg) and cauliflower (5 kg)] were produced in a joint venture with Agricultural Services/Planters/FAREI.

Tissue-culture plantlets of fruits trees (banana) and ornamentals are regularly produced and sold by both Agricultural Services and Food and Agricultural Research and Extension Institute (FAREI). However, the supply of planting materials for orchard development or backyard growing by the Agricultural Services is extremely tedious and slow, with unduly long waiting times. It must be stepped up to encourage the setting up of orchards, which can provide an opportunity for land moving out of sugarcane.

In order to produce sufficient food crop seeds as well as fruit and ornamental plants to meet the development objectives of the sector, the following measures are proposed:

- i. Maintaining support to the Quality Declared Seeds (QDS) project and extending—the range of food crops; and encouraging more planters to undertake seed production as an agri-business;
- ii. Creating enabling environment for agro-entrepreneurs and the corporate sector to undertake QDS and produce planting materials for orchard and ornamental crops;
- iii. Facilitating the introduction of elite and disease-free germplasm for diversification of food production and ornamentals production; and
- iv. Increasing the production of high-value and disease-free tissue culture plantlets.

4. LIVESTOCK SECTOR

4.1 Background

Our dependency on imports renders the nation food insecure, especially with soaring food prices and price fluctuations, rising costs of freight, international political disturbances and uncertainties in exporting countries, and climatic variations all of which impact significantly on the national economy. The risks associated with imports call for production of at least a buffer stock for strategic/security reasons. The aim of the livestock sector development is thus to boost local production and marketing of milk, meat, poultry and related value-added products, thereby increasing food self-sufficiency and the sector's contribution to economy.

The agricultural sector has since long been concentrated on sugar-cane leaving limited land for production of other food commodities. Lately, pressure on agricultural land has come from projects of greater economic value in other sectors (tourism, IRS/RES) and stifled the agricultural sector, more specifically the livestock sub-sector. However, within the new trade environment and following the phasing out of preferential trade agreements, diversification of agriculture away from sugar production presents significant opportunities for livestock development to meet local demand and reduce imports. Livestock production can thus contribute to nutritional and food security and in the process provide employment opportunities, enhance income and improve the livelihood of farmers.

For years the sector has been constrained mainly by high cost of animal feed and also by limited number of commercial farms, lack of appropriate breeding stock, insufficient land allocated for livestock activities and fodder production, low adoption rate of good husbandry practices by farmers, inadequate veterinary services, and pressure from environmental and sanitary laws.

In recent strategic plans, namely Vision 2020, Blueprint for a Sustainable Diversified Agri Food Sector 2008-2015, Food Security Fund Strategic Plans 2008-2011 and 2013 -2015, various measures were proposed to spearhead development in the sector and open up new avenues. Recommendations to address problems and remove impediments to development related *inter alia* to the upgrading and re-organization of the veterinary services, tagging and registration of animals, re-organisation of the illegal slaughter squad of the MMA, setting up of a meat-and-milk advisory board, etc. While these were pre-requisites for the success of the Food Security Fund Strategic Plan (FSFSP), the targets were not fully achieved.

Sustaining an adequate level of meat and milk production is still the major challenge facing the livestock sector, which has now to face additional issues arising from climate change and concerns for food safety along the commodity value chain. These explain why this development programme is designed to be environment friendly and sustainable with focus on bio-farming. To address these additional factors, a concerted, participatory approach is essential within each sub-sector by way of a stakeholders' forum to formulate and follow-up on appropriate policies/strategies and actions relevant to each commodity value chain.

4.2 Analysis of the current situation

At any one time, Mauritius has an estimated livestock population of 6,000 cattle (800 farmers), 26,600 goats (2600 farmers), 2,700 sheep (200 farmers), 65,000 deer (58 production units), 17,500 pigs (450 farmers), 2,000 rabbits (170 farmers) and 4.6 million birds (500 farmers). These farmers produce around 5 million litres of milk, 1,300 tonnes of meat, 47,000 tonnes poultry meat and around 200 million eggs. The contribution of livestock to agricultural GDP improved from 13.5% to 23% over the period 2006-2013. Nonetheless, in 2014 local production met only 9% of our requirements for meat (excluding poultry) and 4% for milk, whilst 100% self-sufficiency was maintained for poultry meat, eggs and venison.

Over the period 2006-2013, the value of imports for dairy products increased from MUR 1.2 billion to MUR 2.1 billion while imports of meat and meat preparations increased from MUR 1.9 billion to MUR 3.4 billion representing an average overall increase of 77 % for milk and meat. The evolution of the farmer population, livestock numbers and production, and per capita consumption of livestock products for the period 2006 to 2014 is shown in **Annex 2**.

4.3 Dairy

The dairy sub-sector has been and still is largely characterized by traditional backyard producers operating singly on a low-input-low-output system of production, and are dispersed geographically throughout the island. The number of farmers and dairy cattle changed significantly from 1716 farmers rearing 6,934 heads in 2006 to reach 816 farmers rearing 6,041 heads in 2014. It must be noted that the latter figure includes a total of 2,223 breeding heifers imported by two companies during the intervening period.

Milk production increased from 3.3 million litres in 2008 to reach 6 million litres in 2012 due mainly to the coming in operation of two corporate farms with a starting herd size of around 825 heads under the Village Laitier project. However, milk production for 2014 is estimated at only 5 million litres. This follows possibly from decisions taken by Government since 2009 to disengage in certain core activities, which led to the closing down of (i) the Milk Marketing Scheme operated by the Agricultural Marketing Board for milk collection, (ii) the Livestock Feed Factory, which previously supplied low-cost animal feed, and (iii) the Livestock Production Unit at Palmar as a supplier of breeding stock. These changes impacted negatively on the sector, leading to a reduction in the number of cow-breeders and in herd-size and causing farmers to revert to poor animal feeding practices, thereby resulting in a significant decrease in both production and productivity.

New schemes set up in 2009 under the Food Security Fund provided support to dairy farmers to construct/renovate cowsheds, purchase equipment, acquire improved breeding animals and cultivate fodder. However, their impact on milk production was not significant. Productivity was low due to delays in procuring breeding animals, poor management and husbandry practices adopted by beneficiaries, and high mortality rate.

4.4 Beef

The supply of fresh beef on the local market is undertaken by some 245 farmers who do fattening only and an additional 571 farmers who do both dairy-keeping and beef fattening. Some private companies import young animals which are fattened until slaughter whereas the small livestock farmers raise mainly the male calves originating from the dairy sector.

Local beef production (including animals from Rodrigues but excluding imported animals fattened for slaughter) has witnessed a drastic decline over the years from 450 tonnes in 1990 to reach its lowest production of 27 tonnes in 2008 as reported in Slaughter Statistics 2008 of Mauritius Meat Authority, mainly as a result of liberalisation in 1996. Following the implementation of support measures to revamp the sector, production increased to 180 tonnes in 2011, but that increase was not sustained and production dropped back to 60 tonnes in 2014 representing a self-sufficiency of only 1%.

The local market is relatively inelastic as illustrated by the stability in the consumption per capita which stands at 4.47 kg per year. It is observed that there is almost no fluctuation in price of beef throughout the year. However, the price for live animals do rise but exclusively due to a one-off rise in demand for the Eid festival (Qurbani).

The supply of live fattened beef animals is not secured as it depends on availability on the external market, sanitary barriers as well as the severely restricted availability of livestock carriers. In addition, the demand and the price keep increasing. Besides, previous schemes launched in 2010 for importation of weaners and for 2 pilot beef farms did not materialise. Hence the need to increase the local production is highly justified and new incentives are needed for importation of weaners and production of breeding stock. Considering the limited land available for beef fattening, it is proposed to target a production of 250 tonnes representing a self-sufficiency of around 10.5% for fresh beef by 2020.

4.5 Pig

Pig production is carried out across the island by some 450 pig breeders rearing a pig population of 18,000 heads. The farms are concentrated at Albion, Olivia, St. Martin and Bassin Requin. Some 40% of local pig production comes from St. Martin and Bassin Requin. More than 90 % of the pig breeders are engaged in both fattening and breeding activities, 8% in fattening solely and 2% in breeding activities only. At present 10 cooperative societies are active and are regrouped under two

federations. The level of animal husbandry and waste management poor, and producers have difficulty to comply with environmental and health regulations. High cost of feed is a serious issue.

A Pig Steering Committee has been set up to monitor the relocation of pig breeders at St Martin and setting up of reproductive farms.

Following the outbreak of African Swine Fever in 2007 and measures taken to re-launch pig production, the population witnessed a rapid increase to peak at 23,285 heads in 2011. This over-production has impacted negatively on the sub-sector resulting in poor feeding practices, production of poor carcasses and illegal slaughter. Slaughter statistics has since shown a sustained reduction in number of pigs slaughtered at the Central Abattoir with pork production decreasing from 650 tonnes in 2011 to 558 tonnes in 2014. Imports of frozen pork also increased to reach 1,025 tonnes in 2014 as locally produced carcasses do not match the quality required by processors.

There is no structured marketing system for pork. The marketing of fattened pigs is mainly dominated by middlemen and butchers. One Government-owned slaughter house, 18 registered butchers, four processing plants and a dozen of meat shops are presently supporting the pig industry. There is no carcass grading system and carcass quality is generally poor. The system also lacks facilities such as a '*salle de découpe*' to process pig meat into value-added products.

4.6 Goat/Sheep

Following the drastic decline in the national goat herd from 72,696 heads in 1983 to 29,281 heads (2,600 farmers) in 2014, concerted effort and government incentives contributed to reverse this trend and the goat/sheep population increased to 30,107 heads (by 3,050 farmers) in 2011. However, both the national herd and the number of farmers have remained unchanged up to 2014, despite support measures from both Government and service providers. This is explained by the limited capacity of existing farms to increase herd size, coupled with space restrictions and environmental constraints since most of these farmers operate in their backyard and in residential zones.

Based on abattoir slaughter statistics, local production of goat meat has increased from 18.7 tonnes in 2008 to 28.4 tonnes in 2014 with a peak in production of 45 tonnes in 2011. On the other hand, there has been a significant decrease in the slaughter of imported goats from 67 tonnes in 2006 to only 9 tonnes in 2014, possibly explained by increasing slaughter at home (i.e. not accounted in slaughterhouse statistics) and/or consumer preference for local goat meat.

In general, interest for goat rearing has rekindled among existing and prospective farmers for the production of young animals for breeding or for fattening for meat. However, further development in the goat sector is hindered by acute shortage of parent stock and the high level of mortality prevailing on goat farms. Measures to boost the sector have involved the importation of improved breeds as well as financial support for the setting-up of multiplier goat farms.

This renewed interest has also extended to sheep production. Sheep show hardiness compared to goats, which are affected by diseases (Contagious Caprine Pleuro-pneumonia, goat pox, pneumonia, etc.). Following action taken to promote and encourage sheep production, the sheep population increased two-fold during the period 2006 to 2014, with the present herd size standing at around 2,700 heads.

4.7 Venison

Deer farming has now established itself as a full-fledged economic activity and forms an integral part of the livestock sector. Venison has become the main source of red meat consumed by all ethnic groups, and is well appreciated by tourists.

The bulk (90%) of the venison is produced on some 50 extensive deer chassées while the remaining 10% comes from 8 intensive farms. The total acreage occupied by the deer sub-sector is estimated at 25,000 hectares of which 15,000 are privately owned and 10,000 area leased State forest lands. The local deer population is estimated at 65,000 heads of which an estimated 20,000 heads are reared on State lands. The remaining 45,000 are reared on private lands and include around 10,000 heads reared in intensive farms on about 1,000 hectares.

During the last 10 years, the annual production of venison fluctuated between 450 and 500 tonnes, of which 350 to 400 tonnes are produced on private farms and 100 tonnes on State lands. The totality of

venison produced is disposed of quite easily on the local market with a per capita consumption of 0.44 kg per annum. Most of it is marketed exclusively during the hunting season (June to September). Only 15 to 20 tonnes are produced by intensive farms during the close season, and carcasses are processed at the Central Abattoir and marketed by the Mauritius Deer Farming Co-operative Society Limited. However, production from intensive farms declined from 44 tonnes in 2009/2010 to 14.4 tonnes in 2014, which is attributed to transfer of breeding animals to chassées.

4.8 Poultry

The country is self-sufficient in chicken meat and eggs, with annual production in 2014 standing at 47,500 tonnes for meat and 200 M eggs.

However, the country still imports other poultry species (ducks, turkeys, quails, etc.) and pre-cooked poultry products. In recent years, the import of processed poultry products rose from 1,200 tonnes in 2006 to 3,800 tonnes in 2014, equivalent to around 8% of total production. In order to increase the competitiveness of the sector, support is needed to poultry operators/new entrepreneurs to increase production efficiency and to engage in further processing of poultry meat.

Furthermore, the industry is highly dependant on imported raw materials for feed manufacture although it has shown its resilience to price increases. It is also threatened by the possible introduction of highly pathogenic diseases such as Avian Flu, thereby increasing its vulnerability. Other concerns facing poultry producers are waste disposal and shortage of labour.

4.8.1 Turkey

MAIFS is also encouraging farmers to embark in turkey production. Rearing of locally-adapted turkey breeds used to be an artisanal activity but productivity was low.

Lately, the Poultry Breeding Centre at AS has imported two batches of hybrids on a trial basis to supply local turkey keepers operating at backyard level. Some 30 small breeders are now raising 2-3 heads, and 20 larger ones are raising 5-10 heads each. However, there are some practical difficulties over mating of parent stock that need to be sorted out before scaling up production.

Turkey meat, traditionally consumed on special occasions, is now consumed all year round and is well appreciated by health conscious people on account of its low fat and high protein content. Since 2009, the import of turkey and derived products has increased fourfold from 103 tonnes to 406 tonnes valued at MUR 43.3 M in 2013.

4.8.2 Other poultry species

The supply of day-old broilers and layers by the Ministry of Agro Industry and Food Security poultry breeding centre has been toned down, and the existing facilities are now concentrated on diversification opportunities and geared towards promoting other poultry species. Rearing of ducks and turkeys among others are promising avenues for diversification of the production base.

Local production of duck is mainly carried out by private companies which are involved in the importation of parent stock, production of ducklings, fattening and preparation of speciality products (fatty liver, magret, confit, etc.). There are around 300 farmers engaged in backyard duck-rearing and three large companies producing in total more than 300 tonnes of duck meat annually. To promote the production and consumption of ducks, the Poultry Breeding Centre of the MAIFS has been supplying around 1,200 ducklings each month to small farmers.

4.9 Rabbit

Rabbit rearing is traditionally carried out to cater for a selected/ niche market in terms of meat for consumption and secondly for the pet industry. Rabbit is classified as a white meat and considered a major source of protein. Rabbit production can be promoted easily within a short period as rabbits are prolific breeders and grow fast. Moreover rabbit production does not require high initial investment.

Rabbit production has increased from some 3,400 rabbits (272 farmers) in 2006 to over 4,500 heads (340 farmers) in 2010, but has since then witnessed a decline to only 170 farmers owning some 1,900 heads in 2014. The factors contributing to this drastic decrease are presumably the closure of the Livestock Feed Factory which resulted in a three-fold price increase for concentrate feed; shortage of quality breeding animals; and absence of a regular market for rabbit meat. Several new entrepreneurs

have expressed interest to move into rabbit-rearing on a medium scale but are concerned about the marketing aspects.

4.10 Fodder production

Fodder production constitutes an important component in livestock production and the tradition has been to collect free fodder wherever available and sugar-cane tops during the cane-harvest season. Due to decreasing availability of fodder sites as a result of urbanisation, fodder cultivation has now become a *sine-qua-non* activity and should be integrated in livestock production.

Research programmes for the development of fodder production has identified appropriate fodder species with high nutritive value. Support by way of grant schemes provided to encourage and promote fodder production has led to fresh plantation of around 90 hectares. Such high-quality fodder in ruminant production will reduce reliance on concentrate feeds and thereby bring down feed costs.

In order to reach targets for 2020, the national livestock herd must increase and accordingly the fodder and feed requirements are expected to increase across all species. Current requirements of fodder for ruminants are estimated at 170,000 tonnes annually while projected requirements for 2020 are about 275,000 tonnes. Urgent actions must be initiated to bridge the gap. It is estimated that 600 ha of land will be required by 2020 to cater for this increased fodder requirement.

4.11 Apiculture

Apiculture is practiced mainly as a part-time activity in Mauritius. There are currently 240 beekeepers keeping some 2,000 bee colonies. Annual honey production is expected to drop from 35 tonnes to less than 20 owing to infestation by the varroa mite, and as a result honey importation will increase well above the current 100 tonnes annually.

Since August 2014, the honey industry faces a new, serious threat. The varroa mite, the most destructive pest of honey bees, was detected in the western part of the island. Immediately, a containment/eradication plan was implemented, and 260 bee colonies (including wild ones) that were affected with varroa mite were eliminated.

Good honey yield is dependent upon adequate sources of nectar from different natural and cultivated melliferous plants. Unfortunately, the area under melliferous plants, especially Campèche and Eucalyptus has been decreasing over the years to provide space mainly for urbanization.

The two main limiting factors for the expansion of apiculture in Mauritius are the varroa mite and the shortage of melliferous plants. Apiculture can only be boosted by the control (and eventual eradication) of the varroa mite coupled with the plantation of suitable melliferous plants in the forests, along roads and in landscaping sites.

4.12 SWOT analysis at the sub-sector level

• Strengths

- Government initiatives to boost up livestock production and supply of safe food to the population, plus a strong commitment to deploy resources, release land and implement special schemes.
- Existing institutions for provision of support services such as training, research, extension and veterinary care, with a pool of experienced staff, technical skills and essential infrastructure.
- Farmer's experience
- Emergence of some medium-sized and market-oriented producers.
- Easy trainability of the existing operators and most of the potential operators.
- No major notifiable animal diseases
- Increased vigilance in disease control and prevention (early warning system, rapid alert system and contingency plans)

▪ Weaknesses

- High cost of production, inputs and technologies, hence adversely affecting competitiveness
- Limited access to land, labor, capital and agricultural machinery

- Low adoption of good animal husbandry practices
- Difficulties to import good quality breeding animals
- Lack of cooperation among farmers to cluster for economies of scale
- Inadequate infrastructure, market intelligence and value addition
- Difficulties to comply with environmental exigencies
- Inadequate food safety system
- Inappropriate legislation in the sector
- Lack of organised market structure and market intelligence
- Ageing farming community
- Labour scarcity
- **Opportunities**
 - Possibility to improve service delivery by joint review processes and by better coordination across the Ministry
 - Setting up of regional livestock zones and multiplier farms for goats and heifers; more land available for non-sugar sector following reforms in the sugar industry
 - High demand for livestock products; increasing consumer awareness for safer food
 - Increase vigilance in disease control and prevention (early warning system, rapid alert system and contingency plans)
 - Public Private Partnership for operating small scale abattoirs
 - Possibility for updating and harmonizing regulations
 - Increased scope of accreditation of Food Technology Laboratory.
 - Availability of by-products for use as animal feeds
 - Emergence of new target groups in the sector (agribusinesses, investors, sugar planters diversifying, vulnerable groups, retrenched workers, women, unemployed, youth).
- **Risks**
 - Failing to improve service delivery (implications for beneficiaries and services)
 - Low interest of stakeholders in the livestock sector due to low return on investment compared to other economic sectors
 - Cheap imports of dairy, meat and meat products, and risks of dumping from other countries.
 - Risks of introducing animal diseases and zoonoses.
 - Urbanisation and development of non-agricultural activities
 - Climate change
 - Competition for land for infrastructure and bio-mass production for fuel.

4.13 Emerging challenges

1. Urbanisation and development of non-agricultural activities
2. New trading environment whereby food safety, disease control and surveillance and animal welfare, etc. are taking global proportions
3. Increasing consumer awareness for safer foods and the use of eco-friendly practices, coupled with the implementation of the zero pesticides residue regulations in the European Union
4. Emergence of new target groups in the agricultural sector (agribusinesses, investors, sugar planters diversifying, vulnerable groups, retrenched workers, women, unemployed, youth, VRS).
5. Labour scarcity
6. Cheap import of dairy, meat and meat products, and risk of dumping.
7. High cost of quality inputs (feed and fodder)
8. Climate change and adverse environmental factors
9. Re-emerging animal diseases.

4.14 Constraints and problems of farmers

Major problems of livestock farmers, at least among the small farmer community, are of a non-technical nature and cut across all the main species raised, as follows:

- Inadequate availability of land to start livestock projects
- Inadequate availability of breeding stock
- Lack of finance, and high rates of interest
- Inadequate veterinary services
- No structured market for livestock products (milk, meat, animals)
- High price of livestock feed and inadequate feed subsidy
- No insurance scheme for death of animals
- Environmental regulations are too stringent
- No legislation for registration of farmers and animals
- No traceability of animals/no record keeping
- No transport facilities to carry fodder
- Theft of animals.

In addition, cattle rearing is faced with limited availability of bagasse and its high price; and no safe way to bury dead animals. Straying of goats is also a problem. Venison presents problems of its own, and is discussed separately under 4.15 below.

Main technical issues are as follows:

- | | |
|-------------------|--|
| Cattle | <ul style="list-style-type: none">• Low conception rate of cows, hence high calving intervals• Poor milk yield• Inadequate feeding according to physiological status• Poor housing conditions, waste management and hygiene• Stomoxys flies. |
| Goat/Sheep | <ul style="list-style-type: none">• Poor productivity due to inbreeding, premature mating, worm infestation and diseases occurrence• Poor assistance for veterinary care. |
| Pig | <ul style="list-style-type: none">• Inbreeding• Health problems such as diarrhea, pneumonia• Piglet mortality due to crushing by sows and other reasons. |
| Poultry | <ul style="list-style-type: none">• Health problems such as Newcastle, Coccidiosis• Limited availability of litter• No facilities to analyse the quality of feed. |

4.15 The case of Venison

Venison has issues of its own. Its production is constrained by high costs associated with land rent, wild game farming/stalking annual fees, start-up costs and supplementary feeding. It suffers losses due to poaching and pests and diseases. Expansion is hampered by limits set on land clearing and pasture development on leased state land; low stocking density in chassées. Besides, the potential for export cannot be tapped on account of the non-compliance to EU and other international standards of the Central Abattoir. But with the introduction of “Halal Certification” and setting up of a new abattoir to EU norms, it is expected that per capita consumption would increase to 0.5 kg/annum by 2020, and hence annual production would need to be increased to 600 tonnes. To that effect, certain actions will be necessary:

- i. Conducting a survey to document the deer population on deer farms island-wide
- ii. Encouraging new entrants in deer farming
- iii. Setting up of financial schemes for establishment of new deer farms
- iv. Review rental fees and wild game farming/stalking annual fees

- v. Ensure new slaughter-house meets EU norms
- vi. Ensuring provision and distribution of bagasse and molasses for supplementary feeding
- vii. Establishing promising leguminous browse species on deer farms to increase pasture and animal productivity; and
- viii. Re-enforcing measures to combat poaching.

4.16 Opportunities for improving self-sufficiency

On the basis of the existing status of the livestock species, recent trends and in view of the different incentive schemes already under way, realistic targets have been set for 2020 as presented below (**Table 2**). Whilst the levels achievable for poultry, goat/mutton, pork and rabbit reflect a satisfactory measure of self-sufficiency, concern remains for milk and beef. Nonetheless some progress is possible if the appropriate conditions are made to prevail.

Turkey presents an opportunity for diversification if the problems of sourcing parent stock is resolved. Alternatively, local breeding programmes could be initiated for improvement of the local races once the techniques of artificial insemination would have been mastered. It is too early to set any target.

Table 2: Production targets for 2020

	Production			Self Sufficiency 2020 (%)
	Baseline 2014	Projected 2017	Projected 2020	
Milk	5 M litres	6.5 M litres	7.4 M litres	6
Beef	60 t	150 t	200 t	10.5 (fresh beef) 4 (total beef)
Goat/mutton	32.3 t	70 t	100 t	100 (fresh meat)
Venison	440 t	500 t	600 t	100
Pork	558 t	700	850 t	65
Rabbit meat	25 t	30 t	35 t	100
Poultry meat	47,500 t	48,000 t	50,000 t	100
Honey	20 t	25 t	35 t	25

4.17 Priority issues and strategic intervention areas for the Livestock sector

The priority issues are addressed below under into 12 strategic intervention areas which are pre-requisites to achieve the targets set for 2020 and ultimately for the sustainable development of the livestock sector, and therefore require immediate attention.

4.17.1 Efficient and harmonised support services

Supporting services from the public sector are important drivers of change and development, especially for the majority of small-holder livestock farmers. Effective extension services, research, training and farmer empowerment are necessary interventions to bring about the technological innovations that are badly required to turn the livestock sector into a commercially viable and environmentally sustainable sector. These efforts have to be backed up by a regular and reliable delivery of veterinary services, disease surveillance and preparedness to respond to alerts, as well as adequate disease control measures.

To that end, the re-organisation of the livestock institutions under MAIFS is necessary. Following a recent FAO diagnosis, proposals have been made to re-structure the AS so it concentrates on policy, control and regulatory functions and sheds off its services on to FAREI and other providers. This has implications for veterinary care and artificial inseminations, free drug scheme amongst others. It is

imperative that the transfer of responsibilities be smooth so that the small farmers are not penalised or denied service. On positive side, it will bring more livestock services under one management, which should in principle assure better coordination between extension, research and veterinary care.

It is imperative that the MAIFS proceeds to implement the re-organisation of AS and reviews the allocation of resources (human, financial and infrastructural) for an effective transition.

4.17.2 Cost of production

Livestock production is highly dependent on imported, costly inputs comprising mainly of animal feeds and breeding animals. Lack of economies of scale also has a major impact on the cost of production.

The strategy is to:

- i. Facilitate access to feed/fodder by renovating and bringing the Livestock Feed Factory back into operation; by maintaining/ increasing the subsidy on purchased concentrate feeds; and to by-products (bagasse and molasses) from the cane industry to improve productivity of animals.
- ii. Facilitate access to quality breeding animals by setting up heifer farms;
- iii. Improve animal productivity by strengthening research and development; improving the success rate of AI from 30% to 55% (dairy); and capacity building of farmers.

4.17.3 Land availability and environment exigencies

Livestock development is constrained by limited land resources and the environment exigencies which limit livestock operations in specific areas. Furthermore, initial high capital investment is required for implementation of projects in the sector. In the Government programme 2015-2019, mention was made of creation of “special livestock zones” to address problems related to environment and provision of necessary amenities for sustainable production.

The strategy is to:

- i. Identify and set up additional Livestock Zones for cattle and small ruminants, pigs, bio-farming, fodder production and agro-forestry:
 - Provision of utilities and infrastructural facilities for operation of farms (Build, Operate and Lease), efficient production and service delivery;
 - Clustering of farmers after due sensitisation on benefits of clustering; training and hand-holding and mentoring;
- ii. Identification of appropriate sites for environment- friendly incineration/burial and disposal of dead animals and slaughter waste; and
- iii. Promotion of fodder development.

4.17.4 Public/Private Partnership

Public/Private sector investments and financing are necessary for improvement of productivity and efficiency along the livestock value chain (production, marketing, processing and consumption promotion). In order to commercialise livestock production, strategies and interventions proposed need to be given immediate attention especially with regard to improvement of financial services and incentives favourable for private sector participation in production, processing and marketing of livestock and livestock products.

To that effect, the following strategy is proposed :

- i. Creation of an enabling environment based on schemes to encourage Public/Private partnerships and to assist farmers to meet market requirements; and
- ii. Promotion of the ‘filière’ (VCA) approach by setting up and facilitating its stakeholder’s forum.

4.17.5 Legal and Regulatory Framework

Existing legislation for the livestock sector are outdated, and should be reviewed and adapted to address the present needs. There is also a need to harmonise with other legislations relating to livestock production, processing and marketing and to formulate new legislation to regulate the sector.

- i. Review and formulation of new legislations and regulatory functions of different bodies/department of MAIFS, which implies:
 - Audit of all existing laws and regulations through a consultancy
 - Review of legislation pertaining to Fishing and Shooting Lease Act.
 - Enactment of Animal Health Bill
 - Preparation of Animal Production Bill
 - Review of Veterinary Council Act.
- ii. Setting up appropriate mechanisms for enforcement of regulations and a squad (Police Agricole) to track illegal activities.

4.17.6 Professionalisation of farmers

Livestock farmers are characterised as traditional, backyard producers operating on a low-input-low-output system of production, and therefore reluctant to change. There is a need therefore to professionalise existing farmers and to encourage new entrants in the livestock sector to adopt a professional approach to farming. To start off, FAREI's Farmer Training School can provide short MQA non-award training courses and delivers NTC3 in agriculture to those who are out of the education mainstream. Specialised training courses with the support of MITD and UoM may follow for further skill development. In addition, farmers need to be supported in their endeavour through special programmes destined to improve their welfare.

- i. Capacity building, which will imply developing curricula for specialised courses in animal husbandry and veterinary care; and running certificate courses on animal production and health (UoM/MITD);
- ii. Categorisation of farming community by re-defining small/medium/large scale farmers;
- iii. Creation of a unified Registration System for Farmers accessible to all service providers;
- iv. Promotion of joint ventures and entrepreneurship by:
- v. Running courses on entrepreneurship
- vi. Initiating regional exchange programmes
- vii. Delivery of "certificate of competency" in livestock activities
- viii. Provision of incubator facilities for value addition
- ix. Provision of start-up kits.
- x. Promoting the use of latest technology/ICT to enhance knowledge of farmers and boost their production;
- xi. Running awareness campaigns to attract professionals (especially from the younger generation), with incentives for start-ups;
- xii. Improving the welfare of farmers by enhancing their quality of life and incentives for socio economic development; and
- xiii. Running Livestock Insurance Schemes or alternative funds to compensate farmers for loss of animals and other risks.

4.17.7 Breeding stock

Animal genetic resources (AnGR) for food and agriculture are essential for food security and contribute to the livelihoods of the farmers. However, genetic improvement programs in Mauritius have favoured the use of exotic breeds for crossbreeding, upgrading, or replacement. These programs

are mostly implemented without clear policies, regulatory frameworks, strategic thinking and a long term view and motivated by the objective of rapid productivity gains resulting in indiscriminate, uncoordinated or uncontrolled crossbreeding. The establishment of national breeding policies/strategies is a recommendation of the FAO and aims at promoting the sustainable use, development & conservation of animal genetic resources to avoid erosion of animal genetic resources and indiscriminate cross breeding.

This should be achieved by:

- i. Establishing genetic conservation and improvement programmes;
- ii. Conservation of local genetic resources driven by incentive schemes for on-farm conservation;
- iii. Setting up of a national breeding farm for conservation;
- iv. Preparation of breeding plans for all species for genetic improvement, and use of genetically improved breeds (animal/semen) to upgrade local breeds;
- v. Reviewing the AI service and upgrading the AI Lab to ensure ready availability of semen;
- vi. Develop private / public partnerships for production of breeding stock; and
- vii. Provide legal framework to prevent slaughter of productive breeding animals.

4.17.8 Animal health and veterinary care

Veterinary care is one of the key elements that enable sustainable livestock production. Without an effective veterinary service, animal production becomes an expensive and difficult endeavour. This will be addressed within the forthcoming re-structuring of the Agricultural Services. The proposals therefore comprise of:

- i. Review and modernisation of the organisational structure and mandate of the Division of Veterinary Services
- ii. Reinforce Disease Surveillance programmes by strengthening the capacity of Animal Health Laboratory at DVS for diagnosis of diseases, to be supplemented with MoUs with international and local reference laboratories for tests which are not run in-house, and training of staff (as e.g. in epidemiology)
- iii. Improve the delivery and effectiveness of animal health care by strengthening of field intervention capacity for prompt and effective service delivery and the provision of adequate veterinary drugs and equipment;
- iv. Provide training to farmers in basic veterinary care and first-aid for livestock, so they may be empowered to attend to minor cases and thereby relieve the pressure of public services;
- v. Introduction of para-veterinary services so as to reduce the pressure on veterinarians, which would require appropriate amendments to the Veterinary Council Act to cater for registration of para-vets; curriculum development for para-vets and formulation of relevant training programmes for the para-vets after due vetting by the Council.

4.17.9 Food Safety (Veterinary Public Health)

The country is threatened by existing and emerging animal diseases. Moreover, cases of food poisoning arising from contamination of livestock products call for strict vigilance and establishment of protocols for monitoring and control. Food safety, disease control and surveillance, and animal welfare are taking global dimensions in the new trade environment. To that effect, the following actions are proposed:

- i. Enforcement of safety practices at farm level by setting up a 'Police Agricole' to monitor hygiene practices; and encourage adoption of good hygiene practices through incentives and/or certification;
- ii. Capacity building for the monitoring and detection of residues and contaminants in livestock products and animal feeds; enhancing the control of chemical and microbiological risks at farm level and in end-products; and strengthening laboratory facilities for rapid diagnosis; and

- iii. Ensuring food safety, through an MOU for coordination between MAIFS and Ministry of Health regarding food safety issues, which would cover, *inter alia*:
 - monitoring of poultry slaughter-houses;
 - inspection and certification of poultry meat;
 - monitoring of imported meat at entry ports; and
 - control of veterinary pharmaceutical products.

4.17.10 Boosting apiculture

Boosting apiculture and honey production will be effected by:

- i. Increasing the area under melliferous plants
- ii. Control of the varroa mite
- iii. Improvement to honey quality in the local market.

4.17.11 Marketing of livestock products

Marketing of livestock products in Mauritius can be divided into two major segments: marketing of imported products and marketing of local products. The absence of a structured marketing channel for livestock products is a major constraint for the development of the livestock sector. To oversee to a more orderly marketing, measures are proposed as follows:

- i. Construction of a modern Slaughterhouse fully compliant to EU norms.
- ii. Setting up of a Trade and Marketing Bureau to encourage farmers to choose formal marketing channels and help to combat illegal slaughter;
- iii. Consideration will be given to the design and operation of mobile slaughter and processing units e.g. for pork, which would relieve small producers of costly transport;
- iv. Setting up new slaughter facilities, and operation of 3 meat shops on its premises;
- v. Ensuring the supply of safe deer meat by requiring that all deer carcasses after hunting be processed at the slaughterhouse for removal of hides and inspection by veterinarians prior to sale;
- vi. Preventing productive female cattle from being slaughtered prematurely, FAREI will operate a platform to link farmers wishing to sell their animals to dairy farmers who wish to increase/replace their stock (buyer/seller) or offer the outright purchase of productive animals.
- vii. Promotion of entrepreneurship for more value-addition activities;
- viii. Setting up of a programme for certification of farmers, farms and farm products, and providing the necessary human resources and training to match; and
- ix. Organisation of an Annual Livestock Fair.

4.17.12 Import/Export of livestock and livestock products

The import of livestock and livestock products is liberalised. Although an Import Permit Committee operates, the current mechanism to control importation is barely adequate, more especially for the import of livestock products. For live animals, it has been observed that imports are severely constrained by the unavailability of a livestock carrier and the excessive cost of chartering one. This reflects adversely on consumer prices for fresh meat. In order to encourage local industry and to ensure adequate supply of livestock products to consumers at fair prices, there is need to :

- i. Review the import mechanism;
- ii. Provide the service of a livestock carrier and associated logistic support to facilitate the importation of live animals (cattle, sheep and goats) and weaner cattle by butchers and other stakeholders and entrepreneurs.

4.18 Sustainable livestock production

As a SIDS, Mauritius is especially vulnerable to climate change. Impacts, direct and indirect, can lead to reduced quality and availability of feed and fodder, can cause greater competition for resources with other sectors, and increased incidence of pests and diseases leading to lower productivity and increased mortality of livestock. On the other hand, livestock production itself

contributes to increase Green House Gases directly via methane from enteric fermentation of ruminants, and this needs to be properly managed.

Moreover, there is increasing concern on methods of production, especially regarding the use of veterinary products and growth enhancers in intensive livestock production. Besides, animal welfare, rights of animals and the humane treatment of animals at slaughter are becoming major issues among civil society organisations.

The following measures are proposed:

- i. Support adoption of good management practices
 - Enhancing the use of eco-friendly technologies and farming practices
 - Education/Sensitisation programme on animal welfare
 - Improving the pest and disease warning system.
 - Promoting clean, green and ethical animal production systems
- ii. Encouraging the production of small livestock including turkey, duck, rabbit etc. with a parallel campaign to encourage the public to consume such types of meat.
- iii. Promoting bio-farming, which will imply the development of local standards, a package of incentives for motivate farmers to switch to production of bio-products; and consumer education over their merits.

5. FORESTRY

5.1 The current situation of Forestry

About 25% (around 47,103 hectares) of the total land area Mauritius is covered by forests, with an estimated 25,000 hectares privately-owned and some 22,103 hectares state-owned. Good quality native forest i.e. having more than 50% native plant cover, is estimated to cover less than 2% of the island, with the remaining forests consisting of plantation forestry or highly-degraded vegetation invaded by alien plant and animal species, thereby posing serious threat to biodiversity.

Rapid economic development, limited land area, an increasing population and more lucrative alternative land uses such as housing development and ranching bring constant pressure to bear on these forest lands. Thus in recent decades up until 2003-2004, some 10,000 hectares of forest lands had been cleared mostly for infrastructural developments, e.g. built-up areas, roads, agriculture, reservoirs, etc. Thankfully, de-forestation has been minimal since, due largely to the rigorous application of sustainable forest management principles.

5.2 The value of the forest sector

Forests are invaluable assets that need to be conserved and further enhanced, more so for a SIDS with its unique forest and rich biodiversity, harbouring a high number of native and endemic species. Forests contribute to the betterment of our daily life, in economic or in environmental terms. Indeed, forests in small islands are limited in area but have nonetheless great ecological, social and cultural significance, with their environmental function outweighing their direct economic function.

Forests are the home of our rich biodiversity. With over 690 native flowering plant species and over 180 species of vertebrates and invertebrates, Mauritius has a substantial amount of biodiversity. Out of these, 55 are endemic and 20 are endangered due to habitat loss, introduced animals and human-related activities. Thus, Mauritius is reported to have the world's third most endangered biodiversity.

Especially in Mauritius, the soil and water conservation functions of forests are crucial because the volume and availability of fresh water determine the level of development of the agricultural, manufacturing and tourism sectors. Besides, our coastal forests act as buffers against strong winds and cyclones, and offer a natural backdrop to tourist beaches. Mangroves, where they exist, serve as nurseries and breeding grounds for numerous fish and shellfish, including shrimps. Coastal forests and mangroves also help contain soil erosion and sedimentation of coastal waters.

In recent times, since global warming and climate change have come up as major challenges for the planet, the contribution of forests to vital environmental functions and their potential to mitigate the ill-effects of global warming have been understood and recognized.

5.3 Carbon Sequestration and Greenhouse effect

Due to man-made hazards, the thin layer of atmosphere that cloak and protect the Earth has unfortunately been dramatically changed. Carbon dioxide, methane and nitrous oxide are greenhouse gases that trap some of the sun's heat and prevent the Earth from freezing. However, unprecedented levels of human activity such as deforestation and burning of fossil fuels are increasing the greenhouse gases effect. On the other hand, carbon sequestration is the process of capturing and storing atmospheric Carbon Dioxide over the long term. Trees and plants do this so well through photosynthesis, sequestering carbon during the day, and in the process regenerate oxygen back to the atmosphere. A single tropical tree can sequester up to 23 kg of carbon yearly. On these accounts, forests are considered as the lungs of the Earth, essential to life and present the main means to mitigate climate change and global warming.

For these reasons, the conservation and restoration of our native forests are of highest priority. These are reflected in the National Forest Policy (2006). If well managed, the forest resources of Mauritius can contribute to environmental rehabilitation, creation of job opportunities, supply of wood and non-wood products, food security, ecotourism, recreation and national well-being.

Henceforth, management will aim at non-consumptive use of our forests while concurrently enhancing their vital protective functions, e.g. protection of watersheds, habitats for fauna and flora, flood control, carbon sequestration, etc. A gradual shift will be maintained away from the traditional timber exploitation activities to others that are less destructive and more rewarding in the long term,

e.g. ecotourism, provision of leisure and recreation, medicinal plants, fodder, sustainable exploitation of non-timber products like venison and honey.

5.4 Economic Functions

The forests of Mauritius provide a range of wood and non-wood forest products. Timber, poles, firewood, honey, deer, grass, fibres, fruits and medicinal plants are common examples. The forest sector provides direct and indirect employment to some 5,000 people in forest resource management activities, biodiversity conservation, tree planting to provide soil cover in environmentally fragile areas, wood production, primary and secondary processing of wood, wildlife capture and export, deer ranching and eco-tourism. The upland forests of Mauritius play a vital role in soil and water conservation and the production of rain-fed and irrigated agricultural crops at middle and low altitudes. The contribution of the sector to the Gross National Product is estimated to be about one percent. This is a gross under-estimate since the ecological services of forests, now deemed to be of considerable value, are not considered in National Accounts.

5.5 Social Functions

Rapid industrialization during the past few decades has resulted in higher standards of living and new aspirations of the people of Mauritius. However, a modern lifestyle also brings with it stress and pressure on the population. This increases demand for leisure and recreation in natural surroundings. Ecotourism is on the rise. More and more people are visiting the forests for leisure activities such as shooting, fishing, jogging, camping, picnicking, collecting wild fruits, watching wildlife and, as a result, are expecting better facilities and services from the forest sector.

5.6 Policy, Legislation and International Conventions

A National Forest Policy was elaborated in 2006 following consultation among stakeholders from Government, private sector and civil society, and set out to protect and enhance the country's natural environment, biodiversity and national heritage. It flagged serious issues needing attention:

- Degradation of native forests by invasive alien species;
- Forest destruction by recurrent cyclones, fire, insect pests and diseases;
- Deer ranching.

At the same time, it evoked possibilities for the development of in-land recreation, eco-tourism and other small forest-based businesses for income generation.

Furthermore, it emphasised the environmental and protective functions of forests in preference to timber production, and recommended a gradual phasing-out of forest exploitation for timber. It highlighted the need for:

- Conservation and protection of watersheds and other environmentally-sensitive areas;
- Increasing tree cover to enhance the environment and the carbon sink capacity of our forests;
- Conversion of abandoned sugar-cane lands to forestry in environmentally sensitive areas.

5.7 Main Legislation for the Protection of Forests

The Forests and Reserves Act No. 41 of 1983 (as amended by Act No.1 of 1986 and Act No. 7 of 2003) is the principal legislation governing the administration and management of forest resources. It, *inter-alia*, makes provision for the creation of "National Forest" and sets up a Nature Reserves Board. It provides protection for State forest lands as well as river and mountain reserves, but does not cover activities undertaken on private-owned forest lands.

Other related legislation include the :

- Shooting and Fishing Leases Act (1966);
- the Wildlife and National Parks Act No.13 (1993), dealing with the management of wildlife and National Parks and the conservation of fauna and flora.

The Act, *inter-alia*, makes provision for the creation of National Parks, reserves and buffer zones where:

- (a) such land is of natural, scenic, scientific, educational, and recreational or other importance or value to the state; and
 - (b) the preservation of the land is necessary to properly protect, to permit access to or management of, or to allow public viewing or enjoyment of an area of such land.
- The Environment Protection Act of 1991 (as amended in 2002), which provides for the protection and management of the environmental assets of Mauritius so that their capacity to sustain the society and its development remains unimpaired and to foster harmony between quality of life, environmental protection and sustainable development for the present and future generations.
 - The Pas Geometriques Act of 1895 (as amended by Act No. 35 of 1989), which declares areas along the coast known as Pas Geometriques to be public domain and makes provision for the survey of lands in such kind of land areas, the grant of leases, rights of lessees, and prohibits dumping on Pas Geometriques.
 - The Plants Act of 1976 (repealed by The Plant Protection Act No. 10 of 2006) which provides for the prevention, control and eradication of plant diseases; it regulates export and import of plants; and it provides the authority to restrict the cultivation of certain plant varieties.

5.8 International Conventions, Agreements and Co-operation

With regard to forestry and related matters, the Government of Mauritius is signatory to various International Conventions. These include, *inter alia*:

- The African Convention for the Protection of Nature and Natural Resources, 1968;
- The Convention on Wetlands of International Importance Especially as Waterfowl Habitat (RAMSAR), 1971;
- The Convention for the Protection of the World Cultural and Natural Heritage, 1972;
- The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973
- The United Nations Framework Convention on Climate Change (UNFCCC) (1992) and Kyoto Protocol, 1999;
- The Convention on Biological Diversity (CBD), 1992;
- The Convention to Combat Drought and Desertification in Africa (UNCCD), 1995;
- The Cartagena Protocol on Biosafety to the Convention on Biological Diversity, 2000;
- The United Nations Forum on Forests (UNFF); and
- SADC Protocol on Forestry, 2002.

5.9 Forest management

All the plantation forests on State lands in Mauritius are now managed according to the principles of sustainable forest management, which are embodied in the National Forest Policy 2006. This has helped curb the rate of deforestation to below 0.1% annually after 2005.

However, there is virtually no scientific management on private forests. These forests are mostly scrublands and degraded native forests which have been severely invaded with alien species, and are mainly used for extensive deer ranching and ecotourism development.

5.10 Native Forest

Almost all of the remaining State-owned native forests have been legally declared as Nature Reserves or National Parks and are, as such, legally protected. There are seven inland Nature Reserves, seven Islets Nature Reserves, two inland National Parks, eight Islets National Park and one Endemic Garden. No timber exploitation is carried out in these areas and they are managed solely for the conservation of biodiversity, soil and water conservation and other environmental functions.

Weeding operations and other forest restoration activities are carried out in some of these areas to control invasive weeds and prevent forest degradation.

5.11 Plantation Forest

The forest plantations consist of species of economic importance such as pine, eucalyptus and araucaria, and most are leased for deer ranching. This activity, when carefully regulated, offers an additional protection in terms of fencing and watchmanship. Timber exploitation is effected on state forest plantations and is restricted to specific areas where logging impact is minimal. About 50% of forest plantations have been set aside for environmental functions and soil and water conservation (mostly in water catchment areas and slopes). In line with the National Forest Policy 2006, timber exploitation is gradually being phased out in Mauritius and the exotic timber yielding species are gradually being replaced by native species.

5.12 Silviculture

Silviculture aims at the production of higher volume of superior quality timber of economically valuable species per unit area as well as the restoration of natural forests and creation of new forests. It covers all management practices, and includes harvesting for timber-yielding species. Three main types of silvicultural systems are practiced in Mauritius. In the clear-felling system, areas of mature trees are clear-felled in a single operation (e.g. pine, araucaria) and re-planted. In selection felling, individual trees or groups of trees are selected for felling. This is practiced where growth is uneven, with species with long rotation (e.g. mahogany), on steep topography and in water catchment areas. Alternatively, there is the coppice forest system, whereby trees of coppicing species (e.g. Eucalyptus) are felled, and new crops are re-generated through stool (stump) coppices.

5.13 The Forestry Service

5.13.1 Staffing

The Forestry Service is responsible for the management of the State Forest Lands in Mauritius. It is led by the Conservator of Forests, who is assisted by a Deputy Conservator of Forests and two Assistant Conservators of Forests, three Divisional Forest Officers, 8 Chief Forest Conservation and Enforcement Officers, 12 Principal Forest Conservation and Enforcement Officers, 37 Senior Forest Conservation and Enforcement Officers and 53 Forest Conservation and Enforcement Officers. Approximately 330 General Workers are deployed in various sections of the Forestry Service. In addition, a Survey Unit is operated by one Surveyor, one Survey Technician, one Technical Design Officer, one Management Support Officer, one Head Survey Field Worker and eight Survey Field Workers. About 40 Administrative staff Cadres are attached to support the Service.

5.13.2 Main Activities of the Forestry Service

- **Enforcement of Forest Laws:** Regular patrol over 20,000 hectares of State Forest Lands, River Reserves and Mountain Reserves, with contraventions (39 in 2014) and eventually prosecution for offenders; processing about 500 requests annually for development on river reserves; and handling complaints regarding illegal development. In addition, some 300 requests are attended annually regarding the issue of Clearance Certificates on River Reserves and Mountain Reserves, requests for firewood, felling of trees in Government compounds, EIA applications and Environmental Clearances including National Project Reports.
- **Production of Plants:** production of some 350,000 plants annually in its seven nurseries, of which some 200,000 are used in-house for reforestation/ afforestation programmes. About 100,000 plants are sold to the public annually, and some 25,000 are issued free to organizations, youth clubs, schools, etc. under the National Tree Planting Campaign.
- **Reforestation/Afforestation and Maintenance of Forest plantations:** About 25 ha are reforested/afforested and some 200 ha of forest plantations maintained annually. Tree cover in water catchment areas and on hill slopes are maintained and increased for soil and water conservation and to enhance carbon sequestration.
- **Exploitation of Forest Produce:** Timber is exploited for commercial purposes by sixty registered wood merchants and approximately 787 m³ of timber, 97 m³ of poles, 2702 m³ of firewood and 25 000 units of bamboo were produced locally in 2014, under the control of Forest Officers.

Other non-wood forest produce such as Chinese Guava fruits, Ravenala leaves, etc. are collected by the public.

- **Shooting and Fishing/Deer Ranching** : About 10,607 ha of State forest lands are leased for shooting and fishing purposes under the Shooting & Fishing Leases Act of 1966. Deer ranching has now become an important economic activity, and the production of venison is about 475 tonnes annually (375 tonnes from private forest lands & 100 tonnes from state forest lands).
- **Creation and Maintenance of Firebreaks in Forest**: About 30 km of fire-breaks are created/maintained annually in fire-prone and sensitive areas (Ile D'Ambre, Ile aux Benitiers and Signal Mountain).
- **Conservation of Biological Diversity**: Nature Reserves and other State Native forests are effectively managed for the protection of indigenous flora and fauna. *In-situ* and *ex-situ* conservation of indigenous plants are also effected. Some 50,000 indigenous plants belonging to 150 species are raised annually by the Tree Seed Centre and the Greenhouse Unit. Native plant gardens and nature corners are created and monitored in schools and on Government premises.
- **Recreational Forestry**: Nature Walks are operated at Monvert in Forest Side, at Powder Mills in Pamplemousses and at Sophie near Mare aux Vacoas for leisure and recreational activities. The visitor's and interpretation centres are used to raise awareness through photo displays with descriptive texts, Power-Point presentations, and talks.
- **Education, Awareness and Research work** : About 30 schools and 15 community centres are targeted annually for sensitization and raising awareness about the value of forests and forest conservation. These are also disseminated through media (radio, TV, newspapers and pamphlets). The Service collaborates with NGOs, private land owners, university students as well as local and foreign institutions (universities, etc) for scientific studies related to forest and regular assistance is provided to university students for their projects.
- **Protected Area Network Project (PAN)**: The Forestry Service, together with the National Parks and Conservation Service, are actively participating in the PAN project for the removal of invasive alien species in the native forest areas, including Nature Reserves.

5.14 Strategy 2016-2020

5.14.1 Mission and Vision

In view of the ever more important roles of forest areas in the fields of environmental protection, conservation of biodiversity and mitigation of the impacts of climate change, a new vision and mission is being proposed to take forestry forward.

Vision: *A healthy, green environment meeting the needs and aspirations of present and future generations for environmental, social and economic benefits derived from trees in and outside forest areas.*

Mission: *To enhance our tree cover and manage forests and trees outside of forests with the participation and on behalf of the people of Mauritius.*

5.14.2 Strategic Goals

1. Tree planting programme are implemented to increase tree cover throughout the island.
2. Existing legislation and policies are reviewed to increase tree and forest protection.
3. Environmentally-sensitive areas such as watershed and steep slopes are managed for sustainable development and protected.
4. Biodiversity and eco-system services are enhanced.
5. Awareness is created among the general public on the importance and value of the trees and forests.

Towards this mission/goal, the following five objectives have been identified as well as the strategies necessary to achieve them.

5.14.3 Objective 1: Increased tree cover over the island

Strategies:

1. Launching of a nationwide campaign/programme to plant 160,000 trees, preferentially native species, annually from 2016-2020. This is best done with active participation of individuals, institutions and civil society organisations in tree planting and protection activities and coupled with awareness campaign on the importance of forests and trees in improving the natural environment for healthy living.
2. In view of the severe, commercial losses caused to fruit production by bats, consideration will be given to scattered fruit tree plantings in forest areas. At bearing stage, these trees could provide alternative targets for the bat population and divert them away from commercial orchards and backyard fruit trees. The operational details, sites and choice of fruit species must however be determined. Such a scheme is necessarily a medium to long-term strategy.
3. Selecting appropriate species and propagating materials corresponding to plantation sites to avoid loss of biodiversity through mixing of populations.
4. Developing innovative, financial schemes to increase tree cover and manage tree plantations. Owners of degraded forest lands and the general public to be provided with incentives to plant trees, such as free or subsidised seedlings, training on maintenance and management of new plantings, and extending the tree planting programmes to privately-owned forest lands. Such schemes could be extended to abandoned, fallow plots of land which would otherwise turn into wastelands. Some form of carbon trading scheme can eventually be devised to assist the process.
5. Increasing the capacity of forest nurseries and implementing more efficient seedling production technologies to provide for increased plantings.

5.14.4 Objective 2: Review of the existing laws, legislation and policies to increase tree and forest protection.

Strategies:

1. Review and amend the Forests and Reserves Act 41 of 1983 (amended by Act No.1 and Act No. 7 of 2008) to include access and control of felling of trees and removal of forest produce on private forest land; to revise the composition and meeting schedules of the Nature Reserves Board; to increase the penalties for offences under the Act including illegal felling of trees, littering and dumping on Reserves and State forest land; and to arrange for more biodiversity-rich areas to be proclaimed as Nature Reserves.
2. Consultations to be initiated with relevant stakeholders to review the Shooting and Fishing Lease Act of 1966.
3. Review of the National Forest Policy (2006) and preparation of the National Forest Action Plan.

While it provides for the conservation, protection and development of forests through sustainable forest management, with emphasis on the environmental functions of forests rather than their exploitation for timber and produce, it does not provide protection of private forest lands except for the mountain and river reserves. Furthermore, the growing impact and mitigation measures of climate change and green economy issues like the Clean Development Mechanism are not covered by the current policy. The policy should now be re-formulated to highlight awareness and information on all aspects of forestry so as to enhance understanding and appreciation of our forests including their environmental and social value. FAO has pledged technical assistance for this undertaking.
4. Formulating the National Forest Action Programme 2016-2025, with technical support of FAO, to ensure that private forests are managed and maintained in an ecologically sustainable manner as well as to promote and support adaptive forest management to combat natural disasters and climate change. Forests thus managed will provide the basis for nature conservation and biological diversity as well as for economic development and employment opportunities in a wide range of sectors, including tourism and recreation, water supply, agro-forestry, deer ranching and food security amongst others.

5. Enactment of the Native Terrestrial Biodiversity and National Parks Act.

To this end, a draft Bill has already been reviewed by the State Law Office and will now have to be passed through Parliament. The main objective is to strengthen the protection, conservation and management of native, terrestrial biodiversity in Mauritius, and thereby giving effect to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) and other biodiversity related conventions to which Mauritius is party. The act will also provide for the establishment, control and management of National Parks and Special Reserves and related matters.

6. Increase the number of trees to be replanted for every tree felled on State Land, River Reserves, Mountain Reserves, Road reserves, Pas Geometriques, public beaches and public compounds.

In line with a Cabinet decision of 17 February 2012, at least two trees should be replanted for every tree felled on any State Land. It is now proposed to step up to thrice the number of trees felled.

5.14.5 Objective 3: The sustainable development, management and protection of environmentally-sensitive areas such as watersheds and steep slopes.

Strategies:

1. Mapping of environmentally sensitive areas
2. Surveying the main water catchment areas for legal protection; control of infrastructural and agricultural development; and the proclamation of the catchment areas around the main reservoirs as National Forest.
3. Arranging for public-private partnership or incentives for proper watershed management practices on private lands, and possible acquisition (with equitable compensation) of private forests in critical areas considered of national importance;
4. Implementing the re-forestation and re-stocking of steep slopes, and taking measures to minimise soil erosion and sedimentation in reservoirs.
5. Developing and implementing forest rehabilitation models for biodiversity conservation in watershed areas and river reserves to enhance landscape and improve water conservation.
6. Promoting more efficient use of land resources in water catchments for protection of recharge zones and water resources from pollution and depletion. Prepare and implement a public awareness and extension programmes to sensitise people on the need for watershed protection.

5.14.6 Objective 4: Enhance biodiversity and ecosystem services.

Strategies:

1. Increasing the protection of biodiversity-rich areas through additional legal provisions.
2. Increasing the quality of native forests and enhancing wildlife habitats
3. Increasing the native tree cover.
4. Discouraging the production, sale and use of known invasive alien species.
5. Eradication / control of invasive alien species in biodiversity-rich areas.
6. Prohibition of the importation of known alien invasive species.

To that end, the following actions will be undertaken:

- a comprehensive 5-year plan will be prepared to integrate conservation activities such as biodiversity assessments and opportunities for mitigation, in partnership with stakeholders. Indicators will be developed for monitoring and improvement;
- priority areas for conservation and rehabilitation will be identified;
- protection of native species and attenuation of invasive species through amendments to the law and monitoring protocols; developing incentives for private land-owners to protect and restore pristine forests; and research on methods to eradicate/control invasive alien species and to select/restore native species;

- all endangered species will be secured in ex-situ collections and in-situ managed areas;
- the capacity of forest nurseries to produce native species will be stepped up;
- cooperation with research institutions and NGOs will be initiated for, inter alia, phenological studies of endangered plant species;
- the use of native species will be encouraged in landscaping projects;
- exotic forest plantations will be gradually replaced by native species;
- capacity for forest restoration will be built through training in conservation methods and ecosystem restoration; and
- a strategy for eco-tourism and eco-system services will be developed with external technical assistance.

5.14.7 Objective 5: Awareness on importance of trees and forests

Strategies:

1. Developing strong partnerships with key stakeholders for better co-ordination with government agencies, private sector and civil society.
2. Generation and distribution of informative materials on importance of forests and trees for dissemination through media (radio, newspaper, TV and internet) and local communities.
3. Organisation of quiz, essay competition and painting competition on the importance of trees, deforestation, climate change and related themes.
4. Guided tours to the public by forest officers at the Nature Walks.
5. Undertaking Knowledge-Attitude-Perception surveys to fine-tune messages and media campaigns.

6. BIODIVERSITY

6.1 Overview

Mauritius has a rich biodiversity but one of the most threatened floras in the world, with its 691 species of which 273 are single island endemics and another 150 are Mascarene endemics. As regards fauna, the only native mammals are bats (fruit bats and tomb bats) and to-date nine endemic species of land bird and eleven endemic reptile species exist on the island. Of the invertebrate fauna, only butterflies and land snails have been studied.

The country has equally rich coastal zone of wetlands and mangroves, lagoon corals and fringing coral reefs. Freshwater biodiversity is contained within some 90 rivers and streams, several man-made reservoirs, natural lakes and marshy areas; it is low in diversity and endemism; there are 18 species of fish of which thirteen are native. Over the years, the mangrove cover has significantly decreased to reach around 25 ha.

It has a diverse marine environment with its five reef types and so far 159 species of scleractinian corals have been recorded. Of the 340 species of fish identified, 42 are of economic importance. Seven species of shrimps have also been identified. Other invertebrates include octopus, mussels, oysters, barnacles and clams. Over 160 genera of marine algal have so far been identified in coastal waters. Seventeen marine mammals have been recorded in Mauritian waters mostly during the migration to Antarctica for calving, and some dolphins are resident in local waters. A diagnostic analysis in 2012 reported only 40 % of live coral cover exists in the lagoon and annual total fish catch had declined from 19,690 tonnes in 1993 to 5,270 tonnes in 2011. To conserve marine biodiversity, 6 Fishing Reserves and 2 Marine Parks have thus been established so far in Mauritius.

Among the islets, the marine eco-system around St Brandon is still virtually intact with abundant large reef fish, corals and sea creatures. It is an important seabird site with eight species breeding, but seabird numbers appear to be declining on account of poaching and introduced rats.

Wetlands are also an integral component of biodiversity and provide many ecosystem services such as habitat for a wide array of flora and fauna species, water storage and flood control, sediment and nutrient retention, carbon sink, shoreline stabilization and aesthetic and educational purposes. They are however subject to important pressures, especially for back-filling to make way for development projects. As environmentally-sensitive areas, wetlands are closely monitored. Mauritius has three Wetlands of International Importance, namely the Pointe d'Esny Wetland, Blue Bay Marine Park and the Rivulet Terre Rouge Estuary Bird Sanctuary. At the latter site, rare species are protected and conserved. The most common migratory birds are the common sandpiper, tern and whimbrel.

Biodiversity is under threat in Mauritius and its offshore islets due to loss of biodiversity and loss/degradation of habitats as a result of deforestation/land degradation and siltation of lagoons, filling of marshy areas and wetlands, sand and coral mining, over-exploitation of resources, and pressure for development amongst others. The key drivers identified are land clearing for development and other purposes (mainly in privately owned land), invasive alien species, habitat modification for deer ranching, pollution from land-based sources and activities and adverse impacts of climate change.

6.2 The National Parks and Conservation Service (NPCS)

The NPCS was officially established in 1994 to be responsible for all issues related to the conservation of terrestrial flora and fauna in Mauritius and for the provision of related advice. Its vision is that people in Mauritius enjoy a healthy environment and an enhanced quality of life through the effective conservation and sustainable use of biodiversity in line with national and international commitments but nonetheless respectful of local values. Its key mission is to ensure a sustainable management and restoration of native terrestrial Mauritian fauna and flora so as to retain its genetic biodiversity for the future generations.

It is governed by the Wildlife and National Parks Act (1993), and NPCS has upgraded the legislative framework to provide an overall protection to all biodiversity and to be in line with International Conventions especially CITES and CBD (two major biodiversity related conventions). The new Native Terrestrial Biodiversity and National Parks Act (2015) has been proclaimed and is in force as from 1 November 2015.

6.3 International Conventions

The National Parks and Conservation Service is the focal point for several Conventions and Agreements related to biodiversity. Some of these Conventions are:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), ratified on 27 Jan 1975. The convention deals with all matters related to international trade of endangered species of flora and fauna.
- Convention on Biological Diversity (CBD) ratified in June 1992. This convention deals with the protection and sustainable use of all biological resources.
- Ramsar Convention on wetlands ratified on 30th January 2001
- African Eurasian Waterbird Agreement (AEWA), entered into force on 1st November 1999 and Convention on Migratory Species of Animals (CMS) ratified on 1st June 2008

6.4 NPCS action

NPCS recent action plans have centred on in-situ conservation and ecosystem approaches. NPCS currently manages:

- 10 legally proclaimed protected areas on the mainland - two National Parks, seven Nature Reserves and one bird sanctuary- covering a total area of 7,292 ha.
- 8 Islets National Park, 7 Nature Reserves and one Ancient Monument - covering a total area of 735 ha.
- The Ile aux Aigrettes Nature Reserve is leased for conservation management purposes to the Mauritian Wildlife Foundation (MWF).

6.5 The Vallée d'Osterlog Endemic Garden

This Garden forms part of the 2% remnant native and endemic forest that remains in Mauritius. Its management is governed by the Vallée D'Osterlog Endemic Garden Foundation Act of 2007. Its vision is to be the reference Endemic Garden of Mauritius with mission to contribute to biodiversity conservation at global level and to knowledge dissemination and research on the endemic flora and fauna of Mauritius.

Future action for Mauritius will continue on the same working principles. Activities will continue to be based on the development of representative and viable protected area networks, the control of invasive alien species, the management of key components of biodiversity, the enhanced identification (particularly of freshwater ecosystems) and monitoring of biodiversity and mechanisms to enable sustainable use through ecotourism development and sound management of natural resources. Emphasis is also placed on the sound application of modern biotechnology through the balanced implementation of the provisions of the Cartagena Protocol on Biosafety. NPCS will continue to empower stakeholder partnerships and ensure the mainstreaming of the conservation and sustainable use of biodiversity.

6.6 Invasive Alien Species

While the NPCS continues its conservation activities and maintains these sites, there are other critical activities related to protection from loss and degradation. Invasive alien species (IAS) have been singled out as a major cause of bio-diversity loss. These are introduced plants, animals and micro-organisms whose establishment and spread threaten ecosystems, habitats or species (including humans). IAS thus represent a major threat to the economy, environment and society. Over the years, a variety of actions have been undertaken to address this threat but in spite of some significant successes, the problems posed by IAS appear to be increasing.

For a comprehensive and coordinated approach to addressing IAS issues, a National Invasive Alien Species Committee (NIASC) was established to develop a National Invasive Alien Species Strategy as a first step to the management the IAS threat with the involvement of non-governmental and civil society organisations, the private sector and the general public. The strategy has been outlined in the a project document entitled 'National Invasive Alien Species Strategy and Action Plan' (NIASSAP)

for the Republic of Mauritius produced in 2010 to cover up to 2020. There is need to update this NIASSAP and to look for funds for its implementation.

6.7 Strategy for management of invasive species

The proposed strategy consists of five Management Elements and five cross-cutting issues.

The Management Elements, with their accompanying goal or goals listed hereunder in order of priority are based on the maxim that “prevention is better than cure”, in line with CBD Guiding Principle 2.1

1. **Prevention** - to minimise the number of unintended and intended IAS introductions to the Republic of Mauritius;
2. **Early Detection and Rapid Response** - to minimise the number of IAS that go on to have harmful consequences once they are introduced to the Republic of Mauritius;
3. **Eradication** - an agreed framework for eradication priorities in place, eradications undertaken as necessary and results disseminated;
4. **Control and Management** - to contain the distribution and abundance of IAS in the Republic of Mauritius to a long-term acceptable level; and
5. **Restoration** - to undertake ecosystem restoration where necessary in the Republic of Mauritius to achieve long-term ecosystem goals.

The Cross-Cutting Elements, again listed with their goal or goals are:

6. **Legal, policy and Institutional Frameworks** - to have a coordinated policy and management framework that minimises the risk of IAS to the economy, environment and society of the Republic of Mauritius;
7. **Capacity Building and Education** - to make available appropriately skilled personnel from the Republic of Mauritius or elsewhere to implement all aspects of IAS management in the country;
8. **Information Management and Research** - (i) To have a clear understanding of the economic, environmental and social impacts of IAS that have become established in the Republic of Mauritius; (ii) to have ready access to critical information that will support IAS management programmes and (iii) to provide a strong scientific basis for decision-making and resource allocation;
9. **Public Awareness and Engagement** - The general public, decision-makers, scientists and other stakeholders in the Republic of Mauritius should have a high level of awareness of IAS risks and the benefits of IAS prevention and management for the economy, environment and society; and
10. **International Cooperation** – (i) The Republic of Mauritius to have access to the necessary information, technical support and other resources it needs to effectively meet its national and international obligations; (ii) Mauritian IAS experiences and lessons learned are effectively disseminated to help IAS initiatives regionally and internationally; and (iii) the Republic of Mauritius is not a source of IAS for other countries.

The report has also developed the detailed actions to implement the strategy. Sufficient human, technical and financial resources must be deployed for its sustainable implementation.

6.8 Updating the current NBSAP

A project is currently under way to assist Mauritius integrate its obligations under the CBD into its national development and sectoral planning frameworks. It is expected to produce measurable targets for biodiversity conservation and sustainable use. The emphasis will be on developing biodiversity targets in response to the Aichi Targets and to be in line with CBD strategic plan (2011-2020); updating the NBSAP and integrating new aspects such as mainstreaming and anchoring the implementation of the plan in development frameworks, valuing ecosystem services and promoting ecosystem-based adaptation and resilience; and strengthening resource mobilisation, CBD reporting and exchange mechanisms.

These will be included in a revised National Biodiversity Strategy and Action Plan (NBSAP) which should guide NPCS activities to 2020.

6.9 Agro-biodiversity

Agro-biodiversity is more closely linked to production in the non-sugar sector and more specifically to food security (i.e. vegetables, fruits, medicinal plants and livestock). But over the years, agriculture has lost plant genetic resources as emphasis was placed on a limited number of high-yielding varieties and breeds, often imported hybrids; and stations which harboured valuable species and varieties were released for development. Such practices narrow the genetic base and may pose serious threat to long-term food security. Furthermore, limited land and capacity for research, incomplete inventories, weak communication and collaboration between institutions, and the risk of introduced Living Modified Organisms are further complications.

6.9.1 Plant Genetic Resources Unit

Therefore since 1995 the Plant Genetic Resources Unit of the Agricultural Services started the collection of local germplasm for food and agriculture. It runs one seed-bank at Curepipe as well as a field gene bank at Nouvelle Découverte where vegetatively-propagated accessions are conserved. The Endemic or Native Plants corner at Sir Seewoosagur Botanical Garden at Pamplemousses, remains under the responsibility of the PGRU. Other Agricultural Centres provide facilities for the regeneration and multiplication exercises. To optimise the existing facilities, the PGR unit has extended its mandate to other flora of national importance such as crop wild relatives.

Actually, there are 471 accessions in the gene bank consisting of the following genera: *Amaranthus*, *Allium*, *Brassica*, *Cucurbita*, *Lycopersicon*, *Solanum* and *Vigna*. Wild relatives of pigeon pea, cucumber, potato, eggplant and tomato are kept as well as a rare pea and three endemic coffee species. Local litchi and pineapple varieties are included. Also, FAREI holds a limited collection for onion, taro and anthurium. For potato, a germplasm comprising of 120 imported clones and another 20 locally developed clones are maintained. About 69 species of medicinal plants and ornamentals have been identified, many of them are native and about 10 % are endemics.

Given the heterogeneous agro-ecological conditions that prevail in Mauritius, genetic and species diversity have a special significance for the maintenance and enhancement of productivity in agricultural crops, all the more so under climatic change. Such diversity provides sources of natural resistance to diseases, pests, drought and other stresses, and contribute to stability and food security for farmers. In view of its value to sustainable development, the conservation, characterisation and use of plant genetic resources is crucial. Safeguard for traditional knowledge is covered in the CBD Treaty of PGRFA. Mauritius ratified the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits and is active in regional initiatives.

The PGR Unit will maintain its technical activities, namely:

- Management of the field Gene Bank and field conservation of germplasm;
- Collection of accessions;
- Monitoring and maintenance of accessions in the Seed Gene bank.
- Regeneration, multiplication and characterisation of accessions; and
- Rescue of endangered species.

To strengthen the operation of the Unit, it is proposed to:

- set up a National Plant Genetic Resources Committee to coordinate the Plant Genetic Resources for Food and Agriculture (PGRFA) activities and PGRFA related issues;
- drafting of a PGRFA Bill, and eventual enactment;
- running a pre-breeding exercise,
- characterisation and cataloguing of the existing germplasm; and
- promoting the use of under-utilised local germplasm.

6.9.2 Animal Genetic Resources

Livestock diversity is essential to food and livelihood security providing meat, milk, eggs, manure, leather and a range of other products and services. They contribute to the ecosystems in which they live, providing services such as seed dispersal and nutrient cycling. In order to address the increasing demand for livestock products there has been significant import of exotic genetics and indiscriminate cross-breeding which has led to increasing erosion of animal genetic resources. The Creole cattle population which was around 32,300 in the 70's (representing 70% of the total cattle population) declined to around 100 heads in 2015, representing less than 2% of the total herd. Thus, according to the classification of International Union for Conservation of Nature (IUCN) the Creole cattle falls under the category "critically endangered species". Other species that require conservation actions are the mongoose pig, Rodriguan chicken and Rodriguaise sheep. The Rusa deer (*Cervus timorensis russa*) has established itself as a full-fledged economic activity and as an integral part of the livestock sector. With the gradual decline of the local cattle population, venison has become the main source of red meat. Its population increased from 45,000 in 1988 to reach 65,000 in 2014.

Within the internationally agreed framework, member states are committed to implement the FAO Global Plan of Action for Animal Genetic Resources which aims at promoting the sustainable use, development and conservation of AnGR. In this respect FAREI has set up a nucleus for conservation and utilisation of Creole cattle and local goats at Curepipe Livestock Research Station. They have been characterised phenotypically and are being monitored for productive and reproductive performance. Under the conservation of farm animal genetic resources, a new nucleus of Creole cattle has also been set up at Richelieu Open Prison farm and for local goats at FAREI's Belle Mare Centre. A total of 68 Creole cattle and 52 local goats are being kept in those herds.

Major constraints regarding priority actions are linked to the low contribution of livestock in the economy and the lack of funding for implementing programmes. There is no specific programme/projects with financing for animal genetic resources. Monitoring of existing activities is embedded in Research Programmes of the FAREI. Lack of resources (human, financial and infrastructural) limits further action.

The policies or legislation that exist do not discriminate between species or breeds nationally or in particular production systems or imported animals. A clear policy is therefore necessary. Furthermore, Government has taken steps to enable farmers to access good breeds of cattle, goats, sheep and pigs. However, this genetic potential needs to be maintained by a functioning and efficient artificial insemination service for all three species of livestock. This service is presently available mainly for cattle and to a lesser extent for pigs. In the long-run, continued mass importation of foreign breeds is not economical.

Priority actions will therefore involve :

- i. Defining a national breeding policy with clearly defined breeding objectives and establishment of breeding programmes at national level;
- ii. Developing a framework for in-situ conservation at farmer's level;
- iii. A systematic genetic improvement program, to be developed for each species;
- iv. Regular importation of bulls, bucks and boars;
- v. Developing corresponding AI services.

7. CROSS-CUTTING ISSUES

As well as the specific subject area issues, there are also a range of wider, cross-cutting concerns that must be addressed. Gender and youth, the environment and climate change are among these.

7.1 Climate Change

The climate of Mauritius is complex, showing wide variations across the country and with a variety of micro-climates. Meteorological observations have confirmed a change in climate parameters. Between 1950 and 2008, the average temperature has risen by 0.74 C and annual precipitation has decreased by 8%. Climate variability and extreme climatic events such as flash floods are also on the rise.

Agriculture is highly vulnerable to climate extremes and climate variability, which give rise to disasters and results in lower agricultural productivity, crop loss or crop failure. Changes in temperature and rainfall associated with climate change are expected to shift crop production ranges and calendar; change the incidence and severity of pests, diseases and weeds; modify crop development patterns; worsen the water stress; increase stress on livestock; and modify the set of feasible crops. All of these possible effects will adversely affect production, prices, incomes and ultimately the livelihoods and lives of the farming community. The impact and economic cost of such events can be significant on national food production and food security. One can expect our food insecurity to increase.

On the other hand, agriculture also holds significant potential to help resolve the problem. It is therefore essential and urgent to implement adaptation and mitigation strategies for climate change. Some priority issues are mentioned below covering a shift in orientation of institutions, moving to climate-smart agriculture, and mitigation. Some key technical areas in need of strengthening are discussed in depth.

7.1.1 Adaptation to Climate Change

According to the International Panel on Climate Change (IPCC), global warming is a reality and that the phenomenon will continue over the next century. The Mauritius Meteorological Services has already established that the general trend is towards a rise in temperature and a decrease in the amount of precipitation. As a SIDS, Mauritius is highly vulnerable to climate change.

Any increase in temperature, change in amount and pattern of precipitation, extreme climatic events and sea level rise will have a profound effect on local agriculture as climate is the most significant factor determining plant growth and productivity. The possible impacts would include heat stress in plants, soil moisture stress, higher pest and disease incidence, shift in dominant pests and diseases, shift in vegetation zones, and lower productivity in the livestock sector. As a result, adaptation and mitigation will be key strategies for the Mauritian agriculture.

The following measures are being proposed as part of an adaptation strategy:

- i. Screening of crop varieties suitable for changing climatic conditions;
- ii. Developing protected culture systems;
- iii. Adopting rain-water harvest systems and using water-saving technologies for irrigation;
- iv. Promoting Integrated Pest and Disease Management;
- v. Optimising the use of chemical fertilisers;
- vi. Introducing and promoting soil conservation methods;
- vii. Promoting mixed cropping and agro-ecological farming; and
- viii. Implementing an agricultural insurance scheme.

Agriculture however, is itself responsible for an estimated one third of climate change, mainly through deforestation, the use of fossil fuel based fertilisers and the burning of biomass. Most of the methane in the atmosphere comes from domestic ruminants, forest fires, wetland rice cultivation and

waste products while conventional tillage and fertiliser use account for the majority of nitrous oxides emissions.

Agriculture offers good potential for reducing emissions of greenhouse gas (GHG), namely through:

- i. Recycling and composting crop residues and livestock wastes;
- ii. Carbon sequestration in biomass and soil organic matter; and
- iii. Adopting Good Agricultural Practices, including natural farming systems and agro-forestry;
- iv. Promoting the use of solar panels, wind turbines and production of biomass to generate renewable energy;
- v. Minimal use of agrochemicals (fertilisers and pesticides) in crop production.

7.1.3 Emission of Green House Gases and International Obligations

The Republic of Mauritius is a Party to the United Nations Framework Convention on Climate Change (UNFCCC) and is required, in accordance with Article 12 of the Convention, to report on measures undertaken at national level to implement relevant international obligations and decisions pertaining to climate change. In this context, it has to report at regular intervals on gases emission in order for UNFCCC to assess compliance.

In this endeavor, the following activities will be pursued:

- i. Conduct of a comprehensive GHG Inventory in the agricultural sector;
- ii. Supporting the National Focal Point on Climate Change in the preparation of the:
 - National Inventory Reports,
 - Third National Communication,
 - Biennial Update Report,
 - Intended Nationally Determined Contribution (INDC),
 - 2050 pathways calculator for evaluating climate change strategies.
- iii. Setting up a Climate Change Working Group at FAREI to coordinate climate change issues among institutions and key stakeholders in the agricultural sector.
- iv. Following up on related issues, namely:
 - Capacity building to monitor climate change and design indicators for agriculture;
 - Promotion of practices for the adaptation and mitigation of agricultural systems;
 - Practices to increase the resilience of agricultural systems;
 - Climate and disaster risk management in agriculture; and
 - Data and information collection, early warning and dissemination.

7.1.4 Mainstreaming Climate Change in Research and Extension

To that effect, research institutions covering crops, livestock, forestry and natural resources management will have to adapt their portfolio and their priorities to reflect this urgency, but must re-think about policies and institutional arrangements that govern agricultural production, value chains and natural resource management. The approach to research should involve more inter-disciplinary teams and engage in collaborative research and experimentation with stakeholders. FAREI has adopted this approach for some time already but must now re-orient and extend their know-how to cover the wider dimensions of Climate Change adaptation. Work programmes and projects must recognise and reflect the need for adaptation. Communication must be stepped up to create awareness of Climate Change and related issues for farmers, but must now go beyond mere transfer of knowledge into facilitation and intermediation to advance innovative ideas.

Given the multi-disciplinary nature of CC and the multiple actors within agriculture, it has become necessary to set up a Climate Change Working Group under the responsibility of FAREI to share information, coordinate for concerted actions and to interface with other bodies and international agencies whenever required. Its first tasks would be to undertake a detailed identification of climate impacts, vulnerabilities and coping measures and to improve climate information and forecasts.

7.1.5 Promotion and development of climate-smart agriculture practices (crop and livestock)

Climate Smart Agriculture is an approach to developing the technical, policy and investment conditions so as to achieve sustainable agricultural development for food security under climate change. This calls for the comprehensive integration of the climate change effects into agricultural planning, investment and programmes. Small-scale composting has no doubt been promoted, but climate change is yet to be properly mainstreamed throughout the agriculture sector. Basically, there is not enough awareness, policy or financial strategy to promote climate smart agriculture; the human and infrastructural capacity for R&D is limited, and coordination amongst stakeholders and institutions is weak.

To address climate smart agriculture (crop and livestock), it is proposed to :

- Disseminate information, improve climate change awareness and highlight the potential of agriculture to capture and sequester carbon and reduce GHG emissions to offset the effects of CC.
- Develop sustainable and natural farming practices for crop and livestock production, such as composting at farm scale; shift from mineral fertilisers, pesticides and herbicides into biologically active plant protectors and control agents; use of minimum-tillage, crop rotation and cover crops.
- Promote soil and water conservation techniques (rainwater harvesting, micro-irrigation, waste water recycling, crop and animal waste management)
- Develop sustainable forest management (forest cover, sustainable use, re-afforestation, agro-forestry, forest protection, biodiversity);
- Strengthen and re-orient R&D: examples include the identification of cultivars and animal breeds resistant to climate variability, agriculture conservation techniques, integrated nutrient management, animal housing, protection of agro biodiversity);
- Training and capacity building on climate change and climate smart agriculture at all levels (policy, technical, financial, monitoring) with emphasis on knowledge sharing, facilitation and coordination;
- Design incentive schemes for farmers to adopt sustainable farming practices;
- Developing standards and a certification system for an ecological food label;
- Inventory of coping strategies for farmer information, and setting up of support schemes for farmers to cope with climate related disasters;
- Development and promotion of protected culture (sheltered farming);
- Strengthening the pest and disease alert system for the benefit of farmers; and
- Monitoring of climate change and its impacts, and developing appropriate adaptation strategies in collaboration with agencies responsible for the theme of CC.

In addition, options will be explored for promoting agro-forestry, reforestation and afforestation projects for carbon credit markets, especially the voluntary private markets, which are currently the most active, and develop appropriate methodologies for designing and marketing such projects. External expertise will be necessary in this case.

7.1.6 Integrated Pest Management (IPM)

Integrated pest management aims to control insects, plant pathogens and weeds. It emphasizes on use of natural pest control techniques thereby minimizing the risks to human health and the environment. As climate change is expected to facilitate the emergence or resurgence of invasive

pests and plant disease vectors, the integrated pest management strategy will help to keep pace with rapid and dynamic changes in pest diversity and population. IPM has been successfully implemented on a pilot scale for food crops, and various environment-friendly technologies have been tested and used.

But the up-scaling and adoption of the IPM techniques has been slow and limited at national level. This is largely due to insufficient infrastructure to raise biological control agents and test environment-friendly alternatives such as botanical pesticides; limited range of bio-pesticides and their high cost. Similarly, area-wide application of IPM have proved specially complex to arrange. More importantly, there is no policy and regulation framework to promote IPM and farmers do not have market incentives to adopt IPM. Grading and labelling of fresh produce are not practiced, and public information and awareness are limited.

Accordingly, it will be necessary to:

- Develop an integrated strategy and policy to foster adoption of IPM practices
- Strength institutional capacities(and human resources, infrastructure and equipment) in R&D on IPM technologies, surveillance and early detection of pests and diseases.
- Review policy and regulation framework to facilitate the introduction of IPM technology and regulate the use and disposal of pesticides
- Increase information and awareness on alternative to pesticides for farmers and food safety for the general public

7.1.7 Fertilisation using an Integrated Plant Nutrient System.

Local food crop producers are heavy users of artificial, chemical fertilisers. These often have negative impacts, leaching into ground-water reserves and run-off to pollute the lagoon. Lately, with production and availability of composts, interest has been revived for natural fertilizers. A more rational use of fertilizers should therefore be promoted, focussing on both crop yields and satisfying plant nutrient requirements but blending both organic and chemical fertilisers. While there is still scope for chemical fertilisers, appropriate dosages should be emphasized in farmer programmes. Farmers should also be educated about the negative effects excessive applications to the environment, and encouraged to switch to biological farming.

Accordingly, it will be necessary to:

- Strength institutional capacities(and human resources, infrastructure and equipment) in R&D on IPNS packages, in-field soil testing, nutrient balance and soil amendment;
- Increase information and awareness of farmers and the general public on the merits of IPNS.

7.1.8 Promotion of efficient irrigation techniques

Efficient irrigation techniques is an appropriate climate change adaptation option for farmers to save water, increase or sustain farmers' income and enhance food security. The Irrigation Authority (IA) provides irrigation facilities over 500 ha of lands to produce some 15,000 tonnes of vegetables/onions annually. However, the irrigation network is limited as a result of the high initial investment costs for micro-irrigation technologies. The strategy is targeting to:

- cover all small-scale food crop growers in drought-prone regions, after the demonstration and promotion of efficient irrigation techniques;
- improve the efficient use of existing irrigation systems using mulching, drought-tolerant or resistant varieties rain-water harvesting, storage and recycling.
- conversion of irrigation systems for sugarcane (high volume – low frequency) to fit requirements of food crops (low volume- high frequency)

An action plan has been developed as follows:

- Survey of drought prone areas and feasibility studies for irrigation project
- Cost and benefit analysis and feasibility study for irrigation on different farm size and crops

- Investment in water infrastructure to support irrigation projects for food crops
- Developing a policy framework for productive use of water in agricultural sector
- Capacity building for researchers, extension agents, farmers and entrepreneurs involved in design, installation and management of irrigation.

7.1.9 Mitigation

Emission of GHG are made up of Carbon Dioxide (CO₂), Methane (CH₄) and Nitrous Oxide (N₂O) and arise from manure and composts used in agricultural soils; field burning of agricultural residues, enteric fermentation in ruminants, and manure management. In 2006, agriculture contributed 4.2% of total national emissions, emanating largely from agricultural soils (59.6%) and the livestock sector (40.4%). Synthetic nitrogen fertilisers are widely used and contribute to N₂O emissions.

In 2010, there were signs of a decline arising mainly from reduction in land area under agriculture and deliberate actions, namely:

- the promotion of Integrated Plant Nutrient System whereby soil fertility is managed to improve and maintain agricultural productivity in a sustainable manner, often using chemical fertilizers in a balanced way. This process has been facilitated by the large-scale production of compost and incentive schemes to encourage its adoption. This approach is commendable, and can be further enhanced by integrating other measures such as :
 - Prevention of land degradation and conservation of soil and plant nutrients
 - Composting and recycling of crop residues
 - Inclusion of legume cover crops on fallow land
 - Minimum and zero-tillage where possible.
 - Usage of inoculant on legume crops.
- Carbon Sequestration, whereby soil serves as a carbon sink. Agriculture is capable of sequestering large amounts of carbon in terms of biomass produced and as soil organic matter in the soil. Support must be continued for IPNS, bio-farming, natural farming practices, and farm and household composting so as to accelerate the build-up of soil organic matter , reduce the need for chemical fertilisers, and thereby sequestering carbon and reducing N₂O emissions. Besides, the tree planting programme under Forestry must be accelerated to make up for change in land use (mainly for infrastructure, agriculture and residential purposes) and ensure a cleaner, greener and safer environment.
- Improved livestock waste management to reduce emissions from animal waste products. Possibilities include composting of solid wastes, covered storage and pasture grazing. Emissions can also be mitigated by production of biogas. Given the high investment costs of bio-digesters, consideration should be given to low-cost alternatives which are more likely to be adopted by small livestock breeders.
- Other possibilities include production of Bio-fuels/ biomass crops such as *Arundo donax* for Renewable Energy in addition to that of sugarcane; optimising ruminant feeding regimes to minimise CH₄ from enteric fermentation and maximise output per unit of GHG.

However, the greatest reductions will arise from integration of good agricultural practices, a minimum of high-intensity inputs and maximising soil carbon. Overall, it is expected that agriculture will contribute significantly in coming years. The scale of bio-farming envisaged by Government will also contribute but will require that standards and certification schemes be first put in place, and awareness raised among consumers.

7.2 Agricultural Land Management

7.2.1 Current situation

Presently, significant proportion of the island of Mauritius to the tune of over 70% is under agriculture and forest lands. In recent years, significant land areas have been moved out of agriculture to make way for infrastructure and residential development. The area of cultivable land,

water courses and biomass sources are under tremendous pressure to meet highly competing and at times conflicting demands for development.

Besides, a large area formerly under sugarcane are now abandoned, and represents a waste of valuable resources as well as missed potential for novel initiatives.

A major concern that will need to be addressed is the conservation of fertile agricultural land, forests and other green landscapes. As these areas are instruments in the adaptation and mitigation of the impacts of climate change, and will help the nation meet its related international commitments, it is imperative that a rational approach be adopted to curb their diversion to other land uses. This is especially important for those problem areas that may require alternative land use and management.

To that effect, a well organised Land Management Information System (or Land Bank) is badly required to reflect the status of land use among the different economic activities and particularly for specific agricultural sub-sectors. At another level, maintenance of green landscapes should be given due attention. Natural places will be essential both for the social well-being of the population and for development of green tourism. The effective use of Remote Sensing, Geographic Information System, and global positioning techniques can provide the basic tools for such a land management information system and ensure constant monitoring of land use, and eventually helping in the sustainable management of land and natural resources.

With scarcity of fertile agricultural land resources in Mauritius, it is essential to have continuous monitoring of the extent and type of both state and private lands available in each region, their current land use pattern, and any change in land use. Much of these lands are leased State Lands, but the Land Use Division of Agricultural Services lacks the resources to enforce the conditions of the lease.

Due to high pressure for efficient land use, certain zones may be identified and dedicated for particular activities such as livestock farming or organic food production. This will help bring down the cost of infrastructure and utilities when shared among operators (e.g. electricity and water networks). In the case of livestock projects, clusters can be sited in suitable locations away from residential zones and thereby avoid environmental problems that normally arise in the localisation of these projects with proper waste management. Similarly for organic or bio-farming, such isolation may be necessary for the producers to qualify for certification; restrictions may then be imposed on producers to follow common guidelines (cahier de charges) in keeping with their objectives.

In regard to the above, it is proposed to:

- (i) ensure that land conversion is done in a rational way in line with the National Physical Development Plan;
- (ii) implement a land management information system;
- (iii) strengthen the Land Use Division with a Land Squad for the effective enforcement of the conditions of leases for State Lands; and
- (iv) strengthen the National Remote Sensing Centre at Bigara with qualified technicians and support staff, updated equipment and software to bring it back to full functionality.

7.2.2 The National Remote Sensing Centre

The original aim of the National Remote Sensing Centre is to develop strategies towards sustainable development and the optimal utilisation of natural resources of Mauritius based on a systematic inventory of the available resources using the Remote Sensing technology (spatial data) and other ancillary information in a Geographic Information System (GIS). Such information associated with area specific potential, problem and socio-economic constraints, can be useful to generate site-specific recommendations for a more orderly planning of agricultural development.

The major objectives in this regard are to:

- (i) generate various thematic maps of natural resources on 1:250,000 scale in digital formats;
- (ii) identify the potentials and problems of land, water and socio-economic parameters;
- (iii) integrate thematic information and socio-economic data for generation of action plans; and,

- (iv) generate plans, maps and tools for:
- Watershed development and protection
 - Land Capability
 - Land Use Change analysis
 - Environmental / Climate Change impact analysis
 - Monitoring of land degradation /erosion/land slide.

In order to revive the National Remote Sensing Centre and help it meet its objectives, the following is envisaged:

- (i) upgrading existing software and hardware;
- (ii) re-deployment of trained staff back to operate the Centre;
- (iii) provision of support staff for ground-truthing, etc.
- (iii) soliciting technical expertise from India to oversee and guide the operation of the Centre;
- (iv) arranging for continuous, up-dated satellite data from the local receiving station and other commercial sources.

7.3 Research and Advisory Services

7.3.1 Research

FAREI is responsible for conducting applied research in respect of non-sugar crops covering horticultural production, protection from pests and diseases, post-harvest management and agro-processing wherever feasible. FAREI is also responsible for research on livestock production and veterinary research, although the latter has been unmanned for a few years now. Its research and technology exchange are primordial to lead the improvement in productivity and raising production levels towards food security. While research will still strive for higher productivity, it will now have to consider as well issues relating to sustainability of the agricultural sector, climate-smart practices and higher food safety standards. Biofarming will require special attention along all its dimensions.

It is therefore all the more important to maintain the investment in crop and livestock research, and to consolidate their linkages to extension/advisory services so that new knowledge is effectively transferred to the farming community.

It is imperative also that the Animal Health sections at FAREI be fully staffed, all the more because of the impending transfer of animal health care and artificial insemination services to FAREI in the wake of reforms at the Agricultural Services.

7.3.2 Advisory Services

Small holder farmers and agro-entrepreneurs in Mauritius require sustained advisory and training support so that they can take advantage of knowledge, technologies and services to remain competitive in their business. The opportunity to develop a new generation of agro-entrepreneurs is more than ever a strategic choice. In this context a human resource developing programme addressing continuous and adapted capacity building of all operators along the value chain of the crop sector is our aim. Training facilities established regionally on model farms and at the Farmers Training School will be operating towards this goal in addressing farmers, processors, workers and agro-entrepreneurs.

In addition to these, the approach will henceforth be more customised for the individual farmers. The 'one size fits all' approach is not effective for innovative and business-oriented farmers. Their interest covers from mere technical issues to farm management and business decision-making.

Besides, the drive for biofarming will require that farmers have a more intimate knowledge of the eco-system and a better understanding of integrated crop management principles, which will be new and complex to most farmers. This situation will require an even closer linkage between research specialists and extension, and ultimately a special effort by extension agents for technology transfer

to farmers. In some instances, extension should now shift its attention from the level of individual farmer to the community level, as for example in area-wide pest management.

7.4 Training of Farmers

The agricultural sector is undergoing major transformations with the need for investment in modern technologies for intensifying production, to ensure food security and consumer demand for agricultural products that are produced in a safe and sustainable way. To meet these challenges, the FAREI has resolutely invested over the years in training capacity both in terms of infrastructure and equipment at its farmer Training School / regional training facilities and capacity building of its staff (training of trainers). This capacity building programme aims at a knowledge based agriculture where professional producers and workers are able to produce more and better within a sustainable context.

A number of innovative steps have been identified to achieve the goals namely:

- Support to target farmer groups (including women) by commodity, problem areas and objectives with reference to resource profile studies. Group meetings, on farm demonstrations, training and publications;
- To incorporate a module on Agro-entrepreneurship and Business Plan Preparation for existing and prospective entrepreneurs in the field of agri-business;
- Training courses focusing on increasing agricultural productivity and sustainability of the farming systems among which the eco-system, Good Agricultural/Husbandry Practices, post-harvest management, food safety and quality;
- Building capacity of staff on new topics climate change, climate compliance, energy audits, low carbon footprint and carbon sequestration; permaculture; traceability; cluster management; and facilitation /governance of value chains; area-wide pest control.
- Entrepreneurship development training courses to focus on potential agri-business opportunities, project feasibility, sustainable production, standards and norms;
- Job oriented award vocational training courses to meet increasing demand for a trained and skilled workforce. Focus will be on competency development in line with the industry's modernization and the adoption of more sophisticated technologies. It will ensure the 'revalorisation' and professionalization of agricultural jobs and availability of a skilled labour pool to meet specific human resource gap. Training will target unemployed, skilling of retrenched workers for improved employability and upgrading existing workforce;
- Training needs assessment of major stakeholders on a regular basis in order to better customise their training;
- The use of Information Communication Technology (ICT) in producing and disseminating knowledge to all stakeholders from production to marketing - The use of "Open and Distance Learning" modes (ODL) has been developed with the assistance of the Commonwealth Of Learning to target new agro entrepreneurs in agri-business. This will help to fill the information and knowledge gaps, and help to boost the sector forward.
- Exchange programmes to gather international experience and exposure to novel technologies; and
- The re-introduction of the Technology Introduction and Diffusion Scheme (TIDS).

7.5 2014 Census of Agriculture

Exceptionally, a Census of Agriculture was carried out in 2014 by Statistics Mauritius with assistance from FAO. It follows the last one run in 1940.

The main objectives of the 2014 Census of Agriculture were to provide important information on the organisational structure of farms at geographic level for better and informed decision making (e.g. farm size, land use, land tenure, crop area harvested, presence of irrigation, livestock numbers, farm

labour as well as the number of holdings with each crop and livestock type); to improve estimates on the contribution of agriculture for the economy; and to provide information on food security.

Highlights based on a preliminary analysis are available at <http://statsmauritius.govmu.org/English/Publications/Pages/Census-of-Agriculture-2014.aspx>.

Statistics Mauritius is now undertaking a detailed analysis and evaluation of the census data including estimates for sectors not covered (viz. sugarcane and tea). A consolidated report and thematic analysis of the data with respect to gender, land and livestock are expected by end 2015. As this Census report comes after a long period, it would be useful to compare its data with the current statistics regularly produced by SM, especially those which are derived from administrative reports.

This census 2014 is nonetheless a major step forward, and will provide a baseline, a valuable tool for long-term planning and monitoring the evolution of agriculture, if only the effort is renewed on a regular basis, say every 10 years. A survey conducted at mid-term will also be useful to update the statistics.

7.6 Agricultural Production and Market Information

The Agricultural Production and Market Information System (APMIS) project was setup by the FAREI to provide farmers and stakeholders access to information mainly related to production, area cultivated and market prices of local food-crops. Constructed in collaboration with farmers and stakeholders and with a simple and user-friendly medium for information dissemination, the APMIS was officially launched in October 2010. The system covers a sufficiently long period of data that is useful for modelling, forecasting, trend analysis and comparisons.

Similarly, some basic livestock information is also available through the system. Mauritius can be considered as one of the rare African country having crop production data available at monthly interval for the whole country and near-to-real-time market price information accessible at no cost.

A number of farmers' training in the use of the interactive system have been carried and the training is on-going. Thus, farmers having internet facilities can access the system on their own or assisted by a family member. For others, a desktop computer is available in regional centers where they may be assisted by officers.

The system will be upgraded to capitalise on novel communication tools, namely with:

- data capture at field level using mobile devices.
- developing decision-support tools for field officers to advise farmers and entrepreneurs;
- operating a dedicated service for entrepreneurs of hydroponics and orchard;
- documenting opportunities for post-harvest and the transformation sector; and
- adapting the APMIS following the forthcoming operation of the auction/wholesale market.

However, information needs extend beyond APMIS. FAO estimates post-harvest losses and food wastage in agriculture each at about 30% on a global scale. No estimates are available for Mauritius. A proper estimation must be made of these losses and wastage for priority crop or livestock operations. Locating the sources of wastage and loss, and arresting them can lead to more effective use of resources and ultimately reflect in higher productivity and cost-effectiveness at farm level.

Similarly, farmers face production risks, which reflects ultimately in reduced income for their families. This can have serious, negative impact on nutrition for themselves and their family. In such a case, it becomes important to think of food security not merely as the national food trade balance but also at the household level where food security depends on income and affordability. With climate change looming ahead, it becomes more important to have regular surveys of the socio-economic status, income, household food security and welfare of farmers can be monitored.

7.7 ICT for effective agricultural knowledge management

In a context of optimising resources, need for cost effective service, changing behaviour of our client who now has different priorities and communication channels, ICTs offer the institution the capacity to work smarter, enhance agricultural extension outreach and to interact in new ways with farmers.

Over the years, FAREI has offered ICT based services among which the SMS Disease Alert to registered growers and the On-line Plant Disease Diagnosis for rapid diagnosis and recommendation for control. With the increasing accessibility and lower cost of ICT, FAREI will further exploit ICT's potential to ensure effective technology/information transfer for agricultural development and food security, and to raise farmers' productivity generally. In particular, focus will be on mobile technologies, collaborative information sharing platforms and e-learning with multi-media based Open and Distance Learning (ODL) materials which offer the advantage of 'flexible' learning i.e. at one's own pace and place.

7.8 Mechanisation

Small-scale foodcrop and livestock production are still dependent on traditional, labour-intensive practices. There is a lack of easily accessible opportunities for mechanisation. Indeed, mechanisation services can provide new opportunities for agri-business if the necessary incentives were in place. In that respect there is need to develop a mechanisation strategy, incentive packages as well as business models for the provision of mechanised services to farmers.

7.9 Gender

According to the Digest of Statistics 2013, the agricultural sector employed a significant number of women, some 17,200, representing some 38% of total employment in agriculture. The 2009 National Livestock Census reports the number of women involved in livestock production activities on a permanent and casual basis at 3,683. Many are still active rearing dairy cattle, goats and sheep on small scale. As regards entrepreneurship, women favour agro-processing activities at cottage level which unfortunately develop rarely into full-fledged businesses. For most women, such activities allow them substantial time to take care of other activities and home care. Many of them are heads of households, often single parents. Anything that improves small-scale livestock rearing and processing of agricultural produce will therefore help women more. FAREI's Women's Unit under Extension and Training has offered good service over the last ten years, but needs now to steer women into real businesses. The Unit should now showcase its success stories and role models. If efforts and technologies are carefully targeted, they can have considerable benefits both in productivity and in personal welfare of women.

7.10 Youth

The local population comprises a high proportion of young people, and it is a challenge for those with limited education or training to find gainful employment. But few are willing to take up employment in agriculture, more so in livestock rearing or start up an activity of their own. More recently though, new incentive schemes were devised to create an environment favouring the entrepreneurial approach to farming, which has rekindled the interest of some youth. This has been possible by, inter alia, facilitation of access to resources such as land for fodder cultivation /pasture and finance for purchase of stock; knowledge, technical skills and mechanical aids for modern farming; and support to design business plans for profitable agri-business.

Many NGOs are providing vocational training to youth who have failed in the primary school system, mostly coming from poor families. They provide basic information and skills for various purposes ranging from improving employability to occupational therapy. Even the prison authorities are now providing training (mainly in livestock rearing) to some categories of inmates to assist with their rehabilitation. Their target audience /beneficiaries represent a pool of untapped potential for agricultural labour or entrepreneurship. FAREI should build special programmes to arouse their interest.

8. INSTITUTIONS

Although the crop producers, livestock keepers and the agro-processors will be the engine for growth and development in the non-sugar sector, the public sector needs to provide the framework for them to play their roles as well as leadership, policies and supporting interventions that will enhance their action in the field. In that context, several institutions operating under the MAIFS will require a review of their roles and a re-orientation of their actions to better respond to the new challenges faced by this sub-sector.

Recent organisational changes have been implemented to bring together FARC and AREU under FAREI for economy and better efficiency; and NAPRO has been set up to perform control and regulatory functions previously performed by the Tobacco Board, the Tea Board and the Mauritius Meat Authority. More reforms are necessary in other key institutions, namely the Agricultural Services, the Agricultural Marketing Board and the Mauritius Meat Authority for which preliminary studies have been completed.

Hereunder is a brief presentation of public institutions involved with the non-sugar sector, with an emphasis on those needing reforms. However, reform or not, all are expected to re-visit the roles and strategies and align their actions to better support the farming community going forward.

8.1 Ministry of Agro-Industry and Food Security (MAIFS).

The Ministry of Agro-Industry and Food Security (MAIFS) is the Ministry entrusted with responsibility for all matters pertaining to Agriculture, and decides on overall policies and agricultural development generally. A number of institutions involved in crop and livestock development operate under the overall guidance of the Ministry.

8.1.1 Agricultural Services (AS)

8.1.1.1 Current status

Under the leadership of the CAO, the Agricultural Services (AS) is the technical arm of the MAIFS for its regulatory and policy functions as well as for provision of miscellaneous services to the farming community. These services are meant to support the non-sugar sector, enhancing food production and food security, and include agricultural input supply e.g. seeds and breeding stock; veterinary care and livestock services; veterinary drugs, plant protection services, pest and disease control; and advice on land use and agricultural projects.

8.1.1.2 Proposals for re-structuring of Agricultural Services

In 2014, the FAO made proposals for the re-structuring of AS into a Department, which will concentrate on regulatory and control functions. The aim is to attain higher operational efficiency, better service delivery, reduce operational cost and higher cost effectiveness. The changes in its structure and function are meant to enhance national food and nutrition security and safety, increase productivity of the food crop and livestock sectors, and provide an enabling environment for the intensification and sustainable development of the agricultural sector.

8.1.1.3 New responsibilities for AS

The Agricultural Services will have focus on policies, planning and programme development, monitoring and evaluation, analytical services, surveillance and enforcement, follow up on international and regional obligation and sustainability of food and the agricultural sector. It will provide a regulatory framework and an enabling environment for the intensification and sustainable development of the food and agricultural system, including the agro-industry sector.

These are priority areas to be covered:

- Formulation of policy frameworks and action plans
- Ensuring the highest standards of food safety and bio-security measures;
- Promotion of economic, social, environmental and structural change in the development of crops, livestock and agro industry;
- Regulation and quality control for agricultural inputs, produce and products;

- Accreditation of laboratories for food and animal health;
- Management and control of pests and diseases through crop protection and quarantine services;
- Management and conservation of the natural resource base for agriculture and livestock development;
- Providing guidance to increase the national self-sufficiency;
- Regulating agricultural resources and the country's germplasm from being transferred out or from extinction;
- Protection of new plant varieties and the property rights of plant breeders;
- Crop quality compliance and certifications of farms for quality and safety;
- Quality control and certification of seeds and seed quality;
- Development of standards, methodology and guidelines for competitiveness of agriculture;
- Planning and evaluation of the policies and directions of agricultural development.

These involve fundamental changes in operations which will require new roles and competencies for staff. The transition phase must be managed carefully to ensure that the transfer of resources and responsibilities to other service providers is smooth and that no disruption occurs in the supply of essential services and inputs to the farming community. A Re-organisation Committee comprising of key stakeholders under the leadership of MAIFS could oversee this transition.

8.1.2 Forestry Services

The Forestry Service, headed by the Conservator of Forests is responsible for the management of the State Forest Lands including 'native' forests and Nature Reserves for the protection of the ecosystem. It has to contend with increasing pressure for conversion to unrelated activities. Its main activities are shifting to soil, water and biodiversity protection as well as raising awareness about forest conservation and protection. These are in keeping with the new roles of forests in the mitigation of climate change impacts, and should be re-enforced. More details appear at chapter 5.

8.1.3 National Parks and Conservation Service

NPCS was established in 1994 under Section 8 of the Wildlife & National Parks Act 1993. It is the government's adviser on all matters relating to terrestrial flora and fauna conservation, and works to protect and conserve biodiversity for future generations. Under its Director, NPCS, it strives for their sustainable management and restoration through in-situ and ex-situ conservation, ecosystem restoration, public awareness, promotion of ecotourism, research and implementation of international conventions. More details appear at chapter 6.

8.1.4 National Agricultural Products Regulatory Office (NAPRO)

NAPRO was set up under the National Agricultural Products Regulatory Office Act 2013, operating as a division of Ministry of Agro-Industry & Food Security and mandated to control and regulate the import, export, production and sale of meat, tea, tobacco and derived products as well as their preparation, processing, packing and manufacturing. It also regulates the activities and the premises related to slaughtering of animals, and determines the sale price for tea / tobacco leaves.

It is empowered to license operators of meat shop, slaughterhouse, tannery; import and storage of meat and meat products; venison dealers and retailers; and cultivators, manufacturers, importers and exporters of tea and tobacco.

8.1.5 Small Farmers Welfare Fund

The Fund has been created to promote the economic and social welfare of small farmers and their families. It registers farmers and can set up schemes and projects or create special funds in line with its policy. Among its schemes:

- the Agricultural Calamities Solidarity Scheme (ACASS) designed to provide financial support to small planters on crop losses caused by cyclones, drought or excessive rainfall, and to small breeders on death of animals caused by disease;
- the Compost Subsidy Scheme whereby free compost is provided to small registered farmers (up to a maximum of 1 ton/arpent) to enable farmers utilizing non chemical fertilizers (compost) to improve the quality of agricultural lands for sustainable agriculture, reduce production costs and promote production of chemical free agricultural products for the benefit of consumers;
- the Calf Productivity Incentive Scheme whereby a cash incentive of MUR 2,500 per calf is payable to breeders for calves they have successfully bred up to three months, for a maximum of 30 weaned calves per year;
- pre-market Test and Certification Scheme;
- certifications to small farmers for VAT refund on the purchase of agricultural equipment so as to encourage farmers adopt modern technologies.

Whilst the concern for farmer welfare is laudable, there is unfortunately no data about the socio-economic conditions of the farming community. This gap must be addressed as a matter of priority so that the impact of policies on farmers' income and well-being may be better appreciated.

8.1.6 Mauritius Society for Animal Welfare

Mauritius Society for Animal Welfare (MSAW) replaces the Mauritius Society for the Prevention of Cruelty to Animals (MSPCA). The objects and functions of the MSAW have been broadened as they include not only the catching and disposal of stray dogs but also of stray cats, humane education and the prevention of cruelty to animals, the promotion of the welfare and good treatment of animals.

Recent cases of ill-treatment of animals have received world-wide coverage via social media and even protest marches here. Elsewhere, concern over animal welfare extends to farm animals and animal rights to such a point that management needs to adapt. Accordingly, a survey of the situation on local farms would be a useful first step before farmers are sensitised on animal welfare.

8.1.7 Mauritius Meat Authority (MMA)

The Meat Authority was established by the Meat Act 1974. It regulates the fresh meat market. Its main activities are slaughter, dressing and transportation of cattle, goats, pigs, sheep and deer meat to markets. Its functions are to ensure that slaughter is done in line with hygienic, sanitary and environmental norms, and that only carcasses fit for human consumption are released for sale.

Among the forthcoming initiatives, there is a provision for new slaughter facilities in keeping with EU norms, and the operation of meat shops on its premises for the benefit of consumers, strengthening to track and combat illegal slaughter; advocacy for the acquisition of a 'livestock carrier' by the authorities to ensure fair competition for import of animals.

8.1.8 Irrigation Authority

The Irrigation Authority has been set up under the Irrigation Authority Act No. 39 of 1978 and functions for the preparation of schemes for irrigation of specific areas; to implement and manage irrigation projects and to do all other acts incidental thereto; and to undertake research into the optimum use of water made available for irrigation.

IA is contributing towards food security by providing irrigation facilities to some 500 ha of lands and producing some 15,000 tonnes vegetables/onions. Its main activities of the Irrigation Authority include feasibility studies for new irrigation projects; design, construction, supervision and implementation of irrigation projects; operation and maintenance of irrigation projects; provision of irrigation at subsidised rates and other incentives to planters; and advice to planters on matters related to irrigation and water management.

Given the impending rise of ambient temperature, crops will face higher risks of water stress, and the availability of irrigation becomes all the more critical for successful cropping. More irrigation schemes, more water storage and a more rational use of irrigation water will be required. Besides, whenever it is available, water will need to be used more rationally and efficiently. Hence the need

for research on conversion of systems for more efficient water use as well as tooling and technical training of farmers in crop water scheduling and budgeting. Rainwater harvesting from rooftops and small-scale structures for in-field rain-water collection should be promoted more forcefully.

8.1.9 Agricultural Marketing Board (AMB)

8.1.9.1 Current status

The Agricultural Marketing Board (AMB) was established in 1964 under the Mauritius Agricultural Marketing Act of 1963 as a measure to promote diversification of agriculture. Its mission is to maximize consumer satisfaction by providing high quality, innovative products and services reliably and cost effectively. AMB is there to encourage local production of as much of the country's food requirements as is economically feasible; to ensure that marketing costs are at a minimum, consistent with satisfying consumer demand; to limit price fluctuations in line with consumer preferences; and to operate its installations and other resources with maximum efficiency for the benefit of producers and consumers.

8.1.9.2 Reforms anticipated

Following a study in 2013 and recent consultations with stakeholders, actions are envisaged to broaden AMB's scope of business while maintaining its social role:

- **Cross Border Initiative**
 - AMB to extend its present MOU's with Rodrigues, India, South Africa to Seychelles, SADC, CAADP/COMESA and IOR to find alternative source of supply for food security reasons
 - AMB will seek the possibility of re-exporting goods onto the African continent.
- **Seeds Marketing** : To extend range of seeds from potato, onion bean and garlic seeds to new variety of onion and other seeds in the horticulture.
- **Contract Farming**: To establish contract with the private sector including cooperatives for the guaranteed supply of products such as potatoes, onions and garlic at agreed prices.
- **Review of legal framework** to allow for the extension of its product range to new products such as saffron, garlic paste, fried onions and products in processed forms; provisions for penalty; and control over retail pricing.
- **Opening of new retail outlets** : upgrading of its retail outlets and extending the range of products on sale, after due comparison of new outlets with appointed dealers.
- **Storage Capacity**

Upgrading of its facility at Cluny will continue, to include:

 - the renovation of the cold rooms and refrigeration system at Cluny;
 - building a dedicated warehouse for storage of garlic seeds; and
 - the conversion of 2 dryers into cold rooms for storage of an additional 600 tonnes Onion.
- **Recruitment**

Recruitment to have its necessary staff complement. To that effect, the extension of its administrative building will be necessary to accommodate additional staff.
- **National Wholesale Market**

AMB is on board for the setting up of National Wholesale Market. AMB will manage facilities such as handling area, weighbridge, maintenance, supervision of auction, price fixing mechanism, financial operations while out-sourcing others such as cleaning, waste disposal, composting; and renting out space for service providers such as banking institutions, fertiliser shops, hypermarkets, value-addition enterprise.

8.1.10 Food and Agriculture Research and Extension Institute

8.1.10.1 Current status

FAREI was established in 2014 through the FAREI Act 2013 to take over the functions of the Food and Agricultural Research Council (FARC) and the Agricultural Research and Extension Unit (AREU) as part of reforms to ensure cost-effective and quality services, and optimise human resources.

It has the responsibility to conduct research in non-sugarcane crops, livestock, agro-forestry and to provide an extension service to farmers. Its mission is to support and implement priority research, development and training programmes and appropriate technologies for food security and to enhance competitiveness, sustainability and stakeholder equity across the agri-food value chains.

Its objectives include:

- i. Introduce, develop and promote novel technologies in the food and non-sugar agricultural sector within a sustainable framework;
- ii. Co-ordinate, promote, and harmonise priority research activities in the non-sugar agricultural, food production and forestry sectors;
- iii. Promote and encourage agricultural and agri-business development through the setting up of agricultural youth clubs, agricultural women clubs and agricultural entrepreneur clubs; and
- iv. Promote dissemination and practical application of research results.

To these ends, the institute implements strategic and adaptive research with participation of stakeholders to meet national requirements for improved farm productivity and income. It also seeks to ensure rapid transfer of innovative practices developed into effective production systems for the benefit of growers, consumers and the environment.

8.1.10.2 Reforms

As a corollary to re-structuring of AS, FAREI will be entrusted those services being dropped by AS. Its organisational structure may have to be adjusted, its recurrent budget and human resource pool enlarged, and new competencies acquired. Its livestock sections in particular will need to be strengthened.

8.2 Service Delivery Improvement

For MAIFS to meet its objectives and targets for which it is committed, it is imperative that service delivery by its agencies meets some minimum standards. Indeed, one expects that these minima should improve over time making these institutions more efficient and more effective. Accordingly, each institution should select and improve their important services which have a direct impact on farmers and the general public. Indicators will have to be defined but should cover such criteria as Ease of access, Timeliness, Cost and Value for money, Availability of information, Courtesy, Openness and Transparency, Channels for complaint and Means of redress for complainants, etc.

Accordingly, it will be useful for each institution to examine its services and develop a Service Delivery Improvement Plan, spread over a number of years. Targets shall be realistic but challenging nonetheless. Progress can be monitored quarterly and the plan evaluated annually.

8.3 Consolidated databases

With the ready availability of IT tools, most institutions have established their own individual database of the farmers they service and for other users such as applicants for permits and licenses. In many instances, these refer to one and the same entity. They carry duplicate information which are often out of phase. Accordingly, there is need for a central database of farmers as well as of users of services dispensed by these institutions. Such a system could eventually cater for registration of producers. Due care is however required over data security and privacy issues.

8.4 Monitoring and Evaluation

In most institutions, a system of monitoring work performance is already in place with staff submitting work plans and eventually regular reports of their actual implementation. Generally, staff are amply accountable for their work plans.

However, the system is under-developed. It focuses mainly on inputs and activities, and occasionally outputs. It rarely looks beyond i.e. at outcomes or objectives, which could eventually feed into an analysis of impact in their respective sector. This is all the more difficult since the interventions/schemes/projects associated with the officers' work have not been designed with the measurement of performance in mind. There is thus no baseline to assess outcomes at user/ farmer level and no end-of-project assessment programmed to verify whether the objectives have been attained or to draw lessons for scaling up or otherwise in the future. Often, no exit strategy is defined.

When evaluations are directed at the full impact of interventions rather than just the immediate outputs, they can indeed help to assign causality between inputs and real outcomes. Thus, for a proper evaluation, the interventions should be examined for their relevance, efficiency, effectiveness, impact or sustainability. Evaluations can provide the reasons for success or failure of projects/schemes/policies, and help draw meaningful lessons and recommendations for on-going or future interventions.

However, evaluations have to be planned ahead since they imply the definition of indicators, setting of targets and timeframes, and additional data collected through surveys, interviews, observation etc. for baselines and verification of results. As evaluation involves in-depth data collection and analysis, it is consequently undertaken only a few times during the project life or when it is completed.

Unfortunately, it is observed that evaluation of performance and feedback from farmers are not frequently practiced by institutions. To correct this state of affairs, and for all to maintain focus on results as opposed to mere activities and outputs, a Results-Based-Management (RBM) approach can be effective. All institutions should thus be required to internalise the Project Cycle Management (PCM) guidelines in planning their interventions and activities. This will ensure a proper analysis of problems, definition of objectives, a coherent logic of intervention together with matching, verifiable indicators for monitoring of progress, and evaluations for the measurement of outcome and impact.

9. LEGISLATION

A major role of MAIFS is to provide a policy and regulatory framework for the agricultural sector. These help to guide projects and other interventions, to clarify policies for the benefit of the farming community, and to develop the necessary legislative basis and regulations to underpin and facilitate implementation of policies and activities in the sector.

9.1 Legislation in the non-sugar crop sub-sector

Hereunder are some recent legislations of immediate relevance to the non-sugar sub-sector, with indications of possible amendments.

- **National Agricultural Products Regulatory Office Act 2013**

NAPRO has taken over the functions and activities of the Tobacco Board set up under the Tobacco Production and Marketing Ordinance of 1930, the Tea Board set up under the Tea Industry Control Act of 1975, and the regulatory functions and certain powers of the Mauritius Meat Authority, set up under the Meat Act of 1974.

Some amendments may soon become necessary to enable new tea producers to operate and trade on the local market.

Given the drive for bio-farming, it would be fitting to consider the mandatory registration and the licensing of farmers engaged in specific activities like for other trades. This would facilitate their certification and any verification that they adhere to agreed codes of practice and meet minimum standards for traceability.

- **Food and Agricultural Research & Extension Institute Act 2013**

FAREI was established in 2014 through the FAREI Act 2013 to take over the functions of the Food and Agricultural Research Council (FARC) and the Agricultural Research and Extension Unit (AREU) for economy and operational efficiency.

Here again, some amendments may become necessary for FAREI to accommodate new responsibilities that may accrue as a result of reforms at the Agricultural Services.

- **Seeds Act 2013**

This Act provides for registration of varieties of seeds, seed testing, seed inspection and certification of any seed. It establishes a National Plant Varieties and Seeds Office (NPVSO) within the Ministry responsible for agriculture and a National Plant Varieties and Seeds Committee. It thus regulates the seed business in order to ensure that high quality seeds are supplied to growers.

NPVSO shall:

- i. regulate the cultivation, production, trade, exportation and importation of seeds of any variety of any kind of plant;
- ii. be responsible for the enforcement of the Act.

The Committee shall:

- i. advise the Minister on national policies relating to the cultivation, production, trade, exportation and importation of seeds of any variety of any kind of plant;
- ii. guide and supervise NPVSO in the enforcement of the Act;
- iii. make recommendations to the Minister for the improvement of the seed regulatory system;
- iv. make recommendations to the Minister on the release of any variety in Mauritius.

The Act also provides rules for the internal and external trade in seeds, places restrictions on importation of seed; registration of varieties; and provides for the maintenance of a National Variety List. It is important now to establish the regulatory, institutional and technical frameworks for implementation of this Seed Act (2013).

Preparations and capacity building for activities under the Act are currently receiving technical assistance from IFAD for:

- Developing the full complement of regulations to implement the Act;
- Establishing the National Plant Varieties and Seed Office (NPVSO) to implement the provisions of the Act;
- Building capacity for seed testing, seed certification and VCU/DUS testing;
- Preparation of a National Seed Strategy for the development of the seed sector; and
- Creating opportunities for planters to become professionals in seed business.

- **Plant Protection Act 2006**

National Plant Protection Office (NPPO) has the overall responsibility to ensure law enforcement on plant protection matters, as per provisions made under the Plant Protection Act 2006. The Office is mandated to protect the country from the introduction of exotic pests and diseases through its regulatory activities. It has established bio-security measures with the objective of allowing safe movement of plant and plant products in international trade.

In recent years, several new pests have been recorded in Mauritius which has raised concern among professional farmers and backyard growers alike. It is expected that such new introductions will increase in the future, and accordingly enforcement becomes all the more necessary. To that effect, resources must be strengthened for more effective border control, pest surveillance and the rapid containment of new pests.

- **Chemical Fertilisers Control Act 1980**

The law controls the trade of chemical fertilisers, the conditions relating to containers, label and prohibitions for their marketing, and their chemical composition. It also provides for sampling inspection and specifies the sampling schemes to verify their composition is within acceptable limits of variation or the presence of foreign matter and other substances deleterious to the soil and to the plant.

Lately, organic composts have been produced and marketed on large scale. *Rhizobium* and *Mycorrhiza* fungi are known inoculants that one can expect to take off with bio-farming. Other growth enhancers, plant foods and supplements have also been introduced lately that purport to boost plant productivity. Some contain dyes, pigments and colorants claimed to enhance the colour and freshness of produce.

Being given the expected increased use of organic fertilizers and the growing concern of consumers over food safety, it would be appropriate to amend the legislation to encompass these new forms of fertilizers.

- **Dangerous Chemicals Control Act 2004**

This Act provides for the prevention of damage to health and to the environment caused by dangerous chemicals and for better protection of the workers, members of the public and the environment against dangerous chemicals, among which chemical pesticides are prominent for the agricultural sector.

With the growing concern of consumers over pesticide residues in food products and the renewed interest for alternative pest control methods, new products such as bio-pesticides have come to the fore. Dyes and colorants are also known to have been used to enhance the appearance of fresh produce. Other chemicals such as growth promoters and inhibitors, sprout inhibitors and ripeners are also in use. Their import, trade and usage must now be brought under control of the Act.

In spite of the Act, there is misuse of pesticides mainly because there is no enforcement mechanism so as to ensure that farmers are using pesticides according to recommendations. Accordingly, the following are proposed:

- i. new regulations to be introduced under the Act to cater for inspection, information, guidance and control on:
 - the proper and safe use of pesticides by farmers; and
 - pesticides residues on vegetables, fruits and any other agricultural material such as soil, livestock feed or fodder.

- ii. a new Pesticide Unit to be created under the new regulation to provide for:
 - collection of samples of harvested fruits and vegetables from farmers' fields and from markets for analysis of pesticide residues;
 - monitoring pesticide use by farmers; and
 - issue of warnings/ warrants to offenders.

- **Genetically Modified Organisms Act 2004**

The Act provides for measures to regulate the responsible planning, development, production, use, marketing and application of genetically-modified organisms. It provides for the control of the production and introduction of organisms, the genes or genetic material of which has been modified in a way that does not occur naturally through mating or natural recombination. For this purpose, it establishes a National Biosafety Committee and defines powers of the Permanent Secretary of the Ministry responsible for agriculture.

With the rapid development and adoption of Genetically Modified (GM) crops worldwide, it is quite possible that Mauritius is already importing either GM feed or food or seeds of GM crops. As the subject is a sensitive one comprising of controversial issues related to human health, environment or biodiversity, the full promulgation of the Genetically Modified Organisms Act 2004 is required in order to regulate the potential introduction of GMOs in Mauritius.

- **Organic Agriculture**

With the technical assistance of FAO, national capabilities will be strengthened for the practice of organic agriculture. Amendments will be brought to legislation; secondary regulations and strategic development plans will be drafted; training manuals will be developed and training delivered for farmers, researchers, programme managers and technicians. These would build the institutional framework and the inspection system for Organic Agriculture.

- **Establishment of a Plant Variety Protection System**

A Plant Variety Protection (PVP) system will be set up for implementation of the forthcoming Plant Breeders' Rights Act, which will encourage the development and introduction of new improved plant varieties in Mauritius; it will also enable the country to participate in the SADC Harmonised Seed Regulatory System and benefit from related opportunities.

9.2 Livestock legislation

- **Animal Welfare Act 2013**

The objectives of the new Act are to, among others, protect animals from distress, pain and suffering in the best possible way; promote the welfare and good treatment of animals; and regulate dog keeping, dog breeding and importation of certain dangerous dogs.

Concern over animal welfare now extends to farm animals and animal rights. However, education of local farmers about animal welfare and the provisions of the law need to be introduced, possibly through a collaboration with FAREI's Extension.

- **Animal Diseases Act 1925**

This Act deals with the importation, procedures, diseases of animals. It conveys power of verification, control and quarantine of animals coming from abroad. It is the main tool for the DVS to operate its ambulatory services for treatment of sick animals and artificial insemination.

It provides regulations for veterinary public health; inspection of animal products at the abattoir and at import to ensure safe and wholesome meat and meat products; and certification of animal products for export.

Various recommendations have been made as a result of a Gap Analysis conducted by the OIE in 2011, and should be considered in revising this Act. Besides, the Act focuses on the health aspects and does not cover the production side of animal farming, which needs adjustment.

- **Artificial Insemination of Animals (Control) Act 1946**

The Act provides regulations for controlling the practice of artificial insemination and, in particular, for prohibiting, subject to such exemptions as may be specified in the regulations, the distribution and sale of the semen of any such animal.

Given the recent introduction of artificial insemination for other species than cattle and the possibility for entrepreneurs to provide such services, new regulations are warranted.

- **Veterinary Council Act 1991**

The Council governs the registration of veterinarians and the practice of veterinary care. Its functions include *inter alia* the exercise and maintenance of discipline in the practice of veterinary surgery; the establishment of a code of practice for the veterinary profession on the basis of professional conduct and veterinary ethics; and the handling of complaints.

Considerable interest has been expressed among the larger livestock farmers for training in veterinary first-aid to prepare them to cope with minor surgery and treatment. This would relieve pressure on public services and help address a common complaint over the long delays in attending cases. Actually, such training has already been started. In the same vein, the creation of a new grade of para-veterinarian has been evoked. These changes in the livestock sub-sector warrant a fresh look at the Act.

- **Other related Acts**

Livestock farmers often complain about the difficulties encountered to dispose safely of dead animals. Now that incinerators are in operation across the country, the Animal Destruction Act of 1918 deserves a review.

Many farmers are not satisfied with the animal feed on the market, and are often keen for verification of their composition. The enforcement of the Animal Feed Control Act 1977 should be strengthened to handle their complaints, enable rapid tests and re-assure the community.

9.3 Legislation for Forestry and Biodiversity

The following pertain to protection of forests and natural reserves, and the conservation of biodiversity and wildlife.

- Forests and Reserves Act
- Shooting and Fishing Leases Act 1966
- The Wildlife and National Parks Act
- The Vallée D'Osterlog Endemic Garden Foundation Act 2007

With the increasing social role of forests and biodiversity for the environment and the mitigation of climate change, amendments are anticipated to the Forests and Reserves Act 41 of 1983 (amended by Act No.1 and Act No. 7 of 2008) to include access and control of felling of trees and removal of forest produce on private forest land; to increase the penalties for offences under the Act including illegal felling of trees, littering and dumping on Reserves and State forest land; and to arrange for more biodiversity-rich areas to be proclaimed as Nature Reserves.

More details are discussed at section 5.7 .

The work of NPCS is governed by the Wildlife and National Parks Act. To align with International Conventions especially CITES and CBD, a new Native Terrestrial Biodiversity and National Parks Bill is under preparation. Draft legislation is also under preparation for a Wetlands Bill.

10. INTERNATIONAL & REGIONAL COLLABORATION

10.1 Mauritius benefits from collaboration with a number of international and regional organisations and participates in a number of schemes.

- **Food & Agricultural Organization (FAO)**

- Re-organisation of Agricultural Services (AS)

Preparation for the re-organisation of AS for it to focus on policy, regulatory and control functions, and to improve the delivery and quality of services offered to the agricultural community and related stakeholders.

- Census on Agriculture

Support provided to implement the Census on Agriculture in 2014 including training to local staff as well as the development of an Agricultural Information System

- Strengthening the seeds regulations in Mauritius

Support provided by FAO for the drafting of Regulations under the Seeds Act 2013 and for the development of Mauritius as a Seed Hub in the region.

Besides, the Country Programming Framework 2014-2017 provides for further technical assistance to develop strategies for farm mechanisation and related services, land management, development of organic agriculture as well as the strengthening of agricultural statistics and post-harvest management.

- **International Fund for Agricultural Development (IFAD)**

- Strengthening the Seed Sector

- Set up the administrative and organisational arrangements for the National Plant Varieties and Seeds Office;

- Develop the National Plant Varieties and Seeds Office capacity for seed certification;

- Develop national capacity for Cultivation and Use Testing (VCU) and Distinctness, Uniformity and Stability Testing (DUS); and

- Develop a National Seed Policy and Strategy.

- **Indian Ocean Commission**

- Project entitled 'Freshwater Biodiversity in Mauritius and Rodrigues' involving a desk-top study, and consultations with stakeholders to develop an Action Plan, which will be followed by the implementation of the Action Plan once it is officially approved by the relevant local authority.

- **Organisation Internationale des Epizooties (OIE)**

- Reinforcing Veterinary Governance in Africa (VET-GOV)

The purpose of the pilot project is to improve the quality and efficiency of basic veterinary services in Mauritius mainly by involving private veterinarian in the service delivery and by implementing Private Public Partnerships (PPPs) through which some of the public veterinary service activities can be handed over to private veterinarians. The project will thus assess the effectiveness of the veterinary services provided to small breeders and to consider the possibility of entrusting veterinary care and services to the small breeders to private veterinarians.

- **African Union**

- Animal Resources Information System (ARIS 2)

This project aim at promoting timely data collection and reporting by Member States and to facilitate animal resource information sharing. It is developed by African Union Inter-African Bureau for Animal Resources (AU-IBAR) and Mauritius is implementing this

project to improve the quality, quantity and availability of surveillance and other animal resources information in the country.

- **Comprehensive Africa Agriculture Development Programme (CAADP)**

CAADP was established as part of New Partnership for Africa's Development (NEPAD) and aims to eliminate hunger reduce poverty and enhance food and nutrition in Africa through agriculture. Mauritius has launched the CAADP and signed the National CAADP Compact. Two Consultants have completed a stock-taking exercise of the agricultural sector in Mauritius and will support the drafting of the CAADP Compact.

- **Southern Africa Development Community (SADC)**

- SADC Harmonised Seed Regulatory System

Mauritius acceded to the SADC MOU on Harmonised Seed Regulatory System on 7th October 2013.

- The SADC Plant Breeders' Rights Protocol.

A common platform has been initiated on 27th November 2014 to facilitate the setting up of the SADC Variety Release System. Member states will be able to participate as and when their National Seed Authorities and relevant legislation are established.

- **EDES- Food Safety System**

EDES is a cooperation programme managed by COLEACP (Europe-Africa Caribbean-Pacific Liaison Committee) in collaboration with a consortium of European organisations specialising in food safety. It promotes the setting up of a national risk assessment framework as a basis of the establishment of an efficient sanitary and phytosanitary control system. Mauritius is benefiting from EDES with regards to exports of poultry, pineapple and honey sector.

11. WAY AHEAD

11.1 Risks and Assumptions

The main risks and assumptions to the implementation of the Strategy could be summarised as follows:

- Political and economic situation;
- Capacity of absorption for the management of developmental projects; and more importantly to switch to results-based management;
- Mobilising adequate financial resources from the national budget but also from Development Partners and international programmes and donor agencies.
- Cooperative participation of stakeholders/ farmers in the implementation of the strategy.
- Cooperation and coordination among institutions within MAIFS. This has become more critical than ever on account of the multi-disciplinary approaches required for sustainable agriculture.
- Cooperation and coordination with other Ministries, and in particular with the Ministry of Environment which is the national focal point for climate change. Climate changes have a direct and a significant impact on the agricultural sector as well as on natural resources such as forests, pastures, water and biodiversity. Consequently, it is important that all departments under MAIFS be regularly updated on commitments, developments as well as opportunities for technical support.

11.2 Communication and Visibility

In order to introduce more transparency and eventually accountability from its affiliate institutions, it is highly desirable that the Ministry of Agriculture 2016-2020 Strategy be widely publicised. As a possibility, the document could be launched in a press conference where the objectives, courses of actions, and expected results would be presented.

The MAIFS would organise a series of communication and visibility events to raise awareness of stakeholders and the general public on the main issues of the MAIFS 2016-2020 strategy. These could include seminars, workshops, publicity campaigns, etc. Additionally, the documents may be circulated among Development Partners to elicit technical assistance and funding support.

A final evaluation workshop with wide participation of stakeholders should be organised at the end of the strategy implementation period to publicise achievements and capture comments and ideas to strategise onwards. For the general public, an exhibition would be more appropriate.

11.3 Steering and Coordination

The MAIFS is the administration entrusted with the implementation and financing of this 2016-2020 Strategy. To that effect, the Minister of Agriculture will establish a high-powered Steering Committee (SC) for the follow-up and supervision of the strategy implementation. It shall ensure the proper and timely execution of the provisions of this Plan in order to achieve the expected outcomes within the scheduled timeframe. This Steering Committee will be chaired by the Permanent Secretary of MAIFS and include the Chief Agricultural Officer and his Principal Agricultural Officers, the Chief Executive Officer FAREI and his Assistant Directors, the Conservator of Forests, the Director National Parks & Conservation Service, Officer-in-charge NAPRO, Chief Operations/Executive Officers of Agricultural Marketing Board, Meat Authority and related bodies.

The Agricultural Policy Analysis Unit will be entrusted the secretariat and the coordination. It shall ensure the regular submission of progress reports by implementing agencies as well as the preparation and consolidation of reports, circulation of agenda and documentation for consideration by the Steering Committee. It shall also verify that reports are not merely a narrative of activities but provide a critical assessment of the effectiveness of programmes relative to set targets.

Following the signature and the adoption of this Strategy document, the SC will meet on a regular basis and when needed. It shall call upon and engage technical experts and whoever deemed

appropriate and necessary from the public and the private sectors to enlighten its members. The Steering Committee will fulfill the following duties:

- Review and approve annual operational plans prepared by the relevant agencies for the implementation of the strategy;
- Review and approve the strategy implementation progress reports prepared implementing agencies, including those activities performed under programmes and projects;
- Consider reviews of programmes and projects, and approve recommendations for corrective action as required;
- Provide necessary guidance for the good implementation of the strategy and manage the risks that may arise during the execution;
- Review and approve the Strategy 2016-2020 Monitoring and Evaluation reports.

Implementing agencies shall each prepare and submit a periodic, consolidated progress report. The latter will be based on the reports provided by their subsidiary services, departments and related programmes and projects that include all the activities and expenditures (planned versus executed) in addition to the problems and challenges encountered and future plans and orientations. Monitoring and Evaluation at institutional level has been discussed at chapter 8.

It is expected that an evaluation will be arranged in 3 years i.e. a Mid-Term Evaluation, which will appraise progress made and provide recommendations in relation to the planned activities as well as the strategy objectives and courses of action. A second evaluation report should be run 6 months prior to the end of this Strategy's time-frame for similar purposes, and additionally make recommendations on follow-up strategic orientations. The terms of reference for these evaluations shall be prepared by APAU, but the actual evaluations are best run by independent contractors.

11.4 End word

It is believed that by the end of this Plan's timeframe, the country would have witnessed a significant transition into sustainable agricultural development, fully prepared to meet the challenges of food security and safety, with Agriculture well equipped to cope with the additional risks that climate change may present.

IMPLEMENTATION PLAN (2016 - 2020)

CROP SECTOR

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
1	Intervention area: Enhancing food and nutritional security								
	Institutional strengthening for R & D	16.3	10.2	3.9	2.9	2.9	36.2	FAREI	Office space for research staff Setting up of post harvest facility Molecular laboratory for Plant Pathology Division Purchase of vehicle & tractor Upgrade Entomology Laboratory facility for mass rearing of natural enemies of pests
	Purchase of consumables and laboratory equipment for upgrading analytical facilities in milk testing		5	0.5	0.5	0.5	6.5	FTL	
	Development of fruit orchards								No. of orchards & area
2	Intervention area: Improving competitiveness								
	Training of farmers/services providers	1.5	2.5	2.0	1.6	1.7	9.3	FAREI	No. of training modules developed by category No. of trainings delivered No. of participants by category
	Use of novel connection tools to enhance agricultural extension outreach/market information	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	No. of novel tools introduced
	Award certificate courses for job oriented	1	2	2	2.2	2.2	9.4	FAREI	No. of specialised/skilled workers
	Land Mechanisation Support Scheme	15	15	15	15	15	75	SFWF	To provide affordable land preparation services to non sugar planters
	Farmers' Knowledge Forum	1	1	1	1	1	5	SFWF	To disseminate relevant information continuously to farmers through the Farmers Knowledge
	Acquisition of new technologies	5	5	5	5	5	25	SFWF	To provide financial incentives to farmers to acquire new agricultural technologies
	Organising field days for farm mechanisation	0.2	0.2	0.2	0.2	0.2	1	FAREI	No. of field days organised

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
3	Intervention area: Promoting food safety and efficient and sustainable /system Enhancing food and nutritional security								
	Sensitizing farmers/service providers in bio farming	0.1	0.1	0.1	0.1	0.1	0.5	FAREI	No. of sensitization programmes held
	Training of farmers for certification in bio farming	2.0	1.8	2.0	2.0	2.0	9.8	FAREI	No. of farmers trained
	Improving water use efficiency	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	
	Transfer of developed packages on bio farming	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	No. of farmers adopting farmers
	Capacity building and training for bio-farming scheme		0.3	0.3			0.6	FTL	
	Staff recruitment + Upgrading of lab facilities		1	1	1		3	FTL	
	Promoting use of international Codex Alimentarius standards and harmonisation		0.5	0.5	0.5	0.5	2	FTL	
	Printing of poster		0.3				0.3	FTL	
	Increasing scope of accreditation		0.5	0.5	0.5	0.5	2	FTL	
	To maintain Compost Subsidy Scheme	20	20	20	20	20	100	SFWF	To encourage farmers to shift from chemical to non chemical organic fertilisers (compost) and reduce their costs of production
	Farmers Excellence Award Scheme	2	2	2	2	2	10	SFWF	To encourage farmers to adopt Good Agricultural Practices through a reward/incentive system, hence moving towards excellence
	Bio Farming Support Scheme	10	10	10	0	0	30	SFWF	To provide subsidy to farmers on Bio agricultural inputs to encourage adoption of such inputs to promote Bio Farming
	Rain Water Harvesting	1	1	1	1	1	5	SFWF	To provide subsidy to farmers to establish rain water harvesting systems on farms and fields
4	Intervention area: Promoting strong value chain								
	Value chain study for economic crops	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	No of studies conducted
	A1: To maintain the Premarket Test and Certification Scheme for agro processors	5	5	5	5	5	25	SFWF	To provide grant to agro processors to meet with the costs of the Pre-Market Test & Caertification of their products, to enable them tapping higher end market and ensure safe food for the consumers

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	A2: Clustering of small agro processors for marketing purposes	5	5	5	5	5	25	SFWF	To promote clustering of agro processors where the SFWF will be the central point to execute group marketing, packaging design, labeling, etc. so as to tap markets
	A3: Financial incentives to agro processors to acquire Bar Coding for their products	2	2	2	2	2	10	SFWF	To render agro processed products more marketable and assist small agro processors to tap markets.
	A4: Creation of local market outlets for agroprocessors	2	2	2	2	2	10	SFWF	To create market for small agro processors for the sales of their products
5	Intervention area: Developing resilience to climate change								
	Mapping of areas susceptible to climate change and data base	0.1	0.1	0.1	0.1	0.1	0.5	FAREI	Maps developed with database
	Development of climate smart agriculture practices	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	No. of practices developed
	Conduct GHG inventory in crop sector	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	No. of inventories made
6	Intervention area: promoting emergence of agro-entrepreneurs								
	Scheme to encourage youth agro entrepreneurship and agribusiness clusters	0	10	15	15	20	60	FAREI	No of young agro entrepreneurs operating
	Information diffusion	0.8	0.8	0.9	0.9	0.9	4.3	FAREI	No. of publications made
	Support to development of agri business plans	0	0	0	0	0	0	FAREI	No. of plans developed
	Setting up of agro -processing clusters	0.2	0.2	0.2	0.2	0.2	1	FAREI	No. of clusters set
	Registration of Division and staff with Mauritius Qualifications Authority + purchase of equipment+ printing of training manuals +training of entrepreneurs and trainers from Ministry of Gender		1.5	1.5	1.5	1.5	6	FTL	
	Foreign Study Tour for Farmers	1	1	1	1	1	5	SFWF	To organize foreign study tours for farmers to keep abreast of new production techniques and technologies
7	Intervention area: Research and Development								

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Introduction / evaluation of new varieties: To extend the range of high performing varieties to increase production (onion, potato, garlic, pulses, chilli, carrot, crucifers, cucurbits, mushroom, sweet pepper & tomato)	1.6	2.3	2.9	1.9	2	10.7	FAREI	No. of varieties recommended for commercial cultivation
	Breeding to develop new varieties (onion, potato, pulses, crucifers, mushroom, ornamentals)	0.8	0.8	1	0.8	0.8	4.2	FAREI	No. of new varieties/strains developed/released
	Introduction/evaluation of novel technologies in crop production	2.4	1.9	1.9	1.9	1.9	10	FAREI	No. of packages developed/recommended No. of new practices recommended Recommendation of bioponic to growers No. of protocols developed No. of packages developed No. of invitro plantlets sold to planters
	Microbiological risk assessment studies to acquire baseline data on the safety of local foods		0.5	0.5	0.5	0.5	2	FTL	
	Development of novel products		0.1	0.1	0.1	0.1	0.4	FTL	
	Capacity building and upgrading of facilities for setting up of a sensory laboratory for enhancing product development process in local industries		0.5	0.5			1	FTL	
Pest and Disease Management									
	Maintain pest & disease surveillance/diagnosis for farmers	0.9	0.8	0.6	0.6	0.6	3.5	FAREI	No. of pest & disease alerts issued No. of plant samples diagnosed
	Develop integrated pest and disease	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	No. of packages developed
	Certification of potato seed quality in seed certification	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	Amount of seeds certified
	Tea Sector: Nursery to produce tea plantlets for in filling and new plantation	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	
A	Maintenance of Nursery at Petit Merlo						0.5	NAPRO	

	Action Plan	Budget (Rs M)					Total	Implementati ting agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
B	Setting up of nursery at Curepipe Experiment Station		0.8				0.8	NAPRO	
C	Collection of cuttings & potting		0.24				0.24	NAPRO	
D	Raising to transplanting stage & distribution			0.1			0.1	NAPRO	
Agricultural Biotechnology									
	Development of protocols for producing invitro plantlets	0.2	0.2	0.2	0.2	0.2	1	FAREI	No. of protocols developed
	Production of invitro plantlets	0.2	0.2	0.2	0.2	0.2	1	FAREI	No. of plantlets sold to planters
8 Potato									
	Increase storage capacity				30.0		30	amb	
	Maintain scheme for potato seed		5.0				5	amb	
9 Onion									
	Increase storage capacity		55.0				55	amb	
	Maintain scheme for onion seed							amb	
10 Garlic									
	Increase storage capacity							amb	
	Maintain scheme for garlic seed							amb	
	Construction of a warehouse adapted for garlic seeds		5				5	amb	
11 Freight Rebate Scheme									
	to boost local production and export of fruits & vegetables		25	25	30	30	110	MOA/Amb	
12 Project IA									
	Palma SSIP		2.5				2.5	IA	
	Plaisance (N) SSIP			4			4	IA	
	Belle Mare & Trou D'Eau Douce SSIP - Phase 1	7					7	IA	
	Phase 2		5	5			10	IA	
	Arsenal Litchi Project		5				5	IA	
	Improving Efficiency of Pumping Station			2			2	IA	
	Rivière du Rempart Irrigation Project				6		6	IA	
	Pointe aux Piments Irrigation Project					10	10	IA	
	Rehabilitation of Drip Irrigation System			5	5	5	15	IA	

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
13	Implementation of GMO unit								
	Detection of GMO (planting material, food, feed primarily in maize and soya.		1.5	1	1	1	4.5	FTL	
	Accreditation of GMO Lab – 2019 (ISO 17025)			0.5	0.5	1	2	FTL	
14	Intervention area: Creating an enabling environment and options for risk management							SFWF	
	Agricultural Calamities Solidarity Scheme		20				20	SFWF	To provide financial support on crop losses caused by natural calamities and death of animals, to assist farmers in restarting their activities promptly and enhance their sustainability
	Agricultural Insurance Scheme including crop, livestock and sheltered farming			60		60	120	SFWF	To provide financial support on crop losses caused by natural calamities and death of animals, to assist farmers in restarting their activities promptly and enhance their sustainability
	Sheltered Farming Scheme	10	10	10	10	10	50	SFWF	To provide incentives to small planters for the setting up of low cost protected culture/structures for better control over environmental conditions
	Accident Cover Scheme	3	3	3	3	3	15	SFWF	To provide financial support in case of redundancy, covering medical expenses and disability compensation caused by injury
	Farmers Pension Scheme	1.2	1.2	1.2	1.2	1.2	6	SFWF	To enable farmers having disposable income at retirement and provide this incentive for young unemployed to join the agricultural sector with the assurance of secured revenue at retirement.

	Action Plan	Budget (Rs M)					Total	Implementati ting agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Medical Check Up for Farmers including cholinesterase test	0.5	0.5	0.5	0.5	0.5	2.5	SFWF	To prevent/cure diseases at initial stage to ensure farmers are in good health
	Central Database for Farmers (Note: For the first year an additional of 0.5M will be required to enhance the process of collection of data and to up grade the existing database)	3.5	3	3	3	3	15.5	SFWF	To capture among others information on the socio economic conditions of the farming community
	Training of planters, breeders and agroprocessors in Business Management/Entrepreneurship Courses	2	2	2	2	2	10	SFWF	To increase the effectiveness and sustainability of their business
	Scholarship Scheme for children of farmers	1.5	1.5	1.5	1.5	1.5	7.5	SFWF	To provide financial support to children of small farmers through the Scholarship Scheme to pursue further studies either at the secondary level or the tertiary level
	Family Fun Days for small farmers and their families	1.5	1.5	1.5	1.5	1.5	7.5	SFWF	To provide leisure activities and to promote networking among farmers hence instilling the feel good factor in the farming community
	Farmers' Kids Club	1.2	1.2	1.5	1.5	1.5	6.9	SFWF	To provide leisure activities for children of farmers during school holidays through the Farmers' Kids Club
	Farmers' Leisure Park	20	1	1	1	1	24	SFWF	To set up a Farmers' Leisure Park including a residential resort to offer leisure activities at affordable rates to the farming community. The leisure park will also promote educational, cultural activities etc and will as well promote exchange of ideas and networking among farmers

	Action Plan	Budget (Rs M)					Total	Implementati ting agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Agricultural Meteorology (Early Warning System)	1	1	1	1	1	5	SFWF	To provide updated meteorological information to farmers for their localities on a daily basis
	Measures to eliminate Agricultural thefts	1	1	1	1	1	5	SFWF	To assist farmers in creating the proper environment to eliminate thefts of agricultural produce and to sensitise farmers on their rights and preventive measures to be taken to protect their fields and ensure their own security
TOTAL		155.2	269.74	241.9	198.6	237.3	1103.24		

LIVESTOCK SECTOR

	Action	Budget (Rs M)					Total	Implementing Agency	Indicators
		2015	2016	2017	2018	2019			
1	Intervention area 1. : Efficient and Harmonised Support Services								
	Proposed activities								
	Re-organisation of AS and institutions under MAIFS	0.5	0.5	0.5	0.5	0.5	2.5		
	Review allocation of resources for strengthening of FAREI (infrastructure, human resource, logistic, equipment,IT)	10	5	3	3	3	24	FAREI	Building rehabilitated, equipment/machinery and vehicles purchased, staff recruited, animal Health division operational
2	Intervention area 2. : Cost of Production								
	Proposed activity								
	Renovation of livestock feed factory		100	0	0	0	100	AS	
	Maintain/increase feed subsidy and facilitate access to bagasse and molasses	10	10	10	10	10	50	MAIFS/FAREI/AS	No. of beneficiaries Quantity of feed subsidised
	Setting up of heifer farms		20		20		40	FAREI/AS	No. of heifer farms set up No. of breeding animals produced

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
3	Intervention area 3. : Land availability and environment exigencies								
	Proposed activities								
	Identify livestock zones for cattle small ruminants, pigs, biofarming, fodder and agroforestry		5	5	0	0	10	MAIFS/FAREI/AS	
	Provide utilities and infrastructural facilities for efficient production (BLO)		10	10	10	10	40	MAIFS/AS/FAREI	
	Promote clustering of farmers and agri business development	0.2	0.2	0.2	0.2	0.2	1	FAREI	No. of training conducted No. of cluster formed
	Identify sites and provide facilities for disposal of dead animals and slaughter waste							DVS/APD/FAREI	
	Promote establishment of fodder plantations	5	2	2	2	2	13	FAREI/MAIFS/AS	Area under fodder cultivation
4	Intervention area 4. : Public/Private Partnership								
	Proposed activities								
	Set up schemes to encourage PPP	10	10	10	10	10	50	MAIFS/FAREI	No. of schemes set up No. of PPP promoted
	Set up schemes to assist farmers to meet market requirements							MAIFS/FAREI/AS	No. of schemes set up no of beneficiaries
	Set up stakeholders forums to promote filiere approach	0.2	0.2	0.2	0.2	0.2	1	FAREI	No. of forums set up
	Value chain analysis for different commodities	0.15	0.3	0.3	0.25		1	FAREI	No. of VCA carried out and disseminated
5	Intervention area 5. : Legal and Regulatory Framework								
	Proposed activities								
	Enactment of Animal Health bill		1	0	0	0	1	MAIFS/DVS	
	Preparation of animal production bill		1	0	0	0	1	APD/DVS/FAREI	
	Review of Veterinary Council Act		0.2	0	0	0	0.2	MAIFS/DVS	

	Action Plan	Budget (Rs M)					Total	Implementati ting agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Setting up of a squad (Police Agricole) to combat illegal activities in the Livestock Sector (e.g illegal Slaughter)		0.3	0.3	0.3	0.3	1.2	MMA/DVS	
6	Intervention area 6. : Professionalisation of farmers								
	Proposed activities								
	Capacity building (curriculum development for specialised courses on aimal husbandry and veterinary care)	2	1	1	1	1	6	FAREI	Curriculum developed No. of training effected No. of farmers/entrepreneur trained No. of skilled workers trained
	Create a unified registration system	10	10	0.5	0.5	0.5	21.5	DVS/FAREI/SF WF	Creation of registration system
	Promote joint ventures and entrepreneurship	2	2	1	1	1	7	FAREI	No. of joint ventures promoted No. of benefitting entrepreneurs
	Promote incubator facilities and start up kits	6	6	6	6	6	30	FAREI	No. of incubator facilities
	Promote use technology/ICT	1	2	1	1	1	6	FAREI	No. of farmers using ICT No. of ICT tools used disseminated
7	Intervention area 7.: Breeding stock -Farm Animal General Genetic Resources								
	Proposed activities								
	Formulate National breeding policy		0.5				0.5		Breeding policy formulated
	Genetic conservation and improvement programmes	2	3	2	2	2	11	FAREI/DVS	No. of species in conservation programme No. of animals per species
	Set up scheme for on-farm conservation of local genetic resources	3	2	1	1	1	8	FAREI/DVS	No. of schemes set up No.of beneficiaries
	Set up national breeding farm for conservation	15	10	5	5	5	40	FAREI	National breeding farm for conservation setup
	Breed characterisation		1	1	1		3	FAREI	No. of breeds characterised
	Review AI service and upgrade AI lab		10	5	5	0	20	DVS	

	Action Plan	Budget (Rs M)					Total	Implementati ting agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Develop PPP for production of breeding stock		0	0	0	0	0	MAIFS	
	Provide legal framework to prevent slaughter of productive breeding animals		0.5	0.5	0	0	1	DVS/MMA/M AIFS	
8	Intervention area 8. : Animal Health and Veterinary care							DVS	
	Proposed activities							DVS	
	Reinforce Disease surveillance programmes		3	3	3	0	9	DVS	
	Strengthen field intervention capacity for prompt and effective service delivery		3	3	3	0	9	DVS	
	Capacity building (epidemiology)		3	3	3	0	9	DVS	
	Provide adequate veterinary drugs and equipment		3	3	3	0	9	DVS	
9	Intervention area 9. : Food Safety (Veterinary Public Health)							DVS/FTL	
	Proposed activities								
	Enforcement of safety practices at farm level		2	1	1	0	4	DVS/FTL	
	Capacity building for the monitoring and detection of residues/contaminants in livestock products and animal feeds		1	1	1	0	3	DVS/FTL	
	Establish MOU between MAIFS and Min. of Health regarding food safety issues(Monitoring and inspection of poultry slaughter-houses, control of veterinary products		0.1	0.1	0	0	0.2	DVS	
10	Intervention area 10. : Boosting Apiculture							AS/Entomolog y	
11	Intervention area 11. : Marketing of livestock products								
	Proposed activities								

	Action Plan	Budget (Rs M)					Total	Implementati ing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Promote entrepreneurship and value addition	1	1	1	1	1	5	FAREI	No. of training/meetings conducted No products developed
	Provide market intelligence	0.1	0.1	0.1	0.1	0.1	0.5	FAREI	Market intelligence in place
	Establish platform between buyers and sellers	0.2	0.1	0.1	0.1	0.1	0.6	FAREI	Platform set up No.of buyers/sellers using platform No.of animals traded
	Organise annual livestock fair	3	3	3	3	3	15	FAREI	Livestock fair organised
	Promotion campaign for local livestock products		0.2	0.2	0.2	0.2	0.8	MAIFS/APD	
	Set up a programme for certification of farms and farm products		5	1	1	1	8	APD/FTL	
	Setting up of a market structure for live animals		0.2	0.2	0.2	0	0.6	MMA	
	Construction of a New Slaughter House		100	100	50	0	250	MMA	
	Government Quarantine		5	35	35	0	75		
12.0	Intervention area 12. : Import/Export of livestock and livestock products								
	Proposed activities								
	Review import mechanism		0.2	0.1	0.1	0	0.4	MMA/DVS	
	Provide livestock carrier facilities for importation of live animals		300	200	0	0	500	MMA	
	Provide incentive for importation of weaners and beef type breeding cattle		12	12	0	0	24	MAIFS/MMA	
13.0	Cross Cutting Issues								
	Strengthening Research and Development								
	Upgrade Research facilities		2	2	1	1	6	FAREI	Research facilities improved
	Increase productivity through improved reproduction and nutrition in - Dairy and beef - Goat and sheep - Pig - small livestock (turkey,duck, rabbit)		1	1	1	1	4	FAREI	No.of R & D projects implemented/category No. of new practices recommended No. of feeding recommendations

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Improving animal health through - pest and diseases control - Use of local forages for parasites control - Study the incidence and control of mastitis - Monitor incidence of veterinary drug residues - Study on causes of on-farm mortality (cattle, goat and pig) - Study on the mineral dynamics in dairy cattle to address recumbancy		1	2	2	1	1	FAREI	No. of studies carried out No. of recommendations
	Promote fodder production and conservation - Broaden forage based through introduction and evaluation of new fodder species/varieties - Conservation of fodder - Investigate production of fodder through hydroponic technology		0.5	0.5	0.5	0.5	2	FAREI	No. of fodder species introduced / evaluation No. of recommendations
	Promote agro processing activities		0.2	0.2	0.2	0.2	0.8	FAREI	No. of entrepreneurs trained in agro processing No. of products developed
	Capacity Building								
	Training of farmers	2	2	2	2	2	10	FAREI	No. of farmers trained
	Training of staff	0.5	0.5	0.5	0.5	0.5	2.5	FAREI	No. of staff trained
	Training of service providers	0.2	0.2	0.2	0.2	0.2	1	FAREI	No. of service providers trained
	Sustainable livestock production								
	Adaptation to Climate Change (capacity building)	1	2	2	1	1	7	FAREI/DVS	No. of training conducted/attendance
	Conduct GHG inventory in the livestock sector	1	1	0.5	0.5	0	3	FAREI	GHG inventory completed
	Promote climate smart practices and clean, green and ethical animal production	5	5	5	5	5	25	FAREI	No. of training/workshop conducted/attendance

	Action Plan	Budget (Rs M)					Total	Implementati ting agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Encourage production of small livestock including turkey, duck, rabbit, etc. (incentives)	0.5	0.5	0.5	0.5	0.5	2.5	FAREI/APD	No. of farmers involved in rearing of small livestock No. of animals reared per species
	Provide incentive for production of bioproduct		10	10	5	5	30	AS/FTL	No. of beneficiaries
	TOTAL	91.55	681.5	458.7	204.05	77	1507.8		

FORESTRY SECTOR

	Action	Budget (Rs M)					Total	Implementing Agency	Indicators
		2015	2016	2017	2018	2019			
1	Identify available planting space	0.2	0.2	0.2	0.2	0.2	1	FS,Mo.LG,Mo. Env, NPCS,NGOs	
	Short-listing of appropriate plants available	0.1	0.1	0.1	0.1	0.1	0.5	FS,Mo.LG,Mo. Env, NPCS,NGOs	List of plants for planting available
	Sign MoU with recipient organisation		0.1	0.1	0.1	0.1	0.4	MAIFS/FS, Mo.Lands	
	Start planting campaign		2	2	2	2	8	FS/Local Gov./MoEv/NP CS	Production of brochure, Posters, Video clips, Public exhibition/Tv publicity etc
2	Train personnel of recipient organisation in arboriculture		0.5	0.5	0.75	0.75	2.5	FS	
	Prepare and adopt a reforestation Bill		2				2	MAIFS/FS, State Law Office(SLO)	Consultants/logistics/workshops

	Action Plan	Budget (Rs M)					Total	Implementati ting agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Set up a reforestation fund		1				1	MAIFS/FS, State Law Office(SLO)	
	Procurement of light mechanical equipment		2	2			4	MAIFS/FS	Tools/equipments/ Irrigation network
3	Enhance manpower and provide training		1	1				MAIFS/FS	Recruitment/training
	Identify new methods of propagation		1	1			2	MAIFS/FS	Tissue culture/Air layering/Grafting
	Free issue of plants for planting along roadside and public areas	0.5	1	1	1	1	4.5	MAIFS/FS	Issue of plants
	Provide owners of degraded forest lands and the general public with the following incentives to plant trees:							MAIFS/FS	
	Free or subsidized seedlings		0.2	0.2	0.2	0.2	0.8	MAIFS/FS	
	Training on maintenance and management of new planting		0.2	0.2	0.2	0.2	0.8	MAIFS/FS	Short Training programme
	Provide private nurseries with free plant materials for propagation		0.1	0.1	0.1	0.1	0.4	MAIFS/FS	Seeds/Cuttings/seedlings
4	Develop a policy on landscaping projects for a minimal threshold of native species to be included		1	1			2	MAIFS/FS,Mo. Env, Mo.LG	
	Amend the Forests and reserves act to control felling of trees on private lands		0.5				0.5	MAIFS/FS, State Law Office(SLO)	New regulation(s)
	Increase penalties and fines associated with the Forests and Reserves Act		0.2				0.2	MAIFS/FS, State Law Office(SLO)	Amend Forest and Reserve Act

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Revise the Shooting and Fishing Lease Act of 1966		0.5				0.5	MAIFS/FS, State Law Office(SLO)	Review the Act and amend
	Promote eco-tourism on state forest lands and impose a special levy to support reforestation		2				2	MAIFS/FS, Mo. Tourism, SLO, Mo.Env	Offshore islets/ Nature Walks/ creation of new forest amenities. Advertising of nature based tourism; media, brochures, posters, newspapers,etc.
	Update the National forest Policy		0.5	0.5	0.5		1.5	FS	Consultants/logistics/workshops
5	Prepare a National Forest Action Program		0.5	1			1.5	MAIFS/FS	Consultants/logistics/workshops
	Pass the Native Terrestrial Biodiversity and National Parks Bill								Already adopted
	Setting up a communication and coordination mechanism with other ministries and relevant stakeholders for concerted effort		1	0.5	0.5		2	MAIFS/FS	Workshops/set up of a committee
	Identifying main catchment areas for legal protection and proclamation of these catchment areas as National Forest		0.5	1	0.5	1	3	MAIFS/FS, Private Forest Owners, Mo.Env	Proclamation of National Forests under Forest and Reserve Act
	Control infrastructural and agricultural development in water catchment areas through improved legislation		1	0.5	0.5	0.5	2.5	MAIFS/FS	Review of Forest and Reserve Act. Recruitment of additional Forest Officers for enforcement
	Undertake public awareness and extension programmes to sensitise people on the need for watershed protection		0.5	0.5	0.5	0.5	2	MAIFS/FS	Purchase of logistics/Pamphlets/posters/Banners/ Public exhibitions/workshops
6	Implementing a restocking programme on steep slopes and erosion prone areas		1	1	1.5	1.5	5	MAIFS/FS	List of areas prone to erosion. Propagation of plants to used in the project.

	<i>Action Plan</i>	<i>Budget (Rs M)</i>					<i>Total</i>	<i>Implementati ing agency</i>	<i>Output indicators</i>
		<i>2015/16</i>	<i>2016/17</i>	<i>2017/18</i>	<i>2018/19</i>	<i>2019/20</i>			
	Develop a forest rehabilitation model for biodiversity conservation in watershed areas		0.5	0.5			1	MAIFS/FS	Consultants/logistics/workshops
	Set up a coordination meeting of experienced technical staff		0.2				0.2	MAIFS/FS/NP CS/Mo. ENV/Mo. Lands	Overseeing that the goals set are achieved
	Amend laws accordingly							State Law Office, MAIFS	Review and amend laws pertaining to forests, land use, water bodies and sustainable environment
	Conducting research on the best methods of eradicating/controlling invasive alien species and selecting and restoring native species		3	2	2	2	9	State Law Office, MAIFS	Assesing current methods in use and their impacts. Assesment of methods being used elsewhere in the world and feasibility of replication of these methods
	Developing incentives for private land owners to protect and restore pristine forests		10	10	10		30	MAIFS,FS,SLO, Private Land Owners	Subsidise herbicides/pesticides/fertilizers, train personnel, counselling on practices and methodology, free issue of native plants
	Establish and implement population monitoring protocols		1	1	1	1	4	FS,NPCS, NGO's, Mo. Env, Agricultural Services, SSRBG, Vallee D'Osterlog	Fence areas rich in biodiversity, extension of existing nature reserves, proclamation of new nature reserves
	Increase native species production capacity of forest nurseries		10	2	2	2	16	MAIFS,FS	Extension of Nuseries, logistics, tools, equipments and Man power

	Action Plan	Budget (Rs M)					Total	Implementing agency	Output indicators
		2015/16	2016/17	2017/18	2018/19	2019/20			
	Undertake phenological studies of endangered plant species		2	2	2	2	8	FS,NPCS	Close monitoring of endangered, set up of methodology, creation of database
	Fostering research and cooperation with academic institutions and non-governmental organizations		3	3	3	3	12	MAIFS,FS,NPC S,Mo. Env, UoM,UTM, FAREI, MSIRI, NGOs	Workshops, in-house training, courses
	Gradual replacement of exotic forest plantation by native species.		10	10	10	10	40	MAIFS,FS, Mo. Env	Exploitation of exotic forest plantation, bulldozing, planting, weeding, recruiting
	Prepare and adopt policy decisions		2	2	2	2	8	MAIFS,FS,NPC S, Mo.Env	
	Provide training in conservation methods and ecosystem restoration		0.5	0.5			1	FS	In-House training
7	Hire the services of a consultant				0.5		0.5	MAIFS,Mo. Tou	Review project and propose amendments if any
	Train frontline staff education delivery methods, public speaking and use of multi media		3	3	3	3	12	Mo.Edu, UoM	Diploma course
	Develop a pedagogical package of fun learning that can be easily implementable at schools		5	5	5	5	20	Mo.Edu,Press and media companies	Books, games, quiz
	Identify key stake holders and co-ordinate activities with all government departments, services and interested parties		0.5				0.5	MAIFS, Mo.Env, Mo.LG	Involvement of stakeholders

	<i>Action Plan</i>	<i>Budget (Rs M)</i>					<i>Total</i>	<i>Implementati ing agency</i>	<i>Output indicators</i>
		<i>2015/16</i>	<i>2016/17</i>	<i>2017/18</i>	<i>2018/19</i>	<i>2019/20</i>			
	Generation of informative material and graphics on importance of forests and trees for dissemination through media (radio, newspaper, TV and internet).		2				2	MAIFS	Short films, news letters, pamphlets, posters, painting and photography competition
	Propose special events within nature walks e.g art exhibitions, yoga sessions, trail expeditions etc		1	1	1	1	4	MAIFS, Mo.AC, Mo. Tourism	Organise events on International Day celebration, Open Days
TOTAL		0.8	74.3	56.4	50.15	39.15	218.8		
BIODIVERSITY SECTOR									
	<i>Action Plan</i>	<i>Budget (Rs M)</i>					<i>Total</i>	<i>Implementin g body</i>	<i>Output indicators</i>
		<i>2015/16</i>	<i>2016/17</i>	<i>2017/18</i>	<i>2018/19</i>	<i>2019/20</i>			
1	Restoration of endemic/native forest								
	Removal of invasive alien plant species and maintenance weeding at the Garden	0.5	0.5	0.5	0.5	0.5	2.5	VOEGF	Cutting, uprooting and felling down of invasive alien plant species. Recruitment of 5 manually workers on contract.
	Propagation of endemic/native plants for reforestation at the Garden		2.0				2.0	VOEGF	Setting up of a modern Nursery.
2	Creation of leisure, recreational activities and awareness								
	Safari for visitors at the Garden		2.0				2.0	VOEGF	Setting up of a mini Safari Bus.
	Development of nature based activities at the Garden	3.0	6.0	6.0	6.0	6.0	27.0	VOEGF	No. of Nature Based Activities set up.
	Upgrading access roads (about 7km) to Vallée d'Osterlog Endemic Garden		50.0	50.0			100.0		Parent Ministry (Ministry of Agro Industry & Food Security) to liaise with District Council of Grand-Port/NDU for implementation of the project.
	Awareness and marketing		0.5	0.5	0.5	0.5	2.0	VOEGF	No. of Advertising and Educational campaigns organised.
TOTAL		3.5	61.0	57.0	7.0	7.0	135.5		
TOTAL		251.1	1086.5	814.0	459.8	360.5	2965.3		

Annex 1

Annual production (tonnes) for selected foodcrops and fruits (2009-2014)

Crop	2009	2010	2011	2012	2013	2014*
Crucifers	7,486	7,243	8,200	7,376	7,885	7,387
Carrot	7,442	5,437	5,291	4,504	4,972	4,430
Chillies	1,227	1,322	1,383	1,466	1,487	1,670
Cucurbits	28,175	28,654	27,248	27,009	27,023	28,263
Garlic	28	24	34	98	107	163
Onion	4,855	5,799	4,898	7,098	7,772	5,912
Potato	19,828	21,709	21,561	20,442	16,451	19,404
Tomato	12,586	12,339	11,354	13,150	11,201	10,997
Ginger	616	1,356	748	1,156	991	535
Ladies Finger	1,519	1,593	909	1,001	1,098	1,381
Lettuce	920	934	906	931	1,016	1,398
Legume crops	2,368	2,564	3,246	3,058	2,781	2,550
Brinjal	2,829	2,684	3,202	3,227	3,378	3,549
Echalote	1,097	1,251	1,145	1,312	1,181	1,460
Leek	224	263	227	173	166	188
Sweet Potato	900	799	1,136	1,220	1,091	780
Eddoes	370	319	320	404	517	730
Manioc	400	449	301	500	507	466
Beet	534	748	877	558	646	638
Maize	112	328	320	413	634	625
Groundnut	587	558	499	723	431	618
Sweet Pepper	37	5	3	5	4	4
Total Foodcrops	94,140	96,378	93,808	95,824	91,339	93,148
Rice (Paddy)	-	-	316	831	646	N.A.
Pineapple	8,880	6,528	10,922	14,121	15,957	10,788
Banana	10,920	11,936	10,544	10,196	10,181	8,833
Grand Total	113,940	114,842	115,590	120,972	118,123	112,769

*provisional

Annex 2

Table 1: Animal Population Trend

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cattle	6,934	6,936	7,327	7,237	7,491	6,596	7,302	7,240	6,041
Pigs	15,550	17,223	6,699	14,108	22,650	23,285	15,287	15,961	17,511
Goat	23,726	24,411	25,994	26,014	27,819	28,176	27,430	25,702	26,558
Sheep	1,264	1,101	1,548	2,023	2,022	1,931	2,211	2,510	2,723
Deer	70,000	70,000	70,000	70,000	70,000	70,000	65,000	65,000	65,000
Rabbit	3,400	3406	3891	5,121	4,534	3,347	3,007	2,292	1,926

Table 2: Number of Livestock Farmers

	2006	2007	2008	2009	2010	2011	2012	2013	2014
Cattle	1716	1,700	1,758	1,157	1,123	1022	953	872	816
Pig	447	490	604	477	501	551	439	412	444
Goat	2,350	3,083	3,126	2,832	2,927	3049	2,933	2810	2653
Sheep	49	96	147	147	155	149	162	191	205
Rabbit	272	275	322	369	340	293	264	231	170

Table 3: Production Trend (tonnes)

Type	2006	2007	2008	2009	2010	2011	2012	2013	2014
Beef (t)	41.5	113	27.2	36.5	88.4	136.1	180.7	90	60.5
Goat meat	29.3	24	18.7	22.2	28.8	45	36	30.5	28.1
Mutton	3.1	4.0	13.3	14.2	9.4	5.1	4.6	2.6	4.3
Pork	681	511	330	428	623	650	652	615	557
Game (including Venison)	620	625	625	625	625	625	625	625	625
Venison	466	496	496	457	480	503	505	460	440
Rabbit	25	25	25	25	25	25	25	25	25
Poultry (t)	36,000	36,000	42,200	44,200	46,200	47,200	47,400	46,700	47,500
Milk (M litres)	4.02	3.5	3.3	3.4	3.6	4.0	6.0	5.0	5.0

Table 4: Per Capita Consumption of Livestock Products

	2006	2007	2008	2009	2010	2011	2012	2013
Fresh Milk (litre)	5.00	5.41	5.78	5.21	5.19	5.88	6.51	5.79
Milk (powdered, kg)	10.25	10.00	9.73	9.78	10.27	10.47	11.21	9.53
Eggs (unit)	148	141	123	113	121	125	132	137
Meat and Meat Preparations (kg)	43.06	45.74	47.45	48.62	50.18	51.14	53.85	53.06
Poultry (kg)	28.06	31.09	32.53	33.97	35.4	35.7	36.95	36.52
Meat (other than poultry, t)	15.00	14.65	14.92	14.65	14.78	15.44	16.90	16.54

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