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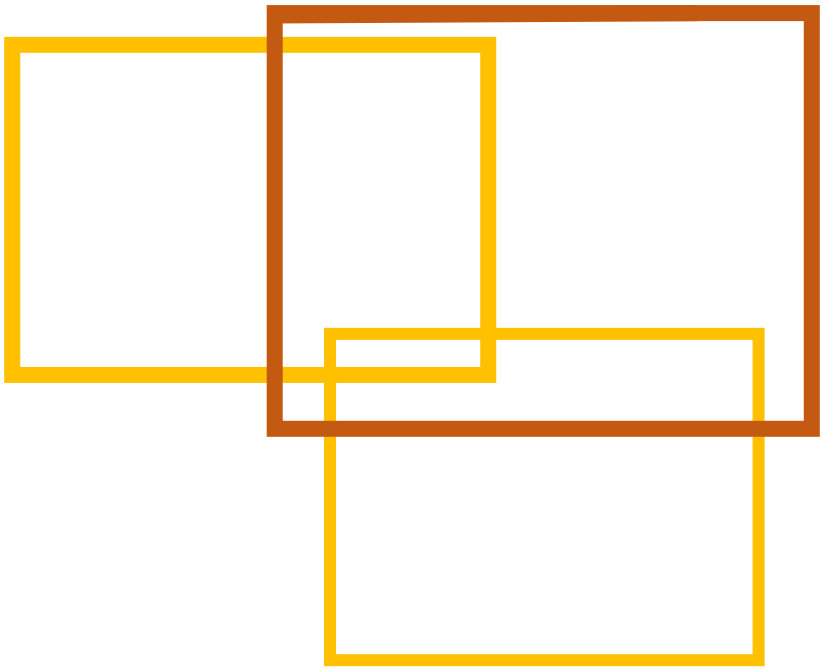

Integrated Pest Management Plan (IPMP)

Nigeria Agro-Processing, Productivity Enhancement and Livelihood Improvement Support Project (APPELISP)

December 2016

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ACRONYMS

ABIR	Agribusiness Investment Region
APP	Agricultural Promotion Policy
APPEALS	Agro-Processing, Productivity Enhancement and Livelihood
ABU	Ahmadu Bello University
ADP	Agricultural Development Project
AIDS	Acquired Immune Deficiency Syndrome
APP	Agricultural Promotion Policy
ATA	Agricultural Transformation Agenda
BP	Bank Procedure
CADP	Commercial Agriculture Development Project
CBOs	Community Based Organizations
CO	Carbon Monoxide
CRIN	Cocoa Research Institute of Nigeria
CSP	Centre du Secteur Privé
DDT	Dichlochphenyl trichloroethane
DFID	Department for International Development
EA	Environmental Assessment
ECOWAS	Economic Community of West African States
EMC	Executive Management Committee

ESIA	Environmental and Social Impact Assessment
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
EU	European Union
FAO	Food and Agricultural Organization
FCT	Federal Capital Territory
FEPA	Federal Environmental Protection Agency
FGN	Federal Government of Nigeria
FMARD	Federal Ministry of Agriculture and Rural Development
FMEnv.	Federal Ministry of Environment
FMH	Federal Ministry of Health
FMLP	Federal Ministry of Labour and Productivity
FORMECU	Forestry Monitoring and Evaluation Coordinating Unit
GDP	Gross Domestic Product
GEMS	Growth and Empowerment in States
GNI	Gross National Income
IDA	International Development Association
IFC	International Finance Corporation
IITA	International Institute for Tropical Agriculture
IPM	Integrated Pest Management
IPMP	Integrated Pest Management Project
ITCZ	Inter-Tropical Convergence Zone
KADP	Kogi Agricultural Development Project
LFN	Laws of the Federation of Nigeria
LGA	Local Government Area
M&E	Monitoring & Evaluation
MARD	Ministry of Agricultural Resource Development
MDAs	Ministries, Departments and Agencies
MRL	Maximum Residue Levels
NAFDAC	National Agency for Food and Drug Administration and Control
NBS	National Bureau of Statistics
NCO	National Coordinating Office
NGO	Non-Governmental Organisation
NO_X	Nitrogen Oxide
NGR	Nigerian Naira
MRL	Maximum Residue Levels
NESREA	National Environmental Standards and Regulations Enforcement
OHS	Occupational and Health Safety
OP	Operational Policy
PCBs	Polychlorinated biphenyls
PDO	Project Development Objectives
PEIA	Poverty Eradication Initiative in Africa
pH	Power of Hydrogen
PIC	Prior Informed Consent
PIU	Project Implementation Unit
PLM	Participatory Learning Modules
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment

PPP	Public-Private-Partnerships
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SCO	State Coordinating Office
SCPZs	Multiple Staple Crop Processing Zones
SMA	State Ministry of Agriculture
SMEs	Small and Medium Enterprises
SO_2	Sulphur dioxide
SPV	Specific Purpose vehicle
TRIMING	Transforming Irrigation Management in Nigeria
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USA	United States of America
WAAPP	West Africa Agriculture Productivity Program
WAFRINET	West Africa Network
WHO	World Health Organization

UNITS

Km	kilometer
µg/m^3	Micrograms per Cubic Metre
µmhos/cm	Micromhoms per Centimetre
mm	Millimetre

EXECUTIVE SUMMARY

ES 1 Context

The Integrated Pest Management Plan (IPMP) of the Nigeria Staple Crop Processing Zone (SCPZ) project, was prepared, consulted upon reviewed and subsequently disclosed in Nigeria and World Bank InfoShop on April 23, 2015 and April 29, 2015 respectively. This IPMP has now been updated to incorporate the changes in the original design of the project as requested by the borrower. These changes include geographical extension to other states and additional value chains. These changes did not trigger new World Bank safeguard policies. In addition, the potentially significant adverse impacts are not envisaged to exceed what was expected in the original design of the SCPZ project. Overall, impacts are expected to positively foster and help ensure environmental sustainability and social inclusion.

The project concept is embodied in transforming small subsistence farmers' production system (farming 1-5 ha) become a market-oriented agricultural undertaking and support middle size farmers (5-10ha) address constraints in enhancing productivity and their effective participation in value chains. The project concept is embodied in transforming small subsistence farmers' production system (farming 1-5 ha) become a market-oriented agricultural undertaking and support middle size farmers (5-10ha) address constraints in enhancing productivity and their effective participation in value chains.

The agriculture sector of Nigeria is characterized by low productivity; little and untimely access to inputs; lack of seed funds for establishing agro-processing plants by producer cooperatives; lack of access to supportive infrastructure; challenging business environment; limited access to markets; and low level of technology adaption; weak quality control mechanism; and low capacity at all levels. The project will address some of these challenges: (i) improving access to seed capital through grants and matching grants; (ii) support to productivity enhancement through introduction of new technologies and agricultural inputs; (iii) improve access to infrastructure by supporting investment; (iv) improving the capacity of producer cooperative through training and TA, especially for targeted women and youth groups; (v) facilitate market linkage through out-growers schemes; and (vi) facilitate on-farm value addition by targeting limited value chains and linking farmers to the supply chain. Within that context, the project-support will allow to achieve three priority goals: exploit export potential, improve food security and enhance livelihoods. The type of value chains to be supported will be aligned towards the achievement of these priority goals – in the immediate, short-run and medium-term.

The objective of the APPELIS Project is to support agricultural productivity growth and value addition by greater inclusion of smaller categories of farmers, production and processing units and opening it up beyond the model SCPZ in Alape, Kogi State to more states in Nigeria along the APP priority value chain corridor for better representation of various agro-ecological and geo-political zones of the country. The project is also aimed to use the existing implementation structures of the World Bank funded Commercial Agriculture Development Project (CADP) to fast track implementation of the new project and to take advantage of the achievements and experiences already gained in the 5 CADP participating states (Cross River, Enugu, Kaduna, Kano and Lagos), working on 8 value chains (rice, maize, poultry, aquaculture, dairy, milk, cashew, oil palm and cocoa). Kogi State which was the basis for the preparation of this project in its early design will also be added for the development and agro-processing of the cassava value chain.

The Productivity Enhancement and Livelihood Improvement Support Project (APPEALS) Project, which seeks to obtain funding to the sum of **US$**200m from the World Bank, is in line with the Agriculture Promotion Policy1, which intends to build on the legacy of the ATA and to support policy thrusts on Food Security, Import Substitution, Job Creation and Economic Diversification. The policy thrust has three key thematic areas: Productivity Enhancement, Crowding in Private Investment, and FMARD' Institutional Realignment. The proposed project will support the government new policy thrust and priorities for the agriculture sector across the three thematic areas of the APP, focusing more on Theme 1- productivity Enhancements 1, and contributing to some extend to Theme 2 Crowding in Private Investment and Theme 3- FMARD Institutional realignment.

The proposed project is expected to cover the five states being supported under CADP, plus Kogi state which was the basis for the preparation of this project in its early design

Project direct beneficiaries are estimated at a minimum of 60,000 individuals living in the six participating states, with about 10,000 per state, constituted mostly by farmers and their cooperatives societies, as well as individuals and owners, associates and workers of small and medium scale business enterprises along and around the supported priority value chains. It is anticipated that 35 percent of the total direct beneficiaries will be women. By design, the project has a dedicated sub-component to benefit women and youth that will allow them to develop agri-business that is expected to create jobs and improve their livelihoods.

ES3: Relationship of the OP 4.09-Pest Management with other triggered Safeguard Policies

Safeguard policies potentially triggered by the APPEALS based on EA screening result are:

S/N	Safeguard Policies Triggered by the APPEALS	Yes	No
1	Environmental Assessment (OP/OB/GP 4.01)	*	
2	Natural Habitats (OP/BP 4.04)	*	
3	Pest Management (OP 4.09)	*	
4	Indigenous peoples (OP 4.10)		*
5	Physical Cultural Heritage (OP 4.11)		*
6	Involuntary Resettlement (OP/BP 4.12)	*	
7	Forest (OP 4.36)		*
8	Safety of Dams (OP/BP 4.37)	*	
9	Projects on International Waterways (OP/BP/GP 7.50)		*
10	Projects in Disputed Areas (OP/BP/GP 7.60)		*

OP/BP 4.01 takes into account the biophysical and social environments. The Bank requires Environmental Assessment to help ensure that projects which it is financing are environmentally sound and sustainable. Since land use change and construction works will occur at the project sites (extensive cultivation of land, building of the processing plants, access roads construction and rehabilitation, provision of jetties, etc) this project thus triggers OP/BP 4.01.

In Bank-financed agricultural projects, pest infestations/ populations are controlled through integrated pest management methods (biological, cultural etc), since the APPEALS is a major agricultural project, for the purposes of Bank involvement and the obvious need to address pest management, OP 4.09 is triggered.

The objective of OP 4.11 on Physical Cultural Resources is to avoid or mitigate adverse impacts of Bank financed development projects on cultural resources. This is usually addressed in an Environmental and Social Management Framework (ESMF) or specifically, in and Environmental and Social Impact Assessment (ESIA) or Environmental and Social Management Plan (ESMP). However, because the developments associated with this project will be implemented on brown fields majorly, this safeguard policy is not triggered for this project.

The APPEALS is also likely to cause involuntary resettlement of farmers, hunters, herdsmen, farm land and lands used for other purposes originally part of the project locations. If farmers or other project affected people are to lose their farms, lands or livelihood, under Bank safeguard policies, a resettlement policy framework (RPF) is needed for this project.

A Resettlement Action Framework (RPF) was prepared as a separate instrument to address the involuntary resettlement issues that might result from project implementation. Simultaneously, an Environmental and Social Management Framework (ESMF) was prepared to provide guidance and principles for addressing potential environmental and social impacts that may result from civil works activities. However, the ESMF does not completely address the concerns that relate to pest control for the project. Thus, the preparation of this Integrated Pest

Management Plan (IPMP) becomes necessary to complement the ESMF as it is intended to proffer suitable Integrated Pest Management (IPM) methods for the project sites and ensure that pesticides application are minimized or completely avoided.

Safety of Dams (OP/BP 4.37): Small dams, dykes and weir will be constructed by the project. This because the provision of water for agro processing; productivity enhancement and livelihood improvement support activities might impound streams water and require the establishment of weirs and/or dams. These are small dams and generic dam safety measures designed by qualified engineer should be sufficient.

ES4: Rationale for the IPMP

Integrated Pest Management (IPM) brings together, into a workable combination the best strategies of all control methods that apply to a given problem created by the activities of pests. IPM has been defined in various ways but a more scientific definition describes it as, "the **practical** manipulation of pest populations using sound **ecological** principles to keep pest populations below a level causing economic injury".

Considering the land mass required for the large-scale cultivation, breeding and processing of the value chains, there is undoubtedly the likelihood of infestation by pests, currently within the proposed area or migratory pests. In line with the World Bank Environmental and Social Safeguard Policies, an agricultural development project such as this will trigger **World Bank's Operational Policy OP 4.09** (Pest Management), hence the need for an Integrated Pest Management Plan (IPMP) which is the suitable safeguard instrument for tackling pest management issues.

ES 5: Scope of the IPMP

This IPMP covers the existing national and international legislations on the use of chemicals for pest management. It also assesses the Nigerian experience in pest management and in-country capacity in implementing integrated pest management approaches. Other areas addressed by it include training and awareness creation for the public and users of pesticides on safety measures, description of pesticides banned for use in Nigeria as well as those approved for use.

Specifically, it also identifies institutional responsibility with regards to mitigation measures and monitoring indicators to be observed in order to evaluate the performance and effectiveness of the IPMP.

The IPMP will be reviewed and cleared by International Development Association (IDA) prior to disclosure country wide in Nigeria and InfoShop along with the ESMF report.

ES6: Legislative and Regulatory Framework

A number of legislations, policies and treaties were considered in this study. They include National extant laws, International conventions and treaties and the World Bank Operational

Policy 4.09. These legislations are listed below, while comprehensive details are contained in the body of this report;

National Laws and Policies

- Federal Ministry of Agriculture & Rural Development (1988)
- National Policy on the Environment, 1989
- FEPA Decree 58 of 1988 as amended by Decree 59 of 1992 and 1999 but complemented by rules and regulations such as FEPA S.1.5, FEPA S.1.9 dealing with disposal and distribution/use of pesticides.
- NAFDAC Decree 15 of 1993, as amended by Decree 19 of 1999.
- The Factories Acts 1990 being implemented by the Factories Inspectorate Division of FMLP.
- The Harmful Waste (Special Criminal Provisions etc.) Decree 42 of 1988 being implemented by FMEV.

International conventions & Treaties

- Montreal Protocol
- Bamako Convention on Hazardous Wastes
- Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal
- Stockholm Convention on Persistent Organic Pollutants (POP)
- International Code of Conduct for the Distribution and Use of Pesticides
- Rotterdam Convention

World Bank OP 4.09

This policy supports safe, effective, and environmentally sound pest management and promotes the use of biological and environmental control methods. It states that the assessment of the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management should be undertaken for any project that involves pest management. Projects that include the manufacture, use, or disposal of environmentally significant quantities of pest control products are classified as Category A. Depending on the level of environmental risk, other projects involving pest management issues are classified as A, B, C, or FI.

The national extant laws in Nigeria are consistent with international laws, World Bank Operational Policy 4.09 as well as annex C of OP4.01 on the procurement, use, handling and disposal of pesticides. However, in the event of any discordance between the existing laws in Nigeria and the World Bank safeguard policies the more stringent of the two will take precedence.

ES7: Assessment of the Capacity of Nigeria on the Implementation of IPMP

In order to reduce the incidences of pest in Nigeria a number of project based interventions have been carried including those funded by the World Bank and FAO on IPM. They include the

Cocoa farmers training on the use of IPM for pest control, the IPM for pest control in the National FADAMA Agricultural Development in Nigeria, Commercial Agriculture Development Project (CADP) and the farmer's training on IPM under the Transforming Irrigation Management in Nigeria (TRIMING) project. There are also other IPM implementation cases addressing key crops in Nigeria, for example, for control of root knot nematodes in tomato and for downy mildew control in maize. Similarly, there was the IPM recommendations for control of the African Rice Gall Midge including the combination of resistant crop varieties with seed dressing, timely planting, and pest monitoring to guide pesticide applications. Based on the successes recorded in the aforementioned IPM cases, it can be concluded that there exists capacity within the country on the use of IPM. However, for the proposed project, additional training and awareness creation will be required as detailed in this report.

ES8: Adverse Environmental & Health Impacts

This IPMP identified a number of environmental and health risk that may be encountered through unsafe use of synthetic chemical pesticides in the project areas.

Environmental

1. **Soil contamination**

   Pesticides which are still used in agricultural land in and around the project sites could enter soil during spraying resulting in wash-off or run-off into soil. Some pesticides such as soil fumigants and nematocides which are applied directly into soil to control pests and plant diseases are often retained in the soil. Long-term excessive use of pesticides will cause higher pesticide residues in the soil which will cause soil contamination within the area.

2. **Surface and Groundwater Contamination**

   Generally, there are four major routes through which pesticides reach the water: they may drift outside of the intended area when sprayed, may percolate, or leach through soil, may be carried to the water as runoff, or may be spilled. Pesticides typically enter surface water when rainfall or irrigation water exceeds the infiltration capacity of soil and resulting runoff then transports pesticides to streams, rivers, and other surface-water bodies. Groundwater contamination may occur when pesticide residue in surface water, such as drainages, streams, and municipal wastewater is leached downward into groundwater. Contamination of groundwater is likely to occur if pesticide applications are adopted by the proposed project as the most preferred measure for pest management.

3. **Air Pollution**

   Vapour from sprayed pesticides will be released into the air, and if the chemical compound is very stable, vapour may travel beyond the project intervention sites. Whether pesticides are applied by spraying or by surface application, air is usually the medium through which the chemicals move to their intended and unintended targets.

While some of the active ingredients in pesticides stay in the atmosphere for only a short while, others may last longer and may have the potential to contaminate the air, affecting humans and animals. Reliable data on how pesticides behave in air, such as distance travelled, are lacking, because adequate monitoring is unavailable.

4. **Harm to Non-target Species**

   The environmental impact of pesticides consists of the effects of pesticides on non-target species. Over 98 percentof sprayed insecticides and 95 percentof herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields. Runoff can carry pesticides into aquatic environments while wind can carry them to other fields, grazing areas, human settlements and undeveloped areas, potentially affecting other species. Other problems emerge from poor production, transport and storage practices. Over time, repeated application increases pest resistance, while its effects on other species can facilitate the pest's resurgence.

Potential Site-related Health Concerns

1. Consumption of crops and plants grown under chemical pest control could cause health hazards to humans and animals within and around the project site.
2. Certain kinds of chemical intoxication especially after drinking pesticide contaminated water is a medium to high likelihood. This is a crucial potential impact considering that most of the locals within the project areas get drinking water from surface and groundwater sources.
3. Skin, eye, and nose irritation
4. Possibility of cancers, neurologic, endocrine and reproductive problems form direct and indirect exposure to pesticides
5. Occupational health and safety risks: Long term inhalation of toxic pesticides sprayed, could eventually result in respiratory illnesses or disease conditions

ES9: Integrated Pest Management Plan

The IPMP for the APPEALS is developed to reduce dependency on pesticides and encourage integrated pest control methods. It considers a) IPM methods before planting (site selection, soil improvement practices, selection of appropriate value chain varieties and selection of planting materials; and IPM methods to be applied after planting such as biological, cultural, physical, chemical methods. It also designs a program for capacity building in IPM. By identifying institutional responsibilities, the IPMP also provides an information basis for stakeholder groups to establish functional mechanisms which will help project actors and Partners understand and respond to IPM needs.

ES10: Framework for Implementation

Consistent with the National Draft Policy document for SCPZs, the IPMP also identified implementation arrangements and describes responsibilities at the State and National levels. The

institutions will carry out joint supervision missions with the World Bank and provide administrative and technical support to the project intervention sites to ensure compliance with this IPMP. Some of these include the Federal Ministry of Agriculture and Rural Development, APPEALS State Coordinating Offices (SCOs), State FADAMA III and Agricultural Development Project (ADP), and other MDAs

ES12: Capacity Building and Awareness

Capacity building and awareness will be very important to the project beneficiaries in the understanding and implementation of this IPMP. The training modules and communication strategy are well spelled out in this report.

ES13 Budget for Implementation

Approximately **US$ 1,200,000 w**ill be required to effectively implement the IPMP over a Seven-year period.

Line item	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6	Yr. 7	**Total**
1. Capacity building & Awareness								
All training programs (See table 6.0)	168,000	140,000	140,000	60,000	60,000	55,000	30,000	653,000
Radio jingles and handbill on IPM	20,000	14,000	8,200	8,200	5,000	0	0	55,400
Sub-total	188,000	154,000	148,200	68,200	65,000	55,000	30,000	708,400
2. Environmental management								
Equipment; bed nets; improved species	7,200	10,800	10,800	7,200	3,600	3,600	3,000	46,200
Support to IPM research and development	14,300	18,000	18,000	7,200	7,200	7,200	5,700	77,600
Pest/vector surveillance	3,500	5,700	5,700	5,700	3,600	3,600	3,600	31,400
Sub-total	25,000	34,500	34,500	20,100	14,400	14,400	12,300	155,200
3. Occupational Health & Safety								
Personal Protective Equipment (Hand gloves, gas mask, safety boot and overall wear)	36,000	36,000	25,000	25,000	21,500	18,000	14,000	175,500
Chemical Neutralizer and first Aid	25,000	18,000	14,300	14,300	14,300	6,500	0	92,400
Sub-total	61,000	54,000	39,300	39,300	35,800	24,500	14,000	267,900
4. Project management								
IPMP coordination	2,600	2,900	2,600	2,600	2,600	2,600	2,600	18,500
Monitoring and evaluation	5,800	7,300	7,250	7,250	7,200	7,200	8,000	50,000
Sub-total	8,400	10,200	9,850	9,850	9,800	9,800	10,600	68,500
Grand total	282,400	252,700	231,850	137,450	125,000	103,700	66,900	1,200,000

PART 1: INTRODUCTION

1.1 Project Background

The Integrated Pest Management Plan (IPMP) of the Nigeria Agro-Processing, Productivity Enhancement and Livelihood Improvement Support Project (APPEALS) was prepared, consulted upon reviewed and subsequently disclosed in Nigeria and World Bank InfoShop on April 23, 2015 and April 29, 2015 respectively. This IPMU has now been updated to incorporate the changes in the original design of the project as requested by the borrower. These changes include geographical extension to other states and additional value chains. These changes did not trigger new World Bank safeguard policies. In addition, the potentially significant adverse impacts are not envisaged to exceed what was expected in the original design of the SCPZ project. Overall, the changes in the scope of the SCPZ project are expected to positively foster and help ensure environmental sustainability and social inclusion.

1. Introduction

Agriculture has been acknowledged to possess the greatest potential for sustainable economic development especially in terms of its resource-based approach to growth. This notwithstanding, Nigeria's comparative advantage in many agricultural products is being hampered by poor access to reasonably priced infrastructure and low cost financing along with problems in securing regular feedstock supplies. Also, the issue of instability in the policy and regulatory environment, which has been cited over the years to be the most common challenge to investment in building processing facilities across Nigeria, has been a factor militating against Nigeria's agricultural potential.

Nigeria's food import bill of over two trillion naira annually is not only exceptionally high vis-à-vis its national income, but also has an unsustainable annual growth rate of 11%. Thus, in addition to Nigeria's high rates of population growth, the rapid rate of urbanization and changing tastes as well as an ageing farming population would seem to dictate an even greater potential danger of its dependence on basic food imports. Such a high import dependency hurts Nigerian farmers, displacing local production and domestic unemployment (which grew from 4.3 percent in 1970 to 6.4 percent in 1980 and to 24 percent in 2011) while contributing to employment elsewhere. The high food import dependency also fuels domestic inflation and exposes the country, with high susceptibility, to shocks in global markets. This trend of dependency on food imports, with its attendant great danger for national food security, in a world where even the exporting countries are mindful about food adequacy, would therefore appear to be unacceptable and unsustainable fiscally, economically or politically.

It is consequent upon this that the Government of Nigeria came up with several initiatives, amongst which is the Agricultural Transformation Agenda (ATA) (2011-2015) to redress the situation. The ATA policy thrust was to addressing the constraints inherent in the Nigerian Agricultural Sector with a view to unlocking its widely acknowledged potentials through a paradigm shift from government-controlled to private-sector led agriculture, ATA achieved some level of success through deregulating the seed, fertilizer and mechanization sectors; improving farmers' access to modern farm inputs. However, the ATA could not deliver on its entire mandate as post-harvest losses still persists with growth in food production still limited due to gaps in input supplies. Today, Nigeria still import food for domestic consumption and is unable to earn significant foreign exchange from agricultural sector.

Based on the aforementioned gaps, the new federal Agricultural Promotion Policy (APP) is a strategy that focuses on maximizing the gains of the ATA while closing the gaps inherent. The Federal Ministry of Agriculture & Rural Development (FMARD) in consultation with partners has identified an initial pool of crops and related activities that will be driven through Agro Processing; Productivity Enhancement and Livelihood Improvement Support Project to tackling the aforementioned gaps.

First, FMARD will prioritize improving productivity into a number of domestically focused crops and activities. These are rice, wheat, maize, fish (aquaculture), dairy milk, soya beans, poultry, horticulture (fruits and vegetables), and sugar. It is believed that the gap can be closed by partnering closely with private investors across farmer groups and companies to develop end to end value chain solutions. The project provides opportunity for agro-investors, off takers, farmers, processors, agro-research organizations, State governments and MDAs to partner mutually to boost productivity and enhance value addition.

Second, FMARD will prioritize for export markets the production of the following crops and activities: cowpeas, cocoa, cashew, cassava (starch, chips and ethanol), ginger, sesame, oil palm, yams, horticulture (fruits and vegetables), beef and cotton. FMARD will also work with a network of investors, farmers, processors and other stakeholders to deepen the supporting infrastructure to ensure that quality standards are defined and maintained across the value chain. That will involve adding more testing laboratories, improving traceability of crops, disseminating intelligence on export markets and consumer preferences, etc. The goal is to build a high quality brand for Nigerian foods based on rigorous data and processes that protect food safety for both domestic and export market consumers.

The objective of this project is to support agricultural productivity growth and value addition by greater inclusion of smaller categories of farmers and processing units and opening it up to more states in Nigeria along the APP priority value chain corridor for better representation of various agro-ecological and geo-political zones of the country. The project is also aimed to use the existing implementation structures of the Commercial Agriculture Development Project (CADP) to fast track implementation of the new project and to take advantage of the achievements and experiences already gained in the World Bank funded CADP participating states in Nigeria.

Project Overview and Setup

The Agro Processing; Productivity Enhancement and Livelihood Improvement Support Project, which seeks to obtain funding to the sum of US$200M from the World Bank, is in line with the Agriculture Promotion Policy, which intends to build on the legacy of the ATA and to support policy thrusts on Food Security, Import Substitution, Job Creation and Economic Diversification. The policy thrust has three key thematic areas: Productivity Enhancement, Crowding in Private Investment, and FMARD' Institutional Realignment. The proposed project will support the government new policy thrust and priorities for the agriculture sector across the three thematic areas of the APP, focusing more on Theme 1- productivity Enhancements 1, and contributing to some extend to Theme 2 Crowding in Private Investment and Theme 3- FMARD Institutional realignment.

Project Development Objective

The Project Development Objective (PDO) is to enhance agricultural productivity of small and medium scale farmers and improve value addition of priority value chains in participating States. The PDO will be achieved through supporting farmers productivity and their linkage to markets, facilitating consolidation of agricultural product and cottage processing, facilitating farmers and small and medium businesses' clustering and connection to infrastructure network and business services, and providing technical assistance and institutional support both to beneficiaries, federal and state government for value chain development. Creation of jobs along the value chains will be contingent to increased productivity, production, and improving processing and marketing of the targeted value chains. The Project will focus its support on priority value chains as identified in the Green Alternative- the Agricultural Promotion Policy (2016-2020), through business alliance, promotion of greater farmers-agribusiness linkages and support to critical infrastructures in value chain development. In the period 2016-2020, the APP prioritizes the development of the following value chains: (a) rice, wheat, maize, soybean, dairy milk, tomatoes, sorghum, poultry, sugar cane, horticulture (fruits and vegetables), crops for the domestic market as well as for food security; and (b) cocoa, cassava, oil palm, sesame, and gum Arabic for the export market. Cassava, ginger, cowpea, cotton, fish (aquaculture), horticulture (fruits and vegetables), yam, and cashew nuts will be developed for both the domestic and export markets.

1. The proposed project is expected to initially cover 6 states across the six geo-political zones of Nigeria. The States are Cross River, Enugu, Kaduna, Kano, Kogi and Lagos, Additional states may be added during project implementation based on funding availability, states readiness to participate, and potential for expanding agribusiness clusters and corridors in the prospective participating states.

A. Project Beneficiaries

Project direct beneficiaries are estimated at a minimum of 60,000 individuals living in the six participating states, with about 10,000 per state, constituted mostly by farmers and their cooperatives societies, as well as individuals and owners, associates and workers of small and medium scale business enterprises along and around the supported priority value chains. It is

anticipated that 35 percent of the total direct beneficiaries will be women. By design, the project has a dedicated sub-component to benefit women and youth that will allow them to develop agri-business that is expected to create jobs and improve their livelihoods.

B. PDO-Level Results Indicators

- Increase in productivity of agricultural produce by project supported farmers
- Increase in processed output by project beneficiaries
- Number of beneficiaries supported by the Project (% women, % youth)

1.1.1 Direct Investment Components of the Project

The Project has 5 components as follows:

1: Production and Productivity Enhancement
2: Primary processing, Value Addition, Post-Harvest Management and Women and Youth Empowerment.
3: Infrastructure Support to Agribusiness Clusters
4: Technical Assistance, Knowledge Management and Communication
5: Project Management and Coordination

Component 1: Production and Productivity Enhancement (US$40 m: The objective of this component is to improve farmer's participation to agribusiness supply chains and response to the market requirement. Project will support small and medium scale farmers and their cooperative societies through business alliances, linking farmers to off-takers. To ensure consistent supply to off-takers, the project will support increase of small and medium farmer's productivity and total output in the participating states through the use of improved and appropriate technology, and structuring farmers/out-growers contracts. A matching grant mechanism will be used as an incentive to stimulate farmer's participation, and unlock the financing constraint which dramatically limits small farmer's access to improved inputs and technologies. It is expected that 30 percent of project supported farmers (about 30,000) will adopt at least one of 100 improved technologies that will be disseminated with the project support. The activities to be funded under this component include: (a) structuring of contract farming and out-grower schemes based on value chain investment plans and stakeholder mapping for each of the three priority value chains in each of the 6 participating states (b) introduction and demonstration of improved technologies, and support to farmers through matching grants mechanism for their adoption; and (c) strengthening FMARD inputs control and quality assurance.

Component 2: Primary processing and Value Addition Post-Harvest Management and Women and Youth Empowerment. (US$92m): The component will address post-harvest losses, facilitate consolidation of produce and primary processing by farmers' cooperative societies, and small and medium scale enterprises in project intervention areas, focusing on gender sensitive activities along the core segment of the value chains (production, processing marketing) and ancillary businesses (agro-dealership, haulage, packaging, business management, etc.). The component will support common goods for cooperatives, producer organizations, women and youth, through construction/rehabilitation of aggregation facilities, procurement and installation of equipment from cottage processing, storage, as well as quality assurance facilities, provision of business development services (technical assistance in business management, marketing, access to market information and financial services). The expected outcomes include the construction or rehabilitation of about 90 aggregation facilities; 10,000 farmers reached with agricultural assets under the project and Women and Youth empowered through grants, start-ups and mentorship.

Activities to be financed under this component are organized around three subcomponents: (i) Women and Youth Empowerment, consisting of provision of grants for start-up of new business or consolidation of existing business, to individuals or group beneficiaries following agreed

eligibility criteria and selection procedures; (ii) Commodity aggregation and cottage processing; through rehabilitation or construction of about 90 units of simple design aggregation centers, and provision of income generating assets such as equipment and machinery for post-harvest handling, storage and quality management, clearing, sorting, processing and packaging for organized group beneficiaries in target production clusters; (iii) Market development and linkage to business services, including support to market information and grain exchange platforms and facilitating value chains coordination around the aggregation centers. It is expected that about 10,000 women and youths will directly benefit from the grant mechanism under subcomponent (i), while another 10,000 cooperative and group members will benefit from the assets provided for the 90 aggregation centers under subcomponent (ii).

Component 3. Infrastructure Support to Agribusiness Clusters (US$40m): This component aims at improving the physical environment (last mile connection to roads and utilities) for agro-industrial and cottage processing units in defined agribusiness clusters with significant potential for greater inclusion of small to medium size farmers in to the agribusiness supply chains through the business alliances. It will tackle major constraints to make efficient the supply of raw materials and competitive agro-processing. The component will provide such support in collaboration with other project such as such as the World Bank–assisted Rural Access and Mobility Program) and by aligning with the federal and state government's programs on infrastructure. The project will not finance construction or rehabilitation of dams, or extracting water from existing dams. However if there is need for construction of small dams, dikes, and weirs, a qualified engineer will hired to supervise the construction and ensure compliance with the World Bank Operational Policies 4.37 on safety of dams. Activities to be financed under this component are clustered around the following subcomponents Infrastructure support to production, consisting of design and construction or rehabilitation of access roads, provision of jetties and water for production; and Infrastructure support to processing and value addition, consisting of provision of last mile connection to roads networks and utilities (water, energy, etc.).

Component 4. Technical Assistance, Knowledge Management and Communication (US$12.5m).

The objectives is to build capacity of project staff and partners in the relevant areas of value chains development, harness knowledge acquired an generated under the project, facilitate exchanges of experience and build capacity of stakeholders participating in the implementation of the project, and support the FMARD on strategic and technical studies for scaling up agricultural productivity and processing programs. Activities to be financed under this component are clustered around the following subcomponents: (i) Capacity Building and support to collaborating institutions: activities to be finance include preparation and implementation of project capacity building and training plan, and support to collaborating institutions at federal and state level; (ii) Communication and outreach: preparation and implementation of project communication strategy and plans, including the development of communication and reporting tools, and facilitating public access to project information. .

Component 5. Project Management and Coordination – (: US$15.5m):

The objective is to ensure effective management and coordination of the project for proper accomplishment of project related goals and objectives. This component will carry out technical, financial, administrative, monitoring & evaluation activities during the entire project period. Activities to be financed under this component are organized around the following subcomponents This component will be implemented through 3 subcomponents as it follows: (i) Project management and coordination, which include additional works and equipment for upgrading NCO and SCO offices, consultant services, salaries for NCO and SCOS staff competitively selected; operating costs, equipment and tools necessary to carry project day to day activities by NCO and SCOs; (ii) Monitoring and Evaluation (M&E): equipment, operating cost, workshops, and consulting services for conducting M&E related activities, including periodic surveys to inform project performance, beneficiary assessments and impact evaluations, reporting on project performance, and for implementing the Gender tracker; (iii) Environmental and Social Safeguards and Grievance Redress Mechanism, consisting of consultancy services, workshops and operating cost related to the preparation, implementation and monitoring of environmental and social safeguards instruments, as well as establishment of an effective grievance redress mechanism (GRM).

1.5 Rational for the IPMP

Integrated Pest Management (IPM) brings together, into a workable combination the best strategies of all control methods that apply to a given problem created by the activities of pests. IPM has been defined in various ways but a more scientific definition describes it as, "the **practical** manipulation of pest populations using sound **ecological** principles to keep pest populations below a level causing economic injury".

Considering the land mass required for the large-scale cultivation, breeding and processing of the value chains sites, there is undoubtedly the likelihood of infestation by pests, currently within the proposed area or migratory pests. In line with World Bank Environmental and Social Safeguard Policies, an agricultural development project such as this will trigger **World Bank's Operational Policy OP 4.09** (Pest Management), hence the need for an Integrated Pest Management Plan (IPMP) which is the suitable safeguard instrument for tackling pest management issues.

1.6 Scope of the IPMP

This IPMP covers the existing national and international legislations on the use of chemicals for pest management. It also assesses the Nigerian experience in pest management and capacity on integrated pest management approach. Other areas addressed by it include training and awareness for the public and users of pesticides on safety measures, description of pesticides banned for use in Nigeria as well as those approved for use.

Specifically, it also identifies institutional responsibility with regards to mitigation measures and monitoring indicators to be observed in order to evaluate the performance and effectiveness of

the IPMP. The IPMP will be reviewed and cleared by IDA prior to disclosure country wide in Nigeria and Info-Shop along with the ESMF report.

PART 2: DESCRIPTION OF PROJECT AREA

2.1 The Bio-Physical Environmental Features

Nigeria is situated in West Africa lying between latitudes 4°00 N and 14°00N and longitudes 2°50' E and 14°45' E, bordered to its south by the Gulf of Guinea for about 850km, by the Republic of Benin to the West for 773km, Republic of Niger to its North for 1497km, Chad at its North Eastern boundary (Lake Chad water boundary) for 87km and Cameroon to its East for 1,690km (see map below).

Figure 2.1: Map of Nigeria showing the 36 states and FCT, Africa Map inset

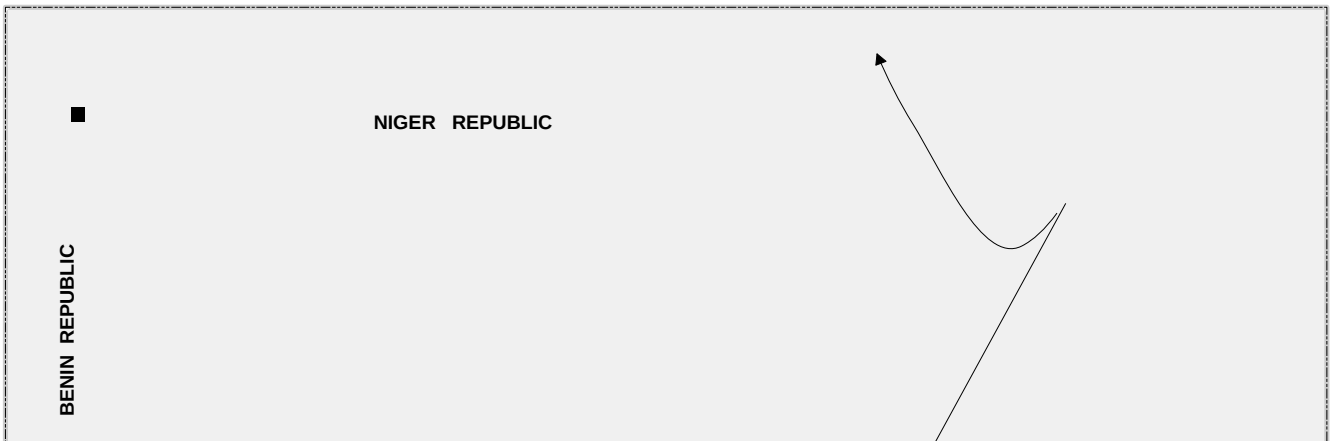
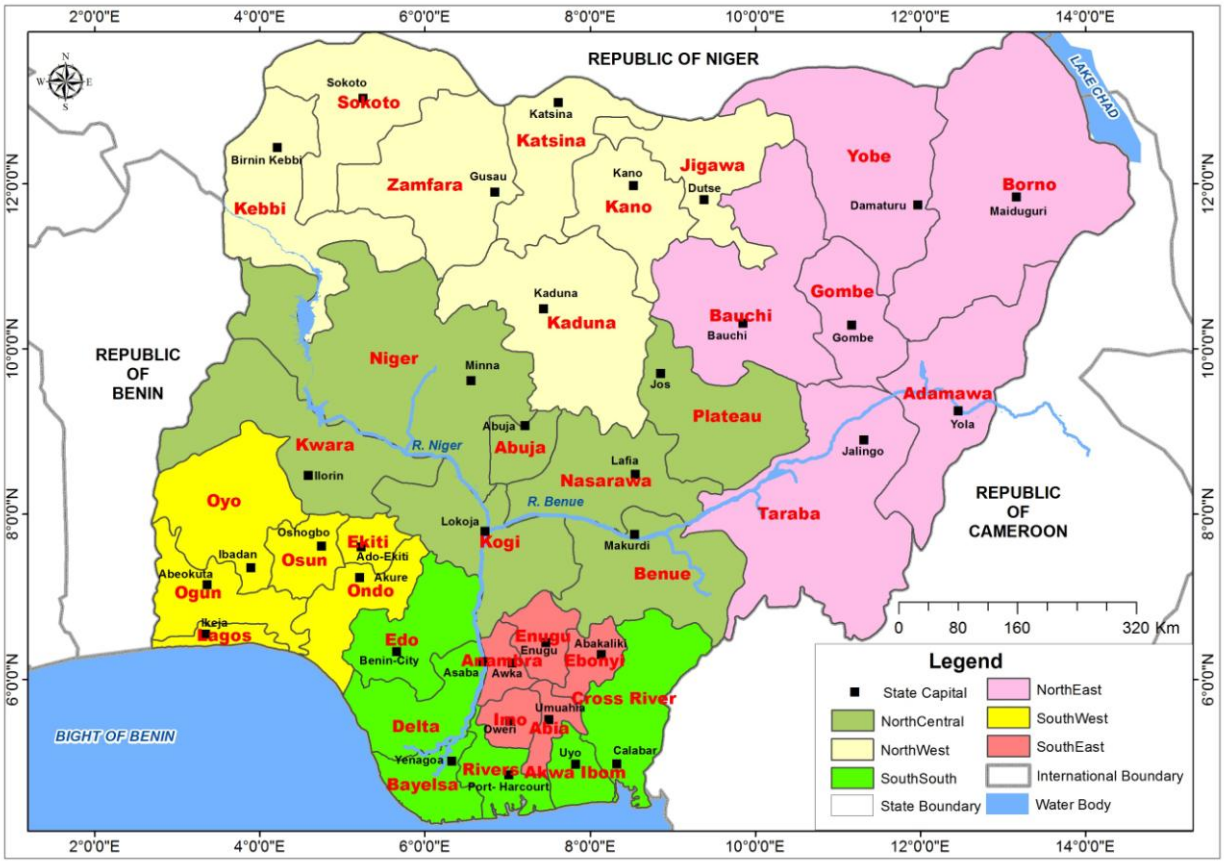


Figure 2.2: Map of Nigeria showing the 6 geopolitical zones with the 36 states and FCT



Nigeria has a total area of 923,768 sq. km of which the total land area is 913,768 sq. km while 10,000 sq. km is water. Nigeria is blessed with abundant water resources estimated at 226 billion m^3 of surface water and about 40 billion m^3 of ground water. Administratively, Nigeria is a federation with 36 federating units (states) and the Federal Capital Territory (FCT). The federating states are divided into Local Government Areas (LGAs). Presently, there are 774 LGAs in Nigeria. Synoptically, Nigeria is divided into six different geopolitical zones; these are North-west, North-east, North-central, South-east, South-west, and South-south. There are no administrative buildings or headquarters for these zones. The main characteristics of the biological, physical, and socio-economic environment of Nigeria are summarized below.

2.1.1 Physical Environment

2.1.1.1 Climate

Nigeria's climate varies from arid in the north, tropical in the center and equatorial in the south. The climate is largely controlled by prevailing winds and the country's proximity to the Atlantic Ocean. The two dominant air masses are the dry wind from the Sahara and the wet wind from the Atlantic Ocean. Marginal alterations have been recorded due to landform characteristics, configuration of surrounding shoreline and the generally flat topography of the country. Important climatic variables within the tropics as related to Nigeria are summarized below.

2.1.1.2 Rainfall

Rainfall is the single most important element for defining the climatic seasons in the tropics. Hence, Nigeria has two dominant seasons; the wet and the dry seasons. Rainfall throughout Nigeria depends on the interaction of the tropical maritime air mass and the tropical continental mass which meet along the inter-tropical convergence zone (ITCZ). The annual average rainfall around the country is between 2000mm and 3000mm.

2.1.1.3 Temperature

Nigeria's climate is characterized by relatively high temperatures. The average annual maximum ranges from 35^0C in the north to 31^0C in the south; the average annual minimum is from 23^0C in the south to 18^0C in the north. However, on the Jos plateau and the eastern highlands, altitude makes for relatively lower temperatures, with the maximum no more than 28^0C and the minimum sometimes as low as 14^0C.

2.1.1.4 Wind

Two principal wind currents affect Nigeria. The south-westerlies dominate the rainy season of the year while north-easterlies dominate the dry season. Depending on the shifts in the pressure belts in the Gulf of Guinea, these winds are interspersed respectively by south-easterlies and north-westerlies in different parts of the year. The wetter winds prevail for more than 70% due to the strong influence of the breeze from the Atlantic Ocean.

Mean annual wind speed varies between 2 to 6 m/s. Speeds in dry season (November -March) are lower. In the wet season (April–October), daily average speed could rise to 15 m/s. Values of up to 25 m/s are sometimes experienced particularly in the North when rain is about to fall and it is characterized by sand storm due to inducement by convective rainfall activities and relative diffusion.

2.1.1.5 Ambient Air Quality

Generally, air quality in the Nigeria complies with regulatory standards. However, variations have been noticed in major industrial cities like Lagos, Ibadan, Aba, Kano, Port Harcourt and Kaduna, and Agbara section of Ogun state. The Federal Ministry of Environment (FMEnv) has established national standards (Table 4.1) for gaseous emissions against which air quality parameters monitored are compared in order to ascertain its quality.

Table 2.1: Nigerian Ambient Air Quality Standard

Air Pollutants	**Emission Limits**
Particulates	250 ($\mu g/m^3$)
SO2	0.1 (ppm)
Non-methane Hydrocarbon	160 ($\mu g/m^3$)
CO	11.4 ($\mu g/m^3$) or 10 (ppm)
NO_X	0.04-0.06 (ppm)
Photochemical Oxidant	0.6 (ppm)

Source: FMEnv, 1991

Table 2.2: Air Quality Classification Based on TSP Values

Range of TSP Values (Pg/m^3)	**Class of Air Quality**
0 – 75	High Quality
76 – 230	Moderate Quality
231 – 600	Poor Quality

Source: Jain, et. al (1976)

Geology

Nigeria lies on the southern portion of the West African Craton. The geological setting comprises broadly crystalline basement complex rocks and sedimentary formations. They occur in equal proportions around the country. The former are highly mineralized and give rise to soils of high nutrient status, although variable from place to place. The latter are found in the south-east, north-east and north-west of the country, and give rise to sandy and less variable soils that are deficient in plant nutrient.

Topography

Nigeria has varying landforms and much of the country is dominated by plains, generally less than 610m above mean sea level. The eastern border with the Republic of Cameroun is lined by an almost continuous range of mountains which rise to about 2,419m at Chappal Waddi, Taraba state - the highest known point in Nigeria.

In the North, the Jos Plateau rises abruptly from a general level of about 609.5m in the Hausa Plains to an average level of some 1,219m, but reaches 1,781.6m in Shere Hills. The area west of the River Niger is dominated by the plain, which rises gently from the coast northwards ’to the area of crystalline rocks where inselbergs rise abruptly above the surrounding plains. The Idanre Hills, the highest point of these inselbergs, rises to about 981m above sea level. In general, the land surface of the country could be classified into three broad physical units or major relief features namely: the plains; the highlands; the troughs and the river valleys.

Soils Characteristics

The broad pattern of soil distribution in the country reflects both the climatic conditions and the geological structure; heavily leached, reddish-brown, sandy soils are found in the south, and light or moderately leached, yellowish-brown, sandy soils in the north. The difference in color relates to the extent of leaching the soil has undergone. Nigeria soils are highly weathered and are characterized by light texture, low pH value, low organic matter, low potassium levels, variable phosphorous levels with clay contents ranging between 7 percent to 43 percent.

Surface and Ground Water Hydrology

Nigeria has two major rivers, the Niger and the Benue, which traverse the northwest and northeast portion of the country, then merge at Lokoja before draining down to the Atlantic. There are several other rivers and quite a number of minor streams and rivulets that crisscross the entire Nigerian land mass. These include the Ogun, Oshun, Imo, Cross, Osse, Nun and the Anambra rivers in the south and the Kaduna, the Gongola, Sokoto – Rima and the Hadeija in the North.

Generally, the water quality in the rivers of Nigeria is very good. The average electrical conductivity in the main rivers ranges between 48-65 Umhos/cm^2, although higher values have

been reported in swamps and floodplains with levels of 100-150 Umhos/cm2. Total dissolved solids (TDS) concentration in the rivers is about 100mg/l while pH is less than 6.5. These rivers are also low in nutrients, with an average nitrogen content of 0.32mg/l and a total phosphorous content of 0.1 mg/l. The records indicate water of high quality according to FMEnv limits.

2.1.2. Biological Environment

Fauna

Animals found both in forests and savannas include leopards, golden cats, monkeys, gorillas, and wild pigs. Today these animals can only be found in protected places as the Yankari Park, Gashaka Gumti Park, and Cross River Park. Rodents such as the squirrel, porcupine, and cane rat constitute the largest family of mammals. The northern savannah abounds in guinea fowl. Other common birds include quail, vultures, kites, bustards, and gray parrots. The rivers contain crocodiles, hippopotamuses, and a great variety of wild marine life.

In the rain forest, few large animals notably gorillas, chimpanzees, baboons and monkeys are present. Crocodiles, lizards, and snakes of many species are also present. Hippopotamuses, elephants, giraffes, leopards, and lions now remain only in scattered localities and in diminishing number. Wildcats, however, are more common and widely distributed. Wildlife in the savanna includes antelope, lions, leopards, gazelles, and desert hyenas. Nigeria also abounds in bird life with a great number of species being represented.

Flora

Vegetation varies dramatically in relation to climate, soil, elevation, and human impact on the environment. In the low-lying coastal region, mangroves line the brackish lagoons and creeks, while swamp forest grows where the water is fresh. Farther inland, this vegetation gives way to tropical forest, with its many economy species of tropical hardwoods, including Mahogany, Iroko, and Obeche.

North of the forest is the Guinea Savannah, a region of tall grasses and shrubs. The southern margin of the Guinea Savannah has been so altered by humans that it is also called the derived savannah. Beyond the Guinea savannah lies the Sudan Savannah, a region characterized by shorter grasses and more scattered, drought-resistant trees such as the baobab, tamarind, and acacia. In the northeastern corner of Nigeria, the very dry semi-desert Sahel Savannah abounds.

2.1.2.1 Drivers of Vegetation Cover Change

Three dominant drivers of vegetal cover changes in Nigeria have been identified. Asides the climatic variations, it has been noted that oil prospecting or exploration has shaped the landscape in the South-South, while small holder rainfed agriculture through fallow and over grazing is

responsible for the vegetal changes in the south-west, South east and the Northern part of the country. In addition, other anthropogenic activities such as Landuse/Landcover change for housing and industrial spaces are culprits. For instance, in a seasonal trend analysis for the period between 2000-2010 studies derived from the forestry monitoring and evaluation coordinating unit (FORMECU) by Adeofun, et al, land use land cover and rainfall were observed to be drivers of vegetation change in Kogi State. The study revealed that conversion to land use types such as built-up-area and agricultural land was attributed to a high population growth rate from 2,147,756m^2 in 1991 to 3,314,043m^2 in 2006 (FGEG 2007). Also, Nathaniel (2012) revealed in his study that there was a decrease of about -50.9 percentin vegetation cover between 1986 and 2007(Table 4.3). For instance, this conversion of vegetation into other land use land cover, coupled with climatic variation, has influence on vegetation greening-up and greening-down in Kogi state and Nigeria in general.

Table 2.3: Land-use and Land Cover Distribution of Kogi state (Area (Km^2)

Land cover categories	Year 1976	Year 1995
Agricultural land	21902.65	23081.94
Built-up-area	20.77	124.23
Disturbed forest	568.76	299.94
Forest plantation	2.20	39.14
Fresh water march/swamp	1319.37	333.32
Riparian forest	1777.46	1027.92
Rock outcrop/un-vegetated area	73.11	65.10
Tree crop plantation	1.63	1.60
Undisturbed forest	1142.26	427.22
Water body	5.17	73.88
Woodland savannah	2097.00	3100.22
Grassland	57.56	393.43
Total	**28967.94**	**28967.94**

Source: Osunmadewa, B. And Christine Wessollek, C.(2012)

2.1.2.3 Ecological Problems

Commencement and operations of developmental projects often result in the direct removal or disturbance of plants, animals, and habitats/biotic communities. Ecological problems in Nigeria (which had led to scarcity, extinction or migration of plants and animal species) vary from states or regions to another. For instance, over grazing and lack of succulent grasses for animals feed in the north had forced the herdsmen to migrate southward for grazing which often leads to perpetual conflicts between herdsmen and the host communities.

In the south, particularly within the oil producing states where gas is flared for 24 hours continuously, this results in ecological problems for plants and animal (nocturnal animals) and Plants that need light (photosynthesis) and dark hours to be productive. However, these oil producing states with 24 hours light from gas flaring has resulted in ecological issues in the south-south.

In the same vein, leaching and massive gully erosion is the prevailing ecological problems in south-west (rainforest zone) and south -eastern and north-east respectively.

These problems are compounded by the annual bush burning of the savannah that further exposes the top soil to more erosion. Floods pose a problem on the flood plains during the rainy season, while aridity is a problem to several areas at short distances from the rivers during the dry season. Much damage is done to land and property as a result of these phenomena.

2.2 Description of Social Environment

2.2.1 The Demographics

Presently, Nigeria is one of the seven most populous countries; and the most populous back nation in the world with an estimate of 186,988 million people (UN, 2016) with an average population density of 205.3 persons per sqkm. This makes Nigeria the largest country by population, in Africa. According to the 2015 UN new report on population estimates and projections, Nigeria might be overtaking the United States to become the world's third largest country around 35 years from now. Presently, Nigeria's annual average population growth rate is 2.7 while the average urban growth rate is 4.7 (UN, 2015). The reason for the increase in the population and annual growth rate is attributed to high-fertility rate

However, according to the National Population Census conducted in 2006, Nigeria population by state is shown in the table 4.4 blow.

Table 2.4: Nigeria Population figures, 2006

S/N	State	Population		State	Population
1	Abia	2,845,380	20	Kano	9,401,288
2	Adamawa	3,178,950	21	Katsina	5,801,584
3	Akwa Ibom	3,902,051	22	Kebbi	3,256,541
4	Anambra	4,177,828	23	Kogi	3,314,043
5	Bauchi	4,653,066	24	Kwara	2,365,353
6	Bayelsa	1,704,515	25	Lagos	9,113,605
7	Benue	4,253,641	26	Nasarawa	1,869,377
8	Borno	4,171,104	27	Niger	3,954,772
9	Cross River	2,892,988	28	Ogun	3,751,140
10	Delta	4,112,445	29	Ondo	3,460,877

11	Ebonyi	2,176,947	30	Osun	3,416,959
12	Edo	3,233,366	31	Oyo	5,580,894
13	Ekiti	2,398,957	32	Plateau	3,206,531
14	Enugu	3,267,837	33	Rivers	5,198,716
15	Abuja	1,406,239	34	Sokoto	3,702,676
16	Gombe	2,365,040	35	Taraba	2,294,800
17	Imo	3,927,563	36	Yobe	2,321,339
18	Jigawa	4,361,002	37	Zamfara	3,278,873
19	Kaduna	6,113,503		Total	**140, 431,790**

Source: NBS

Nigeria total population as at 2006 was 140, 439, 790 with male of 71,345,488 and the female total number was 69,086,302 representing 50.8 percentand 49.19 percentrespectively. These figures show that there is a close margin between Nigeria male and female populations.

The real significance of Nigeria's demographic situation is that it simultaneously has a large population and one of the highest rates of growth in the world, causing its projection to move up so rapidly in total population. Many known factors could alter the above estimate. Insurgence, militancy, and other factors such as AIDS are factors that could have a dramatic impact on Nigeria's future demographics. While AIDS is not the critical national health concern, because it is so in other sub-Saharan countries, it may grow to become a problem of great concern.

Rural – Urban migration in Nigeria, like in most other countries is fueled by the pursuit for increased economic/ livelihood opportunities. Presently, it is estimated that 47.8 percentor 90.1 million people live in the urban centers. About 68.8 percentor 40.3million of this urban population are considered to be low-income earners. This pressure has forced changes in urbanization patterns, for instance, giving rise to a significant increase in peri-urban growth centers, as migrants from rural communities particularly the youths move daily and permanently into the cities to work but can only afford to live in new sprawling growth centers outside these cities, often where basic infrastructure and social services are either very poor or not available.

2.2.2 Ethnic Groups and Religion

Nigeria, has more than 250 ethnic groups, the larger of which are the Hausa and Fulani who are predominantly from the Northern part of Nigeria and represent approximately 29 percentof the population, the Yoruba, predominantly from the South (South West) and represent approximately 21 percent of the population and the Igbo, predominantly from the East represent about 18 percent of the population. The other large groups are the Ijaw with about 10%, the Kanuri with about 4%, the Ibibio with about 3.5 percent and the TIV with about 2.5%. The Middle Belt region of Nigeria shows the greatest degree of ethnic diversity, particularly in Adamawa, Taraba and Plateau States.

English is the official language while the vast majority of the population conducts commercial activities in their ethnic language and "pidgin" English. The literacy level of the population is 57.1 percent (male: 67.3%, female: 47.3%). Predominantly the people are Muslims (50%) and Christians (40%) with few animists (10%).

2.2.3 Land Use Pattern

The estimated land area of Nigeria is 924,000 km^2. Land use varies based on location and the needs of the community. However, the different uses of land revolve around agriculture, industry and social needs such as the provision of infrastructure. Recent data shows that between 50%- 60 percent of the land area of Nigeria is under various forms of intensive rainfed small holder agriculture (crop and animal) production and forest plantation.

2.2.4 Land Tenure in Nigeria

The Land Use Decree of 1978 vests all land in the state through the office of the governor. Land is to be held in trust and administered for the use and common benefit of all Nigerians according to the provisions of the Act. By this legal instrument, the state replaced the traditional institutions of traditional rulership and chieftaincy in their roles as keepers of communal land. Control and management of land in urban areas is the responsibility of the state governor, while all other land (rural, public, etc.) is the responsibility of the Local Government of the area. The governor is empowered to designate certain areas as urban land and to grant statutory rights of occupancy of fixed periods and rights of access to any person, subject to rental arrangements fixed by and payable to the state. The local government can grant a customary right of occupancy to land in the local government area (LGA) to any person or organization for agriculture, grazing, residential or other purposes.

2.2.5 Public Health Features

The increase in urban and slum area population over the years, coupled with the significant decline in the performance of the State Water Agencies to provide potable water (it is estimated that only 50 percent of the urban and 20 percent of the peri-urban have access to reliable water supply), and with poor or no acceptable sanitation or drainage infrastructure in many of these areas, the prevalence rate for diseases such as diarrhea, malaria, dysentery and other serious health conditions are high.

2.2.6 Poverty

Recent economic down-turn in Nigeria has further increased the existing poverty level. Present inflation rate in Nigeria as at September 2016 was 17.91%. According to the World Bank national account data file, the latest value for GNI per capita, Atlas method in Nigeria fell from US$2,970.00 as of 2014 to US$2820 in 2015 as against US$6050 for South Africa in the same period

It is estimated that 60 percent of the total population of Nigeria live below the poverty line. The average percentage of the urban poor (i.e. % of population below national poverty line) is a staggering 45 percent compared with the USA average of 32%.

2.2.7 Economics

The Nigerian economy rests on two pillars: oil/gas and agriculture. Both sectors contribute 65 - 70 percent of GDP, while the secondary sector (manufacturing) contributes about 7 percent and the tertiary sector (transport, trade, housing etc) contributes about 25%.

Nigeria's major industries are located in Lagos, Agbara and Sango Otta (Ogun State), Port Harcourt, Ibadan, Aba, Onitsha, Calabar, Kano, Jos and Kaduna.

2*.2.8 Literacy*

Nigeria literacy level varies from one state to another and it also varies among male and female population. Literacy level is higher in the south compared to the northern region. According to UNESCO 2015 survey, 65 million Nigerians are illiterate. This figure represents about 35%. Illiteracy has adverse effects on individual and society. Recent data shows that Ekiti state, one of the states in the southern region is the highest literacy state in Nigeria.

2.2.9 Facilities: Transportation, Electricity, and Education

The main transportation means in Nigeria is the road. Water transportation is fairly developed in some coastal areas such as Lagos, Delta, Akwa-Ibom and River states. Air transportation is considered fair with major airports in Lagos, Abuja, Port Harcourt, Kano and Kaduna. There are airport/airstrip facilities at least in 20 states of Nigeria. The railway sector has experienced a major decline in the last decades but efforts are being made to revive it and extend its geographical links. There is a regular/daily movement of rail in Lagos from Sango-to Iddo/Apapa. Recently, Abuja - Kaduna rail system was recently commission while effort to initiate the construction of Lagos – Kano and Lagos-Calabar is also in top gear.

There are two main sources of electric power in Nigeria; they are hydro and gas turbine. Recently, several companies have had their purchase agreements concluded and awaiting their licenses to generate power from Solar which will be added to the national grid to further boost the present power generation which has been fluctuating between 3800 -5070 megawatts. Nigeria power sector had been sectionalized into three; the generation, transmission, and the distribution. The Transmission is solely by the Federal government while generation and distribution had been privatized. Electricity is supplied through the national grid. Though the power supply is still erratic, significant progress in improving the power supply situation has been made in recent years; and government is promoting the development of independent power supply to augment the current inadequate supply.

With regard to educational facilities, Nigeria is reasonably served. All the Nigerian states have a federal university. There are over 150 universities consisting of federal, state, religious, and private owned schools. High schools in most states are insufficient and are in dilapidated state, except for states in the southern part of the country.

The Federal Government concluded the refurbishing of existing tertiary health institutions nationwide in 2014. There is at least one primary health care facility in each of the 774 local government areas of the country.

2.2.10 Agricultural Production and Livelihoods

Agriculture in Nigeria is largely subsistence and is characterized by intensive small holder rainfed farming and extensive grazing. Various schemes had been put in place to further boost agricultural production, these includes medium to large irrigation schemes, FADAMA projects, grazing zones/routes, and Agro-allied business such as fertilizer production. In addition to fish farming activity, some coastal/riverine communities also engage in fishing activities and other aquatic resources

Agricultural produce in Nigeria varies from one region to the other. Major produce in the north are cereals (such as millet, millet), rice, maize, beans, soya beans and vegetables. Irish potato, yam, and potato are the main agricultural produce in the middle belt while cassava, cash crops such as cocoa, coffee, cola nuts and cashew nuts are grown in the south-western Nigeria. Also, red oil production and cassava are exceptionally produced at the south-eastern region.

Taking the Kogi state as a case study, the agricultural land used in the model Kogi state SCPZ is characterized by arable land that supports the cultivation of cassava, yam, maize, sorghum, and vegetables. In Kogi state alone, about 90 percent of the population engages in agricultural activities as a major means of livelihood; although a large proportion of this (about 98%) consists of subsistence farming while the Fulani nomadic are engage in cattle grazing activities.

Pastoralism is a livelihood in Nigeria and it is essentially practiced by the Fulani settlement / herdsmen. Prior to the SCPZ project, there has been a recent effort, to increase agricultural production, by The Federal Government of Nigeria and the World Bank aimed at the enhancement of farming production and processing in the area. This is through the FADAMA projects and Commercial Agriculture (CADP). Positive outcome of the impact of the FADAMA 3 programmes on productivity, income and welfare of the people is evident as all year cultivation and production of farm produce is available, particularly the food crops such as beans etc.

2.2.11 Women and their right to Ownership of Farmland in Nigeria

In Nigeria, farmland is majorly owned by men especially in the north; meanwhile women, particularly in the southern Nigeria have access to their husband's or family's farmland either as

inheritance or otherwise. The Survey carried out in Kogi state for instance corroborated that lands are not culturally owned by women. Some of the women interviewed during field studies indicated that they own farms and have access to farmland from their husbands and/or community heads on non-payment conditions. It is only in Alape, Kabba-Bunu through GEMS 3 systematic land titling report that land ownership to about 20 percent by women is recorded. The study traced the development to, widows who have direct transfer of the right to their late husband's land inheritance and other categories to those who received land from the community for residential purposes.

2.2.12 *Vulnerable people*

Large proportion of the population in Nigeria depend on agriculture and land based resources for livelihood. Significant acquisition of land for this project without proper mitigation measures will expose some social groups to economic vulnerability. This might include women farmers and women heads of households as well as aged people and people with disabilities. While the proportion of the potential vulnerable women and aged persons are not readily determined at this stage, the ratio of disabled people is estimated to account for less than 1 percent of the population of the communities.

2.2.13 Land Competition and Conflict

Nigeria is a peaceful nation until recently where pockets of violence and insecurity had been recorded in the North-east and South-south regions. The recent conflicts between Nigerians subsistence farmers (in Kaduna, Benue, Enugu and some states in the South-west) and herdsmen's is unprecedented owing to the search for animal feed at the expense of cultivated lands.

In Kogi state model SCPZ area for instance, there is largely peaceful co-existence in the communities and among indigenes and settlers with respect to land use and social interactions. However, there was a major incessant conflict, across the 5 local government areas, over the use of land by the Fulani pastoralists for grazing their cattle. Nomadic pastoralists have no land use rights and depend largely on the hospitality/generosity of their hosts. They may have access to routes, corridors/passageways for wildlife and domestic animals, indicating a desire by government to provide grazing land for both nomadic and settled pastoralists. However, existing grazing reserves are only rudimentary lacking any facilities. Thus, generally, nomads move to open pasture to raise stock as well as avoid contact with agricultural communities.

The cattle movements avoid areas of tsetse fly infestation and other diseases and follow the location of farming communities for crops residues and markets for their products, thus trampling into the farm land. The increasing human population, irrigation and expansion of town and villages accelerated the encroachment of land cultivation and urbanization into grazing area and stock routes, leading to competition for resources and create farmer/herder clashes which have resulted in heavy losses of lives and properties. The local farmers claim that the Fulani's

cattle frequently destroy their crops, resulting in conflict which are sometimes violent. However, efforts are on-going both at the state and federal level to curtail these incessant conflicts.

2.2.14 Land Tenure and Land Use across the ABIR influence communities

Detailed Nationwide evaluations of land rights and use in rural areas as a whole has not yet been conducted. However, a number of important assessments have been undertaken with respect to the land tentatively earmarked for the Model SCPZ in Kogi state, namely the PEIA Report and the Initial Land Tenure Assessment prepared by GEMS3. The area tentatively slated for principal tenant is currently inhabited by a number of different communities, including so-called "indigene" Bunu communities, presided over by a number of different chiefs arrayed in a complex hierarchy. Other groups include "settlers" (mainly Tiv and Igbira) who obtain usufructory rights by paying small annual tribute to the Bunu chiefs. Also, Fulani communities reside in and graze animals in the area, and in some cases, engage in settled agriculture. Estimates vary as to the number of potentially affected people who live in the 30,000 hectare area, and final figures will depend on the configuration of the area, which is reportedly being revised to exclude some of the larger nucleated villages. In any event, it is likely that at least several thousand people utilize land within the area that the principal tenant anticipates including in its farm. Land rights in the area are generally undocumented, governed by custom and few if any formal certificates of occupancy have been issued, especially with respect to agricultural land.

2.2.15 Infrastructure (Road and Electricity)

Lack of good roads to evacuate agricultural produce had caused a huge lost to Nigerians farmers and had frustrated many of them out of the business. Unlike Lagos and Abuja, road infrastructure in many states of Nigeria are grossly inadequate; some of the existing ones are either in bad shapes or had been abandoned by the motorists.

Regarding electricity, although most parts of the country have been connected to the National Grid, this development however, does not in any way translate to power availability as many households in Nigeria are either in blackout or make use of local generators for energy supply for those that could afford them.

2.2.16 Water Supply for Agricultural Use

Nigeria has the potential to irrigate about 3.1 million hectares of farmland but only 150,000 hectares has been fully developed. Irrigation has potential of increasing agricultural productivity by as much as ten-fold. Fishery can be greatly enhanced by effective utilization of dams/irrigation facility. Therefore, the proposed project will benefit from the irrigation potential of the country.

PART 3: PEST MANAGEMENT CONCERNS AND CONTROL MEASURES IN NIGERIA

3.1 Pest and diseases Problems of Agriculture in Nigeria

Pests and disease vectors constitute serious hazards to public health, food security and general welfare of the citizenry in Nigeria. It is estimated that agricultural pests destroy about 50 percent of crops, fruits, ornamental plants, vegetables and livestock annually. Household pests also destroy property such as furniture items, clothing, books, etc. Estimated cost of damage caused by pests runs into millions of Naira annually.

Vectors transmit several diseases of public health importance in Nigeria. Malaria, which is transmitted by the Anopheles mosquitoes, is responsible for considerable morbidity and mortality particularly among children less than 5 years and pregnant women. Onchocerciasis (River Blindness) transmitted by Black flies is responsible for the high incidence of blindness in most rural and remote areas of Nigeria. This disease has resulted in depopulation of many fertile

farming areas thus contributing significantly to food insecurity and poverty. Lassa fever and Yellow fever transmitted by *M. natalensis* (rats) and *Aedes* mosquitoes respectively have been reported to occur in epidemic proportions in some parts of Nigeria.

Farmers often respond to pest infestations in crops by heavy applications of pesticides which threaten environmental quality and pose risks to human and livestock health. Pesticides used in vegetable agro-ecosystems, for example, include WHO toxicity Class 1a materials such as ***parathion***, and Class 1b materials such as ***Furadan/carbofuran***. The incautious dependence on chemical pest control options undermines national economic growth through farmers' non-compliance with trade barriers on pesticide residues in export produce. According to EC directive 91/414, for example, approximately 80 percent of the active ingredients used in Africa will be banned for use in Europe, and IPM is a fast-emerging trade policy issue.

3.2 Control methods of pests and diseases in Nigeria

Pest management methods in Nigeria vary with the type of pests and agriculture. Most of the pest control operations in Nigeria today are by the use of pesticides. Pesticides were once seen as the only answer to most of the pest problems. Now, due to the increasing concerns about the environment, the development of pest resistance to pesticides and the increasing economic pressures on farming and the food Industry they are increasingly being seen as just one of a range of control measures available.

Mainly pest management controls used in Nigeria include:

1. **Cultural control**: which refers to the adjustment of crop husbandry techniques by the farmer. These to a minimum include:

    - Crop Rotation
    - Alteration of planting date
    - Disposal of crop residues
    - Choice of resistant crop variety
    - Management of Irrigation

2. **Biological Control**: which involves either encouraging or introducing natural enemies of the pest or interfering with the life cycle of the pest

3. **Chemical controls**: which employs the use of toxic pesticides to kill pests.

The use of spray for the application of pesticides and herbicides has been in long use in Nigeria. It has been estimated that about 125,000 - 130,000 metric tons of pesticides are applied every year in Nigeria. They have been applied to control pests in cereals, vegetables and cash crops

like cocoa. In 1991, cocoa pesticides accounted for about 31 percent of the total agro-chemical market of which fungicides accounted for 65 percent and insecticides 35 percent (Ikemefuna, 1998).

Pesticide application equipment has been introduced into the Nigerian cocoa farming system, together with the pesticides to be applied, ever since they were used in the industrialized world. Practically, all the different techniques available have, at a given time, been introduced more or less successfully along with the screening of new insecticides, fungicides and herbicides, new spraying pumps are usually evaluated by the Cocoa Research Institute of Nigeria (CRIN), for their efficiency before they are recommended for use in the application of cocoa pesticides. CRIN has the mandate to screen and recommend potential cocoa pesticides and spraying equipment in Nigeria. However, with the new European Union (EU) Legislation on Maximum Residue Levels (MRLs) allowed on cocoa beans and products, some of the pesticides still undergoing screening and the previously recommended pesticides were banned. This new regulation, which came into effect September 1, 2008, has left very few pesticides for use on cocoa both on farm and post farm activities in Nigeria.

3.3 Assessment of Capacity of Nigeria on Integrated Pest Management

Although, the cultural and physical control measures to pest control have been in use in Nigeria, some of them have not provided sufficient and environmentally friendly options for pest management. For instance, bush burning as a way of controlling pest causes deforestation and loss of biodiversity and therefore should be discouraged. Other practices as outlined in the previous section are not in line with best practices and cannot support large-scale agriculture.

The conventional chemical control has been the means generally used to control crop invasions by pests in large agricultural programs in Nigeria. This approach has led to numerous cases of recorded intoxications each year, the resistance of numerous pests to many chemicals (case of *Helicoverpa armigera* to pyrethroids), the destruction of useful species, the perturbation of the ecological balance, the dependence towards synthetic chemical pesticides and the growing debt of farmers compelled to use increasingly expensive products, the deviances in the use of cotton pesticides on some food crops such as cowpea, etc.

In order to reduce the incidences of pest in Nigeria a number of project based interventions have been carried out on IPM. They include the Cocoa farmers training on the use of IPM to pest control and the IPM for pest control in the National FADAMA Agricultural Development in Nigeria, the IPM for pest control in the Commercial Agriculture Development Project (CADP), and the farmer's training on IPM under the Transforming Irrigation Management in Nigeria (TRIMING) project. There are also other IPM implementation cases amongst the key crops in Nigeria. For example, for control of root knot nematodes in tomato and okra, farmers are encouraged to integrate resistant crop varieties with seed dressing and compatible crop rotation schemes to prevent build-up of the pests. For downy mildew control in maize, farmer training by

the Rice/Maize center in Ibadan has promoted the integration of resistant crop varieties with seed dressing (using Apron plus), timely identification, rogueing and burning of affected plants and general farm hygiene. Similarly, IPM recommendations for control of the African Rice Gall Midge include combination of resistant crop varieties with seed dressing, timely planting, pest monitoring to guide pesticide applications. Based on the successes recorded in the aforementioned IPM case studies, it can be concluded that there exists capacity within country on the use of IPM.

PART 4: EXISTING LEGISLATIONS ON AND POLICIES ON USE OF CHEMICAL FOR PEST MANAGEMENT

4.1 Extant Laws of Nigeria on Pesticides Management

A number of other legislations and institutional framework are available using five main organizations (FMEnv, FMARD, FMH, NAFDAC and FMLP) exist for the regulation of the distribution and use of pesticides in Nigeria. The existing legislative tools are:

- Federal Ministry of Agriculture & Rural Development (1988)
- National Policy on the environment, 1989
- FEPA Decree 58 of 1988 as amended by Decree 59 of 1992 and 1999 but complemented by rules and regulations such as FEPA S.1.5, FEPA S.1.9 dealing with disposal and distribution/use of pesticides.
- NAFDAC Decree 15 of 1993, as amended by Decree 19 of 1999.
- The Factories Acts 1990 being implemented by the Factories Inspectorate Division of FMLP.
- The Harmful Waste (Special Criminal Provisions etc) Decree 42 of 1988 being implemented by FMEV.

Nigerian Agricultural Policy (1988)

The general pest control objectives in the existing (1988) agricultural policy for Nigeria are to:

- Control, and/or eradicate and maintain good surveillance of the major economic pests whose outbreaks are responsible for large-scale damage/loss to agricultural production.
- Provide protection to man and animals against vectors of deadly diseases.

National Policy on the Environment 1989

This Policy aims to achieve sustainable development in Nigeria, and in particular to:

- secure a quality of environment adequate for good health and wellbeing;
- conserve and use the environment and natural resources for the benefit of present and future generations;
- restore, maintain and enhance the ecosystems and ecological processes essential for the functioning of the biosphere to preserve biological diversity and the principle of optimum sustainable yield in the use of living natural resources and ecosystems;
- raise public awareness and promote understanding of the essential linkages between the environment, resources and development, and encourage individuals and community participation in environmental improvement efforts; and
- co-operate with other countries, international organizations and agencies to achieve optimal use of trans-boundary natural resources and effective prevention or abatement of trans-boundary environmental degradation.

Federal Environmental Protection Agency Act 58 of 1988 as amended by Decree 59 of 1992 into

This Act specifies the guideline and rules guiding the dealing with distribution, use and disposal of pesticides in Nigeria. The Act also mandates the Agency to establish instruments for air quality standards, water quality standards, atmospheric protection and ozone layer protection. In discharging the mandate, the FEPA in 1991 published a number of regulations for the protection of the environment, including the waste management and Hazardous Waste Regulation- which provides a comprehensive list of chemicals and chemical wastes by toxicity classification.

National Environmental Standards and Regulations Enforcement Agency (NESREA) Act 2007

NESREA is charged with the responsibility for the protection and development of the environment, biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology, including coordination and liaison with relevant stakeholders within and outside Nigeria on matters of enforcement of environmental standards, regulations, rules, laws, policies and guidelines.

The National Agency for Food and Drug Administration and Control (NAFDAC)

NAFDAC was established by Decree 15 of 1993 as amended by Decree 19 of 1999 and now Act Cap N1 Laws of the Federation of Nigeria (LFN) 2004, to regulate and control the manufacture, importation, exportation, distribution, advertisement, sale and use of food, drugs, cosmetics, chemicals, medical devices and packaged water in Nigeria for the protection of human health. In discharge of its statutory responsibility, NAFADAC has approved the list of chemicals allowed in Nigeria for the control of pest. This list is attached in the annex 2 of this report.

The Factories Act 1990

The Factories decree 1990 was a landmark in legislation in occupational health in Nigeria. It provides a substantial revision of the colonial legislation, Factories Act 1958, in which the definition of a factory was changed from an enterprise with 10 or more workers to a premise with one or more workers thereby providing oversight for the numerous small-scale enterprises that engage the majority of the workforce in Nigeria. It stipulates the enforcement of compliance on factories, industries and organizations that employ labour on the protection of the right of workers to friendly environment, health and safety.

The Harmful Wastes (Special Criminal Provision) Act 42 of 1988

This Act which was established on the 25th of November 1988 was necessitated by the illegal use and dumping of toxic wastes in the port town of Koko in Southern Nigeria. The Act defines harmful waste to mean any injuries, poisonous or toxic substances which are capable of subjecting anybody to the risk of health. As contained in the section 1, it is an offence to purchase, sale, import, transit, transport, deposit and/or store any banned or obsolete chemical or any other form of wastes in the Nigeria territory or water.

4.2 International Conventions & Treaties Relevant to Pest Management in Nigeria

Nigeria is a signatory to many conventions on the protection of the environment, which lay credence to the IPMP under study. Some of these conventions pertinent to this study include:

- Montreal Protocol
- Bamako Convention on Hazardous Wastes
- Basel Convention on Transboundary Movements of Hazardous Wastes and their Disposal
- Stockholm Convention on Persistent Organic Pollutants (POPs)
- International Code of Conduct for the Distribution and Use of Pesticides
- Rotterdam Convention

Among the aforementioned conventions, a certain number of them have a direct importance with pesticides and the fight against pollution, particularly the Stockholm Convention on persistent

organic pollutants. This convention, in accordance with Principle 15 of the Rio Declaration on Environmental and Development, aims at protecting human health and the environment from persistent organic pollutants such as aldrin, dieldrin, chlordane, endrin, heptacholic, hexachlorobenzene, mirex, toxaphene, DDT and PCBs. It is a global treaty to protect human health and the environment from highly dangerous, long-lasting chemicals by restricting and ultimately eliminating their production, use, trade, release and storage. The Convention was adopted in Stockholm, Sweden on May 22, 2001. It calls for outright banning and destruction of 12 Persistent Organic Pollutants, 9 of which are pesticides. These are: Pesticides POPs: Aldrin, Chlordane, DDT, Dieldrin, Endrin, Heptachlor, Hexachlorobenzene, Mirex, Toxaphene. The Industrial POPs: Dioxins, Furans, Polychlorinated biphenyls (PCBs).

The Rotterdam Convention

The Rotterdam Convention on the Prior Informed Consent on Procedure for Certain Hazardous Chemicals and Pesticides in International Trade is a global treaty that came into force in February 2004. It is designed to protect public health and the environment by promoting informed decision–making by importing countries in relation to products that have been banned or severely restricted by at least two other Parties to the Convention. It formalizes the voluntary principles established in the International Code of Conduct.

The Rotterdam Convention on Prior Informed Consent (PIC) aims to help participating countries make informed decisions about the potentially hazardous chemicals that might be shipped to them, and to facilitate communication of these decisions to other countries. The Convention requires exporting Parties to honour the decisions of importing Parties.

The key principles of PIC are:

- International shipment of a pesticide included in the PIC list should not occur against the wishes of the importing country.
- In the absence of a decision from an importing country, the export may proceed if the pesticide is registered in the country, or if it has previously been used or imported into the country.
- If an importing country decides not to consent to further imports, the decision must be applied to imports from all sources, and domestic manufacturing and use must cease.;
- Recommendations for inclusion of banned and severely restricted chemicals in the PIC procedure must be supported by risk evaluations reflecting prevailing conditions at the national level.

Basel Convention

The Basel Convention on the Control of Transboundary Movements of - Hazardous Wastes and their Disposal was concluded in Basel, Switzerland on March 22, 1989, and entered into force in May 1992. The Basel Convention contains specific provisions for the monitoring of implementation and compliance. A number of articles in the Convention oblige Parties (national governments which have acceded to the Convention) to take appropriate measures to implement

and enforce its provisions, including measures to prevent and punish conduct in contravention of the Convention.

The key principles/outcomes of the Basel convention are:

- In order to minimize the threat, hazardous wastes should be dealt with as close to where they are produced as possible.
- Transboundary movements of hazardous wastes or other wastes can take place only upon prior written notification by the State of export to the competent authorities of the States of import and transit (if appropriate).
- Each shipment of hazardous waste or other waste must be accompanied by a movement document from the point at which a transboundary movement begins to the point of disposal. Hazardous waste shipments made without such documents are illegal.
- Outright bans on the export of these wastes to certain countries; however, Transboundary movements can take place, if the state of export does not have the capability of managing or disposing of the hazardous waste in an environmentally sound manner.

There is also the support for the document of harmonization of rules governing the pesticide agreement in the ECOWAS zone adopted at the 60th ordinary session of the ECOWAS Council of Ministers held at Abuja on 17 and 18 May 2008. The aim of this common regulation is to:

- Protect the West African populations and environment against the potential hazards of pesticide use;
- Facilitate intra and inter-state trade in pesticides through the establishment of rules and principles accepted by common consent at the regional level to remove the trade barriers;
- Facilitate an appropriate and timely access by farmers to quality pesticides;
- Contribute to the creation of a suitable environment for private investment in the pesticide industry, and;
- Promote public-private sector partnership.

This regulation is applicable to all activities involving the experimentation as well as authorization, trade in utilization and control of pesticides and bio pesticides in the member countries.

4.3 World Bank OP 4.09

The policy supports safe, effective, and environmentally sound pest management and promotes the use of biological and environmental control methods. It encourages the assessment of the capacity of the country's regulatory framework and institutions to promote and support safe, effective, and environmentally sound pest management. Projects that include the manufacture, use, or disposal of environmentally significant quantities of pest control products are classified as Category A. Depending on the level of environmental risk, other projects involving pest management issues are classified as A, B, C, or FI.

The World Bank OP 4.09 ensures that EA covers potential issues related to pest management and considers appropriate alternative designs or mitigation measures. It places premium on using biological pest control measures, but where chemical pesticides must be used, it encourages the country's capacity to manage the procurement, handling, application and disposal of pest control products be evaluated and the capacity to monitor the precision of pest control and the impact of pesticide use, and to develop and implement ecologically based pest management program.

OP/BP4.01 annex C exempts procurement of impregnated bed nets and WHO Class III insecticides for intra-domiciliary malaria control from the requirement of preparing a pest management plan. In those cases, preparation of a hazard assessment would suffice. A hazard assessment identifies risks associated with the transport, storage, handling and use of the pesticides and provides measures to minimize these risks. The policy further provides that the PMP may be limited to pest control product screening when all of the following conditions are met:

- Expected quantities of pest control products are not significant from a health or environment standpoint,
- No significant environment or health concerns related to pest control need to be addressed,
- The project will not introduce pesticide use or other non-indigenous biological control into an area, or significantly increase the level of pesticide use;
- Products to be financed fall in class 111 or table 5 of the WHO Classification of pesticides by hazards.

The OP 4.09 principles provide general guidance that will be followed during appraisal on how to address pest management issues in different categories of projects to which OP 4.09 applies. These are provided as follows:

1. Do no harm

All projects: The do-no-harm principle applies to all projects under any circumstances. Its concerns entail that pest management activities in Bank projects are sustainable and that health and environmental risks of pesticide use are minimized and can properly be managed by the user.

Projects that directly or indirectly finance pesticides: For pesticides, directly or indirectly procured under Bank financed projects the policy states that it needs to be established that their use is justified under an IPM approach. It stipulates that optimum use should be made of available non-chemical pest management techniques to reduce reliance on synthetic chemical pesticides and that adequate measures be incorporated in the project design to reduce risks associated with the handling and use of pesticides to a level that can be managed by the users. The policy encourages monitoring of the effectiveness of these measures in order to achieve project objectives.

Projects that do not finance pesticides, but nevertheless indirectly increase or alter pesticide use, or affect pest management: If no pesticides are procured under the project, but if the project nevertheless affects pest management by maintaining or expanding pest management practices that are unsustainable, not based on an IPM approach, and/or pose significant health and environmental risks, then it would be appropriate to set out clear targets for moving current practices towards IPM and to provide the necessary support to this process. Immediate measures may be required to reduce risks associated with the handling and use of pesticides to a level that can be managed by the users. These may be addressed via:

- Determining justification of pesticide use (that is whether pesticides use is justified under an IPM approach;
- Determining if pesticides use is justified in economic terms;
- Determining appropriateness or otherwise of products through selection and procurement of pesticides
- Identification of risks and risk management to mitigate environmental and health concerns.

2. Do-Good Principle

The do-good principle calls for enhancing policy reform and strengthening the regulatory framework and institutional capacity for the implementation of IPM and the control of pesticides. The expected level of project involvement depends on the circumstances and the scope of the project. Relevant factors in this respect are the:

- Magnitude of the activity involving or affecting pest management.
- Nature of the risks involved.
- Size of the gap between actual practices and good practices.
- Geographical scope of the project.
- Degree to which policy reform and capacity building fit in the project.

PART 5: IDENTIFICATION OF POTENTIALLY ADVERSE IMPACTS OF PESTICIDES

5.1 Global Concerns on the Use of Pesticides

Pesticides are toxic substances released most times intentionally into our environment. This includes substances that kill weeds (herbicides), insects (insecticides), fungus (fungicides), rodents (rodenticides), and others. The use of toxic pesticides to manage pest problems has become a common practice around the world. Pesticides are used almost everywhere not only in agricultural fields, but also in homes, parks, schools, buildings, forests, and roads. Though they could be very useful in managing pest problems, they are also a great environmental and health risk.

5.1.11 Persistent Organic Pollutants (POPs)

In May 2001 Nigeria became a signatory to the Stockholm Convention on Persistent Organic Pollutants, and ratified in 2004. Under Annex A (listed for Elimination) of the convention, Parties must take measures to eliminate the production and use of the chemicals listed under Annex A. These obsolete pesticides are characterized by a high persistence in the environment (e.g. half-life for DDT in soil ranges from 22 to 30 years, Toxaphene -14 years, Mirex -12 years, Dieldrin- 7 years, Chlordecone up to 30 years), low water solubility and thus potential to accumulate in fatty tissue of living organisms including humans and toxicity to both human and wildlife. Due to intensive releases to the environment in past several decades, and tendency to long-range trans-boundary atmospheric transport, they are now widely distributed and are found around a globe. Most agricultural pesticides could constitute any of the POPs chemicals, which if are in use pose adverse environmental, animal and human health risks.

Considering that Nigeria is a Signatory, the country is obligated to stop the use of POPs pesticides if still in use. For other pesticides, which are not POPs, the issue of toxicity still remains and the consequence of application on agricultural farm land, and resultant wider environmental and social impacts.

5.2 Pesticides and Human Health

Pesticides have been linked to a wide range of human health hazards, ranging from short-term impacts such as headaches and nausea to chronic impacts like cancer, reproductive abnormalities, and endocrine disruption. Chronic health effects may occur years after even minimal exposure to pesticides in the environment, or result from the pesticide residues, which we ingest through our food and water. Pesticides can cause many types of cancer in humans. Some of the most prevalent forms include leukemia, non-Hodgkins lymphoma, brain, bone, breast, ovarian, prostate, testicular and liver cancers.

5.3 Identification of Potential Environmental and Health Risks Associated with Pesticides

Potential adverse environmental and health risks of pesticides applications that are of concern to the proposed project may include:

5.3.1 Environmental

1. **Soil contamination**

   Pesticides which are still used in agricultural land in and around the proposed sites could enter soil during spraying resulting in wash-off or run-off into soil. Some pesticides such as soil fumigants and nematocides which are applied directly into soil to control pests and plant diseases are often retained in the soil. Long-term excessive use of pesticides will cause higher pesticide residues in the soil which will cause soil contamination within the area.

2. **Surface and Groundwater Contamination**

   Generally, there are four major routes through which pesticides reach the water: they may drift outside of the intended area when sprayed, may percolate, or leach through soil, may be carried to the water as runoff, or may be spilled. Pesticides typically enter surface water when rainfall or irrigation water exceeds the infiltration capacity of soil and resulting runoff then transports pesticides to streams, rivers, and other surface-water bodies. Groundwater contamination may occur when pesticide residue in surface water such as drainages, streams, and municipal wastewater is leached downward into groundwater.. Groundwater contamination may also occur from pesticide residue in surface water, such as drainages, streams, and municipal wastewater.

3. **Air Pollution**

   Vapour from sprayed pesticides will be released into the air, and if the chemical compound is very stable, the vapour may travel beyond the project intervention sites. Whether pesticides are applied by spraying or by surface application, air is the usual the medium through which the chemicals move to their intended and unintended targets. While some of the active ingredients in pesticides stay in the atmosphere for only a short while, others may last longer and may have the potential to contaminate the air, affecting humans and animals. Reliable data on how pesticides behave in air, such as distance travelled, are lacking, because adequate monitoring is unavailable.

4. **Harm to Non-target Species**

   The **environmental impact of pesticides** consists of the effects of pesticides on non-target species. Over 98 percent of sprayed insecticides and 95 percent of herbicides reach a destination other than their target species, because they are sprayed or spread across entire agricultural fields. Runoff can carry pesticides into aquatic environments while wind can carry them to other fields, grazing areas, human settlements and undeveloped areas, potentially affecting other species. Other problems emerge from poor production,

transport and storage practices. Over time, repeated application increases pest resistance, while its effects on other species can facilitate the pest's resurgence.

5.3.2 Health

General

Pesticides can enter the body through inhalation of aerosols, dust and vapour that contain pesticides; through oral exposure by consuming food and water; and through skin exposure by direct contact. The effects of pesticides on human health depend on the toxicity of the chemical and the length and magnitude of exposure. Farmer, farm workers and their families experience the greatest exposure to agricultural pesticides through direct contact.

Children are more susceptible and sensitive to pesticides, because they are still developing and have a weaker immune system than adults. Children may be more exposed due to their closer proximity to the ground and tendency to put unfamiliar objects in their mouth. Hand to mouth contact depends on the child's age. Children under the age of six months are more apt to experience exposure from breast milk and inhalation of small particles. Pesticides can bioaccumulate in the body over time.

Potential Site-related Health Concerns

1. Consumption of crops and plants grown under chemical pest control could cause health hazards to humans and animals within and around the project site.
2. Certain kinds of chemical intoxication especially after drinking pesticide contaminated water is a medium to high likelihood. This is a crucial potential impact considering that most of the locals get drinking water from surface and groundwater sources.
3. Skin, eye, and nose irritation
4. Possibility of cancers, neurologic, endocrine and reproductive problems form direct and indirect exposure to pesticides.
5. Occupational health and safety risks. Long term inhalation of toxic pesticides sprayed, could eventually result in respiratory illnesses or disease conditions.

Table 5.1: Matrix of Some WHO Classified Pesticides and their Effects

Pesticides	**Result of accidental exposure**		
	WHO Class	**Effects of acute intoxication**	**Effects of chronic intoxication**
Clorpyriphos ethyle (1)	II (Moderatly dangerous)	Nausea. Dizziness. Vomiting. Cough. Loss of consciousness. Convulsions. Constriction of the pupil. Muscle cramps. Salivation. A severe exposure may cause inhibition of cholinesterase Exposure above the Occupational Exposure Limit (OEL) may result in death	The substance may have effects on the nervous system, cholinesterase inhibitor
Fenitrothion(1)	II (Moderatly dangerous)	Cramps. Diarrhea. Dizziness. Headache. Nausea. Loss of consciousness.A severe exposure may cause inhibition of cholinesterase exposure above the OEL may result in death	The substance may have effects on the nervous system, cholinesterase inhibitor
Malathion (1)	III (Slightly hazardous)	The substance may have effects on the nervous system, causing convulsions, muscle cramps, vomiting, diarrhea, excessive salivation, sweating, difficulty breathing, loss of consciousness. A severe exposure may cause inhibition of cholinesterase Exposure above the OEL may result in death.	A prolonged or repeated contact may cause skin sensitization. Cholinesterase inhibitor; possibility of cumulative effects
Dizinon	II (moderatly hazardous)	The main symptom of soft acute diazinon poisoning are headache, nausea, dizziness, pinpoint pupils, blurred vision, tightness in the chest, difficulty in breathing, muscle weakness or twitching, difficulty in walking, vomiting abdominal cramps and diarrhea Effects on the central nervous system may include confusion, anxiety, drowseness, depression, difficulty in concentrating, slurred speech, poor recall, insomnia, nightmares and a form of toxic psychosis resulting in bizarre behavior.	Cholinstrase inhibitor.Accumulation of acetylcholine at junctions between nerves and glands results in gland secretion;and accumulation between nerves in the brain causes sensory and behavioral disturbances.
Cypermethrin	II (moderatly hazardious)	Symptoms of acute poisoning include abnormal facial sensations, dizziness, headache, nausea, anorexia and fatigue, vomiting and increased stomach secretion	Chronic symptoms include brain and locomotry disorders, polyneurophasy and immuno-suppression and resembles the multiple chemical sensitivity syndrome
Carbosulfan	II (Modrately hazardous	The acute symptoms of carbosulfan in humans are characterstics of other organoposphate and carbamate insecticides. Signs include dizziness, salivation, excess salivation, nausea, abdominal cramps,	-

Pesticides	**Result of accidental exposure**		
	WHO Class	**Effects of acute intoxication**	**Effects of chronic intoxication**
		vomiting, diarrhea, blurred vision, pi-point pupils, difficulty breathing and muscle twitching	
Carbaryl	II (Modrately hazardous	>> >> >>	-
Profenofos	II (Modrately hazardious	Muscarinic, nicotinic and central nervous system manifestations	There is no available data concerning chronic toxicity of profenofos

5.4 Impact Mitigation through IPMP

Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of multiple practices with a view to reduce reliance or use of pesticides. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment. By applying basic IPM principles historical and future pest with respect to the proposed project site will be managed in an environmentally safe manner thus reducing increased dependency on pesticides or other environmentally unsafe approaches.

Specifically, knowledge on biological, cultural and mechanical control measures that have been used in other agricultural programs in Nigeria by the FADAMA projects, IITA, FAO, CADP, TRIMING project etc, will provide a strong platform for proffering practicable safe measures towards mitigating adverse impacts of identified pests in the project area.

Compared to traditional pesticide applications which pose immeasurable health and environmental risks, and may result in severe current and future losses (environmental, public, health, occupational health, social and financial), an Integrated Pest Management Plan (IPMP) will be the most appropriate pest management approach for the proposed project. The IPMP for the project will lay down mitigation measures, institutional responsibilities and capacity building needs.

PART 6: INTEGRATED PEST MANAGEMENT PLAN FOR THE APPEALS

6.1 IPMP Overview

Considering that the project is seeking financial support from the World Bank, it is of essence to note that World Bank's lending operations are performed in line with the Bank's environmental and social safeguard policies. The policies recommend that certain safeguard instruments are prepared to proactively manage projects which may triggered safeguards.

This Integrated Pest Management Plan (IPMP) is intended to help manage the adverse effects of identified pests and pesticides on the value chains in the project sites to acceptable levels. The plan is designed to minimize potential adverse impacts on human health and the environment and to advance ecologically based IPM.

This IPMP also recommends practical and cost-effective actions to prevent or reduce significant impacts to tolerable levels. It also establishes institutional arrangements and personnel capacity building needs. It shall complement the Environmental and Social Management Framework (ESMF) and other safeguards instruments of the project.

The IPMP for the proposed project is developed to reduce dependency on pesticides and encourage integrated pest control methods such as biological, cultural, physical, chemical methods and design a program for capacity building in IPM. By identifying institutional responsibilities, the IPMP also provides an information basis for stakeholder groups to establish functional mechanisms which will help the project actors and partners understand and respond to IPM needs.

6.2 Specific IPMP Objectives

1. Assist the target State governments to plan and design location specific IPM activities.
2. Promote participatory approaches in IPM to learn, test, select and implement "best-bet" IPM options.
3. Promote biodiversity monitoring to serve as early warning systems on pest status, alien invasive species, beneficial species, and migratory pests.
4. Establish linkages to drive the draft policy document for SCPZ in Nigeria and ensure compliance with national and international conventions and guidelines on pesticide use in agriculture.
5. Monitor and evaluate the benefits of IPM including its impact on the environment and health.

6.3 Integrated Pest Management Methods Suitable for the Value Chains within the Project Area

In implementing IPM for the proposed project, the use of highly persistent and highly toxic chemicals must be avoided in pest management. Natural pest control methods should be employed to effectively reduce or eliminate pest or disease infestation without harming humans, crops and other organisms like chemicals sometimes do.

Tables 6.1 and 6.2 present effective control methods (cultural, biological and chemical) for managing common pests and diseases of the value chains within the project area. It is only when natural methods are not adequate or available to manage the type or scale of pests and/or disease in a situation should chemical methods be applied. The combination of two or more natural methods may produce a more effective result when applied strategically.

The *IFC Guidelines on Pesticide Handling and Application* provides a criterion for choosing pesticides based on the following factors in decreasing order of importance:

i) Biodegradability;
ii) Toxicity to mammals and fish;
iii) Occupational health and safety risks; and
iv) Costs

Table 6.1: Value Chain Pests and Control methods in Nigeria

S/N	*CROPS*	*PESTS*	*CONTROL METHODS*		
			CULTURAL	*BIOLOGICAL*	*CHEMICAL*
1.	Rice	Nematodes (Apelenchoides besseyi; Hirshmanniella grazilis; H.oryza;H.spinicaudata) Stem borers	Land fallow and planting of trap crops Adopting crop rotation techniques	Encouraging or introducing natural enemies of the pest or interfering with the life cycle of the pest	-
2.	Wheat	Quelea birds Grasshoppers	Land fallow technique and planting of trap crops	Encouraging or introducing natural enemies of the pest or	-

		Nematodes Termites Aphids Stem borers	Adopting crop rotation techniques Use of scare-crows to scare the birds	interfering with the life cycle of the pest.	
3.	Cassava	Green mite Cassava mealy bug Variegated grasshopper.	Crop Rotation Alteration of planting date Disposal of crop residues Choice of resistant crop variety Management of Irrigation.	Encouraging or introducing natural enemies of the pest or interfering with the life cycle of the pest	-
4.	Maize	Quelea birds Grass cutters Rats Bush fowls Termites and Mole cricket Stem borers Shoot flies Armyworms	Bird scaring using Scare-crows Use of traps for rats, grass cutters, bush fowls Removal and destruction of infested plants and plant residue (applicable to Stem borers, armyworms & termites)	Encouraging or introducing natural enemies of the pest or interfering with the life cycle of the pest	Aerial spraying of organophosphorus pesticides
5.	Soya bean	Caterpillars Whitefly	Adopting crop rotation techniques Removal and destruction of infested plants and plant residues	Encouraging or introducing natural enemies of the pest or interfering with the life cycle of the pest.	--
6.	Horticulture (fruits & Vegetables)	Nematode Caterpillars (Moths and Butterflies) Beetles	Use of resistant species Adoption of crop rotation techniques.	Soil solarisation	-

		Grasshoppers Stem borers			
7.	Sugar Cane	Nematode Stem borers	Use of resistant species. Adoption of crop rotation techniques.	Soil solarisation	-
8.	Fish	Flukes Leeches Anchor worm Lice Nematode	Avoid introduction of raw plants or snails	--	Use of organophosphates Potassium Permanganate bath against fresh water parasites or salt water bath for fresh water parasites
9.	***Cocoa***	Cocoa Mirids	Erection or planting of Shade as canopy management helps to reduce the pest population Alternative hosts of Mirid pests should not be used as shade trees on cocoa farms	The black ant (*Dolichoderus thoracicus*) has been used in some farms as a control measure against Mirids.	Application of Actellic/Talstar and Promecarb insecticides. Insecticides are applied as foliar spray four times per year at monthly intervals
		Cocoa pod borer (CPB)	Sanitation practices involving the complete harvesting of ripe or damaged pods, burying of pod husk, placenta, rotten pods and all harvest remains Regular pruning of the cocoa canopy to less than 4 m in height Pod-sleeving with plastic bags also reduces attacks of CPB	Ants such as the black ant (*Dolichoderus thoracicus*) and the weaver ant (*Oecophylla smaragdina*) are very important for biological control The fungus *Beauvaria bassiana* has been found to infect larvae and pupae of the cocoa pod borer, causing a 100%	Improved control using relatively small amounts of contact *pyrethroid* or *carbamate* insecticides, applied to the undersides of lower branches, keeps the CPB population below economic damage levels

				death rate Pod Borer Moths and some other insects secret pheromones which serve as traps to the male Pod Borers, thereby interrupting the reproduction cycle of the Pests	
		Mistletoe	Cultural control is so far the only method that has proven to be effective; Good maintenance of top shade to prevent germination of Mistletoe seeds is a useful long-term measure Cutting-out/removal of Mistletoes is recommended every other year	--	chemicals are not effective, as it is impossible to apply them safely and efficiently
		Stem borer	Pruning of infested branches does reduce stem borer populations but is labour intensive Hand picking of adults and removal of larvae using pieces of wire can achieve good results but it must start as soon as infestation is spotted Planting of barrier crops such as dense stands of *Leucaena glauca*, taro or sweet potato or *Pueraria* species, at least 15m	The fungus *Beauveria bassiana* infects the larvae of **Stem borer** Ants (*Oecophylla and Anoplolepis species*) have in some cases served to reduce **Stem borer** larvae population	--

			away from the cocoa plant		
		Termites	Deep ploughing or hand tilling breaks open underground nests and exposes termites to drying out under the sun and to predators Burning straw at the entrances of termite knolls suffocates and kills the colony. Flooding nests with water washes away or drowns the termites A traditional method for mound building termites has been to break open the nest and remove the queen Removal of plant debris from farms can reduce the potential termite food supply and lead to starvation of the colony	Ants are the greatest enemies of termites and under natural conditions limit their numbers. Driver ants are useful natural enemies to termites as they feed on termite larvae.	Some controlled-release formulations of non-persistent insecticides (e.g. *permethrin and deltamethrin*) can be used as barriers in the soil around roots
10.	***Cotton***	Aphids (Cotton aphid) – *Aphis gossypii*	If aphid population is limited to just a few leaves or shoots then the infestation can be pruned out to provide control Application of reflective mulches such as silver colored plastic can deter aphids from feeding on plants	--	Insecticidal soaps or horticultural oils such as neem or canola oil are usually the best method of control
		Armyworm – *Spodoptera exigua*		Application of *Bacillus thuringiensis*, as a natural enemy, which parasitize the	Application of chemicals such as *Spinosad, and Methoxyfenozide*

				larvae	
		Helicoverpa - Helicoverpa armigera *and* H. punctigera	Tillage of the farm to a depth of at least 10 cm will damage or disturb pupae, seal their emergence tunnels and trap emerging moths Tillage of the farm also leaves survivors open to attack by birds, mice, earwigs, and wasp parasites Post-harvest cultivation (pupae busting) to reduce the overwintering stage of *Helicoverpa* is one of the most important cultural control practices available	Application of some beneficial insects can affect all *Helicoverpa* life stages: eg. Assassin bug, green lacewing and tachinid flies	--
		***Cotton bollworm* (**Helicoverpa zea)	Monitor plants for eggs and young larvae	Increased utilization of no-till practices results in increased in-field populations of fire ants, which are excellent predators on caterpillars of cotton bollworm pests *Bacillus thuringiensis* or *Entrust SC* may be applied to control insects on organically grown plants	Use of Organophosphates like *bifenthrin* against larvae and adults

		***Cutworms* (*Blackcutworm, Variegated cutworm*) -** Agrotis ipsilon	Removal of all plant residue from soil after harvest or at least two weeks before planting plastic or foil collars fitted around plant stems to cover the bottom 3 inches above the soil line and extending a couple of inches into the soil can prevent larvae severing plants Hand-pick larvae after dark Spread diatomaceous earth around the base of the plants	--	These pests are chemically controlled, by the addition or spraying of insecticides like *carbaryl, and deltamethrin*
11.	***Oil Palm***	**Mealy Bugs** *(Dysmicoccus brevipes)*	--	Mealy bugs can potentially be controlled by the introduction of natural enemies such as lady beetles	--
		Rhinoceros beetle (*Oryctes rhinoceros*)	Destroying of any decaying logs in plantation by chopping and burning to kill any larvae that may be inside Removal of any dead trees from plantation and destroy by burning Planting of cover crop to deter egg laying by females as they do not lay eggs in areas covered by vegetation Hooked wire can be used to extract larvae that are boring into young crowns	--	--
12.	***Yam***	**Mealy bugs** (*Rastrococcus Spp*)	Pruning out of heavily infested branches	Introduction of natural Mealy Bug enemies like	Horticultural oils or soapy solutions can be used to treat

				Ants etc.	heavy infestations It is not advised to use chemicals for control, as they may decrease the population of natural enemies, leading to Mealy bug outbreak
		White Scale insects – *Aspidiella hartii*	Inspection of yams in storage regularly, and removal of scale infested tubers Use of scale-free seed-yam for planting	--	Use of white oil (made from vegetable oils), soap solution or horticultural oil (made from petroleum) on yams infested with scale: (i) after harvest and before yams are stored; (ii) during storage, on yams when infestations begin; and (iii) at the time of planting before the tubers are cut Commercial horticultural oil can also be used. White oil, soap and horticultural oil-sprays work by blocking the breathing holes of insects causing suffocation and death. Spraying the undersides of leaves; the oils must contact the insects. The application of *malathion* is useful against scales insects, but it is likely to kill natural enemies
13.	Cowpea	Cowpea aphid *Aphis craccivora*	Use insect resistant varieties Multiplication plots and environs should be weed and	--	Spray using pesticides like *Bacillus thuringiensis* (branded as Cyber Force or Cyber

			ants free		Diforce)
		Cowpea pod borer *Maruca vitrata*	--	--	Spray using pesticides like *Bacillus thuringiensis* (branded as Cyber Force or Cyber Diforce)
		Cowpea Weevil *Callosobruchus spp*	Host-Plant Resistance. Resistant varieties are available at Research Institutes in Nigeria Harvesting at the right time to prevent infestation of pods in the field Cold storage at 4 degrees Celsius	--	Fumigation of the storage facility Seed treatment with Phostoxin
		Army worms *Spodoptera exigua*	--	Biological control by natural enemies which parasitize the larvae	Use available chemicals such as Bifenthrin
		Corn earworm *Helicoverpa zea*	Monitor plants for eggs and young larvae	Biological control of natural enemies that could be damaged by chemicals	*Bacillus thuringiensis* or Entrust SC may be applied to control the insects on organically grown plants
14.	Cashew	**Tea Mosquite** *Helopaltis antonii*	Dead trees and those which are beyond recovery should be removed from the plantation	--	--
		Cashew weevil Mecicorynus loripes	Remove bark from infested areas and destroy any larvae or	--	--

			pupae found, this process should be repeated every month for up to six months; severely infested trees should be removed and destroyed; remove all adult weevils from tree prior to destruction and also remove bark and kill all larvae and pupae		
		Helopeltis bugs *Helopeltis schoutedeni*	Monitor crop regularly for signs of damage. avoid interplanting cashew with other crops which are hosts for helopeltis bugs such as tea and cotton	Conserve populations of natural enemies, weaver ants can reduce populations African weaver ants (*Oecophylla longinoda*) have proved to be very effective as bioagents to Helopeltis and other sucking bug control	--
		Stem borers ***Mecocorynus loripes***	Control approach is basically physical confrontation to adults and larvae	--	--
		Mealy bug *Pseudococcus longispinus*	--	Use of bioagents such as Ladybird beetles (*Chilocorus spp*) and Lacewing flies (*Chrysopa spp*) have proved to be useful	--
15.	Ginger	Shoot borer	Collect all emerged adult and destroy. Install light trap during Mid May to June. July month for	Treatment of shoots with Beaveria bassiana	

			adult mass trapping. In the Stem borer infested field collection of dead heart and destruction of the same		
		White grub *Holotrichia spp*	Leaving the land fallow for 2 years reduce the pest population. Growing of resistant crops such as sunflower also checks the build-up of grub. Sowing of Trap crops	Application of Beauveria bassiana or Metarhizium anisopliae mixed with vermicompost @5g/kg or drenching the soil with these entomopathogenic fungi @5g/l	
		Leaf roller ***Udaspes folus***	Field Sanitation should be maintained.	Application of *Bacillus thuringiensis*	
		Shoot boring weevil	Remove alternate host plants such as wild turmeric and cardamom. The congregating adult beetles can be collected and destroyed.	--	Spraying of Nimbicidine or Carbofuran
16.	Sesame	**Hawk Moth**	Deep ploughing exposes the pupae for predation to insectivorous birds. • Hand picking (collection) and destruction of caterpillars	Use common biological practices	--
		Bihar hairy caterpillar	Dig the trenches of 1 inch depth between the fields to kill the larvae in pits. Irrigate once to avoid prolonged mid-season drought to prevent pre-harvest infestation	Use common biological practices	--
		Gall Fly	Use common Cultural methods	Use common biological practices	--
		Leaf Roller	Use common Cultural methods	Use common biological	--

				practices	
		Leaf Hopper	Use common Cultural methods	Use common biological practices	Application of Oxydemeton–methyl
17.	Dairy Milk (Cow)	**Cattle Tail Lice**	Applications for tail lice should be timed to obtain control of both flies and lice. This optimum timing of proper pesticides can result in the control of more than one pest for the cost of controlling one species.	--	Tail louse control can be readily achieved by timed treatments with insecticides like permethrin.
		Deer Flies	Traps have been effective when used around cattle that are confined to manageable areas	There are no effective biological control programs for controlling tabanids. There are native beneficial insects that target tabanids. Eggs are parasitizied by such Hymenopteran families as Trichogrammatidae, Scelionidae, and Chalcididae. Diapriidae and Pteromalidae (Hymenoptera), and Bombyliidae and Tachinidae (Diptera) parasitize the larvae and pupa. Tabanid adults are used as provisions for nest building wasps. Cattle egrets and killdeer are also tabanid feeders	Application of Emulsified GardStar spray
		Mosquitoes	The most effective control method available is source	--	--

			reduction by removing or draining mosquito breeding sites.		
		Scabies Mite	--	--	Application of Scabicur lotion on the affected areas
		Spinose ear tick	--	--	Application of Scabicur lotion on the affected areas
18.	Tomato	**Cutworms**	Elimination of weeds around garden beds at least two weeks before planting. Hand-picking cutworms at night may help	--	--
		Aphids	Crushing aphids by hand or blasting them off with a strong jet of water	--	--
		Hornworms	Hand-picking caterpillars in the early evening, when they are most active, is quite effective. Rototilling or using thickly sheet-mulch beds to destroy pupae between seasons	General predators, such as praying mantises or wasps, also reduce populations	Bacillus thuringiensis (1) or spinosad (1) sprays, both organic, can help with control
		StinkBugs	Hand-picking of stinkbugs; Elimination of weeds around garden beds at least two weeks before planting	--	-
		Snails and Slugs	Raising of tomato plants and especially fruit off the ground by using cages or staking	--	--
19.	Sorghum	**Lesser cornstalk borer**	Rescue treatments, once damage is detected, are not effective	--	Preventive insecticides, such as systemic seed treatments applied at planting in a band over the row, best controls LCSB.
		Billbugs	Preventive treatment is most	--	-

			effective using systemic seed treatments or at-planting insecticides, but rescue treatments are rarely effective.		
		Cutworms	Control weeds several weeks before planting. Cutworm rescue treatments using a foliar-applied insecticide may be useful	--	Cutworms can be controlled preventively using at planting soil insecticides or by pre-plant, at-planting or post at-planting or post emergence foliar sprays. Spay in a band over the row
		Chinch Bug	In seedlings, treat when two or more adults are found on 20 percent of seedlings. On taller plants up to 6 inches, treat when 75 percent of plants are infested OR five or more chinch bugs per plant are present	--	Post-emergence applications should be directed at the base of plants using enough final spray and pressure to ensure good coverage. Getting good spray coverage becomes more difficult in larger plants
		Aphids and Greenbug	Systemic seed treatments normally are not justified specifically for aphid control, but if used they will control aphids for about 20 days after planting.	Usually natural enemies such as lady beetles, hover fly larvae, parasitic wasps and others will control aphid infestations	In larger plants, an insecticide treatment may be needed if aphids are causing the discoloration and death of two or more leaves.

Table 6.2: Value Chain Diseases and Control methods in Nigeria

S/N	*CROPS*	*DISEASES*	*CONTROL METHODS*		
			CULTURAL	*BIOLOGICAL*	*CHEMICAL*
1.	Rice	Blast (Pyricularia oryza) Brown leaf spot (Cochliobolus miyabeanus) Black kernel (Curvularia spp)	Adopting crop rotation techniques	--	--
2.	Wheat	Foot and root rot Rusts (stem rust, brown rust and leaf rust) Smut; loose smut	Land fallow and the planting of trap crops. Adopting crop rotation techniques. Use of scare-crows to scare the birds.	--	--
3.	Cassava	Cassava Mosaic Bacterial blight Anthracnose Root rot	Crop Rotation Alteration of planting date Disposal of crop residues Choice of resistant crop variety	--	--

4.	Maize	Rust Turcicum blight Curvularia leaf spot Maydis blight Smut. Nematode	Use of crop rotation planting technique. Removal and burning of infected plants	Use of resistant varieties	Spraying with systemic fungicides eg. Benomyl and Dithane M45. Seed dressing with Furadan or Apron plus. Use of Furadan 3G and other fumigant nematicides
5.	Soya bean	Rust Bacterial pustule Phytophthora seedling blight and root and stem rot Frogeye leaf spot Cowpea mild mottle Soyabean mottle mosaic	Use of Crop rotation planting techniques	Plant resistant varieties	Use of Foliar fungicide Treatment of seeds with systemic insecticides and application of one or two foliar sprays of insecticides to reduce the insect vector during pre-flowering stage
6.	Fish	Coccidiosis Hexamitosis Streptococcosis Dropsy Vibrio	--	--	Use of coccidiostat monensin, sulfamidimine or amprolium
7.	***Cocoa***	**Witches' Broom** – *Crinipellis perniciosa*	Phytosanitary pruning is an effective means of control of Witches' Broom	A very effective biocontrol agent for Witches' Broom is *Trichoderma stromaticum*	--

			Complete removal of all infected material is advocated, but it is an impossible task because hidden inoculum sources always remain		
		Vascular Streak Dieback (VSD) – *Oncobasidium theobromae*	Seedlings should be raised well away from infected areas to ensure that stock transplanted into the field is initially disease-free. Nurseries should be protected by growing seedlings in a shade house or under a plastic shelter, which keeps the leaves dry for all but a few hours after watering Covering nurseries with roofs also stop spores falling on the young cocoa seedlings. Ensure Monthly inspection and pruning of infected stems with the first sign of yellowing	--	--
		Frosty Pod Rot - *Crinipellis roreri*	Removal of diseased pods from the cocoa trees is the main cultural approach to Frosty Pod control	Application of antagonistic fungi or bacteria is effective in reducing the incidence of Frosty Pod	Copper fungicides and organic protectants (especially *chlorothalonil*) applied

			Diseased pods must be removed from the tree, weekly during peaks of pod-set and development, but less frequently when fruiting is sparse	Application of Bacteria from *genera Bacillus* and *Pseudomonas*	on the early stages of pod development, from the start of the main pod-set peaks until most pods are 3 months old have generally proven effective and may be economical
		Black Pod -*Phytophthora species*	Cultural control is quite effective by making it more difficult for the fungi to spread through the crop. Field inspections should begin at the start of the rainy season. After 2-3 days of continuous rainfall, check for and remove primary infections on pods. Infected plant material needs to be disposed of carefully.	Conserving natural beneficials by maintaining leaf litter mulch to cover the soil will contribute to the break-down of Black Pod-infected crop debris and reduces the level of inoculum at soil level.	Using fungicides of copper oxide or copper sulphate either singly or in combination with metalaxyl, combined with cultural method is an integrated approach
		Cocoa Swollen Shoot Virus – *CSSV*	Isolating new cocoa plantings from infected cocoa by using barriers of CSSV-immune crops.	--	--
8.	Cotton	**Alternaria leaf spot** - *Alternaria macrospora*	Plow crop residue into the soil to reduce inoculum levels	Provide plants with adequate irrigation and nutrients, particularly potassium	Applications of appropriate foliar fungicides may be required on susceptible cultivars.

		Asochyta blight – *Asochyta gossypii*	Plow crop debris into soil after harvest	--	--
		Cercospora Leaf Spot – *Carcospora gossypina*	Plow crop residue into the soil to reduce inoculum levels provide plants with adequate irrigation and nutrients	--	Applications of appropriate foliar fungicides may be required on susceptible cultivars
		Fusarium wilt - *Fusarium oxysporum*	Use on certified, disease-free seed	--	Fumigating the soil may reduce disease incidence Application of chemicals like *Metalaxyl, Triadimenol, Mefenoxam,and Iprodione*
9.	***Oil palm***	**Bacterial Bud rot –** *Erwinia Spp*	Plant oil palm varieties with resistance to the bacteria Rotting tissue on spear leaves should be removed to prevent bacteria spreading to buds	--	Palm buds can be protected using copper-based fungicides
		Ganoderma butt rot – *Ganoderma Spp*	Palms should be monitored closely for signs of disease, especially if a palm has died or been removed nearby as fungi can colonize old stumps and release spores Avoidance of replanting	--	--

			palm in soil where an infected palm has been removed		
		Oil Palm Witt – *Fusarium oxysporum*	Dead or dying trees should be felled and burned to prevent spread in plantations If palms are replanted, then new palm should be planted a distance of 3.9m from infested stump	--	Treatment of soil within a 3m radius of infested stumps with *dazomet,* and subsequent covering with leaves for a period of 30 days
		Pestalotiopsis Leaf spot – *Pestalotiopsis Spp*	Removal and destruction of severely diseased palms from plantation, Adequate spacing during planting of palms to allow air to circulate between trees Removal of weeds from palm plantation	--	Application of appropriate broad spectrum foliar fungicides can be used as a chemical method for control of Leaf Spot disease
10.	***Yam***	**Anthracnose** - *Colletotrichum gleosporoides*	The most effective method of controlling the disease is to plant yam varieties that are resistant to anthracnose such as TDA 291 or TDA 297	--	The use of Benomyl, thiabendazole as a chemical method of control of yam anthracnose had been proven effective
		Dry rot disease – Scutellonema bradys	Treating tubers with hot water for 40 min at 50-55 C before sowing and after harvest to reduce disease	--	--

			both in field and storage Follow crop rotation with non-host or antagonist crops like ground nut, sorghum, maize, chill pepper etc.		
		Yam Mosaic diseases – *Yam Mosaic potyvirus*	Use of healthy, large and disease free tubers or setts for planting Regular weeding of farm land Collection and destruction of crop debris		
11.	Cowpea	**Antracnose** (Collectotrichum spp)	Use of resistant varieties for planting is the best method of control practice of good field sanitation such as removing crop debris from field after harvest to reduce levels of inoculum	--	--
		Bacteria blight (Fungi) *Xanthomonas campestris*	Use of certified seeds and resistant varieties	--	Spraying of plants with an appropriate protective copper based fungicide before appearance of symptoms Treatment of seeds with an appropriate antibiotic prior to planting to kill off bacteria

		Brown blotch (Fungi) *Collectrichum capsici*	Use of resistant varieties for planting is the best method of control Use of only certified disease-free seed Good field sanitation practice such as removing crop debris from field after harvest to reduce levels of inoculum	--	--
		Brown Rust (Fungi) *Uromyces spp*	--	--	Sprays of sulphur or potassium carbonate can help to control the disease
12	Cashew	**Anthracnose** *Collectotrichum gloeospoides*	--	--	A protective coating of copper-based fungicide on susceptible parts of plant can prevent the disease. Fungicide should be applied when buds begin to expand through to fruit set but are not required during dry periods
		Die Back or Pink Disease	This disease can be controlled by the pruning of the affected branches below the spot of infection and destroying them, protecting the cut surface by application of Bordeaux paste and spraying of Bordeaux mixture 1% twice in May - June and the second in October.	--	--
		Damping off of Seedling	It can be controlled by provision of adequate	--	--

			drainage in the nursery and dranching the beds/polybags with *0.*1 % Cersen, Bordeaux mixture 1%, Diathane - M-45 0.25% or Feltef 0.1%.		
		Powdery Mildew disease	--	--	Powdery is basically controlled by use of Sulphur dust, but due to likely environmental acidification problems, alternative fungicides have been tested and registered for use in Nigeria
		Leaf and nut blight disease	--	--	-
13.	Ginger	**Bacterial Wilt**	Use of disease free seeds. Sowing should be done on disease free land based on previous history. 4 to 5 years of crop rotation will prevent disease incidence Provide proper drainage will prevent water stagnation		Treatment with trichoderma viride or T. Herzianum + Pseudomonas florescens before sowing.
		Dry Rot	Seed rhizomes are to be selected from disease free garden	--	Application of Trichoderma harzianum along with neem cake @ 1 kg/bed helps in preventing the disease. Use Bordeaux mixture or copper fungicides@ 2.5 gm / lit water as spot drenching
		Soft Rot	Use disease free, healthy rhizome for planting. Provision of good drainage	Bio fumigation with residues of cruciferous crops like mustard, toria, rapeseed	Application of neem cake @ 2.5 quintals along with Trichoderma viride @ 2.5 kg/ha at

					the time of planting. Drenching with Bordeaux mixture @1% or COC @0.3% for effective management of the disease.
		Leaf Spot	Growing the crop under partial shade	--	Application of Bordeaux mixture at 1% or COC at 0.3%
14.	Sesame	**Alternaria leaf blight**	Avoid planting overlapping crops in adjacent area. Crop rotations, viz., sesame-maize cabbage, okra- sesame - maize, maize - sesame - maize and sesame - finger millet-egg plant are reported effective in reducing disease incidence. Crop rotation with non-host crops, particularly with paddy. Provide good drainage	Use resistant/tolerant varieties. Use healthy, certified and weed seed free seeds. Use sowing in lines to facilitate inter culture operations. Adopt stale seed bed technique to control early germinating weeds. Use straw mulch to control weed growth and to conserve soil moisture	Treatment with Trichoderma @ 4 g/Kg of seed, Pseudomonas fluorescens @ 2 g/Kg seed or Bacillus subtilis @ 2 g/Kg seed or NSKE 4%
		Phytophthora blight	Avoid planting overlapping crops in adjacent area. Crop rotations, viz., sesame-maize cabbage, okra- sesame - maize, maize - sesame - maize and sesame - finger millet-egg plant are reported effective in reducing disease incidence. Crop rotation with non-host crops, particularly with paddy. Provide good drainage	Use resistant/tolerant varieties. Use healthy, certified and weed seed free seeds. Use sowing in lines to facilitate inter culture operations. Adopt stale seed bed technique to control early germinating weeds. Use straw mulch to control weed growth and to conserve soil moisture	Treatment with Trichoderma @ 4 g/Kg of seed, Pseudomonas fluorescens @ 2 g/Kg seed or Bacillus subtilis @ 2 g/Kg seed or NSKE 4%
		Dry root rot	Avoid planting overlapping crops in adjacent area. Crop	Use resistant/tolerant varieties. Use healthy, certified and weed	Treatment with

			rotations, viz., sesame-maize cabbage, okra- sesame - maize, maize - sesame - maize and sesame - finger millet-egg plant are reported effective in reducing disease incidence. Crop rotation with non-host crops, particularly with paddy. Provide good drainage	seed free seeds. Use sowing in lines to facilitate inter culture operations. Adopt stale seed bed technique to control early germinating weeds. Use straw mulch to control weed growth and to conserve soil moisture	Trichoderma @ 4 g/Kg of seed, Pseudomonas fluorescens @ 2 g/Kg seed or Bacillus subtilis @ 2 g/Kg seed or NSKE 4%
		Phyllody	Intercropping of sesamum + redgram (6 : 1)	Use common biological practices	Spray neem oil @ 5 ml/l for vector (leaf hopper) control
15.	Beef	**Tetanus**	Undertaking surgical procedures (such as castration) properly, in a clean environment, with disinfected instruments and surgical area, will significantly reduce the risk of tetanus. The same rules apply to calving, be as clean as possible and minimise contamination. Antitoxin can be useful as a short-acting (up to 21 days) preventative if used at high risk times, however on some farms vaccination may be better, as a three dose course of vaccination can result in protection for over three years.	--	Keep magnesium additions to mineral supplements available from May until October. Commercial mineral mixes that are high in magnesium are readily available. A mix can be made at home, which also features a selenium supplement, with the following recipe (Wahlberg, 1995): 22.5% trace-mineralized salt, 22.5% dicalcium phosphate, 10% of a 0.06% selenium mix; 22.5% magnesium oxide, and 22.5% ground corn. Cattle should eat about one-fourth of a pound of the mixture daily. An emergency treatment includes

					preparing 200mL of a saturated solution of epsom salts. This solution should be injected under the skin of the animal in at least multiple sites with 10 mL injected at each site. A veterinarian should be consulted to provide intravenous magnesium supplements
		Prussic acid poisoning	During grazing management: use certified seed select varieties low in prussic acid follow fertilizer application recommendations do not begin grazing until plants have reached a height of 18 to 20 inches allow frosted sudangrass to thoroughly dry before pasturing dilute intake of infected material with hay and other forages	--	--
		Acetonaemia (ketosis)	Prevention depends on adequate feeding and management practices	When using corticosteroids, it is important to supply an adequate amount of glucose either as a high carbohydrate diet and/or propylene glycol drenches to	A quick-acting glucose supplement is required immediately. Follow-up treatment is aimed at providing a long term

				prevent excessive breakdown of muscle protein	supply of glucose.
		Foot and Mouth Disease	As a result of the loss of production and the infectious state of the disease, infected animals are usually culled	--	Infected carcasses must be disposed of safely by incineration, rendering, burial or other techniques. Milk from infected cows can be inactivated by heating to 100°C (212°F) for more than 20 minutes. Slurry can be heated to 67°C (153°F) for three minutes. Vaccination with one serotype does not protect the animal against other serotypes, and may not protect the animal completely or at all from other strains of the same serotype. Currently, there is no universal FMD vaccine.
		Leptospirosis	Antibiotic therapy should be prescribed for animals with leptospirosis. Antibiotics can also eliminate persitant infections. Infected animals should be segregated from others to avoid transmission of the disease.	In some cases streptomycin is added as a precautionary measure to semen from bulls held at artificial insemination centres.	chemoprophylaxis and vaccination of replacement stock
16.	Tomatoes	**Early Blight**	Avoid getting water on the leaves whenever possible, change the locations where you plant your tomatoes, mulch well around each	--	--

			plant, and clear away all dead or infected plant material at the end of each season. Picking off infected leaves may slow the progression of the disease until the weather is more favorable		
		Speck and Spot	Prevent and control these diseases as you would Early Blight, above. Bacterial spots stop spreading in dry, warm weather.	--	Chemical controls are usually not needed.
		Late Blight	Avoid sprinkler irrigation, very dense planting, or other things which keep humidity high. Remove volunteer potatoes or tomatoes, and clean up debris at the end of the season. Mulching may help prevent initial infection	--	--
		Fusarium Wilt	Cleaning up all tomato debris, including old roots, and solarizing the soil may help.	The typical solution in an infected garden is to grow resistant varieties	--
		Powdery Mildew	--	--	No control is necessary on mature plants, but in the case of young or severely affected plants, sulfur dust (1) provides good control.
17.	Sorghum	**Anthracnose**	Plant resistant varieties; remove other susceptible plants. rotate crops; plow crop debris into soil after harvest	--	--
		Charcoal rot	Plant varieties with strong stems; plant sorghum in fertile soil and avoid	--	--

			overcrowding unless using irrigation; use irrigation during flowering and grain-filling to reduce drought stress; rotate crop with cotton to reduce disease severity		
		Gray Leaf spot	Disease can be controlled by planting sorghum varieties that or tolerant or resistant to the disease	--	--
		Rough spot	Sorghum varieties with a high level of resistance should be planted in areas where the disease is problematic but the disease generally causes only minor losses when present	--	--
		Smut	Disease can be controlled by growing resistant varieties	--	Through the application of appropriate fungicides

The Project will benefit from CADP experience in implementing IPMP. A lot of experience and success has been gained in Nigeria under CADP, FADAMA II and III projects, and WAAPP including application of IPM operations. Therefore, the project stands to gain from shared experience and capacity of these existing projects in terms of challenges and success drivers of IPM operations and other similar areas. That way, project beneficiaries would not require much experimentation time lag in the implementation of this IPM.

6.4 Personal Protective Equipment (PPE)

It is highly important that farmers and personnel who will be involved in the application and handling of pesticides under the Project wear and use adequate personal protective gears in the course of their activities. Wearing PPE can greatly reduce the potential for dermal, inhalation, eye, and oral exposure, of humans to pesticides and thereby significantly reduce the chances of a pesticide poisoning. PPEs for pest handling include the following:

- Protective gloves
- Shoes and socks
- Coveralls or Long-Sleeved shirt and full trousers made from closely woven fabric
- Respiratory Masks

Pesticide stained clothing must be kept from other cloths. PPE should be cleaned and dried in a well-ventilated place before storage.

6.5 Pest Management Planning Matrix

Table 6.2 outlines the matrix of activities, expected results, milestones and performance indicators of the IPMP.

Table 6.3: Planning matrix for the APPEALS

Narrative summary	Expected results	Performance indicators	Assumptions/risks
Goal: Empower the project to contribute significantly to household and national economies through environmentally friendly pest management practices.	• Enhanced in-country value chain production capacity enhanced, environmental quality (investors will ensure that their processes are environmentally compliant, and that waste is properly and safely managed). Improved crop and productivity (resistant, and high yielding varieties will be used). Employment opportunities, youth empowerment and increased income for target states.	• Evidence of improvements in value chain production, availability and sales • Increase in partnerships between farmers and off-takers • Increase in employment (short and Long-term) for skilled and unskilled persons • Environmental protection	• National security remains stable • Government policies continue to support the project in the country.
Purpose 1. In the immediate future, halt and reverse losses cause by pests in order to increase profitability of the project. 2. In the longer term, strengthen national and local capacity to reduce environmental and health risks associated with pest management practices in the project intervention areas	**Medium-term results/outcomes** • Target states are able to prioritize pest problems and identify IPM opportunities to mitigate negative environmental and social impacts associated with pesticides. • Participating states are able to adopt ecologically sound options to reduce cassava crop losses with minimal personal and environmental health risks. • Project decision makers provided with clearer guidelines enabling them to promote IPM approaches and options in agriculture • Collaborate linkages established to develop a national IPM policy to promote compliance with international conventions and guidelines on pesticide use	• Availability of sufficient agricultural products. • Perception of state agencies regarding the value of IPM in agriculture. • Level of compliance with World Bank safeguards, and compliance parameters of other donors etc. • Level of chemical control practices • Types and level of use of alternatives to synthetic pesticides	

Table 6.4: Components activities and expected results of the IPMP

Activities	Expected results	Milestones	Performance indicators	Assumptions/risks
1. Record stakeholders' overviews on staple crop pests. 2. Conduct field diagnosis to specify pests that undermine staple crop production. 2. Identify farmers' coping mechanisms and researcher recommended IPM options against the pests. 3. Develop and explain historical profile of pesticide use and other pest control practices in the project intervention areas 5. Specify partnership opportunities at local, national and international levels to assist in the implementation of the PMP	**Result 1:** Staple crop farmers and other relevant stakeholder groups develop common understanding of key pest problems and agree on corrective action.	• Pest problems diagnosed and related IPM opportunities identified • Potential constraints farmers may face in the use of the technologies specified • Pest lists including quarantine pests and alien invasive species developed. • Potential for improving existing pest control practices assessed • Pest monitoring schemes for early warning on alien invasive species and migratory pests are organized and functional • Action plan for location-specific IPM activities developed • PMP implementation mechanism developed by in all participating states	• Type and nature of participatory methods for problem analysis • Documented information on the status of pests and natural enemies of pest and pollinators in project intervention areas • Inventory of alien invasive species and quarantine pests • Types and availability of natural enemies for use in biological control of named pest • Types and availability of microbial pesticides and botanical pesticides to replace chemical pesticides • Type and number of crop rotation schemes to reduce build-up of named pest species • Type of composting and mulching as alternatives to mineral fertilizers • List of principal actors and of partners	Social, economic and political situation remain stable

Activities	Expected results	Milestones	Performance indicators	Assumptions/risks
1. Develop participatory learning modules (PLM) in line with identified training needs 2. Conduct short to medium term training of farmers, potential project staff and support groups on skills relevant to the PLMs 3. Organize international study visits on specialized IPM skills of relevance to the PLMs 4. Intensify training of men and women farmers in IPM knowledge and skills. 5. Promote farmer-led extension to increase secondary adoption of proven IPM options 6. Strengthen researcher-farmer-extension linkages through participatory research on issues emerging from farmer training 7. Develop/disseminate IPM decision-support information resources for field agents, farmers, policy makers, and the general public	**Result 2**: Human resource capacity for IPM delivery and implementation developed. *In partnership with Nigeria/FAO project TCP/NIR/2903 (T) on sustainable legumes and cereal production through integrated production and pest management for synergy of efforts in participatory learning approaches, and with the CGIAR System-wide Program on IPM (SP-IPM) for supporting IPM resources*	PLM for pest management practices developed and adapted to suit local needs training of trainers programs are completed At least 3 sets of study visits organized for technical support staff Project staff accurately relate pests to respective damage symptoms; recognize natural enemies/biological control agents against the pests; test a range of IPM options and select "best-bet" options to implement and adopt. Trained farmers undertake participatory extension; and also adopt new IPM options At least 70 percentof information materials developed is disseminated and used by extension agents and farmers. Significant reduction in pest damage	Type and number of PLMs developed Type of IPM skills covered in study visits by agric staff Training of farmers' learning groups implemented Gender and number of extension agents and of farmers trained. Gender and number of trained farmers engaged in participatory extension Extent to which new knowledge/skills are used by extension agents & farmers to promote adoption of IPM options Number & type of IPM information materials developed/disseminated Number and type of new IPM options introduced and adopted. Gender and number of farmers adopting IPM technologies. Area of crops under IPM Incremental benefits due to pest control Type and number of user-friendly taxonomic keys for pest and natural enemy recognition by farmers and extension workers	NCO/SCO adopt and apply new improved technologies. Farmers, other project beneficiaries and partners comply with international conventions guiding pesticide use and MRLs in trade Critical mass of staff trained remain within the communities

Table 6.4 (contd.): Components activities and expected results of the PMP

Activities	Expected results	Milestones	Performance indicators	Assumptions/risks
1. Test and promote botanical alternatives to synthetic pesticides. 2. Test and promote microbial alternatives to synthetic pesticides 3. Develop/update a national IPM policy including legislation to govern the manufacture, importation, distribution and use of pesticides 4. Establish a state IPM advisory and oversight committee to guide national and local compliance with World Bank safeguard Policies, OP 4.09; OP 4.01, OP 4.12 and other international conventions concerning pesticide use 5. Sensitize the population on IPM issues and activities through formal and informal educational channels and public awareness campaigns	**Result 3**: Harmful pesticide regimes replaced by environmentally friendly alternatives *In partnership with the:* *1. SP-IPM for sustainable access to microbial pesticides.* *2. Nigeria node (at IAR/ABU) of the West African Network for Taxonomy (WAFRINET) and IITA biodiversity center for identification services.*	• Local commercial enterprises initiated and/or strengthened to produce and/or market botanical pesticides • At least one botanical pesticide widely used in place of chemical pesticides • At least one microbial pesticide registered and widely used in place of chemical pesticides • Surveillance systems to protect project areas from banned/harmful pesticide regimes is fully operational • Existing pesticide regulations are fully enforced • A multi-stakeholder State/National IPM advisory and oversight committee established to guide compliance with international conventions and guidelines on pesticide use, and promote the IPM development • Radio and other public campaigns on impact of pesticides in agriculture, environment and health conducted through radio and TV spots, mass field days, rural market days, information workshops, and focus groups discussions	• Level of reduction in chemical pesticide use; type and number of pesticides replaced by botanical or microbial pesticides • Number of commercial enterprises engaged in the production of botanical pesticides; and quality of the products • Volume of sale of microbial and botanical pesticides • Level of compliance with World Bank safeguard policies by NCO/SCO and pesticide dealers/service providers • Effectiveness of the IPM advisory and oversight committee • Number of pest surveillance groups and pesticide law enforcement mechanisms • Effectiveness of public awareness of campaign	Government and development partners remain committed to international conventions and guidelines on safe pesticide use Critical mass of staff trained remain within the project intervention areas

PART 7: IMPLENTATION STRATEGY

7.1 Context

To ensure that this IPMP is optimally implemented a number of steps are required to be taken. These include:

i. Measures that will ensure capacity building among stakeholders that will implement the IPMP as well as farmers associations and youth expected to be involved in agriculture under the proposed project;
ii. Measures to ensure that POPs pesticides and WHO class I and II pesticides considered to be extremely/highly and moderately hazardous respectively are not procured and/or used;
iii. Measures that will ensure that farmers get the relevant technical aids and education on the implementation of safe and alternative pest control measures rather than the use of chemicals
iv. Measures that ensure that pest resistant varieties of the value chains are procured as a better pest control alternative

7.2 Capacity Building

Training is a fundamental component of the APPEALS's IPMP. A series of trainings have been proposed and are as follows:

Table 7.1 Capacity Building

Modules	Targets	Responsibility Arrangement	Budget in US$
World Bank Environmental and Social Safeguards (emphasis on OP 4.09)	NCO/SCOs; SMA; State ADP	Safeguards Consultant	**55,000**
Occupational Health and Safety (OHS) Basics in chemical pest applications	NCO/SCOs; SMA; State ADP, Farmer Organizations, Youth farmers, extension workers	Independent Consultant	**83,100**
Safe Management of Chemical Pesticides (transportation, storage, handling, storage of empty pesticide containers and final disposal)	NCO/SCOs,; SMA; State ADP, Extension works,	Independent Consultant, CADP, FADAMA III,	**62,000**
Decision making on the selection of IPM approaches or options	NCO/SCOs; SMA; State ADP, farmers	Independent Consultant, FADAMA III	**70,300**
IPM Implementation and Monitoring	NCO/SCOs; SMA; State ADP	Independent Consultant, FADAMA III, CADP	**108,800**
Small group consultations	NCO/SCOs; SMA; State ADP; farmers	Independent Consultant, FADAMA III, CADP	**63,550**

Modules	**Targets**	**Responsibility Arrangement**	**Budget in US$**
Environmental management in pest control	NCO/SCOs; SMA; State ADP; farmers	Independent Consultant	**87,400**
Breeding of natural enemies of pests	NCO/SCOs; SMA; State ADP	Independent Consultant	**122,850**
TOTAL			**653,000**

7.3 Institutional Arrangements and Framework for Implementation

7.3.1 Role and Responsibilities of the project Implementation Units (National and State Coordination Offices)

The overall responsibility for the implementation of the Project will be under the auspices of the Federal Ministry of Agriculture and Rural Development (FMARD). FMARD will execute the Project using the existing structure of the on-going IDA-financed Commercial Agriculture Development Project (CADP). To account for new project activities, associated design and to reflect lessons learned from the execution of CADP, the relevant executing agencies and implementation arrangements both at Federal and State levels will be strengthened. There will be two levels of organizational structures both at Federal and State levels consisting of (a) the oversight organs at each level: the National Steering Committee (NSC) at federal level and the State Steering Committees (SCO) in each participating states, and (b) the operational organs which are the Project Implementation Units with a National Coordinating Office (NCO) at federal level, and the State Coordinating Offices (SCOs) in the participating states.

At the Federal level, the NCO will coordinate Project activities on behalf of the FMARD, and will implement cross cutting activities that benefit all participating states and beyond (in particular under Component 4, and Component 5. The NCO has gained sufficient direct experience in managing the Bank-funded CADP. The NCO will be responsible for managing the designated Account at federal level and financial management, managing procurement at Federal level, coordinating environmental and social safeguards, administering the M&E system, coordinate the work of the different partners at Federal levels, prepare periodic reports and provide support to SCOs. The NCO will be responsible for coordinating and consolidating the preparation of the project Annual Work Plan and Budgets (AWPB), including any safeguards related studies and management plans. A mix of skills needed for the NCO will include an Environmental Specialist and a Social Development Specialist, with responsibility for coordinating environmental and social safeguards. The Environmental and Social Safeguards specialists will supervise and guide the implementation of the IPMP and the other safeguards instruments of the project at state level.

At the State level, project day to day execution will be carried out by the SCO that will be strengthened in those states that have the established structure under CADP; and a new one will be established for those states that do not have such entity at present. The SCOs will coordinate and facilitate project coordination at their respective States and will be responsible for preparing monitoring reports, annual work plans and budgets, facilitating the work and provide periodic reports to SSCs and NCO. SCOs will serve as a Secretariat for the SSCs. As such, the SCOs will have a reporting responsibility both to their respective SSCs and NCO. They will also be responsible for environmental and social safeguards aspects of project execution except.

The State Ministries of Agriculture, through its local structure such as ADPs, will perform a technical support role for the SCOs. SMAs will be responsible for ensuring agricultural personnel availability, to enable sensitization programs and capacity building on IPM practices. SMAs will also be responsible for preparing State-based IPM guidance manuals to foster IPM in the zone and state as a whole. To support the intervention project in technical expertise and advisory. Technical responsibilities will include:

- Development of subsequent IPM training programs for the project
- Advice on selection of best value chain varieties to ensure project outputs are achieved and also foster IPM.
- Ensure that proffered IMP controls as contained in this report are applied. They will be vital for providing guidance and directives on pest control applications and monitoring and evaluation (M&E).
- **Breeding of natural enemies**: Through the provision of funding by the Project, each actor will be responsible for setting up facilities for breeding natural enemies and provide advice on subsequent capacity building needs in breeding of natural hosts.

7.3.9 Roles and Responsibilities of Project Beneficiaries

leader of producer associations and manager of partnering agribusiness companies and SMEs would be adequately sensitized and organized to perform the following roles:

a) Integrate community developmental goals with those of the project for economic and social transformation.
b) Promote group formation and establishment of relevant security personnel for safeguarding the activities within the Zones and its environs.
c) Provision of appropriate security measures to protect lives and properties of Investors
d) Cooperate with the SCO and other partners to ensure that activities carried on consistently with the project manuals and guidelines
e) Organization of farmers into cooperatives for easy access to goods and services for production and processing facilities

7.3.10 Roles and Responsibilities of Non-Governmental Organizations (NGOs)

The roles of NGOs in project locations and to the benefiting communities would include the following:

a) Encouragement of beneficiary participation
b) Participation in identification of beneficiary communities' project needs
c) Assistance in funding community development projects

7.3.11 Roles and Responsibilities of Donor Agencies (World Bank)

The roles of the World Bank: The borrower shall be responsible for ensuring that World Bank Safeguards Policies and extant laws in Nigeria are complied with.

The World Bank will conduct supervision and due diligence missions to the project:

The Bank will provide capacity building and technical support to the borrower as needed;

The World Bank shall share information, including best practices for the sustainability of the project.

7.4 Responsibilities of Federal Ministries

7.4.1 Federal Ministry of Agriculture and Rural Development (FMARD)

The FMARD, through its Agric Business & Market Development Department will provide overall leadership and direction to the other Ministries in the facilitation of the desired operational environment for APPEALS.

Specific roles will include:

a) Provision of the policy and legal framework in Nigeria with a view to ensuring stability and sustainability.
b) Facilitating the provision of funding to support the development and sustenance of project activities
c) Engaging all the critical stakeholders and securing their support, cooperation and participation in the implementation of this policy
d) Establishing, through the APP, FMARD's Development Partnership Projects like the CADP, FADAMA and other donor Projects, a coordinated and sustainable system of support to production activities in the project intervention areas

7.4.2 Federal Ministry of Water Resources

a) Assist in the determination of hydrology potentials of project sites where necessary
b) Facilitate full utilization of irrigation potentials in project intervention areas, including ensuring dam safety as relevant, and support development and maintenance of collection wells, pump stations and irrigation canals
c) Exploration and utilization of appropriate technologies to provide potable and industrial water to agribusiness clusters.

7.4.3 Federal Ministry of Environment

a) Establishment of environmental and social policy guidelines to reduce delays in obtaining approvals for project development
b) Ensuring compliance of to specific environmental and social policy guidelines

7.5 Monitoring and Evaluation

The objectives of monitoring and evaluation for the IPMP are as follows:

- Providing timely information about the success or otherwise of the IPM operation process outlined in this report. This will ensure continuous improvement in the project areas
- To make a final evaluation in order to determine whether the mitigation measures incorporated in the IPMP have been successful.

This section sets out requirements for the monitoring of the environmental and health impacts of the pesticides management activities. Monitoring and evaluation of the agricultural support IPM will be mainstreamed into the overall monitoring and evaluation system for the project's ESMF. The key issues to be considered in the monitoring process are whether a pesticides procurement checklist is available and used during procurement and screening to 1) ensure that POPs pesticides and WHO class Ia and Ib pesticides are not procured or used. 2) Monitor the progress of the IPM implementation vi-a-viz the results.

In specifics, the following are **monitoring indicators** required to achieving IPM project development objectives:

- Reduction in the use and application of pesticides in the area
- Performance ratings in pest management using proffered IPM controls
- Number of farmers and stakeholders aware of the pollution, contamination and toxicity associated with pesticides
- Decline or increase in crop pests in project intervention areas
- The number of farmers or farmers association using biological methods of pest control
- Number of persons trained in the method of spraying and handling of chemical pesticides
- The reported incidences of pest and herbicides concerns among farmers
- The level of use of resistant and improved species of cassava
- Improvement in production/harvest of crops/livestock from use of IPM vi-a-viz the pre-IPM baseline
- Level of understanding of IPM processes
- Level of understanding of World Bank operational policy on pest management among SCOs and farmers associations
- Level of involvement of youth and women in agriculture activities

- Level of unemployment/employment especially in project communities

Towards the course of the above monitoring indicators the following action indicators will be incorporated into a participatory monitoring and evaluation plan.

Capacity to inform: Types and number of participatory learning modules (PLM) delivered; category and number of extension agents and farmers trained and reached with each PLM; category and number of participants reached beyond baseline figures; practical skills/techniques most frequently demanded by extension agents and farmers; and crop/livestock management practices preferred by farmers.

Capacity to motivate: Category and number of agricultural workers and farmers who correctly apply the skills they had learnt; new management practices adopted most by farmers; category and number of other farmers trained by project trained farmers; types of farmer-innovations implemented**;** level of pest damage and losses**;** rate of adoption of IPM practices; impact of the adoption of IPM on production performance.

Major benefits: Increase in production in project intervention areas; increase in farm revenue; social benefits: e.g., improvement in the health status of farmers; level of reduction of pesticide purchase and use.

Sustainability of Process and Results

Short-term technical study visits FADAMA agriculture projects and other ADP projects with proven success in IPM development and implementation will help to create favourable conditions for continuity of IPM processes and results. Scientific information, adapted into user-friendly format will strengthen training and extension delivery, and increase IPM literacy for project beneficiaries.

Evaluation of Results

The evaluation of results of IPM in the project can be carried out by comparing baseline data collected in the planning phase with targets and post project situations.

PART 8: WORKPLAN AND BUDGET

Approximately **US$ 1,200,000** will be required to effectively implement the IPMP over a seven-year period (Table 8.1). This cost covers IPM orientation workshop, capacity building and awareness program, and project management including the cost of monitoring. It will be implemented over the 7-year project cycle. Detail of the work plan and cost are presented in table 8.1.

Table 8.1: Budget summary (US$)

Line item	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	Yr. 6	Yr. 7	**Total**
1. Capacity building & Awareness								
All training programs (See table 6.0)	168,000	140,000	140,000	60,000	60,000	55,000	30,000	653,000
Radio jingles and handbill on IPM	20,000	14,000	8,200	8,200	5,000	0	0	55,400
Sub-total	188,000	154,000	148,200	68,200	65,000	55,000	30,000	708,400
2. Environmental management								
Equipment; bed nets; improved species	7,200	10,800	10,800	7,200	3,600	3,600	3,000	46,200
Support to IPM research and development	14,300	18,000	18,000	7,200	7,200	7,200	5,700	77,600
Pest/vector surveillance	3,500	5,700	5,700	5,700	3,600	3,600	3,600	31,400
Sub-total	25,000	34,500	34,500	20,100	14,400	14,400	12,300	155,200
3. Occupational Health & Safety								
Personal Protective Equipment (Hand gloves, gas mask, safety boot and overall wear)	36,000	36,000	25,000	25,000	21,500	18,000	14,000	175,500
Chemical Neutralizer and first Aid	25,000	18,000	14,300	14,300	14,300	6,500	0	92,400
Sub-total	61,000	54,000	39,300	39,300	35,800	24,500	14,000	267,900
4. Project management								
IPMP coordination	2,600	2,900	2,600	2,600	2,600	2,600	2,600	18,500
Monitoring and evaluation	5,800	7,300	7,250	7,250	7,200	7,200	8,000	50,000
Sub-total	8,400	10,200	9,850	9,850	9,800	9,800	10,600	68,500
Grand total	282,400	252,700	231,850	137,450	125,000	103,700	66,900	1,200,000

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ANNEXES

Annex 1: List of crop and livestock protection products approved for use by NAFDAC

a) Insecticides

Organochlorines insecticides	**Organophosphorus insecticides**	**Carbamates**	**Pyrethroids**
1. Endosulfan	**Organophosphorus** i	1. Carbaryl	1. Lambda – Cyhalothrin
2. Helptachlor	1. Diazinon	2. Carbofuran	2. Cypermethrin
3. Lindane (Restricted to use on Cocoa only)	2. Dichlorvos (DDVP)	3. Propoxur	3. Deltamethrin
	3. Chlorpyrifos	4. Carbosulfan	4. Phenothrin
	4. Chlorpyrifos – Methyl	5. Furathiocarb	5. Permethrin
	5. Dicrotophos	6. Temik (Aldicarb	6. Tetramethrin
	6. Dimethoate		7. Cyfluthrin
	7. Monocrotophos		8. Allethrin
	8. Perimiphos – Ethyl		
	9. Perimiphos – Methyl		
	10. Ethion		
	11. Rugby (Cadusofas)		
	12. Malathion		
	13. Temeguard (Temephos)		
	14. Isazofos		
	15. Parathion – Methyl		
	16. Phosphamidon		
	17. Methidathion		

b) Herbicides and fungicides

Organophosphorus	**Carbamates**	Other herbicides	Fungicides
Organophosphorus 1. Anilofos 2. Piperophos 3. Glyphosate 4. Glyphosate Trimesium (Touchdown or Sulfosate) 5. Amideherbicides (Acetochlor; Alachlor; Propanil; Butachlor; Metalochlor) Triazines and Triazoles (Atrazine; Ametryn; Desmetryn; Terbuthalazine; Terbutrex Terbutryne) Chlorophenoxy herbicides (Prometryn; Simazine; 2.4-D (2.4 Dichlorphenoxy acetiacid) 7. Urea and guadinidines ; (Diuron ; Linurex (=Linuron); Fluometurone; Chloroxuron; Neburon) Quaternary nitrogen compounds (paraquat; diquat)	1. Asulam	1. Dimethachlor 2. Metazachlor 3. Monosodium Methyl Arsonate (MSMA) 4. Fluxixpyr 5. Imazaquine 6. Triassulfuran (Amber) 7. Osethoxydim 8. Oxadiazon (Ronster) 9. Clomaone 10. Trifluralin 11. Stamp 500 (pendimethalin) 12. Fluazifop – P.butyl	1. Benomyl (Nitroheterocyclic Compound) 2. Dazomet (Thiadiazine Fungicide) 3. Folpet (Phthalimide Fungicide) 4. Metalaxyl (Acylalamine Fungcide) 5. Cyproconazole (Alto – 100SL) 6. Bavistin (Carbon) – Benzimide 7. Triadmenol (Bayfidon GR Conzole Fungicide)

Annex 2: Good Management Practices Guide and Pesticides Management Measures

a. **Required measures for the reduction of pesticides-related risks**

Safe use of pesticides

Pesticides are toxic for pests and for humans. However, if sufficient precautions are taken, they should not constitute a threat either for the population or for non-targeted animal species. Most of them can have harmful effects if swallowed or in case of prolonged contact with the skin. When a pesticide is sprayed in the form of fine particles, there is a risk of absorbing them with the air we breathe. There is also a risk of water, food and soil contamination.

Specific precautions should therefore be taken during the transportation, storage and handling of pesticides. The spraying equipment should be regularly cleaned and well maintained to avoid leakages. The individuals using pesticides should learn how to use them safely.

Insecticides registration

Reinforce the registration process of insecticides by ensuring:

- Streamlining, between the national pesticides registration system and other products used in Public Health;
- Adoption of WHO specifications applicable to pesticides for national registration process purposes;
- Reinforcement of the pilot regulatory body;
- Collection and publication of data relating to imported and manufactured products;
- Periodical review of registration.

When planning to buy pesticides to control vectors, consult the guiding principles issued by WHO. For the acquisition of insecticides intended for public health use, the following guidelines are recommended:

- Develop national guidelines applicable to the purchase of products intended for vector control and ensure that all the agencies buying them strictly comply with those guidelines;
- Use synthetic Pyrethroids: Deltamethrin SC, Permethrin EC, Vectron, Icon, Cyfluthrin, as recommended by the national policy;
- Refer to the guiding principles issued by WHO or FAO on calls for tenders, to FAO recommendations regarding labeling and to WHO recommendations regarding products (for indoor spraying);

- Include in calls for tenders, the details regarding technical support, maintenance, training and products recycling that will be part of the after-sale service committing manufacturers; apply the back-to-sender principle;
- Control the quality and quantity of each lot of insecticides and impregnated supports before receiving the orders;
- Ensure that the products are clearly labeled in French and if possible in local language and in the strict respect of national requirements;
- Specify which type of package will guarantee efficiency, preservation duration as well the human and environmental security of handling packaged products while strictly complying with national requirements;
- Ensure that donated pesticides intended for public health, comply with the requirements of the registration process in Mali (CSP) and can be used before their expiry date;
- Establish a consultation, before receiving a donation, between the ministries, agencies concerned and the donors for a sound use of the product;
- Request users to wear protective clothes and equipment recommended in order to reduce their exposition to insecticides to the strict minimum;
- Obtain from the manufacturer a physic-chemical analysis report and the product acceptability certification;
- Request the manufacturer to submit an analysis report of the product and of its formulation along with guidelines to follow in case of intoxication;
- Request the buying agency to perform a physic-chemical analysis of the product before shipping and arrival.

Precautions

Labeling

Pesticides should be packaged and labeled according to WHO standards. The label should be

written in **English** and in the local language (**Hausa, Igbo and Yoruba** as applicable); it should indicate the content, the safety instruction (warning) and any action to be taken in case of accidental ingestion or contamination. The product should always remain in its original container. Take all appropriate precautionary measures and wear protective clothes in accordance with recommendations.

Storage and transportation

Pesticides should be stored in a place that can be locked up and is not accessible to unauthorized individuals or children. The pesticides, should, in no event, be stored in a place where they could be mistaken for food or beverage. They should be kept dry and out of the sun. They should not be transported in a vehicle that also carries food products.

In order to ensure safety during storage and transportation, the public or private agency in

charge of managing purchased insecticides and insecticide-impregnated supports, should

comply with the current regulations as well as the conservation conditions recommended by

the manufacturer regarding:

- Preservation of the original label;
- Prevention of accidental pouring or overflowing;
- Use of appropriate containers;
- Appropriate marking of stored products;
- Specifications regarding the local population;
- Products separation;
- Protection against humidity and contamination by other products;
- Restricted access to storage facilities;
- Locked storage facilities to guarantee product integrity and safety.
- Pesticides warehouses should be located far from human residences or animal shelters, water supplies, wells and channels. They should be located on an elevated surface and secured with fences with restricted access for authorized individuals only.
- Pesticides should not be stored in places where they could be exposed to sunlight, to water or to humidity, which could harm their stability. Warehouses should be secured and well ventilated.
- Pesticides should not be transported in the same vehicle with agricultural products, food products, clothes, toys or cosmetics as these products could become dangerous in case of contamination.
- Pesticides containers should be loaded in vehicles in order to avoid damages during transportation, that their labels will not tear off so that and they would slip off and fall on a road with an uneven surface. Vehicles transporting pesticides should bear a warning sign placed conspicuously and indicating the nature of the cargo.

Distribution

Distribution should be based on the following guidelines:

- Packaging (original or new packaging) should ensure safety during the distribution and avoid the unauthorized sale or distribution of products intended for vector control;
- The distributor should be informed and made aware of the dangerous nature of the cargo;
- The distributor should complete delivery within the agreed deadlines;
- The distribution system of insecticides and impregnated supports should enable to reduce the risks associated with the numerous handlings and transportations;
- In the event the purchasing department is not able to ensure the transportation of the products and materials, it should stipulated in the call for tenders that the supplier is expected to transport the insecticides and impregnated supported up to the warehouse;
- All pesticides and spraying equipment distributors should have an exploitation permit in accordance with the current regulation in Mali.

Disposal of pesticide stocks

After the operations, the remaining stocks of pesticides can be disposed of without risk by

dumping them in a hole dug specifically or in a pit latrine. A pesticide should not be disposed

of by throwing it in a place where there is a risk of contaminating drinking water or for bathing or where it can reach a pond or a river. Some insecticides, such as pyrethroids, are very toxic for fish.

Dig a hole to at least 100 meters from any stream, well or habitat. If in hilly areas, the whole must be dug below. Pour all waters used for hand washing after the treatment. Bury all containers, boxes, bottles, etc. that have contained pesticides. Reseal the hole as quickly as possible. Packaging or cardboard, paper or plastic containers— the latter cleaned — can be burnt, if allowed, far away from homes and drinking water sources, regarding the re-use of containers after cleaning. Pyrethroid suspensions can be discharged on a dry soil where they are quickly absorbed and then will go through a decomposition process making them harmless for the environment.

If there is an amount of insecticide solution left, it can be used to destroy ants and cockroaches. Simply pour a little bit of solution on infested areas (under the kitchen sink, in corners) or to rub a sponge soaked with water on it. To temporarily prevent insect proliferation, a certain amount of solution can be poured inside and around latrines or on other breeding places. Pyrethroid suspensions for mosquito nets treatment and other fabrics can be used days after their preparation. It can also be used to treat mats and rope mattresses to prevent mosquito to bite from the bottom. Mattresses can also be treated against bugs.

Cleaning of empty pesticide packaging and containers

Re-using empty pesticide containers is risky and it is not recommended to do so. However, it is estimated that some pesticide containers are very useful to be simply thrown away after use.

Can we therefore clean and re-use such containers? This depends both on the material and the content. In principle, the label should indicate the possibilities for re-using containers and how to clean them.

Containers having contained pesticides classified as hazardous or extremely dangerous should **not** be re-used. Under certain conditions, containers of pesticides classified as dangerous or that do not present any risk under normal use, can be re-used unless they are not used as food or drink containers or as food containers for animal food. Containers made of materials such as polyethylene that preferentially absorb pesticides, must not be re-used if they have contained pesticides whose active ingredient has been classified as moderately or extremely dangerous regardless of the formulation. Once a recipient is empty, it should be rinsed, then filled

completely with water and allowed to stand for 24 hours. Then it should be emptied and this process should be done over again.

General Hygiene

Do not eat, drink or smoke when handling insecticides. Food should be placed in tightly closed containers. Measurement, dilution and transfer of insecticides should be done with the adequate material. Do not shake or take liquid with unprotected hands. If the nozzle is blocked, press the pump valve or unblock the opening with a flexible rod. After each fill, wash hands and face with water and soap. Eat and drink only after washing hands and face. Take a shower or a bath at the end of the day.

Individual protection

- Adapted coveralls covering hands and legs
- Dust, gas and respirator masks, based on the type of treatment and product used
- Gloves
- Goggles
- Hoods (facial shield)

Protection of the population

- Minimize the exposure of local populations and livestock
- Cover wells and other reservoirs
- Sensitize populations on risks

Protective clothing

Treatments inside homes:

Operators should wear coveralls or a long sleeves shirt over a pair of pants, a flapped hat, a turban or any other type of headgear as well as boots or big shoes. Sandals are not suitable.

Nose and mouth should be protected using a simple method, for example a disposable paper mask, a disposable surgical or washable mask or a clean cotton cloth. Once the fabric is wet, it should be changed. Clothing must be in cotton for easy washing and drying. It must cover the body and contain no opening. In hot and humid climates, it can be uncomfortable to wear additional protective clothing; therefore, one will be forced to spray pesticides during hours when it is very hot.

Preparation of suspensions

People responsible for bagging insecticides and preparing suspensions, particularly for the treatment of mosquito bed net units must take special precautions. In addition to the abovementioned protective clothing, they must wear gloves, an apron and eye protection, for example a facial shield or glasses. Facial shields protect the entire face and keep less warm. Nose

and mouth should be covered as indicated for treatment in homes. They should ensure that they do not touch any part of their body with gloves during pesticide handling.

Treatment of nets

To treat mosquito nets, clothes, grills or with tsetse traps with insecticides, it is necessary to wear long rubber gloves. In some cases, additional protection is required, for example against vapours, dusts or insecticide dusting that could be dangerous. These additional protective accessories should be mentioned on the product label and may consist of aprons, boots, facial masks, coveralls and hats.

Maintenance

Protective clothing should always be impeccably maintained and should be checked periodically to verify tearing, wearing that could lead to skin contamination. Protective clothing and equipment should be washed daily with water and soap. Particular attention should be paid to gloves and they must be replaced once they are torn or show signs of wear. After usage, they should be rinsed in water before removing them. At the end of each working day, they will need to be washed inside and outside.

Safety measures

During spraying

Spurt form the sprayer must not be directed towards a part of the body. A leaking sprayer must be repaired and skin must be washed if it is accidentally contaminated. The household and animals must stay outside during the whole spraying activity. Avoid treating a room where there is a person — a sick person for example — who cannot be taken outside. Before starting spraying activities, kitchen utensils should be taken out and all utensils as well as dishes containing drinks and food. They can be gathered in the centre of the room and covered with plastic film. Hammocks and paintings should not be treated. The bottom part of furniture and the side against the wall should be treated while ensuring that surfaces are effectively treated. Sweep or wash the floor after spraying. Occupants should avoid contact with walls.

Clothing and equipment should be washed every day. Avoid spraying organophosphate or

carbamate for more than 5 to 6 hours daily and wash hands after each filling. If Fenitrothion is

used or old stocks of Malathion are used, operators should control the level of cholinesterase in their blood every week.

Monitoring exposure to organophosphate

There are country kits available on the market to control cholinesterase activity in the blood. If this activity is low, it can be concluded that their excessive exposure to organophosphate insecticide. These dosages should be done every week with people handling such products. Any person whose cholinesterase activity is very low should be stopped from working until it returns to normal.

Fabric spraying

When handling insecticide concentrates, or preparing suspensions, gloves should be worn. Attention should be paid particularly to spraying in the eyes. A big bowl not too high should be used and the room should be well ventilated to avoid inhaling smokes.

b. Measures to minimize transportation, storage, handling and usage risks

Annex 3: WHO Classification (Class I & II)

Extremely hazardous (Class Ia) technical grade active ingredients in pesticides

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Aldicarb [ISO]	116-06-3	2757	C	S	I-S	1	0.93
Brodifacoum [ISO]	56073-10-0	3027	CO	S	R	1	0.3
Bromadiolone [ISO]	28772-56-7	3027	CO	S	R	1	1.12
Bromethalin [ISO]	63333-35-7	2588		S	R	1	2
Calcium cyanide [C]	592-01-8	1575		S	FM	2	39
Captafol [ISO]	2425-06-1			S	F	5	5000
Chlorethoxyfos [ISO]	54593-83-8	3018	OP	L	I	1	1.8
Chlormephos [ISO]	24934-91-6	3018	OP	L	I	2	7
Chlorophacinone [ISO]	3691-35-8	2588		S	R	1	3.1
Difenacoum [ISO]	56073-07-5	3027	CO	S	R	1	1.8
Difethialone [ISO]	104653-34-1	2588		S	R	1	0.56
Diphacinone [ISO]	82-66-6	2588		S	R	1	2.3
Disulfoton [ISO]	298-04-4	3018	OP	L	I	1	2.6
EPN	2104-64-5	2783	OP	S	I	2	14
Ethoprophos [ISO]	13194-48-4	3018	OP	L	I-S	2	D26
Flocoumafen	90035-08-8	3027		S	R	1	0.25
Hexachlorobenzene [ISO]	118-74-1	2729	OC	S	FST	5	D10000
Mercuric chloride [ISO]	7487-94-7	1624	HG	S	F-S	1	1
Mevinphos [ISO]	26718-65-0	3018	OP	L	I	1	D4
Parathion [ISO]	56-38-2	3018	OP	L	I	2	13
Parathion-methyl [ISO]	298-00-0	3018	OP	L	I	2	14
Phenylmercury acetate [ISO]	62-38-4	1674	HG	S	FST	2	24
Phorate [ISO]	298-02-2	3018	OP	L	I	1	2
Phosphamidon	13171-21-6	3018	OP	L	I	2	7
Sodium fluoroacetate [C]	62-74-8	2629		S	R	1	0.2
Sulfotep [ISO]	3689-24-5	1704	OP	L	I	1	5
Tebupirimfos [ISO*]	96182-53-5	3018	OP	L	I	1	1.3
Terbufos [ISO]	13071-79-9	3018	OP	L	I-S	1	c2

Highly hazardous (Class Ib) technical grade active ingredients in pesticides

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Acrolein [C]	107-02-8	1092		L	H	2	29
Allyl alcohol [C]	107-18-6	1098		L	H	3	64
Azinphos-ethyl [ISO]	2642-71-9	2783	OP	S	I	2	12
Azinphos-methyl [ISO]	86-50-0	2783	OP	S	I	2	16
Blasticidin-S	2079-00-7	2588		S	F	2	16
Butocarboxim [ISO]	34681-10-2	2992	C	L	I	3	158
Butoxycarboxim [ISO]	34681-23-7	2992	C	L	I	3	D288
Cadusafos [ISO]	95465-99-9	3018	OP	L	N,I	2	37
Calcium arsenate [C]	7778-44-1	1573	AS	S	I	2	20
Carbofuran [ISO]	1563-66-2	2757	C	S	I	2	8
Chlorfenvinphos [ISO]	470-90-6	3018	OP	L	I	2	31
3-Chloro-1,2-propanediol [C]	96-24-2	2689		L	R	3	112
Coumaphos [ISO]	56-72-4	2783	OP	S	AC,MT	2	7.1
Coumatetralyl [ISO]	5836-29-3	3027	CO	S	R	2	16
Cyfluthrin [ISO]	*68359-37-5*		*PY*	*S*	*I*	*2*	*c15*
Beta-cyfluthrin [ISO]	*68359-37-5*		*PY*	*S*	*I*	*2*	*c11*
Zeta-cypermethrin [ISO]	52315-07-8	3352	PY	L	I	3	c86
Demeton-S-methyl [ISO]	919-86-8	3018	OP	L	I	2	40
Dichlorvos [ISO]	62-73-7	3018	OP	L	I	3	56
Dicrotophos [ISO]	141-66-2	3018	OP	L	I	2	22
Dinoterb [ISO]	1420-07-1	2779	NP	S	H	2	25

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
DNOC [ISO]	534-52-1	2779	NP	S	I-S,H	2	25
Edifenphos [ISO]	17109-49-8	3018	OP	L	F	3	150
Ethiofencarb [ISO]	29973-13-5	2992	C	L	I	3	200
Famphur	52-85-7	2783	OP	S	I	2	48
Fenamiphos [ISO]	22224-92-6	2783	OP	S	N	2	15
Flucythrinate [ISO]	70124-77-5	3352	PY	L	I	3	c67
Fluoroacetamide [C]	640-19-7	2588		S	R	2	13
Formetanate [ISO]	22259-30-9	2757	C	S	AC	2	21
Furathiocarb	65907-30-4	2992	C	L	I-S	2	42
Heptenophos [ISO]	23560-59-0	3018	OP	L	I	3	96
Isoxathion [ISO]	18854-04-8	3018	OP	L	I	3	112
Lead arsenate [C]	7784-40-9	1617	AS	S	L	2	c10
Mecarbam [ISO]	2595-54-2	3018	OP	Oil	I	2	36
Mercuric oxide [ISO]	21908-53-2	1641	HG	S	O	2	18
Methamidophos [ISO]	10265-92-6	2783	OP	S	I	2	30
Methidathion [ISO]	950-37-8	3018	OP	L	I	2	25
Methiocarb [ISO]	2032-65-7	2757	C	S	I	2	20
Methomyl [ISO]	16752-77-5	2757	C	S	I	2	17
Monocrotophos [ISO]	6923-22-4	2783	OP	S	I	2	14
Nicotine [ISO]	54-11-5	1654		L		1	D50
Omethoate [ISO]	1113-02-6	3018	OP	L	I	2	50
Oxamyl [ISO]	23135-22-0	2757	C	S	I	2	6
Oxydemeton-methyl [ISO]	301-12-2	3018	OP	L	I	3	65
Paris green [C]	12002-03-8	1585	AS	S	L	2	22
Pentachlorophenol [ISO]	87-86-5	3155		S	I,F,H	2	D80
Propetamphos [ISO]	31218-83-4	3018	OP	L	I	3	106
Sodium arsenite [C]	7784-46-5	1557	AS	S	R	2	10
Sodium cyanide [C]	143-33-9	1689		S	R	2	6
Strychnine [C]	57-24-9	1692		S	R	2	16
Tefluthrin	79538-32-2	3349	PY	S	I-S	2	c22
Thallium sulfate [C]	7446-18-6	1707		S	R	2	11
Thiofanox [ISO]	39196-18-4	2757	C	S	I-S	2	8
Thiometon [ISO]	640-15-3	3018	OP	Oil	I	3	120
Triazophos [ISO]	24017-47-8	3018	OP	L	I	3	82
Vamidothion [ISO]	2275-23-2	3018	OP	L	I	3	103
Warfarin [ISO]	81-81-2	3027	CO	S	R	2	10
Zinc phosphide [C]	1314-84-7	1714		S	R	2	45

Moderately hazardous (Class II) technical grade active ingredients in pesticides

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Acephate [ISO]	30560-19-1		OP	S	I	4	945
Acifluorfen [ISO]	50594-66-6			S	H	4	1370
Alachlor [ISO]	15972-60-8	2588		S	H	4	930
Alanycarb [ISO]	83130-01-2		C	S	I	4	330
Allethrin [ISO]	584-79-2		PY	Oil	I	4	c685
Ametryn [ISO]	834-12-8		T	S	H	4	110
Amitraz [ISO]	33089-61-1			S	AC	4	800
Anilofos [ISO]	64249-01-0		OP	S	H	4	472
Azaconazole	60207-31-0			S	F	4	308
Azamethiphos [ISO]	35575-96-3		OP	S	I	4	1010
Azocyclotin [ISO]	41083-11-8	2786	OT	S	AC	3	80
Bendiocarb [ISO]	22781-23-3	2757	C	S	I	3	55
Benfuracarb [ISO]	82560-54-1	2992	C	L	I	3	205
Bensulide [ISO]	741-58-2	2902		L	H	3	270
Bensultap [ISO]	17606-31-4			S	I	4	1100
Bentazone [ISO]	25057-89-0			S	H	4	1100
Bifenthrin	82657-04-3	3349	PY	S	I	3	c55
Bilanafos [ISO]	71048-99-2			S	H	3	268
Bioallethrin [C]	584-79-2		PY	L	I	4	c700
Bromoxynil [ISO]	1689-84-5	2588		S	H	3	190
Bromuconazole	116255-48-2			S	F	4	365
Bronopol	52-51-7			S	B	3	254
Butamifos [ISO]	36335-67-8		OP	L	H	4	630
Butralin [ISO]	33629-47-9			S	H	4	1049

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Butroxydim [ISO]	138164-12-2			S	H	4	1635
Butylamine [ISO]	13952-84-6	1992		L	F	4	380
Carbaryl [ISO]	63-25-2	2757	C	S	I	3	c300
Carbosulfan [ISO]	55285-14-8	2992	C	L	I	3	250
Cartap [ISO]	15263-53-3			S	I	4	325
Chloralose [C]	15879-93-3			S	R	4	400
Chlordane [ISO]	57-74-9	2996	OC	L	I	4	460
Chlorfenapyr [ISO]	122453-73-0			S	I,MT	4	441
Chlormequat (chloride) [ISO]	999-81-5			S	PGR	4	670
Chloroacetic acid [C]	79-11-8	1751		S	H	4	650
Chlorphonium chloride [ISO]	115-78-6	2588		S	PGR	3	178
Chlorpyrifos [ISO]	2921-88-2	2783	OP	S	I	3	135
Clomazone [ISO]	81777-89-1			L	H	4	1369
Copper hydroxide [C]	20427-59-2		CU	S	F	4	1000
Copper oxychloride [C]	1332-40-7		CU	S	F	4	1440
Copper sulfate [C]	7758-98-7		CU	S	F	3	300
4-CPA [ISO]	122-88-3		PAA	S	PGR	4	850
Cuprous oxide [C]	1317-39-1		CU	S	F	4	470
Cyanazine [ISO]	21725-46-2		T	S	H	3	288
Cyanophos [ISO]	2636-26-2		OP	L	I	4	610
Cyhalothrin [ISO]	68085-85-8	3352	PY	Oil	Ix	3	c144
Cyhexatin [ISO]	13121-70-5		OT	S	AC	3	*265*
Cymoxanil [ISO]	57966-95-7			S	F	4	1196

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Cypermethrin [ISO]	52315-07-8	3352	PY	L	I	3	c250
Alpha-cypermethrin [ISO]	67375-30-8	3349	PY	S	I	3	c79
Cyphenothrin [(1R)-isomers] [ISO]	39515-40-7	3352	PY	L	I	4	318
Cyproconazole	94361-06-5			S	F	4	1020
2,4-D [ISO]	94-75-7	3345	PAA	S	H	4	375
Dazomet [ISO]	533-74-4			S	F-S	4	640
2,4-DB	94-82-6			S	H	4	700
DDT [ISO]	50-29-3	2761	OC	S	I	3	113
Deltamethrin [ISO]	52918-63-5	3349	PY	S	I	3	c135
Diazinon [ISO]	333-41-5	3018	OP	L	I	4	*300*
Dicamba [ISO]	1918-00-9			S	H	4	1707
Dichlorobenzene [C]	106-46-7			S	FM	4	500-5000
Dichlorophen [ISO]	97-23-4		OC	S	F	4	1250
Dichlorprop [ISO]	7547-66-2			S	H	4	800
Diclofop [ISO]	40483-25-2			S	H	4	565
Dicofol [ISO]	115-32-2		OC	S	AC	4	c690
Difenoconazole [ISO]	119446-68-3			S	F	4	1453
Difenzoquat [ISO]	43222-48-6	2588		S	H	4	470
Dimepiperate [ISO]	61432-55-1		TC	S	H	4	946
Dimethachlor [ISO]	50563-36-5			S	H	4	1600
Dimethipin [ISO]	55290-64-7			S	H	4	1180

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Dimethenamid [ISO]	*87674-68-8*			*L*	*H*	*4*	*371*
Dimethylarsinic acid [C]	75-60-5	1572	AS	S	H	4	1350
Dimethoate [ISO]	60-51-5	2783	OP	S	I	3	c150
Diniconazole [ISO]	83657-24-3			S	F	4	639
Dinobuton [ISO]	973-21-7	2779	NP	S	AC,F	3	140
Dinocap [ISO]	39300-45-3		NP	S	AC,F	4	980
Diphenamid [ISO]	957-51-7			S	H	4	970
Diquat [ISO]	2764-72-9	2781	BP	S	H	3	231
Dithianon [ISO]	3347-22-6			S	F	4	640
Dodine [ISO]	2439-10-3			S	F	4	1000
Endosulfan [ISO]	115-29-7	2761	OC	S	I	3	80
Endothal-sodium [(ISO)]	125-67-9	2588		S	H	3	51
EPTC [ISO]	759-94-4		TC	L	H	4	1652
Esfenvalerate [ISO]	66230-04-4	3349	PY	S	I	3	87
Ethion [ISO]	563-12-2	3018	OP	L	I	3	208
Fenazaquin [ISO]	120928-09-8	2588		S	AC	3	134
Fenitrothion [ISO]	122-14-5		OP	L	I	4	503
Fenobucarb	3766-81-2		C	S	I	4	620
Fenothiocarb [ISO]	62850-32-2		C	S	L	4	1150
Fenpropidin [ISO]	67306-00-7			L	F	4	1440
Fenpropathrin [ISO]	64257-84-7	3349	PY	S	I	3	c66
Fenpyroximate [ISO]	*134098-61-6*			*S*	*AC*	*3*	*245*
Fenthion [ISO]	55-38-9	3018	OP	L	I,L	3	D586
Fentin acetate[(ISO)]	900-95-8	2786	OT	S	F	3	125

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Fentin hydroxide[(ISO)]	76-87-9	2786	OT	S	F	3	108
Fenvalerate [ISO]	51630-58-1	3352	PY	L	I	4	c450
Ferimzone [ISO]	89269-64-7			S	F	4	725
Fipronil	120068-37-3	2588		S	I	3	92
Fluchloralin [ISO]	33245-39-5			S	H	4	1550
Flufenacet [ISO]	142459-58-3			S	H	4	600
Fluoroglycofen	77501-60-1			S	H	4	1550
Flurprimidol [ISO]	56425-91-3			S	PGR	4	709
Flusilazole	85509-19-9			S	F	4	*672*
Flutriafol [ISO]	76674-21-0			S	F,FST	4	1140
Fluxofenim [ISO]	88485-37-4			oil	H	4	670
Fomesafen [ISO]	72178-02-0		OC	S	H	4	1250
Fuberidazole [ISO]	3878-19-1			S	F	4	336
Furalaxyl [ISO]	57646-30-7			S	F	4	940
Gamma-HCH [ISO], Lindane	58-89-9	2761	OC	S	I	3	88
Glufosinate [ISO]	53369-07-6			S	H	4	1625
Guazatine	108173-90-6			S	FST	3	230
Haloxyfop	69806-34-4			S	H	4	*300*
HCH [ISO]	608-73-1	2761	OC	S	I	3	100
Hexazinone [ISO]	51235-04-2			S	H	4	1690
Hydramethylnon	67485-29-4			S	I	4	1200
Imazalil [ISO]	35554-44-0	2588		S	F	3	*227*
Imidacloprid [ISO]	138261-41-3			S	I	4	450

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Iminoctadine [ISO]	13516-27-3			S	F	3	300
Indoxacarb [ISO]	*173584-44-6*			*S*	*I*	*3*	*268*
Ioxynil [ISO]	1689-83-4	2588		S	H	3	110
Ioxynil octanoate [(ISO)]	3861-47-0			S	H	4	390
Iprobenfos	26087-47-8			S	F	4	600
Isoprocarb [ISO]	2631-40-5	2757	C	S	I	4	403
Isoprothiolane [ISO]	50512-35-1			S	F	4	1190
Isoproturon [ISO]	34123-59-6			S	H	4	1800
Isouron [ISO]	55861-78-4			S	H	4	630
Lambda-cyhalothrin	2164-08-1	3349	PY	S	I	3	c56
MCPA [ISO]	94-74-6		PAA	S	H	4	700
MCPA-thioethyl [ISO]	25319-90-8		PAA	S	H	4	790
MCPB [ISO]	94-81-5			S	H	4	680
Mecoprop [ISO]	7085-19-0			S	H	4	930
Mecoprop-P [ISO]	16484-77-8			S	H	4	1050
Mefluidide [ISO]	53780-34-0			S	H	4	1920
Mepiquat [ISO]	15302-91-7			S	PGR	4	1490
Mercurous chloride [C]	10112-91-1	2025	HG	S	F	3	210
Metalaxyl [ISO]	57837-19-1			S	F	4	670
Metaldehyde [ISO]	108-62-3			S	M	3	227
Metamitron [ISO]	41394-05-2			S	H	4	1183
Metam-sodium [(ISO)]	137-42-8	2771		S	F-S	3	285
Metconazole [ISO]	125116-23-6			S	F	4	660
Methacrifos [ISO]	62610-77-9		OP	L	I	4	678

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Methasulfocarb [ISO]	66952-49-6	2757		S	F	3	112
Methylarsonic acid [ISO]	124-58-3		AS	S	H	4	1800
Methyl isothiocyanate [ISO]	556-61-6	2588		S	F-S	3	72
Metolcarb [ISO]	1129-41-5		C	S	I	3	268
Metribuzin [ISO]	21087-64-9			S	H	4	322
Molinate [ISO]	2212-67-1		TC	L	H	4	720
Myclobutanil	88671-89-0			S	F	4	1600
Nabam [ISO]	142-59-6	2771		S	F	4	395
Naled [ISO]	300-76-5	3018	OP	L	I	4	430
2-Napthyloxyacetic acid [ISO]	120-23-0			S	PGR	4	600
Nitrapyrin [ISO]	1929-82-4			S	B-S	4	1072
Nuarimol [ISO]	63284-71-9			S	F	4	1250
Octhilinone [ISO]	26530-20-1			S	F	4	1470
Oxadixyl	77732-09-3			S	F	4	1860
Paclobutrazol [ISO]	76738-62-0			S	PGR	4	1300
Paraquat [ISO]	1910-42-5	2781	BP	S	H	3	150
Pebulate [ISO]	1114-71-2		TC	L	H	4	1120
Pendimethalin [ISO]	40487-42-1			S	H	4	1050
Permethrin [ISO]	52645-53-1	3352	PY	L	I	4	c500
Phenthoate [ISO]	2597-03-7	3018	OP	L	I	4	c400
Phosalone [ISO]	2310-17-0	2783	OP	S	I	3	120
Phosmet [ISO]	732-11-6	2783	OP	S	I,AC	3	113
Phoxim [ISO]	14816-18-3		OP	L	I	4	D1975
Piperophos [ISO]	24151-93-7	3018	OP	oil	H	4	324

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Pirimicarb [ISO]	23103-98-2	2757	C	S	AP	3	147
Pirimiphos-methyl [ISO]	29232-93-7		OP	L	I	4	*1667*
Prallethrin [ISO]	23031-36-9	3352	PY	oil	I	4	460
Prochloraz [ISO]	67747-09-5			S	F	4	1600
Profenofos [ISO]	41198-08-7	3018	OP	L	I	4	358
Propachlor [ISO]	1918-16-7			S	H	4	1500
Propanil [ISO]	709-98-8			S	H	4	c1400
Propiconazole [ISO]	60207-90-1			L	F	4	1520
Propoxur [ISO]	114-26-1	2757	C	S	I	3	95
Prosulfocarb [ISO]	52888-80-9		TC	L	H	4	1820
Prothiofos [ISO]	34643-46-4		OP	L	I	4	925
Pyraclofos [ISO]	77458-01-6	3018	OP	L	I	3	237
Pyrazophos [ISO]	13457-18-6	2784		S	F	4	435
Pyrazoxyfen [ISO]	71561-11-0			S	H	4	1644
Pyrethrins [C]	8003-34-7			L	I	4	500-1000
Pyridaben [ISO]	96489-71-3			S	AC	4	820
Pyridaphenthion	119-12-0		OP	S	I	4	769
Pyroquilon [ISO]	57369-32-1			S	F	4	320
Quinalphos [ISO]	13593-03-8	2783	OP	S	I	3	62
Quinoclamine [ISO]	2797-51-5			S	H	4	1360
Quizalofop	76578-12-6			S	H	4	1670
Quizalofop-p-tefuryl [ISO]	119738-06-6			L	H	4	1012
Rotenone [C]	83-79-4	2588		S	I	3	132-1500
Simetryn [ISO]	1014-70-6		T	S	H	4	1830
Sodium chlorate [ISO]	7775-09-9	1495		S	H	4	1200

Common name	CAS no	UN no	Chem type	Phys state	Main use	GHS	LD_{50} mg/kg
Spiroxamine [ISO]	118134-30-8			L	F	4	500
Sulfluramid [ISO]	4151-50-2			S	I	4	543
2,3,6-TBA [ISO]	50-31-7			S	H	4	1500
TCA [ISO] (acid)	76-03-9	1839		S		4	400
Tebuconazole [ISO]	107534-96-3			S	F	4	1700
Tebufenpyrad [ISO]	119168-77-3			S	MT	4	595
Tebuthiuron [ISO]	34014-18-1			S	H	4	644
Terbumeton [ISO]	33693-04-8		T	S	H	4	483
Tetraconazole [ISO]	112281-77-3			Oil	F	4	1031
Thiacloprid	111988-49-9		S	I		4	*396*
Thiobencarb [ISO]	28249-77-6		TC	L	H	4	1300
Thiocyclam [ISO]	31895-22-4			S	I	4	310
Thiodicarb [ISO]	59669-26-0	2757	C	S	I	3	66
Thiram [ISO]	137-26-8			S	F	4	560
Tralkoxydim [ISO]	87820-88-0			S	H	4	934
Tralomethrin	66841-25-6	3349	PY	S	I	3	c85
Triadimefon [ISO]	43121-43-3			S	F	4	602
Triadimenol [ISO]	55219-65-3			S	FST	4	900
Triazamate [ISO]	112143-82-5	2588		S	AP	3	50-100
Trichlorfon [ISO]	52-68-6		OP	S	I	3	250
Triclopyr [ISO]	55335-06-3			S	H	4	710
Tricyclazole [ISO]	41814-78-2			S	F	4	305
Tridemorph [ISO]	81412-43-3			Oil	F	4	650
Triflumizole	99387-89-0			S	F	4	695
Uniconazole [ISO]	83657-22-1			S	PGR	4	1790
XMC	2655-14-3		C	S	I	4	542
Xylylcarb	2425-10-7		C	S	I	4	380
Ziram [ISO]	137-30-4			S	F	4	1400

Source: WHO Recommended Classification of Pesticides by Hazards and Guidelines to Classification, 2009

Annex 4: Labelling, Packaging, Storage and Disposal (FAO)

Code of Conduct - 2001 revised version	Code of Conduct - 1989 amended version
10.1 All pesticide containers should be clearly labelled in accordance with applicable guidelines, at least in line with the FAO guidelines on good labelling practice (3).	**10.1** All pesticide containers should be clearly labelled in accordance with applicable international guidelines, such as the FAO guidelines on good labelling practice.
10.2 Industry should use labels that:	**10.2** Industry should use labels that:
10.2.1 comply with registration requirements and include recommendations consistent with those of the recognized research and advisory agencies in the country of sale;	**10.2.1** include recommendations consistent with those of the recognized research and advisory agencies in the country of sale;
10.2.2 include appropriate symbols and pictograms whenever possible, in addition to written instructions, warnings and precautions in the appropriate language or languages (3);	**10.2.2** include appropriate symbols and pictograms whenever possible, in addition to written instructions, warnings and precautions;
10.2.3 comply with national or international labelling requirements for dangerous goods in international trade and, if appropriate, clearly show the appropriate WHO hazard classification of the contents (3,35,36);	**10.2.3** in international trade, clearly show appropriate WHO hazard classification of the contents (11) or, if this is inappropriate or inconsistent with national regulations, use the relevant classification;
10.2.4 include, in the appropriate language or languages, a warning against the reuse of containers and instructions for the safe disposal or decontamination of used containers;	**10.2.4** include, in the appropriate language or languages, a warning against the reuse of containers, and instructions for the safe disposal or decontamination of empty containers;
10.2.5 identify each lot or batch of the product in numbers or letters that can be understood without the need for additional code references;	**10.2.5** identify each lot or batch of the product in numbers or letters that can be read, transcribed and communicated by anyone without the need for codes or other means of deciphering;
10.2.6 clearly show the release date (month and year) of the lot or batch and contain relevant information on the storage stability of the product (21).	**10.2.6** are marked with the date (month and year) of formulation of the lot or batch and with relevant information on the storage stability of the product.

10.3 Pesticide industry, in cooperation with government, should ensure that:	**10.3** Industry should ensure that:
10.3.1 packaging, storage and disposal of pesticides conform in principle to the relevant FAO, UNEP[10], WHO guidelines or regulations (27,28, 37, 39, 40) or to other international guidelines where applicable;	**10.3.1** packaging, storage and disposal of pesticides conform in principle to the FAO guidelines for packaging and storage, the FAO guidelines for the disposal of waste pesticides and containers, and WHO specifications for pesticides used in public health;
10.3.2 packaging or repackaging is carried out only on licensed premises where the responsible authority is satisfied that staff are adequately protected against toxic hazards, that the resulting product will be properly packaged and labelled, and that the content will conform to the relevant quality standards.	**10.3.2** in cooperation with governments, packaging or repackaging is carried out only on licensed premises where the responsible authority is convinced that staff are adequately protected against toxic hazards, that the resulting product will be properly packaged and labelled, and that the content will conform to the relevant quality standards.
10.4 Governments should take the necessary regulatory measures to prohibit the repackaging or decanting of any pesticide into food or beverage containers and rigidly enforce punitive measures that effectively deter such practices.	**10.4** Governments should take the necessary regulatory measures to prohibit the repacking, decanting or dispensing of any pesticide into food or beverage containers in trade channels and rigidly enforce punitive measures that effectively deter such practices.
10.5 Governments, with the help of pesticide industry and with multilateral cooperation, should inventory obsolete or unusable stocks of pesticides and used containers, establish and implement an action plan for their disposal, or remediation in the case of contaminated sites (41), and record these activities	*- new paragraph in revised Code -*
10.6 Pesticide industry should be encouraged, with multilateral cooperation, to assist in disposing of any banned or obsolete pesticides and of used containers, in an environmentally sound manner, including reuse with minimal risk where approved and appropriate.	*- new paragraph in revised Code -*

10.7 Governments, pesticide industry, international organizations and the agricultural community should implement policies and practices to prevent the accumulation of obsolete pesticides and used containers (36).		*- new paragraph in revised Code -*

Source: International Code of conduct on the Distribution and Use Pesticides, FAO