

**UNITED NATIONS FRAMEWORK CONVENTIONS ON CLIMATE CHANGE**

**THE INTERNATIONAL FUND FOR AGRICULTURAL DEVELOPMENT  
THE GLOBAL ENVIRONMENT FACILITY  
(Special Climate Change Fund)**

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**THE REPUBLIC OF GHANA**

**PROMOTING A VALUE CHAIN APPROACH TO CLIMATE CHANGE ADAPTATION IN  
AGRICULTURE IN GHANA**

**PROJECT DOCUMENT**

CONFIDENTIAL

October 2011

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## Currency equivalents

Monetary Unit	=	Ghana new cedi (GHS)
USD 1	=	GHS 1.51

## Weights and measures

1 kilogram (kg)	=	2.204 pounds (lb)
1000 kg	=	1 metric tonne (t)
1 metre (m)	=	1.09 yards (yd)
1 square metre (m <sup>2</sup> )	=	10.76 square feet (ft <sup>2</sup> )
1 acre (ac)	=	0.405 ha
1 hectare (ha)	=	2.47 acres

## Abbreviations and acronyms

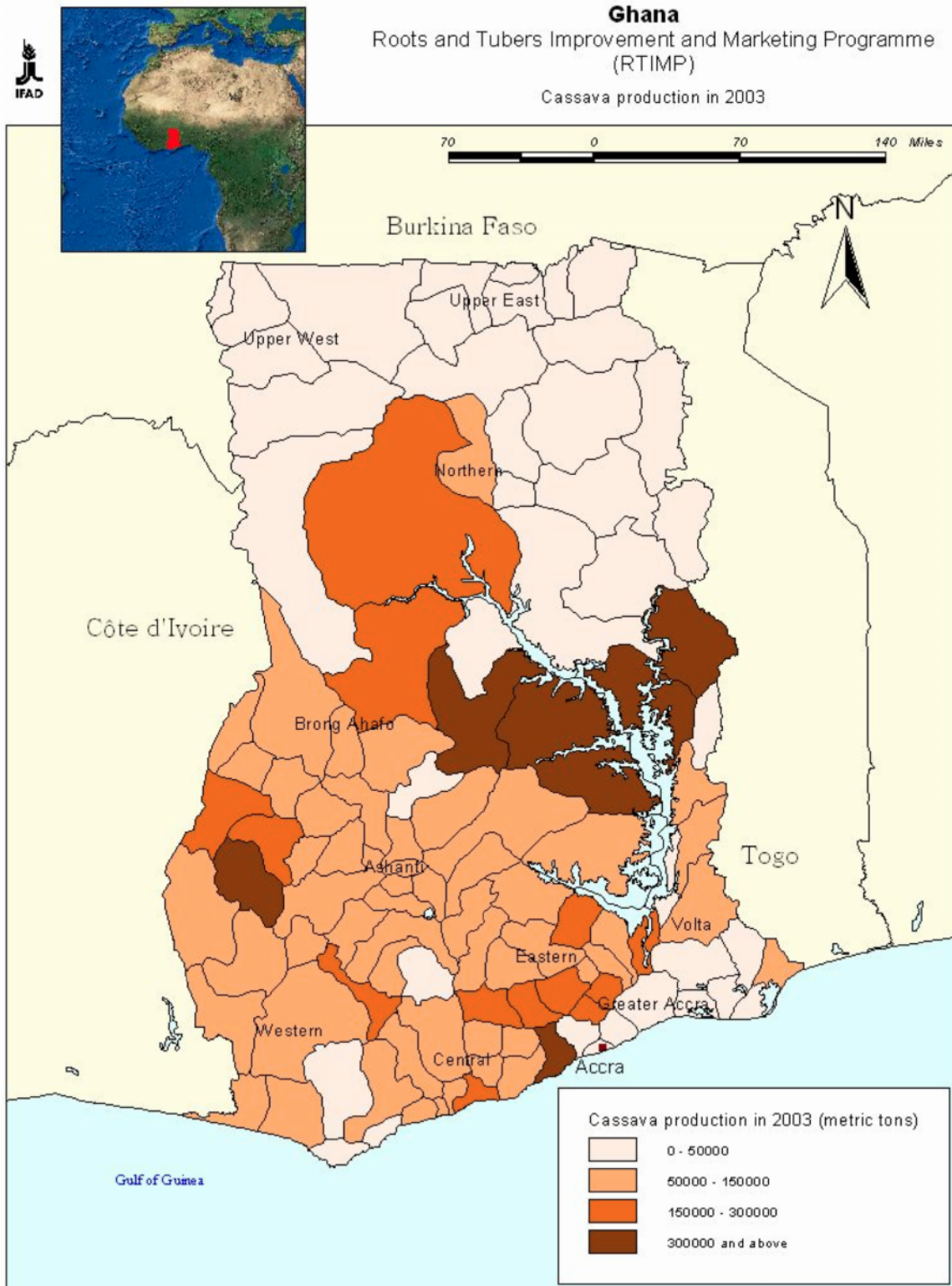
AAGDS	Accelerated Agriculture Growth and Development Strategy
ADB	Agriculture Development Bank
AfDB	African Development Bank
AGDP	Agriculture Gross Domestic Product
AGRA	Alliance for a Green revolution in Africa
AgSSIP	Agricultural Services Sub-sector Investment Programme
AgSWAp	Agriculture Sub-sector Wide Approach
ARI	Animal Research Institute
ASM	Artisanal and Small-scale Mining
BACs	Business Advisory Centres
BEP	Bio-Energy Policy
CBD	United Nations Convention on Biological Diversity
CC	Climate Change
CDM	Clean Development Mechanism
CFSVA	Comprehensive Food Security and Vulnerability Analysis
CIDA	Canadian International Development Agency
CII	Council Implementation Institution
CIMMYT	Netherlands International Maize and Wheat Improvement Centre
CITES	Convention on International Trade in Endangered Species
CO	Carbon Monoxide
COP	Conference of Parties
CRI	Crop Research Institute
CRIG	Cocoa Research Institute of Ghana
CSIR	Council for Scientific and Industrial Research
CWSA	Community Water and Sanitation Agency
CWSD	Community Water and Sanitation Division
DAs	District Assemblies
DACF	District Assembly Common Fund
DANIDA	Danish International Development Agency
DCD	District Coordinating Director
DCE	District Chiefs Executive
DPCUs	District Planning and Coordination Units
DVGs	Disaster Volunteer Groups

EACC	Economics of Adaptation to Climate Change
EEZ	Executive Economic Zone
EPA	Environmental Protection Agency
ERP	Economic Recovery Programme
EU	European Union
FAO	Food and Agriculture Organization
FADEP	Food and Agriculture Development Policy
FC	Forestry Commission
FFF	Farmers Field Fora
FLEGT	Forest Law Enforcement, Governance and Trade
FORIG	Forest Research Institute of Ghana
FRI	Food Research Institute
FRNR	Faculty of Renewable Natural Resources
FSD	Forest Service Division
GCM	Global Climate Model
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GIDA	Ghana Irrigation Development Authority
GIS	Geographic Information System
GMet	Ghana Meteorological Agency
GoG	Government of Ghana
GPCs	Good Processing Centres
GSIF	Ghana Strategic Investment Framework
GTZ	German Agency for Technical Cooperation
GWCL	Ghana Water Sewerage Corporation
GWSC	Ghana Water and Sanitation Commission
HA	Hectare
HH	Household
HQCF	High Quality Cassava Flour
ICRISAT	International Crop Research Institute for the Semi-arid Tropics
IFAD	International Fund for Agriculture Development
IFDC	International Fertilizer Development Centre
IFPRI	International Food Policy Research Institute
IITA	International Institute for Tropical Agriculture
IPCC	International Panel on Climate Change
ITTO	International Timber Trade Organization
IWRM	Integrated Water Resources Management
JICA	Japanese International Cooperation Agency
KNUST	Kwame Nkrumah University of Science and Technology
KP	Kyoto Protocol
LPG	Liquefied Petroleum Gas
MDAs	Ministries, Departments and Agencies
MDGs	Millennium Development Goals
MEF	Micro Enterprises Fund
MEST	Ministry of Environment, Science and Technology
MLFM	Ministry of Land, Forestry and Mines
MLGRD	Ministry of Local Government and Rural Development
MOFA	Ministry of Food and Agriculture
MOTI	Ministry of Trade and Industry
MOWAC	Ministry of Women and Children's Affairs
MoU	Memorandum of Understanding
MSEs	Micro and Small Enterprises
MT	Metric Tonne
MTS	Modified Taungya System
MW	Mega watts
MWRWH	Ministry of Water Resources, Works and Housing
NAAC	National Agriculture Advisory Committee

NADMO	National Disaster Management Organization
NAP	National Action Programme to Combat Drought and Desertification
NCAP	Netherlands Climate Assistance Programme
NCCAS	National Climate Change Adaptation Strategy
NCCC	National Climate Change Committee
NCCSAP	Netherlands Climate Change Studies Assistance Programme
NCWD	National Council on Women and Development
NCWSP	National Community Water and Sanitation Programme
NDI	Northern Development Initiative
NDPC	National Development Planning Commission
NEAP	National Environmental Action Plan
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
NREG	Natural Resources and Environmental Governance
NRM	Natural Resources Management
NSLMC	National Sustainable Land Management Committee
NWP	National Water Policy
OASL	Office of the Administrator of Stool Land
ODA	Overseas Development Assistance
OPRI	Oil Palm Research Institute
PGRRI	Plant Genetic Resources Research Institute
PIM	Programme Implementation Manual
RCC	Regional Coordinating Council
RAFIP	Rural and Agriculture Finance Programme
RELC	Research Extension Farmer Linkages
REP	Rural Enterprises Programme
RTFs	Rural Technology Facilities
RTIMP	Root and Tuber Improvement and Marketing Programme
R&T	Roots and Tubers
SCCF	Special Climate Change Fund
SARI	Savannah Agriculture Research Institute
SDI	Spatial data Information
SEA	Strategic Environmental Assessment
SIDA	Swedish International Development Cooperation Agency
SLM	Sustainable Land Management
SLWM	Sustainable Land and Water Management
SMDC	Sub-Metropolitan District Council
SNEP	Strategic National Energy Plan
SRI	Soil Research Institute
TIDD	Timber Industry Development Division
UCC	University of Cape Coast
UDS	University of Development Studies
UG	University of Ghana
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNDAF	United Nations Development Assistance Programme
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environmental Programme
UNFCCC	United Nations Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
USD	United States Dollar
VAT	Value Added Tax
VPA	Voluntary Partnership Agreement
WATSANS	Water and Sanitation Committees
WB	World Bank

WD	Wildlife Division
WMC	Women Manifesto Coalition
WMO	World Meteorological Organization
WRC	Water Resources Commission
WRI	Water Research Institute
WRIS	Water Resources Information Service
WSDB	Water and Sanitation Board
YIAP	Youth in Agriculture Programme





Source: IFAD

The designations employed and the presentation of the material in this map do not imply the expression of any opinion whatsoever on the part of IFAD concerning the delimitation of the frontiers or boundaries, or the authorities thereof.

## **PROMOTING A VALUE CHAIN APPROACH TO CLIMATE CHANGE ADAPTATION IN AGRICULTURE IN GHANA**

### **PROJECT DOCUMENT**

#### **Executive Summary**

1. The proposed project is designed within the overall framework of the RTIMP implementation in Ghana. The total cost of the project amounts to USD 11,485,000 (USD 2,500,000 of SCCF funding and USD 8,985,000 of estimated co-financing). The overall objective of this SCCF operation is to reduce the vulnerability of the food supply system to the deleterious impacts of climate change. The specific objective is to reduce climate-induced risks in the cassava value chain to the achievement of food security and income generation for pilot rural communities in Ghana.
2. The IFAD/SCCF project will complement the activities undertaken under RTIMP. The SCCF components are fully embedded in the RTIMP in a synergetic manner that will ensure that the SCCF funding is covering additional costs associated with the adaptation needs that were identified in the NCCAS and further discussed at all levels (national, provincial and grass-roots) during the project preparation phase.
3. This SCCF intervention will be articulated around three components: (i) awareness raising on climate change and capacity to address its impacts along the cassava value chain and other complementary food production; (ii) support adaptation to climate change of cassava production; (iii) promote innovative adaptation solutions along the agriculture value chain. Project duration is 30 months, starting in 2012.
4. Within Component 1 of the project a total budget of USD 544,300 is devoted to the development, design, and implementation of a comprehensive capacity building program targeting both project users and beneficiaries in the pilot areas, and the wider public, through a broad variety of tools and materials. Component 2, which specifically focuses on the put in practice of climate change adaptation measures cassava production, has a total budget of USD 863,000. This component foresees an expenditure of 465,200 USD for the setup of 32 pilot plots to test and put in practice cassava production that is resilient to climate change impact in four districts of the country. This component includes rural appraisal workshops, specific training for farmers, and dissemination of the results. This component also addresses the mitigation of the risk of cassava production associated with water scarcity (USD 109,200) and the introduction of community agro-forestry as a measure to reduce the environmental impact of the cassava value chain and ensure a better and more sustainable use of resources such as soil and water (USD 288,600). The rest of the investment is concentrated in Component 3 of the project, and it comprises the largest share of the budget (USD 821,000) including: (i) purchase of small gasification stoves for efficient cassava processing; (ii) set up of a gasification power plant; (iii) set up of a biogas pilot plant; (iv) establishment of refrigerated rooms and honey production room, and (v) small gasification units for mushroom medium sterilization. Component 4 addresses project management and M&E with an amount of US\$ 271,000. SCCF allocations and co-financing by component and outcome are reflected in the financing table hereafter. Detailed project costs are provided in the Project COSTABS (Annex 3).

5. The project will be developed in synergy with the IFAD-supported Roots & Tubers Improvement and Marketing Program (RTIMP), which is the baseline for the SCCF intervention. The overall goal of the RTIMP is to enhance the food security and incomes of poor rural households in Ghana, with special emphasis on women and other vulnerable groups. Its specific objective is to build up competitive, market-based and inclusive commodity chains for roots and tubers (R&T), supported by relevant, effective and sustainable services that are accessible to the rural poor.
6. While RTIMP currently works on improving and increasing R&T crop production and upgrading R&T processing and marketing, it does not specifically address the adaptation needs that cassava value chain actors will need to incorporate in their work to cope with climate change impacts. The SCCF project will support RTIMP to develop, test and disseminate adaptive land and water management practices, to incorporate climate change adaptation criteria in the selection of crop varieties and cropping systems, and to set up effective early warning systems for better agricultural and enterprise planning and decision making. The SCCF project will also incorporate climate change data and modeling in the RTIMP daily work.
7. SCCF resources are grant funding. The total grant value amounts to USD 2,5 million that will mobilise an estimated co-financing of about USD 8,9 million. The main co-financing is estimated from IFAD's operations (namely from RTIMP). The Government and the beneficiaries' contributions will be estimated (mainly as in-kind contributions). Any expenses under the SCCF grant will not be subject to taxes.
8. Annex 3 provides a description of synergies between the SCCF component and the RTIMP operations. It highlights the additionality of the SCCF/Adaptation aspects.
9. The project will contribute significant environmental co-benefits (over and above the adaptation to climate change), principally from reducing the environmental impact of cassava cultivation by: (i) promoting the use of nutrient efficient, drought-tolerant, high-yielding, disease-resisting, early maturing crops and plant varieties; (ii) reducing the amount of water needed, and the generation of cassava waste and wastewater along the chain; (iii) reducing the input of fossil fuels, namely firewood, in the cassava cycle and other complementary food production (i.e. a wider range of cassava derivatives, mushrooms, honey, and vegetable crops); (iv) increasing water harvesting capacity and efficiency in the use of water for production, processing, drinking water and sanitary purposes; (v) adopting agriculture conservation practices that helps increase soil fertility, and reduce soil erosion risk.



## I. SITUATION ANALYSIS

### A. GEOGRAPHICAL AND ENVIRONMENTAL CONTEXT

- The Republic of Ghana, with a total area of 238,539 square kilometres, is located between latitudes 4.5° and 11.5° N and longitudes 3.5° W and 1.3° E. The country shares borders with Togo, Burkina Faso, Cote d'Ivoire and the Gulf of Guinea to the South. Extensive water bodies, including the Lake Volta and Bosomtwi, occupy 3,275 square kilometres, while seasonal and perennial rivers occupy another 23,350 square kilometres. In line with customary and international treaties, Ghana has a 200 nautical mile Exclusive Economic Zone (EEZ). Ghana's capital is Accra. The country is divided into ten administrative regions: Western, Central, Greater Accra, Eastern, Volta, Ashanti, Brong-Ahafo, Northern, Upper East and Upper West.

Table 1 - Administrative regions by size and percentage of total land area<sup>1</sup>

Region	Area (000 km <sup>2</sup> )	% of total area	Population (2008 est.)	% Rural	% Urban	Average size HH	% Female headed HH
Northern	70.38	29.5	2,165,606	73	27	6.3	9
Brong-Ahafo	39.56	16.6	2,164,589	63	37	4.5	26
Ashanti	24.39	10.2	4,589,377	49	51	3.7	41
Western	23.92	10.0	2,424,139	64	36	4.9	27
Volta	20.57	8.6	1,822,054	73	27	4.6	41
Eastern	19.32	8.1	2,267,772	65	35	3.8	38
Upper West	18.48	7.7	624,861	83	18	4.7	16
Central	9.83	4.1	1,801,520	63	37	3.8	27
Upper East	8.84	3.7	983,575	84	16	5.5	19
Greater Accra	3.24	1.4	4,057,434	12	88	3.7	33

- The topography of Ghana is predominantly undulating with slopes of less than 1%. Despite the gentle slopes about 70% of the country is subject to moderate to severe –namely in the Savannah zones- sheet and gully erosion. The highest elevation in Ghana is Mount Afadjato (880 m) in the Akwapim-Togo Ranges. There are five distinct geographical regions: (i) the low plains, stretching across the southern part of the country; (ii) the Ashanti Uplands, stretching from the Côte d'Ivoire border in the west to the elevated edge of the Volta Basin in the east; (iii) the prominent and rugged volcanic heights of the Akwapim-Togo Ranges in the eastern part of the country; (iv) the Volta Basin in central Ghana which covers poor soil areas over 45 % of the nation's total area; (v) the high plains in north and north-west part of Ghana, outside the Volta Basin, consist of a

<sup>1</sup> Ghana Comprehensive Food Security & Vulnerability Analysis 09 (Source FAO); HH: Household

dissected plateau. Soils in the high plains are more arable than those in the Volta Basin.

3. Three main river systems drain the country: (i) the Volta river basin covers 70 percent of the country area and comprises the White and Black Volta, Oti, Daha, Pru, Sene and Afram rivers; (ii) the south-western river system covers 22% of the country area and comprises the Bia, Tano, Ankobra and Pra rivers; (iii) the coastal river system covers 8% of the country area and comprises the Ochi-Nakwa, Ochi Amissah, Ayensu, Densu and Tordzie rivers. Coastal and inland wetlands constitute about 10% of Ghana's total land area; the two most important lakes in the country are Lake Volta and Lake Bosomtwi in the Ashanti region. Groundwater mainly occurs in the three aquifers of the Cenozoic and Mesozoic geological sediments in the extreme south-eastern and western part of the country; yields can reach an average of 184 m<sup>3</sup>/hr in the limestone aquifer. Groundwater also occurs in the Voltaian geological formation, where yields rarely exceed 6 m<sup>3</sup>/hr. Falling groundwater levels have been observed in the Upper Regions where over 2,000 boreholes have been drilled since the mid-1970s in the rural areas to provide potable water to communities.
4. Ghana's climate is influenced by the hot, dry and dusty desert air mass – the harmattan- that blows from the northeast from December to March, and by the tropical maritime air mass that blows from the southwest across the southern Atlantic Ocean. The climate ranges from the bimodal rainfall equatorial type in the south with two rainy seasons -April to June and September to November- to the tropical unimodal monsoon type in the north –rainfall peak in August and September. The rainfall generally decreases from the southwest (over 2,000 mm) to the extreme north (less than 1,100 mm). Exceptionally, the driest area is in the south-eastern coastal strip, where rainfall is about 750 mm. The mean annual temperature averages 27 °C and the mean monthly temperature over most of the country never falls 25 °C. Absolute maxima approach 40 °C especially in the north, where the harmattan wind causes hot days and cool nights. The annual mean relative humidity is about 80% in the south and 44% in the north. Annual potential water evaporation has been estimated as ranging between 1,350 mm in the south to about 2,000 mm in the north. The actual amount of evaporation depends on a number of factors including water availability, vegetation cover and prevailing weather conditions among others.
5. Ghana is divided into 6 major agro-ecological zones: the Rain Forest Zone, the Semi-deciduous Forest Zone, the Forest-Savannah Transition Zone, the Coastal Savannah, the Guinean Savannah and the Sudan Savannah. The forest zones are characterised by heavy rainfall, well distributed throughout the year that promotes a rapid plant growth resulting in an even tree canopy at 30-40 metres, which often includes some deciduous tree species and emergent trees that may attain 60 metres. The Forest-Savannah Transition zone is an ecotonal area where forest fringes are gradually replaced by a savannah-like landscape with a wide range of tall grasses; in this zone, rainfall is mainly bi-modal although in some years it has only one peak. In the interior Savannahs rainfall is uni-modal, starting in April, slowly increasing till its August-September peak, and sharply declining in October; its vegetation forms a continuous grass cover interspersed with fire resistant, deciduous broadleaf trees. The Coastal Savannah zone has a bi-modal rainfall pattern – from March to July is the main season and from September to October is the minor season- and has a quite disturbed vegetation cover due to a very intense human activity during the past decades.

Table 2 - Agro-ecological zones in Ghana

Agro-ecological Zone	Area Ha (x000)	% Total Area	Rainfall Pattern			Mean Annual rain (mm)	Growing Period (Days)	
			Pattern	Major Season	Minor Season		Mean Season	Minor Season
Rain Forest	750	3	Bi-modal	Mar-Jul	Sept-Nov	2,200	150-160	100
Semi-deciduous Forest	740	3	Bi-modal	Mar-Jul	Sept-Nov	1,500	150-160	90
Transition	6,630	28	Bi-modal (uni-modal some years)	Mar-Jul	Sept-Oct	1,300	200-220	60
Guinea Savannah	14,790	63	Uni-modal	May-Sept		1,100	180-200	-
Sudan savannah	190	1	Uni-modal	May-Sept		1,000	150-160	-
Coastal Savannah	580	2	Bi-modal	Mar-Jul	Sept-Oct	800	100-110	60

6. Most of the soils of Ghana are developed on thoroughly weathered parent materials, characterised by inherent or human induced infertility. The soils in the Forest zone are porous, well drained and generally loamy and are distinguished from those of the Savannah zones by the greater accumulation of organic matter in the surface resulting from higher accumulation of biomass. They occur in areas underlain by various igneous, metamorphic and sedimentary rocks, which have influenced the nature and properties of the soil. Soils of the Savannah zones, especially in the Interior Savannah, are low in organic matter (less than 2% in the topsoil), have high levels of iron concretions and are susceptible to severe erosion. These conditions require that manure be incorporated regularly into the soils in the Savannah zones.
  
7. The forest zones of Ghana are part of one of the most species-rich region in West Africa -the *Guinean Moist Forests*- that was designated as one of the 200 Global Ecoregions critical for biodiversity conservation worldwide. In terms of biodiversity, Ghana hosts 3,725 flowering plant species (of which 1,2 % are endemic and 115 species are threatened), 222 mammal species (14 threatened), 206 breeding bird species (14 threatened), 131 reptiles (2 threatened), 33 amphibians and 99 fish species. Sixteen per cent of Ghana's land surface has been set aside to conserve representative samples of natural ecosystem in the form of forest resources, natural parks and other wildlife reserves including various traditional forms of conservation. Ghana has a total of 15 wildlife-protected areas (6 national parks, 6 resource reserves, 2 wildlife sanctuaries, and 1 strict nature reserve), and 5 RAMSAR wetland sites that have been gazetted as protected areas. Other wetlands located in the forest and wildlife reserves of the Mole National Park, Black Volta, Sene, Bia and Owabi Wildlife Sanctuaries are protected too. Some wetlands, which fall outside the conserved wetland areas, are subject to traditional conservation practices such as the rivers Ankobra and Pra. The integrity of all these natural ecosystems and also the various agro-ecosystems are vital to ensure the ecosystem services upon which the population

of Ghana depend. In recent years, potential revenue from future “eco-tourism” and other benefits have been used to raise expectations of local communities. However, many of the resource reserves will struggle to generate significant income to justify these claims from tourism alone.

8. Land use in Ghana is classified as agriculture and non-agriculture land. About 52% (124,000 km<sup>2</sup>) of the land is considered agricultural land or land suitable for agricultural purposes, including annual crops, tree crops, bush fallow and other uses, and unimproved pasture. However, only 18% is currently under cultivation. Land under irrigation is only 0.5% of agricultural land, or 0.04% of all land.
9. Forest and wildlife resources have long been major contributors to Ghana’s economic development, formal and informal employment, livelihoods, and export earnings. Originally, tropical forest ecosystems covered approximately 60.8% (145,000 km<sup>2</sup>) of Ghana. Currently, about 21.7% (49,400 km<sup>2</sup>) of Ghana’s territory is forested, according to FAO, and it contains 381 million MT of carbon in living forest biomass. Of this, 5.3% (260,000 ha) is classified as primary forest. Ghana has 260,000 ha of planted forest.
10. Wetlands in Ghana are very productive and their resources have been traditionally used by local populations as a source of the basic necessities of life, ranging from building materials, hunting and fishing areas, to sources of water for humans and livestock. Local populations have developed traditional knowledge systems and practices, which govern the management of wetlands.

## B. SOCIAL NATIONAL CONTEXT

11. Although the last census in Ghana (2000) counted a population of 18.9 million people, the current population estimate is about 22.9 million people, with an average annual growth rate of 2.7%. The average population density is estimated at around 52 persons per square kilometre. The most populous of the ten regions is Ashanti with approximately 20% of the country population, followed by Greater Accra with 18%. The least populated regions are Upper West (3%) and Upper East (4%). More than half of the population (56%) lives in rural areas, with the highest numbers in the Upper East (84%), Upper West (83%), followed by the Northern and Volta region (both with 73%). Thirty one percent of households are headed by women with the largest share of female’ headed households in Volta and Ashanti (both with 41%) and the lowest prevalence in the Northern region (9%). This may be influenced by the prevailing patrilineal kinship and inheritance system in the inland savannah regions. The average fertility rate is 4.4 children per woman.
12. There are 8 distinct ethnic groups in Ghana, which are subdivided into smaller sub-ethnic groups with a total of about 46 languages and 76 dialects. The most prominent ethnic group is the Akans (over 50% of the total population), followed by the Mole-Dagbon (16.5%) and the Ewe (12.7%). Political and ethnic differentiation shows an informal but clear division between the northern and southern regions of the country.
13. **Poverty:** Ghana is on the right track to achieve MDG1 (eradicate extreme poverty and hunger by 2015) as poverty has dropped from 51% in 1991 to 28.5% in 2006. Nevertheless, regional differences are prominent: 70% of the 28.5% of the poor lives in the 3 northern regions (Upper West, Upper East and Northern), and 54% of the extreme poor lives in the Northern region alone which is home to only 17.2% of the total population. Poverty incidence has significantly been reduced in the other regions, although poverty levels have recently increased in Accra due to rural-urban migration and rapid growth of urban slum areas.



14. Although food from major staple crops –except for wheat and rice- is available in the country, it is not accessible to everyone. According to the Comprehensive Food Security and Vulnerability Analysis (CFSVA) undertaken by the Government of Ghana in 2009, in the country almost 12% of children under the age of five are underweight, 22% of children are stunted or too short for their age, and 7% are wasted or too thin for their height. The Ghana Health Service indicates that malnutrition is estimated to be the underlying cause of 55% of mortality cases in children under the age of five, in addition to poor care and feeding practices, lack of quality health facilities, limited access to safe drinking water, etc.
15. **Gender:** Women and men occupy distinct positions in the Ghanaian economy as a result of a gender division of labour within households and the society at large. Women are involved in repetitive and time-consuming tasks, such as collection of firewood, water fetching, childcare, sweeping, garbage disposal and cooking. Ghanaian women spend more than twice as much time on domestic work as men, according to UNECA. In agriculture, most rural women are predominantly engaged in food crop cultivation/processing and small scale trading, while males are involved in both food and cash crop cultivation generally and on a relatively larger scale. It is estimated that women cultivate almost 40% of all land holdings under production in Ghana. Women’s unpaid labour is critical for livelihoods and the security of household and family members. Workers in the informal sector are usually not protected by labour laws and conventions and have no basic rights such as minimum wage or health care. In addition to their lower levels of involvement in wage work, women as an economic category occupy lower positions in the formal labour sector and, therefore, earn much less money than men in waged work.
16. In Ghana, women’s unequal land rights affect their access to other resources and their economic, social and political status. Women’s access to land is affected by tenure arrangements, inheritance and land use patterns. Thus, although women have land usage rights, their access to the resource depends on its availability and the goodwill of men who control it.
17. **Migration:** Migration within the country from rural to urban areas, and from the northern to the southern regions has increased significantly over the past years. It usually takes place in high numbers during the dry season, a time when agriculture activities are limited and when additional income sources become crucial for the welfare of the family left in the north. The majority of people migrating in search of work across the different agro-ecological zones are young men and women between 15 to 29 years, and they are mostly from agriculturalist households.
18. **Education:** According to the Ghanaian Living Standards Survey, 44.1% of women as opposed to 21.1% of men have no formal education. In spite of this, it appears that Ghana is gradually moving towards the MDG2 by achieving 100% of universal primary education by 2015. At the national level, the average percentage of primary school attendance is 78% in urban areas and 70% in rural areas, with the lowest rates in the rural areas of the Northern and Greater Accra regions. The highest attendance rates are in the urban area of Accra (86%) and in Ashanti (79%), probably an indication of the greater wealth enjoyed by their population. Surprisingly, the considerably high attendance rates in rural areas of Upper East (78%) and Upper West (71%) may be due to the intense governmental efforts to increase access to basic education in these regions. The wealth status of the families has a strong influence in their primary school attendance, with 20% of poor children not attending any school, while non-attendance does not exist among the rich households. No gender disparities exist in primary school and in the first years of secondary school.

19. Secondary school attendance is closely related to the wealth status of the household: only 3% of children from poor households compared to 34% from rich households. The highest attendance rates are in the Accra urban (34%) and other urban areas (21%), while the lowest rates occur in the Northern rural, Eastern rural, and Upper West rural with less than 5%. Gender disparities unfavourable for girls exist in secondary school attendance, especially at the age of 15 years and above, and in the north.
20. **Wealth:** Households living in urban areas are generally much wealthier than their counterparts in the rural areas<sup>2</sup>. While more than half of the rural population (58%) falls into the two lowest wealth quintiles, only 17% of the urban population does. The wealthiest rural regions include Western, Central, Greater Accra, Eastern, and Ashanti with less than 20% of households consider poor.
21. 86% of the population in Ghana have an adequate diet or acceptable food consumption, 9% is vulnerable to food security and 5% is food unsecured with very rare essential source of protein and vitamins. However, there are significant regional differences: in the rural areas of the three northern regions, between 27% (Northern) to 48% (Upper West) of the population is food unsecured or vulnerable to food insecurity. Relatively large shares of households in the rural areas of Ashanti (17%) and Brong-Ahafo (15%) regions are also food unsecured or vulnerable to food insecurity. Crop farming households with less than 2 ha of land cultivated and agro-pastoralists are the groups more affected by poor and borderline food consumption.
22. Sanitation facilities are accessible to 68% of rural households, with high disparities between rich (91%) and poor (10%) households. High disparities also exist among regions. Overall, safe drinking water is accessible for 84% of the population, with high disparities too: while 98% of the rich households have access to improved drinking water sources, 63% of poor households are still drinking water from unprotected wells, springs, rivers or ponds. The use of unsafe sources of drinking water is significantly higher in the rural areas of Brong-Ahafo, Northern, Western and Volta regions (around 40% of households). Interestingly, female households are less likely to use unsafe sanitation facilities (37% of female against 61% of male) and unsafe water sources (10% of female against 19% of male).

### C. ECONOMIC NATIONAL CONTEXT

23. Ghana has one of the strongest growth rates in Sub-Saharan Africa. Since 2003 the country has grown by more than 5% per year, reaching 6.2% in 2008. There are significant economic differences between the north, where less favourable climate conditions, limited capital investments, poor infrastructure and worse educational conditions limit the economic growth, and the more booming south. The driving force of Ghana's economy is the agriculture sector contributing to approximately 38% of GDP in 2008, followed by services (34%) and industry (28%). Although the agriculture sector has been increasing up to 4.8% per year by the end of 2008, it remains well below the target of 6.7%.
24. Ghana's economy is largely informal whereby 91% of all economically active people are informally employed, mostly in the private agriculture sector. This generates a persistent insecurity and vulnerability of the labour force, to a large part made up of women and the youth, and hinders the strengthening of the country's economy. The Ghana Poor Reduction Strategy (GPRS II) intends to establish a "stable macroeconomic environment" by strengthening the private

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<sup>2</sup> Household Wealth Index based on the methodology of the Demography Health Survey (DHS) (See: Ghana Comprehensive Food Security and Vulnerability Analysis, 2009).

sector in agriculture, which makes up the largest part of the informal economy and which has been the main driver of Ghana's economic success so far.

25. Exports of goods and services accounted for about 40% of Ghana's GDP in recent years. Gold, cocoa and timber accounted for 71% of all exports. Horticultural commodities (mainly pineapples, mangoes and bananas) for exports have increased 128% since 2000. Furthermore, the country is increasing its own manufacturing capacity to make a shift from solely exporting raw products from timber and cocoa to the finished and semi-finished products. Oil production and commercial extraction from the country's large oil reserves is predicted to substantially boost Ghana's economy in the near future and will provide relief to Ghana's current account deficit (22.3% in 2008).

## DEVELOPMENT SECTORS

26. **The agricultural sector** contributes 38 % of the GDP, employs 45% of the active population (about 60% of the rural labour force), accounts for about 75% of the export earnings, and contributes to meeting more than 90% of the food needs. On the basis of present projections and the priorities set in the country's strategy for growth and poverty reduction (GPRS II), the agricultural sector will continue to be the key driver for growth in the near future.
27. There are significant differences in the regional distribution of Agriculture GDP across Ghana's agro-ecological zones. The forest zones account for 43% of AGDP, compared to about 10% in the coastal savannah zone, and between 20.5%-26.5% in the inner savannah zones. The northern savannah zones are the main producers of cereals, accounting for more than 70% of the country's sorghum, millet, cowpeas, groundnuts, beef and soybean. On the other hand, the forest zones supplies a large share of high-value products such as cocoa, timber, etc.
28. The agriculture sector provides income to 71% households in Ghana: food crop farming is the most common activity (49%) followed by cash crop production (12%), agro-pastoralism (7%) and fishing (4%). The agriculture sector in Ghana employs more than half of the labour force. More than 90% of farm holdings are less than 2 ha in size and are subsistence farms yet they contribute 80% to Ghana's total agriculture output. According to CFSVA (2009) the grand majority of households (71%) cultivated three crops, followed by 21% cultivating two and 8% cultivating just one crop. At the national level, the main crops cultivated in 2008 were maize, cocoa and cassava, but major differences exist among regions.
29. Most of Ghana's staple food consumption needs are met through domestic food production. MOFA estimated that annual food consumption per capita is about 83 kg of cereals and 337 kg for starchy staples, 30 kg for fish and 7 kg for meat. Staple foods in Ghana include cassava, yam, cocoyam, maize, plantain and rice, and together with cocoa constitute the largest share of national crop production. Apart from rice and wheat imports, Ghana is more or less self-sufficient in its food production, despite it being hugely vulnerable to adverse climate conditions.
30. While roots and tubers (cassava, yam, cocoyam) are predominantly grown and consumed in the southern and central regions. In terms of total quantities, cassava is by far the strongest driving force of the roots and tubers in Ghana. Brong-Ahafo, Eastern and Ashanti regions are by far the largest food crop producers among the 10 regions, with a focus on roots and tubers and plantain. The three northern regions are considered the country's "bread basket" having

contributed to an annual average of about 752 MT or 39% of Ghana's cereal production over the past decade. Legumes such as peanuts, cowpeas and soybeans are also primarily grown in the north and most often used as cash crops. Ghana has also been expanding its production of fruits (pineapple, citrus, banana, cashew, mangoes) and vegetables (tomato, pepper, okro, egg plant and onion) over recent years.

31. 91% of households reported to rely just on rainwater for farming (CFSVA, 2009). From the few number of farmers using some form of irrigation, the largest share resides in Volta (9%), Accra (9%) and Ashanti (7%). Only 10% of farmers can afford to purchase seeds for planting and only 20% use fertilizers.
32. The Fertilizer Subsidy Scheme and the Youth in Agriculture Programme (YIAP) allow farmers to have to access credit through an innovative scheme. Under this programme 11,577 ha of land were put under the cultivation of maize, rice and soybean. Interested farmers formed groups, within their localities, and had access to contiguous stretch of land. YIAP ploughed the land and provided funding for maintenance as credit to be repaid after harvesting. Payment was to be made in either cash or in kind.
33. The main cash crops are cocoa, coffee, cotton, kola, oil palm, coconut and rubber. Cocoa is the most important cash crop, providing more export revenue than gold and timber in 2008, and making the country the world's second largest producer after Cote d'Ivoire. Its production increased by 55% between 2000 and 2008, corresponding to 10% of total cultivated land (1.4 million ha). Cocoa yields also increased significantly by 73%.
34. Agro-pastoralism is mainly practiced in the northern regions. Agro-pastoralists are predominantly small holders that are particularly vulnerable due to limited extension support (technologies, vaccination, etc), poor feeding and health care practices, inadequate agriculture practices such as bush burning that reduce the availability of animal feed, and limited or non-existent output markets. MOFA has a livestock policy to help reduce the incidence of poverty among agro-pastoralists from 59% to 30% by 2015, and increase the supply of meat and dairy products from domestic production up to 30%.
35. **The Forestry Sector:** The forest zones in Ghana are subdivided into the on-reserves (including timber production and areas for permanent protection) and the off-reserves (consisting of natural and secondary forest as well as various forms of agriculture). Forest and wildlife resources have long been major contributors to Ghana's economic development, formal and informal employment, livelihoods, and export earnings.
36. The wood industry is largely made of sawmills but the informal sector is thought to account for 6,000 tertiary enterprises. Companies that have integrated wood processing with logging activities account for about 95% of the logs harvested in Ghana. There are some 70 small-scale processing facilities that account for the remaining 5% of the domestic log market. Wood trade is heavily concentrated in 20 leading companies, which account for about 60% of the total export earnings.
37. According to ITTO (2006) Ghana's wood products exports has recently dropped due to structural constraints, including deficient processing equipments, unskilled labour and low-level production techniques. Ghana's wood products industry can be competitive if changes are implemented collectively by all stakeholders and in a coordinated and cooperative way.
38. The government has made efforts in reforming the legal framework to ensure sustainable development in the forest sector. Recent efforts of reform and new promising initiatives in the forest sector in Ghana show a political will, especially at a local and regional level, to achieve sustainable forest

management. Benefit sharing has become an integrated part of legal frameworks and regulations, including specifications on shares of timber harvesting and tree planting revenues for different stakeholders. Local customary rights have to some degree been recognized, for instance local chiefs and communities have certain rights concerning the control and distribution of rents from timber resources.

39. **The Energy Sector:** The primary indigenous energy in Ghana comprises about 90% biomass, 9% of hydro-energy, and less than 1% solar energy (mainly for sun-drying crops such as cocoa, maize, paddy rice, sorghum, millet, groundnuts and pepper). Net energy import was about 2.6 million tonnes of oil equivalent in 2004, of which 80-83% crude oil and 17-20% petroleum products. Energy losses totalled about 30% of the total primary supply in 2004. Carbon dioxide emissions as a result of the energy usage rose from about 7.7 million tonnes in 2000 to 9.2 million tonnes in 2004.
40. The bulk of energy supply is met from biomass (firewood and charcoal), which accounts for about 71% of total primary energy supply and about 60% of the final energy demand. About 80% of households in Ghana depend on wood-fuel for cooking and water heating in addition to processing, commercial, and industrial uses. The Transition and Savannah Zones of Ghana (mainly Kintampo, Nkoranza, Wenchi, Afram Plains and Damongo districts) provide most of wood resources for wood-fuels. Wood-fuel resources are depleting at a very fast rate as a result of unsustainable practices in the production, marketing, and use of the product that incurs high levels of waste and energy inefficiency. The major wood-fuel providing districts show signs of depletion of the preferred wood-fuel species.
41. The energy sector of Ghana aims to reduce losses in the conversion of wood to charcoal and in the end-use of fuel-wood. This will require a number of priority actions: (i) support for the forestry sector to ensure sustainable management of the country's natural forests and woodlands; (ii) ensure the design and implementation of a regulatory framework for commercial transportation and marketing of wood-fuel; (iii) regulate charcoal exports to ensure that only charcoal from wood waste and planted forest are exported; (iv) establish the needed institutional framework to enhance and co-ordinate wood-fuel related activities as an integral part of national energy development; (v) Promote improved technologies and higher levels of efficiency in the production of charcoal and use of wood-fuels; (vi) Support the development, promotion and introduction of alternative fuels for the substitution of wood-fuels.
42. **Water Sector:** Ghana's total actual renewable water resources are estimated to be 53.2 km<sup>3</sup>/yr. Internally produced surface water amounts to 29 km<sup>3</sup>/yr, while groundwater is estimated at 26.3 km<sup>3</sup>/yr. About 22.9 km<sup>3</sup> of surface water enter the country annually. The Akosombo Dam was completed in the mid-1960s and impounds the Volta River to form Lake Volta, one of the largest artificial lakes. The hydropower capacity of the dam is 912 MW. Lake Volta has a surface area of 8 502 km<sup>2</sup>, a maximum depth of 91 m and a capacity of 147.96 km<sup>3</sup>.
43. The main consumptive water uses in Ghana are for domestic, industrial and irrigation purposes. In 2000, about 652 million m<sup>3</sup> were withdrawn for irrigation 235 million m<sup>3</sup> for domestic purposes (24%) and 95 million m<sup>3</sup> for the industry (10%), giving a total water withdrawal of 982 million m<sup>3</sup>. Current water use for hydroelectricity generation (only at the Akosombo Dam), which is non-consumptive water use, is 37.843 km<sup>3</sup>/yr. The sources of water supply in the country are surface water and groundwater. Groundwater is usually abstracted from boreholes for most rural areas. Falling groundwater levels have been observed in the Upper Regions where over 2,000 boreholes have been drilled since the mid-1970s in the rural areas to provide potable water to communities.

44. The Volta River is shared by 6 countries: Ghana, Côte d'Ivoire, Togo, Burkina Faso, Benin and Mali. There is no mechanism to develop the Volta River together, but a permanent joint commission has been set up to discuss ways of sharing benefits and increasing cooperation for better management of the Volta river basin. Developments in the White Volta Basin by Burkina Faso affect Ghana since it is downstream. This is creating insecurity and conflict, as it is perceived to be the cause of the drop in water level in Lake Volta below the minimum operating level of the Akosombo hydropower plant. Ghana shares hydropower created at Akosombo and Kpong hydropower plants with all the riparian countries except Burkina Faso and Mali.
45. The development of formal irrigation is comparatively recent in Ghana. Total irrigation potential has been estimated at 1.9 million ha. The first scheme was initiated in the early 1960s and 22 public irrigation schemes existed in the country by 2003. In 2000, the total water-managed area in Ghana was estimated to be 30,900 ha. Because most of the public irrigation schemes have deteriorated and need some form of rehabilitation, they are operating at low levels of overall efficiency.
46. The major irrigated crop is rice, with a harvested area of 5,238 ha in 2002. Other frequently produced crops include tomatoes, okra, peppers, aubergine, sugar cane, cucumber, cowpea and maize. Surface water is primarily used to irrigate the developed areas through gravity, pumping or a combination of the two. For most of the irrigation projects in the country, dams have been constructed to store water to be used for irrigating the lands. In a few cases, weirs are built on perennial rivers for irrigation water abstraction.
47. **The mining sector:** Mining is an important economic activity in Ghana, contributing significantly to the country's export earnings, government revenues, and employment. Mineral revenue represented about 4.1% in the national GDP and about 9% of government revenues, and the formal mining sector employed some 15,000 workers in 2004, according to the Minerals Commission. The Minerals Commission estimates that artisanal and small-scale miners, often called "galamsey," might account for an additional 500,000 people. Many of those involved in artisanal and small-scale mining (ASM) are women and children, and a significant number of them are informal participants in the sector.
48. Gold is by far the largest and most important mineral resource in Ghana making up 93% of all mining exports and attracting 60% of all foreign investment. Although the mining sector has seen an impressive growth since the launch of the Economic Recovery Program (ERP) in 1983, it has slowed down and turned to negative over the last few years mainly due to decreasing production capacity in several large mines. Mineral production in Ghana, however, is set to expand as several new mines become operational in the coming years.
49. Over the past two decades, major players in the mining industry have increasingly recognized both the need and obligation to identify and mitigate the adverse environmental consequences of their activities. Today, most large-scale mining operators have elaborated comprehensive environmental impact assessment and management plans. In many cases, environmental problems in large-scale mining are a legacy of past mining operations. Concerns of communities and civil society organizations in Ghana in relation to mining are focused mainly on land use and inadequate compensation systems.

#### **D. INSTITUTIONAL CONTEXT**

50. The national institutions of relevance to this project are: Ministry of Food and Agriculture (MOFA); Ministry of Environment, Science and Technology (MEST), Environmental Protection Agency (EPA); Ministry of Trade and Industry

(MOTI); Ministry of Energy; Energy Commission; Ministry of Water Resources, Works and Housing (MWRWH); Water Resources Commission (WRC); Ministry of Lands and Natural Resources (MLNR); The Forestry Commission (FC); The Ghana Meteorological Agency (GMet); Ministry of Finance and Economic Planning; Ministry of Local Government and Rural Development (MLGRD); Ministry of Women and Children's Affairs (MOWAC); The National Disaster Management Organization (NADMO).

51. The sub-national government level is established at regional, district and sub-district levels, and comprises: Regional Co-ordinating Councils, District Assemblies, Urban/Zonal/Town/ Area councils, and Unit Committees.
52. International Organisations include: the African Development Bank (AfDB), the World Bank (WB), the European Union (EU), the Japanese International Cooperation Agency (JICA), the Danish International Development Agency (DANIDA), the Canadian International Development Agency (CIDA), UN organizations (UNDP, UNEP, FAO, IFAD), The Netherlands Development Cooperation, German Agency for Technical Cooperation (GTZ), Swedish International Development Cooperation Agency (SIDA), the United States Agency for International Development (USAID), and the Brazilian Cooperation Agency among others.
53. **Ministry of Food and Agriculture (MOFA):** MOFA has statutory responsibility for agriculture development in Ghana, except cocoa, coffee and forestry. Its key roles include designing, planning, monitoring and evaluating national policies and Programmes in agriculture. Direct implementation of these Programmes is delegated to other specialised agencies (extension, post harvest, etc.) and/or District Assemblies. MOFA also has an important role in promoting private sector development, including information, statistics and advice to agricultural operators.
54. A National Agriculture Advisory Committee (NAAC) provides the linkage between MOFA and other Ministries, Departments and Agencies (MDAs). The NAAC is supposed to approve the Annual Plan of Work and Budget. In 2000, MOFA launched the Accelerated Agricultural Growth and Development Strategy (AAGDS) to accelerate agricultural GDP growth to 6%, and thereby enabling the sector to contribute to the envisaged economic growth to middle income country. The AgSSIP is one of the major instruments for implementing AAGDS.
55. MOFA established the Women in Agricultural Development directorate in 1989 as a means of enhancing policy-making and implementation of gender sensitive measures to benefit women's agricultural productive activities. Even though MOFA has developed a gender strategy on agricultural development, the interventions have not fully taken climate change impacts into account.
56. The Ghana Irrigation Development Authority (GIDA) under the Ministry of Food and Agriculture (MOFA) focuses mainly on water conservation and irrigation, and is responsible for the development of the country's water resources for irrigated farming, livestock watering and supports fish culture in irrigation ponds and dams. GIDA dams also serve as sources of water for domestic supplies in many rural communities.
57. MOFA is implementing a Root and Tuber Improvement and Marketing Programme (RTIMP), sponsored by the International Fund for Agricultural Development (IFAD) and the Government of Ghana (GoG) for a period of 8 years (2007-2014). The programme, implemented across 60 districts, aims at developing the R&T subsector by supporting commodity chain linkages, increasing and improving R&T production, and upgrading of small-scale R&T processing, business and marketing skills.

- 58. Ministry of Environment, Science and Technology (MEST):** The establishment of the Ministry of Environment was a major outcome of the 1992 Earth Summit. The Ministry has an advisory committee with a secretariat to facilitate the implementation of Agenda 21. MEST hosts a national Committee on Climate Change with the mandate of reviewing policies and programs to complement national priorities and contribute to reduction of greenhouse gas emissions and an increase in carbon sinks. The Ministry is the focal point for UNFCCC activities.
- 59. Environmental Protection Agency:** Ghana also enacted the Environmental Protection Agency Act 1994 (Act 490) as a regulatory and enforcement agency. The Act ensures the application of a set of systematic measures to promote compliance in accordance with Environmental Impact Assessment procedures and measures. EPA is the main Country Implementation Institution (CII) for the technical coordination of activities on climate change, the UNFCCC and other environmental conventions ratified by Ghana (EPA). A national climate change focal point is in place under the Conventions and Projects Implementation Department to act as the "desk" for the implementation of climate change-related issues. The "desk" coordinates the activities of working groups and climate change study teams to support the implementation of Climate Change Project activities.
- 60.** EPA also covers the protection of water resources and regulation of activities within catchment areas including setting effluent standards.
- 61.** The **Ministry of Water Resources, Works and Housing (MWRWH)** is the lead government institution responsible for overall policy formulation, planning, coordination, collaboration, monitoring and evaluation of programmes for water supply and sanitation. The Water Directorate of MWRWH is the focal point for coordination of the water and water-related sanitation sector for policy harmonization, sector-wide monitoring and evaluation of GPRS outcomes and MDG targets as well as coordination of foreign assistance. The MWRWH's main focus is on overall water resources management and drinking water supply, while other sector ministries deal with sector-related water uses such as irrigation under MOFA, and hydro-power under Ministry of Energy. The key agencies of MWRWH carrying out the ministry's water resources management and drinking water programmes are the Water Resources Commission (WRC), the Ghana Water and Sewerage Corporation (GWCL) and the Community Water and Sanitation Agency (CWSA).
- 62.** The Ghana Water Sanitation Commission (GWSC) was made responsible for the provision, distribution and conservation of both the urban and rural water supplies in Ghana for public, domestic and industrial purposes. A Community Water and Sanitation Division (CWSD) was established within the GWSC to manage the National Community Water and Sanitation Programme (NCWSP) for water and sanitation in rural communities and small towns. The CWSD was transformed into the Community Water and Sanitation Agency (CWSA) in 1998, charged with coordinating and facilitating the implementation of the NCWSP in District Assemblies.
- 63.** The Water Resources Information Services (WRIS) institutions (i.e. the Hydrological services Department, the Water Research Institute under the Council of scientific and Industrial Research, and the Ghana Meteorological Agency) provide data and other water resources related information and services to support planning and decision making.
- 64.** The **Water Resources Commission (WRC)** has the mandate to regulate and manage Ghana's water resources and co-ordinate related government policies. The Commission, which provides a forum for integration and collaboration of different interests, is composed of the major stakeholders



involved in the water sector. The commission aims to establish an adequate and cost effective organization and good working relations among all parties, including the private sector, to support Integrated Water Resources Management (IWRM) principles in the management and regulation of the nation's water resources. The WRC functions are: processing of water rights and permits; planning for water resources development and management with river basins (catchments) as the natural units of planning; collating, storing and disseminating data and information on water resources in Ghana; monitoring and assessing activities and programmes for the utilisation and conservation of water resources.

65. **Ministry of Lands and Natural Resources:** This Ministry is entrusted of the management of Ghana's land, forest, wildlife and mineral resources for the sustainable socio-economic growth and development of the country. There are three main institutions dealing with forests: the Forestry Commission (FC), the Office of the Administrator of Stool Lands (OASL) and finally the Land Valuation Board. The most important institution within the forestry sector in Ghana is the Forestry Commission (FC), which is responsible for "the regulation of the utilization of forest and wildlife resources, the conservation and management of those resources and the co-ordination of policies related to them. It consists of three main divisions: the Forestry Services Division (FSD), the Wildlife Division (WD) and the Timber Industry Development Division (TIDD).
66. The FSD is responsible for planning, management, monitoring and control of timber utilization in the on-reserves and the off-reserves (Hansen and Owusu 2007). There are 10 regional offices, each headed by a regional forest officer, in addition to several forest district offices. The WD is managing all wildlife protected areas and wetlands in the country. It is also responsible for monitoring and inventorying of these areas. The TIDD is focused on tracking the movements of wood products in the economy. The division is also responsible for establishing certified product standards as well as promoting improved efficiency of timber processing and reduced waste in the sector.
67. **The Ministry of Trade and Industry (MOTI)** is the lead policy advisor to government on trade, industrial and private sector development with responsibility for the formulation and implementation of policies for the promotion, growth and development of domestic and international trade and industry. The Ministry is also the advocate for the private sector within the government and is the principal agency responsible for monitoring and implementing the Government's private sector development programmes and activities.
68. The Rural Enterprises Programme (REP) is part of the development program of MOTI to create wealth and reduce poverty in rural areas. It contributes directly to the Ghana's GPRS II, and is funded mainly by the Government of Ghana, the International Fund for Agricultural Development (IFAD) and the African Development Bank (AfDB). The goal of REP is to contribute to the reduction of poverty and improvement in the living conditions of the rural poor, and especially increase the incomes of women and vulnerable groups through increased self and wage employment. The immediate project objective is to contribute to the development of competitive rural micro and small-scale enterprises (MSEs) in participating districts backed by good quality, relevant and sustainable support services.
69. **Ministry of Women and Children's Affairs (MOWAC):** The Ministry of Women and Children (MOWAC) is the lead agency responsible for implementing the National Gender and Children's policy launched in September 2004.
70. Ghana established the National Council on Women and Development (NCWD) in 1975 as a response to the UN's mandate that member countries demonstrate commitment to the promotion of women's rights. The NCWD

succeeded in supporting women in a number of areas, such as providing micro-credit opportunities for income-generating activities, passing a number of laws such as the Intestate Succession Law, and building awareness and sensibilization. The NCWD was transformed into the Ministry of Women and Children's Affairs (MOWAC) in 2001. Policy issues on water that affect the wellbeing of women and children is within the mandate of MOWAC. However, similar to the NCWD, MOWAC has not succeeded in articulating specific gender concerns in policy arenas. Even though it has actively participated in the Ghana Poverty Strategy Paper (GPRSP), as well as the Growth and Poverty Reduction Strategy (GPRSP II), the outcome documents have not sufficiently taken gender relations into account.

71. The **National Disaster Management Organization (NADMO)** leads the disaster response network. It is a constitutionally mandated government agency that coordinates emergencies. NADMO has offices at regional, district, and zonal level as well as a network of Disaster Volunteer Groups (DVGs), organized and trained to deal with disasters, inform about disaster preparedness and response locally. A National Platform for Disaster Risk Reduction was launched in 2006.
72. The **Ghana Meteorological Agency (GMet)** engages in various activities to provide weather and climate information to users. Recently, GMet became an agency, which enables it to sell data and deliver data on demand. Their products include five-day weather forecasts issued on a daily basis. GMet also collects statistical data from 22 synoptic weather stations and approximately 200 rain gauges across the country with records extending back to 1961. Furthermore, it participates in regional collaborative efforts with West African World Meteorological Organization (WMO), which include development of three to six months' seasonal forecasts. GMet has also participated in some international work on climate scenarios i.e. in collaboration with the Intergovernmental Panel on Climate Change (IPCC) and the University of East Anglia, UK. It appears that the role of GMet is neither well defined nor integrated in the climate change action plans of other institutions, and much of the information it generates is apparently not widely disseminated or used. Improving dialogue and collaboration between GMet and various users of their information such as EPA, the water sector, agriculture, and the health sector is very much needed.
73. The **Ministry of Local Government and Rural Development (MLGRD)** is responsible for the coordination of local government functions as the Local Government Secretariat, with the political role to nominate District Chief Executives (DCEs) and 30% of the District Assembly (DA) members to be appointed by the President of the Republic. The Ministry also issues instructions and directives to other Ministries, agencies and departments as relates to decentralization. It also monitors the decentralization process and the effectiveness of local government, advises the government on local issues, administers training institutions for local government, provides advise on the review of local administrative boundaries and issues guidelines to and approves the by-laws of the DAs. The National Development Planning Commission (NDPC) provides guidance and assistance to DAs in producing district development plans.
74. **Sub-national government structure:** A three-tier structure of sub-national government is established at regional, district and sub-district levels, and comprises Regional Co-ordinating Councils which main function is to co-ordinate and regulate the DAs in their respective regions (10), District Assemblies (110) Urban, Zonal, Town and Area councils (1300), plus Unit Committees (16,000). The District Assembly (DA) remains the key institution. The financing of local government, is secured through the establishment of the District Assembly Common Fund (DACF). This is determined annually by Parliament, but with allocations not less than 5% of the total revenues of Ghana.

75. **Agricultural Research and Development (R&D) (from Flaherty et al, 2010):** The Council for Scientific and Industrial Research (CSIR) -under MEST- is the main governmental research organization in Ghana, encompassing 13 research agencies, 9 of which conduct agriculture research activities<sup>3</sup>. CSIR accounts for about two-thirds of total researchers and one-half of total spending on agricultural R&D in Ghana. Agricultural research and development (R&D) spending in Ghana has more than doubled during 2000-2008, largely as a result of rising capacity (537 full-time equivalent research staff employed in 2008), salary costs, and increased funding for the Cocoa Research Institute of Ghana (CRIG) following the country's boost in cocoa production. This reflects a policy environment in which the government of Ghana has recognised the importance of the agriculture sector, and R&D in particular, supporting the country's national development agenda.
76. The largest agricultural higher education agency in 2008 was the College of Agriculture and Consumer Sciences at the University of Ghana (UG). The other higher education agencies that conduct agricultural research are various faculties and departments at the Kwame Nkrumah University of Science and Technology (KNUST), the University of Cape Coast (UCC), the University of Development Studies (UDS), and the University of Education Winneba. Generally, the role of the higher education sector in Ghanaian agricultural R&D has become more prominent in recent years.
77. Female researchers constituted 17% of total agricultural research staff in Ghana in 2008. The share of female staff varied significantly across CSIR agencies and has changed very little compared with data from 2001.
78. The focus of agricultural research in Ghana was predominantly on crops, being cassava, cocoa, maize, and rice the most heavily researched. In 2008, crop genetic improvement accounted for 15% of total full time researcher time, while 10% of researchers focused on crop pest and disease control. Water was also a major theme, with a 9% share of total full time researchers.
79. In order to ensure sustained funding of research, partnerships between private sector firms (including farmer groups) and NGOs have been encouraged. The concept of research-extension-farmer linkages (RELCs) was introduced to increase participation of end users in technology development. Nevertheless, non-profit and for profit private companies, although involved in some collaboration with CSIR and the higher education agencies, have so far minimal involvement in agricultural R&D in Ghana.
80. Agricultural R&D is funded primarily by the government, with contributions from donors (i.e. UN agencies and several governmental aid agencies). IFAD has been a major source of funding for R&D at several CSIR agencies, such as SRI and PGRRI through the Root and Tuber Improvement and Marketing Program (RTIMP), which ran from 1999 to 2005 and provided US\$10 million—mostly for cassava improvement. RTIMP expanded on this program to include additional types of roots and tubers and a marketing component at a cost of US\$28 million for 2006–14.

## E. NATIONAL POLICIES AND LEGISLATION

81. Most environmental and agricultural policies and strategies in Ghana reflect sustainable management concerns. The principles of the sustainable management of environmental resources, sustainable use of land, and restoration

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<sup>3</sup> The Animal Research Institute (ARI), the Crops Research Institute (CRI), the Soil Research Institute (SRI), the Oil Palm Research Institute (OPRI), the Food Research Institute (FRI), the Forestry Research Institute of Ghana (FORIG), the Plant Genetic Resources Research Institute (PGRRI), the Savanna Agricultural Research Institute (SARI), and the Water Research Institute (WRI).

of the productive capacity of degraded resources are captured in most of the sectoral policies and action plans. These include Ghana's Environmental Policy, the National Environmental Action Plan (NEAP), the Soil Fertility Management Plan, the Accelerated Agricultural Growth and Development Strategy (AAGDS), and the recently formulated National Wildfire Policy and Water Policy, among others.

82. The **National Land Policy** is the key policy that addresses land sector issues in Ghana. This policy strives toward the judicious use of the nation's land and other natural resources in support of the various socioeconomic activities, and endorses the principle of sustainable resource management. More specifically, the Land Policy provides the framework for dealing with the issues of land ownership, security of tenure, land use, and conservation on a sustainable basis. The National Climate Change Adaptation Strategy (NCCAS) propose the need for a thorough review of the National Land Policy, with a special focus on the process of land degradation and its interrelationship with climate change. Finally, the National Action Program to Combat Drought and Desertification (NAP) provides a long-term strategy to address land degradation in affected areas in Ghana.
83. **Land Tenure:** Complex and uncertain land tenure relations seem to hamper private investments in Ghanaian agriculture. Some recent estimates suggest that as much as about 80% of Ghana's arable land is uncultivated, in part due to insecure property rights. Reform of land tenure systems under customary tenure is a sensitive issue and poses a severe long-term challenge. There is much change occurring in land tenure systems currently, under the impetus of new interests and market pressures, and the Government has initiated a new Land Policy and a Land Administration project that seeks to address land issues comprehensively. But these changes fall short of laying out an action plan or an implementing strategy. The general sense is that land is still a major constraint on agricultural investments, both for small farmers and for commercial investments. There is a need to speed up the pace of reform here in a pro-agriculture policy approach.
84. **Decentralisation:** Ghana has a unique decentralized system of government. This was introduced in 1998, with the creation of the District (including Metropolitan and Municipal) Assembly system. In 1994 the concept was strengthened by the introduction of the funding mechanism known as the District Assemblies Common Fund (DACF) under which 5% of the national budget is allocated to Districts. Decentralization has been extended to lower levels, with the creation of 1,800 Urban/Zonal/Town Councils, and 16,000 Unit Committees in charge of issues such as the registration of births and deaths, organization of communal labour, revenue raising and public education campaigns. The District Assemblies (DAs) collect their own revenues in the form of property taxes, uses fees, licenses and permits.
85. There are 110 DAs, three of which are Metropolitan Assemblies (Accra, Kumasi and Shama Ahanta with population over 250,000), and three of which are Municipal Assemblies (with population over 95,000). DAs have been established as planning authorities by the Local Government Act of 1993, and by the National Development Planning Act of 1994. District Planning and Co-ordinating Units (DPCUs) ensure that planning functions of DAs are undertaken, and carry out the following functions: (i) advise and provide a secretariat for the DA in its planning, programming, monitoring, evaluation and co-ordination functions; (ii) co-ordinate the planning activities of sector development-related departments/agencies in the district; synthesise strategies related to the development of the district into a comprehensive and cohesive framework; formulate and update district development plans; provide information required for planning at the national level. They are involved in the preparation of five-year district development plans

and monitoring implementation of projects financed through the DACF and by donors.

86. Regional Co-ordinating Councils (RCCs) regulate and co-ordinate the DAs in the 10 regions of Ghana. The RCCs comprise the Regional Minister (a government appointee and representative of the central government in the region as chairman), his deputy, two representatives of the Regional House of Chiefs, the District Chief Executives (DCEs), and the Presiding Members of the DA in the Region.
87. Decentralization in Ghana faces a number of weaknesses: (i) the appointment of the DA Major by the President of the country undermines the district representative's accountability as he/she tends to respond more to central government requests than to local demands; (ii) staff at local government level have two masters -their parent ministries and the DAs- and they tend to be more responsive to central government because of career progression incentives and reception of funds; (iii) there is little clarity at the various levels of government and sectoral ministries about what decentralization means for the transfer of power, functions and resources; (iv) inadequate overall funding and significant weaknesses exist in the DAs control for the expenditures of the 5% of national tax revenues and parent ministries disbursements –fiscal decentralization-, which according to the GPRS is a key impediment to local development; (v) planning at the local level is also constrained by scarcity of staff and skills at the DPCUs; (vi) growing disputes over local government boundaries, as there is an absence of maps that firmly indentify them.
88. **Growth and Poverty Reduction Strategy (GPRS):** The second GPRS (2006-2009) is the framework based on which the government addresses prevailing poverty in the country. The GPRS II builds on the progress made under the first GPRS (2002-2004), which saw increased macroeconomic stability with a GDP growth of 5% during that period. While working towards an increase of the average income per capita from USD 400 to USD 1000 by 2015, the government is complementing this endeavour with the implementation of a social protection policy. This policy aims to support and empower those who need it most and who have been left behind during the years of economic development, which disproportionately includes women, children, the unemployed youth.
89. The GPRS II is driven by internationally agreed development objectives addressing poverty reduction (mainly the MDGs and the targets set under the New Partnership for African Development –NEPAD) and is based on the following priority areas: (i) continued macroeconomic stability and growth; (ii) accelerated private sector led growth, with a major focus on the rural economy and the modernization of agriculture; (iii) vigorous human resource development, ensuring access and improved quality of social services, safe drinking water and the provision of a clean environment; (iv) specially designed programmes targeting the poorest and most vulnerable in society, ensuring their access to social services and employment opportunities; (v) good governance and civic responsibility, mainly through decentralization and capacity building.
90. The current global rise in food prices and increased emphasis on food security provides a good opportunity for smallholder farmers and rural enterprises to raise incomes through better integration into markets and agricultural value chains. The GPRS attributes rural poverty largely to poorly-functioning markets for agricultural outputs and to low productivity because of the reliance on rudimentary technology, farming practices and low-yielding inputs. The government wishes to put in place measures to encourage farmers to shift from subsistence agriculture to market-oriented production using simple but relatively more advanced technologies and getting involved in non-farm activities such as processing. The Rural and Agriculture Finance Programme (RAFIP) will help

increase their access to financing by strengthening capabilities of farmers and their associations, developing financial and risk management products, and linking financial institutions to agencies providing technical support to agricultural value chains.

91. The second United Nations Development Assistance Framework (UNDAF 2006-2010) will support the strategic areas of health care, increased gross enrolment and gender equity in basic education, support productive capacity for sustainable livelihoods, strengthen the national response to HIV/AIDS and help establish monitoring and evaluation processes supported by an effective data management information system. All activities target the population living in the most deprived districts of the country.
92. The second national Food and Agriculture Development Policy (FASDEP II) was finalized in 2007. For the first time, the policy officially recognized the centrality of agriculture in the national economy and the crucial role it plays in reducing food insecurity and poverty. Its strategy includes the set up and increased outreach of extension services in all rural areas, particularly in the three northern regions, increased productivity versus increased expansion of land area under cultivation, provision and maintenance of output market opportunities, etc. The FASDEPII is to be implemented through the Agriculture Sector Plan 2009-2015 and the Northern Development Initiative (NDI). The NDI is backed by the Northern Ghana Development Fund and it aims to strengthen the agriculture sector in the three northern regions. The initiative also includes a Food Assistance and Safety Net component specifically targeting the most vulnerable households in the region.
93. The Ghana Agriculture Sustainable Land Management Strategy and Action Plan (2009–2015) has been developed to operationalize portions of the National Land Policy that deal with agriculture land use and sustainable management of land and environment. The Strategy and Action Plan will support sustainable land and water management (SLWM) at all levels by focusing upon: (i) strengthening policies and regulations; (ii) building institutional capacity at all levels within the food and agriculture sector; (iii) promoting technologies for scaling-up of SLWM practices; (iv) building technical capacity at all levels; (v) generating and managing SLWM knowledge to support policy and investment decisions; and (vi) establishing an effective incentive system for SLWM. The Government of Ghana (GoG) is also finalizing the Ghana Strategic Investment Framework (GSIF) for SLWM, which is a programmatic approach to addressing land degradation issues. The objective of the GSIF is to mainstream and scale-up SLWM in the development framework of Ghana at all levels to improve the governance of land management decisions, secure ecosystem services, and improve rural livelihoods.
94. To leverage the scope and impact of existing and planned SLWM interventions, the GoG established a multi-sector platform to improve investment programming. A National Sustainable Land Management Committee (NSLMC) was established in 2007 to promote the SLWM agenda at the policy and strategic level. The Committee is chaired by EPA and MEST, and includes representation from the MOFA, FC, WRC, Energy Commission, National Development Planning Commission, Ministry of Finance and Economic Planning, and Friends of the Earth Ghana. It prepared the GSIF in line with the model of the TerrAfrica partnership and has actively engaged with other regional partners.
95. **The Timber Resource Management Amendment Act** of 2002 provides that the right to harvest trees and extract timber from a specific area of land shall not be granted if there are farms on the land, unless the consent of the owners of the farms has been obtained, or if timber is already being grown on the land under the ownership of any individual or group of individuals. However this legislation has not significantly changed the relationship between timber

merchants and farmers, because most farmers are unable to show clear proof of ownership of trees on their farms. Farmers also tend to be uninformed about forest laws and lack the financial strengths of timber merchants. However, as a result of efforts by some non-governmental organizations, some farmers are now beginning to incorporate trees in their farmlands or to protect existing trees.

96. The Forest Plantation Development Fund Act established a government fund in order to provide financial assistance for the development of private commercial forest plantations. A National Forest Plantation Program was established in 2001 aiming at increasing the forest cover in Ghana by 20,000 hectares per year. The measures chosen to achieve this goal include the Modified Taungya System (MTS) in the on-reserves. An important component of the plantation program is the Community Forestry Management Project (CFMP) in collaboration with the African Development Bank. The CFMP aims to support the governments' poverty reduction program using community based forest plantation development strategies and alternative livelihood support schemes. There are currently five CFMP project sites, and the activities performed include capacity building and institutional strengthening, sustainable livelihood support and integrated forest management.
97. **Climate change:** Ghana signed the UNFCCC in June 1992 in Rio de Janeiro. The Convention entered into force globally on 21 March 1994 and specifically for Ghana on December 5, 1995. In 2002, Ghana's Parliament passed a resolution to ratify the Kyoto Protocol (KP) and the KP entered into force globally on 16 February 2005.
98. Ghana has advanced towards the country's commitment under the UNFCCC mainly through the implementation of climate change projects co-funded by the government with the support of bilateral and multi-lateral agencies. Project activities/studies undertaken in Ghana are:
- Inventory of national greenhouse gas emissions by source and removal by sinks for period 1990-1996 (UNDP/ GEF Project);
  - Vulnerability and adaptation Assessment of water resources and Coastal Zone under the Netherlands Climate Change Studies Assistance Programme Phase I (NCCSAP, Completed in year 2000.);
  - Vulnerability and adaptation assessment for Agricultural Sector (Cereal Production) (UNDP/GEF Project);
  - Mitigation Assessment for Energy, Land use change, and Forestry (UNDP/GEF Project);
  - Guidance for climate change policy Framework (UNDP/GEF Sponsored)
  - National Climate Change Scenario Development;
  - Capacity Building Programme for Clean Development Mechanism (UNEP/ RISØ Project);
  - UNIDO Industrial CDM Capacity Building Projects (UNIDO Project);
  - Preparation of Ghana's Initial National Communication (UNDP/GEF Project);
  - Climate Change Technology Needs and Needs Assessment (UNDP / GEF);
  - The Netherlands Climate Change Assistance Programme Phase 2 (NCAP) to assess impacts of climate change on: human health, fisheries, agriculture (Cocoa and Roots & tubers), land Management (biodiversity, land degradation/ erosion/land use), women's vulnerability to climate change, linkages between Ghana Poverty Reduction Strategy and Climate Change;
  - UNEP Project Support for Article 6 of the Convention – Education, Training and Public Awareness.
99. A significant achievement is the preparation and submission of Ghana's Initial National Communication. The initial national communication was completed in December 2000 and was submitted to the Conference of Parties in March 2001.

100. The idea to prepare a **National Climate Change Adaptation Strategy (NCCAS)** started in 2006 as part of the Netherlands Climate Assistance Programme (NCAP). The NCCAS is the sum of expert views as well as views from governmental and non-governmental organizations, and the private sector both at national and international levels. One of the major driving forces behind the development and finalization of the NCCAS was the acceptance of the national adaptation strategy as a trigger for sector budget support by the Ministry of Finance and Economic Planning under the Natural Resource and Environmental Governance (NREG) programme.
101. The NCCAS provides an overview of the impacts of climate change on different sectors of the Ghanaian economy, and of the traditional adaptation/coping strategies and recommended measures to be taken to address the perceived long-term climate impacts. Priorities identified for increasing adaptation capacities include: (i) increasing national awareness (ii) mainstreaming climate change impacts and adaptation into sectoral policies, plans and programmes, (iii) addressing long-term investments risks, (iv) coping with extreme weather events, (v) improving observation and early warning systems, (vi) strengthening the research and development base, and (vii) enhancing partnership and international cooperation.
102. The National Water Policy includes a focus area on climate change and vulnerability.
103. It is clear that the government of Ghana views the issue of climate change as a critical one for policy-making, particularly in terms of how international commitments are translated into national measures and strategies for mitigation and adaptation. However, just as the efforts at the international level are limited, so are those in Ghana to incorporate gender concerns into the climate change discourse and processes. Even though National Adaptation Plans are in the process of being developed, gender issues and the involvement of women are limited.
104. **The Strategic National Energy Plan 2006-2020:** Should the Ghana GPRS targets to bring the country into a middle income range of USD 1,000 per capita in 2015 be fulfilled, demand for wood-fuels would grow from about 14 million tonnes in 2000 to 54-66 million tonnes by 2020, total petroleum fuel demand will rise from 1.6 million tonnes in 2000 to about 4.5 million tonnes by 2020, and the net final grid electricity consumption will grow from 6,900 Gigawatt/hour in 2000 to about 24,000 Gigawatt/hour by 2020. This will put the country's forests under serious stress, leading to extensive deforestation with major consequences on climate change, agriculture and water resources if significant action is not taken.
105. The Energy Commission of Ghana elaborated a Strategic National Energy Plan (SNEP) for the period 2006 – 2020 whose goal is to contribute to the development of a sound energy market that would provide sufficient, viable and efficient energy services for Ghana's economic development through the formulation of a comprehensive plan. SNEP's vision is to develop an '*Energy Economy*' that would ensure sustainable production, supply and distribution of high quality energy services to all sectors of the economy in an environmentally friendly manner while making significant contribution to the country's export earnings.
106. The following 10 broad objectives of the sector ministry are addressed by the SNEP energy policy: (1) Stimulate economic development by ensuring that energy plays a catalytic role in Ghana's economic development; (2) Consolidate, improve and expand existing energy infrastructure; (3) Increase access to modern energy services for poverty reduction in off-grid areas; (4) Secure and increase future energy security by diversifying sources of energy supply; (5)



Accelerate the development and utilization of renewable energy and energy efficiency technologies; (6) Enhance private sector participation in energy infrastructure development and service delivery; (7) Minimize environmental impacts of energy production, supply and utilisation; (8) Strengthen institutional and human resource capacity and R&D in energy development; (9) Improve governance of the Energy Sector; (10) Sustain and promote commitment to energy integration as part of economic integration of West African states.

107. The SNEP provides a number of policy recommendations by sectors. As far as the demand agriculture sector the SNEP recommends among other issues that the government: (i) devises a separate cost-effective tariff for the agricultural sector –mainly for irrigation and poultry production- to induce electricity consumption and growth; (ii) encourages commercial agricultural projects to meet at least 10% of own energy by providing incentives to develop appropriate alternatives with emphasis on electricity in order to promote decentralised and mini-grid countrywide to complement the national electrification programme, especially in remote areas; (iii) encourages energy efficiency measures in irrigation and other agricultural activities using agricultural inputs as incentives undertakes capacity building, information and awareness campaigns.
108. In terms of policy recommendations for the supply wood-fuel sector, the SNEP recommends the government to support the sustainable management of the country's natural forests and woodlands for sustainable supply of wood including wood-fuels through a number of implementation measures, among which: (i) encourage and assist local community groups or individual entrepreneurs to establish woodlots or plantations to ensure sustainable supply of wood; (ii) introduce wood-fuel production contracts, and define rights and responsibilities of fringing landowning communities in forest reserve management and in the harvesting and sale of the wood-fuels; (iii) support development and introduction of improved technologies and higher levels of efficiency in the production and consumption of wood-fuels, including capacity building to increase the professionalism of fuel-wood producers; (iv) revise the current wood-fuel taxation system to ensure that taxation of wood from sustainably managed areas is less than from unsustainably managed ones and that a substantial part of the tax revenues is used for reforestation and support of sustainable management of woodlands; (v) undertake continuous Energy Efficiency and Conservation Awareness campaign targeting all levels of consumers; (vi) monitor the health impact of wood-fuel production and use especially, on women and children and feed the information to stove designers and for policy formulation.
109. The SNEP objective for the renewable energy sector is to increase the use of renewable energy sources to 10% of the national energy mix by 2020. In terms of policy recommendations, the SNEP recommends the government among other issues to: (i) investigate innovative capital subsidy arrangements and micro-financing to assist rural communities acquire Renewable Energy Technologies and provide decentralised renewable energy systems for individual and commercial needs; (ii) support the promotion of local manufacturing of renewable energy devices and equipment in the medium-to-long term; (iii) develop a system of certification and standardisation in Renewable Energy Technologies in order to ensure high quality installation and performance.
110. The document Bio-Energy Policy (BEP) for Ghana, produced by the Energy Commission in 2010, addresses the policy issues and recommendations for achieving the overall objectives of the Government in ensuring sustainability of the bio-energy sector. BEP provides a number of recommendations: in terms of wood-fuels it recommends to support education, training and awareness creation as well as incentives for the use of improved technologies, sustainable supply, production and utilisation of wood-fuel. In terms of biomass waste it recommends to promote the use agricultural waste and waste cooking fats and oil as bio-fuel

feed stock, as well as provide incentives for use of waste and promote more efficient conversion technologies, and efficient and adequate pricing of energy produced from waste.

111. Being gender a major crosscutting policy issue in Ghana, the SNEP recommends the government to support awareness and advocacy on gender issues in the energy sector (i.e. campaign to address efficiency, health and safety aspects of energy cooking/processing appliances such as wood fuel stoves), and encourage the participation of women in energy programmes, conferences and workshops, to ensure that they are involved at all levels of the decision making process in the energy sector and that they collaborate with local administration to build and demonstrate good practices on sustainable energy uses.
112. **The National Water Policy** is intended to provide a framework for the sustainable development of Ghana's water resources. It is targeted at all water users, water managers and practitioners, investors, decision-makers and policy-makers within the central Governmental and decentralised (district assemblies) structures, non-Governmental organisations and international agencies. The policy also recognises the various cross-sectoral issues related to water-use and the links to other relevant sectoral policies such as those on sanitation, agriculture, transport, and energy. Given the dynamics of water resources availability, utilisation and the relationship with the environment, the policy needs to be reviewed periodically to incorporate necessary changes that may come with time.
113. Consistent with the GPRS, MDGs and NEPAD short term action plan, as well as the Africa Water Vision 2025, the overall goal of the National Water Policy (NWP) is to "achieve sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations". This will be achieved by addressing relevant issues under water resources management, urban water supply and community water and sanitation.
114. In order to meet the IWRM policy objectives, the government will adopt water resources planning as a crosscutting basic component of national economic planning and ensure preparation of IWRM strategies by appropriate and skilled institutional structures, using the various river basins as the planning units. Water resources planning will recognise the "environmental flow" requirements, and will promote partnerships between the public and private sectors for the protection and conservation of water resources through the use of cleaner and efficient technologies, effective waste management and sound land management and agricultural practices; It will also ensure cost recovery and sustainability of water projects, taking into account the specific needs and preferences of the poor.
115. District Assemblies will assume a central role in maintaining the integrity of aquatic ecosystems, supporting rural community on the establishment, management and maintenance of water use efficient techniques, small-scale irrigation and other food production facilities, promoting partnership between the public and private sectors, and encouraging the efficient use of fertilizers to reduce pollution of water bodies and ensure conservation of water.
116. The Government of Ghana formally launched the National Community Water and Sanitation Programme (NCWSP) in 1994 to address the problems of water and sanitation in rural communities and small towns. An underlying principle of the NCWSP is its emphasis on community ownership and management (Com), which entails effective community participation in the planning, implementation and management of the water and sanitation facilities in the belief that, as custodians, communities will ensure the sustainability of these systems. All water and sanitation interventions must recognise and protect the specific needs and roles of women, men and children and the physically

challenged. Women must be seen not only as beneficiaries and water users, but also as water and waste managers and decision-makers.

## II. THREATS, ROOT CAUSES AND BARRIERS ANALYSIS

### A. THREATS

117. **Environmental Degradation:** Natural resources are diminishing in Ghana at an alarming rate. For instance, the survival of the Ghanaian forest has been seriously threatened by the activities of slash-and-burn farmers, poachers, timber companies, and illegal gold miners. Between 1990 and 2010, Ghana lost around 25,080 km<sup>2</sup> of its forest cover, with a deforestation rate of an average of 2% per year (between 115,000 and 135,000 ha/yr). Open woodlands/savannah decline by 37% in the second half of the 20<sup>th</sup> century, from 111,000 km<sup>2</sup> to 69,000 km<sup>2</sup>.
118. In the dryer transition zone above Kumasi, bushfires and overexploitation have eliminated several forest reserves. According to research, bush burning, a widely applied land management practice by many farmers with the intention to improve soil fertility, has demonstrated to have devastating effects on the environment. In livestock rearing areas bush burning often destroys livestock's fodder for the dry season.
119. Recent estimates of the cost of environmental degradation suggest that nearly USD 850 million or an equivalent of 10% of GDP is lost annually. The unsustainable management of the country's natural wealth (forests, wildlife, fisheries, and land resources) costs at least USD 520 million annually, while health effects from environmental problems (water supply and sanitation, and indoor and outdoor air pollution) account for nearly USD 330 million. The cost of environmental degradation to GDP represents almost one half of Ghana's USD 1.5 billion annual Overseas Development Assistance (ODA). Among the natural assets, the large majority of the estimated costs of environmental degradation come from forest depletion in- and off-reserves (63% or 3.5% of GDP). Rapid population growth fuels the demand for more agricultural land and for fuel-wood and other wood products (e.g., charcoal). The reduction of soil fertility/productivity in turn forces farmers to expand their cultivated lands and clear forest areas. The poor enforcement of regulations favours unsustainable logging practices and indiscriminate fuel-wood extraction. A market price that is lower than the real value of wood further contributes to overexploitation of forestry resources in the country.
120. The depletion of these natural assets is interrelated and self-perpetuating. For example, a scarcity of fish stocks usually results in increased pressure on wildlife. Similarly, the loss of soil fertility often leads farmers to clear forests and savanna woodlands in search of productive land. A growing population can further exacerbate the ongoing depletion of natural resources and the associated economic losses.
121. There is an urgent need for Ghana's policy makers to take action and stem this trend. Rehabilitation and sustainable management of key natural resources

like forestland can significantly contribute to future growth. In fact, estimates suggest that Ghana's natural resources contribute twice as much to current social welfare as does produced capital. Policies, regulations, institutions, and incentives across sectors must be aligned to ensure sustainable development, or a "positive" genuine savings rate.

122. **Deforestation:** Deforestation and forest degradation in the country is due to a combination of factors, becoming a key element the extent of illegal logging. For instance, conservative estimations of timber harvest in 2005 provide the figure of 3.3 million m<sup>3</sup>, which is equivalent to more than three times the allowed annual cut. A large amount of the illegal logging is performed by chainsaw lumbering operators, which are often operating on a relatively small scale. Commercial chainsaw lumbering was banned in 1998, however this has not been effectively enforced and the chainsaw lumbering is estimated to be equal in size to the formal conventional timber sector.
123. Charcoal production in the country is still largely based on the rudimentary earth mound technology which is low yielding consuming between 4 – 6 tonnes of wood per every tonne of charcoal produced. Market forces regulate the trade and uncontrolled demand could pose a high environmental risk to the resource base. The production of charcoal in this manner releases a lot of methane gas and other greenhouse gases. Households' wood-fuel utilisation was responsible for about 68% of carbon monoxide (CO), over 50% of methane (CH<sub>4</sub>) and about 68% of nitrous oxide (N<sub>2</sub>O) emissions of the country, all global warming gases.
124. In late 80's two major programmes were instituted to address the issue of inefficient end-use devices used for cooking. These were the: (i) promotion of LPG as a means of achieving energy conservation through fuel shifting to more efficient LPG stoves; and (ii) nationwide promotion of the Ahibenso improved charcoal cooking stove, which was meant to replace the traditional "coalpot". The Ahibenso Improved stove was introduced on the market in 1989. This improved coal pot saves between 35-40% of charcoal over and above the traditional coalpot. Furthermore an expenditure survey conducted among households indicated that it saved between 15-20% of the amount of money normally spent on charcoal. The wood-fuel efficiency programme however fizzled out by the mid 1990s after the Ministry's funding ended.
125. **Land degradation and Soil erosion:** land degradation is increasingly affecting land resources in Ghana, namely in the form of soil erosion. According to the GLASOD<sup>4</sup> survey, 69% of the total land surface in Ghana is affected by moderate to severe erosion. This percentage is well above the average for degraded land area in Sub-Saharan Africa. Soil erosion is present in all agro-ecological zones and regions, although the most vulnerable zones are the inland savannahs, which cover about 50% of the country. Runoff plot studies in bare land in various ecological zones of Ghana show soil losses ranging from 187 t/ha/yr to 0,6 t/ha/yr. Chemical degradation of the soil is considered the second most severe process of land degradation in Ghana. The annual depletion of soil nutrients in 2000 was 35 Kg N, 5 Kg P and 20 Kg K/ha.
126. A recent study<sup>5</sup> estimated land degradation to annually cost around 2% of the national GDP, thus limiting the capacity of Ghana to fulfil its full potential for growth. This figure corresponds to an estimated cost in annual production loss of around 4-5% of the AGDP. Sustainable utilization of the country's land resources is therefore a necessary precondition for achieving and maintaining the economic growth rate necessary for Ghana to reach its main development objectives of attaining the status of middle-income country.

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<sup>4</sup> Global Assessment of Human Induced Soil Degradation.

<sup>5</sup> World Bank, DFID, and ISSER study (2005).

127. Approximately 72% of the whole land area of the country is considered vulnerable to desertification, which is already affecting 40 % of the territory. According to the National Action Programme to Combat Drought and Desertification, the land area prone to desertification has almost doubled in the last decades. The expected raise in population growth and food demand in the next decades will exacerbate this problem.
128. Unsustainable farming practices (particularly the traditional bush-fallow system) and removal of vegetation cover (mainly through deforestation and overgrazing) are the main direct causes of land degradation in Ghana. It is estimated that more than two thirds of the degraded area in the country is a consequence of unsustainable agricultural activities, twice more on average than in Sub-Saharan Africa, according to FAO. Population growth and poverty are the main socioeconomic factors indirectly contributing to land degradation.
129. Land degradation associated with the loss in the quality and quantity of vegetative biomass and with deforestation—one of the major direct causes of land degradation in Ghana— has a major impact on ecosystem services (i.e. reduction of provision of wood and non-wood forest products for both for domestic consumption and for export; biodiversity loss; instability in hydrological regimes; reduction in the land’s resilience to natural climate variability and natural hazards). For example, the Volta River and Lake—which provide several ecosystem services that form the basis for a rich biodiversity and other environmental goods— have been increasingly damaged by severe environmental degradation in the form of lake level fluctuations, water scarcity, nitrification, and siltation mainly from watershed erosion and deforestation.
130. **Mining:** Environmental impacts of mining activity in general include deforestation, habitat loss, land degradation, and water and air pollution from waste dumps and tailings disposal. All of these impacts have contributed to poverty by negatively affecting livelihoods and health of the poor. In particular, the spread of toxic metals to the environment has been a major concern. Cyanide is commonly used for the recovery of gold from the ore in industrial-scale, hard-rock gold mining in Ghana. Other problems with mining include dust and noise pollution from blasting, and risk of water-borne diseases such as malaria from water collected in mine pits.
131. Artisanal and small-scale mining (ASM) is an important source of livelihood for many poor families and is characterized by poor technological practices with significant environmental, social, and health costs, particularly through the use of mercury for amalgamation. This is a serious threat to miners’ health and the environment. Constant exposure to mercury undermines miners’ health and increases medical costs, which further raises the need for and dependency on mercury to extract more gold. A number of studies have observed elevated levels of mercury in the hair, urine, blood, and nail samples of people residing in artisanal gold mining communities.

## B. CROSS-CUTTING THREATS

132. **Climate Change:** Ghana is highly vulnerable to climate change and variability, and the economy is particularly vulnerable because it is heavily dependent on climate-sensitive sectors such as agriculture, forestry and hydropower. The agriculture sector, in particular, is highly vulnerable because it is largely rain-fed with a very low-level of irrigation development. In fact, the predicted increased rainfall variability, and overall drop in rainfall will increase the chances of drought periods and probably reduce agricultural productivity.
133. Historical climate data observed by the Ghana Meteorological Agency across the country between 1969 and 2000 show a progressive and discernible

rise in temperature and a concomitant decrease in rainfall in all agro-ecological zones of the country.

134. Climate change projections are based on a number of IPCC GCM scenarios, so that the widest possible spectrum of climate changes variables are represented. A Global Wet and a Global Dry scenario were used for Ghana. In addition, a Ghana Wet and a Ghana Dry scenario were selected out of 56 IPCC GCM models' results to represent the wettest and driest scenarios applicable to Ghana. Although predictions do not diverge much for projected temperature increases, they vary substantially for precipitation changes.
135. **Temperature:** Based on historical data, Ghana has seen an increase in average temperature of approximately 1°C over the last 30 years. It is expected that mean daily temperatures will increase on average about 0.6°C by 2020, 2°C by 2050 and 3.9°C by 2100. The spatial variations in temperature increases are presented in the table below:

Table 3 – Change in temperature and annual rainfall predicted by 2100 in Ghana

Zone	Increased Maximum Temperature (°C) by 2100	Increased Minimum Temperature (°C) by 2100	Change in Mean Annual Rainfall by 2100 (mm)
Sudan Savannah	3	2.5	-170
Guinean Savannah	2.5	2.5	-74
Transitional	2.5	3	-78
Semi-deciduous Forest	2.5	2.5	-99
Rainforest	2.5	2	+110.5
Coastal Savannah	2.5	No data	No data

136. **Precipitation:** The relationship between increasing temperature and amount of rainfall was also studied both historically and in terms of future predictions. In the last 30 years, rainfall was found to have decreased by 20% and runoff by 30%. Based on future scenarios, it is projected that annual rainfall totals will decrease on average by 2.8% in 2020, by 10.9% in 2050 and between 9-27% by the year 2100, with the range representing spatial variations. The predicted decrease in annual rainfall in the different agro-ecological zones is shown in Table 3. Moreover, the onset of the main rainy season will shift to later periods in the year by more than one month in the period 2030-39. More rainfall is expected during the peak months of August-September, increasing the risk of floods and run-off erosion.
137. **Sea Level Rise:** Historical data shows a sea level rise of 2.1 mm per year over the last 30 years. Vulnerability was assessed assuming a global sea level rise of 1 m by 2100. This will cause inundation of an estimated coastal area of 1,110 km<sup>2</sup> according to EPA projections, coastal erosion, intrusion of saltwater into surface and groundwater sources, and possible increased risk from earthquakes as a result of liquefaction. It is estimated that over 240,000 people living in the coastal zone are at risk of sea level rise.
138. **Water Resources:** Changes in precipitation amount and regime and rise in temperature will cause fluctuations in stream flows and runoffs, and will reduced ground water discharge by 5-22% by 2020 and 30-40% in 2050. This

change will therefore adversely affect the availability of water for irrigation, as well as hydropower generation.

139. The risk of floods and/or drought will particularly increase in the Volta river basin. So far, in the Offin river basin discharges in all the water bodies have been low, and some streams have completely dried up (Gyampoh et al, 2008). Flows in the River Offin have decreased 45% from 6.9 m<sup>3</sup> per second in 1957 to 3.8 m<sup>3</sup> per second in 2006. In the dry seasons of 2006 the flow was so low that the riverbed was exposed, and some of the wells dug by communities to ensure availability of water year round also dried up, indicating a possible reduction in groundwater. Water availability is decreasing at a time when the communities' water demand is increasing because of population growth.
140. **Health:** Heat and water related diseases are becoming more common in Ghana. For instance, in the Offin basin malaria incidence has increased because of unusually high night temperatures. During prolonged rainfall shortages, water sources become scarce, stagnant and contaminated, raising the incidence of diarrhoea and bilharzias. Shingles and other skin conditions, some of which were previously rare in the communities, have also become common during periods of high temperatures, according to people interviewed.
141. Cassava, one of the main food crops in Ghana and a major staple for more than 80% of the country's households contains different concentrations of cyanogenic glycosides depending on varieties and growing conditions. It causes cyanide-related chronic health problems and death if not appropriately processed before consumption. Bitter cassava varieties, with higher cyanide content are considered to have better defenses against pests and pathogens, to have a longer self-life after harvest, and to be more effective in nitrogen storage. If so, coping with climate change impacts, which will increase the risk of pests and diseases, may require the need to adopt bitter cassava varieties, which in turn will have higher health risks. In addition to this, the production of cyanogens increases under drought conditions, so CC predicted higher drought will also rise the risk of cyanide-related health problems (i.e. the cyanide-related konzo neurological disease has a higher occurrence in Africa during drought periods).
142. **Economy:** A recent study on the economics of Adaptation to climate change (EACC), which is based on two climate change models (NCAR and CSIRO) and the generated "Ghana Dry" and "Ghana Wet" scenarios for the period 2010-2050, has predicted impacts on the economic sectors of the country. Significant adverse economic-wide effects are suggested, with a projected decline in real GDP ranging from 5.4% per annum (Ghana Dry) to 2.1% per annum (Ghana Wet) by 2050. There is relative decline in real household consumption levels of 5-10% in 2050, with rural households suffering greater reductions compared to urban households. The output of the agriculture sector is estimated to decline by between 6.4% (Ghana Dry) and 0.8% (Ghana Wet) by 2050.
143. According to EACC, losses in agriculture could be as much as USD122 million per annum, while losses in transport and hydropower could be up to USD 630 million and USD 70 million, respectively. Total economy-wide impacts are estimated to range from USD 158–765 million per annum.
144. **Agriculture:** Ghana's agriculture sector is highly vulnerable to climate change and variability because it is predominantly rainfed and it is characterised by low levels of productivity. Year-to-year income variability in Ghana is already high in the baseline scenario (i.e. in the Northern Savannah income can drop by more than 10% in bad years, but can also rise by 20% in good years). The average annual AGDP is estimated to reduce between 3-8% by 2050 compared to the baseline scenario of USD 15.3 billion. Cassava productivity or yields are expected to reduce by 3%, 13.5% and 53% in 2020, 2050 and 2080 respectively.

Percent reductions in cocoyam productivity are 11.8%, 29.6% and 68% in 2020, 2050 and 2050 respectively. For maize, GDP is predicted to decline between 1% (Ghana Wet) and 17.2% (Global Wet) relative to baseline by 2040.

145. Considering that Ghana's cocoa production is the second largest production in the world (about 20% of the world market) it is reasonable to expect that climate change will have a significant impact in this sector worldwide. Cocoa is highly sensitive to changes in climate, from changes in hours of sun, to rainfall and application of water, soil conditions and particularly to temperature due to effects on evapo-transpiration. Climate change could also alter stages and rates of development of cocoa pests and pathogens, modify host resistance and result in changes in the physiology of host-pathogen/pests interaction. The most likely consequences are shifts in the geographical distribution of host and pathogen/pests, altered crop yields and crop losses which, will impact socio-economic variables such as farm income, livelihood and farm-level decision making. Cocoa GDP changes show considerable variations across the different climate scenarios, from adverse effects to slight positive impacts from a national-wide perspective, although strong adverse impacts at the regional level (I.e. in the Brong-Ahafo region, which accounts for around 28% of total production) are expected from 2030 onward.
146. In all scenarios the projected impacts on livestock incomes are pronounced by 2050 across Ghana (31% reduction of baseline), although the effects varies significantly across agro-ecological zones. For instance, in the 3 northern regions, under the most pronounced temperature and precipitation effects of the Ghana Dry scenario, livestock incomes fall bellow 70%.
147. Increased CO<sub>2</sub> alters the physical structures and the carbon/nitrogen balance in plants that in turn alters the plant's growth rate, yield, susceptibility to pest attack, and susceptibility to water stress. According to the scientific assessment of the consequences of, and adaptation responses to climate change in roots and tuber undertaken by EPA in Ghana, the incidence of diseases and pests, especially alien ones as a result of change in temperature and humidity and long droughts could increase their presence and damage to crop yield especially cassava.
148. **Energy:** The economic impact of climate change on the water and energy sector by 2050 will represent a decline of 3% to 6% per annum on average from a the baseline GDP of USD 2.33 billion. The bulk of Ghana's energy consumption is from biomass in the form of firewood and charcoal, which accounts for about 59% of total energy consumption. This is an indicator of extreme poverty and an obstacle to improved livelihood conditions. The household sector accounts for 52% of total energy consumption. The energy sector has begun to show signs of being susceptible to climate change. In particular, the effect of highly variable precipitation, and increased temperatures in some areas will cause a general reduction in annual river flow in Ghana (by 15-20 % in 2020) and consequently a significant reduction in hydropower generation of 60% for 2020. It will also lead to a reduction in biomass production resulting from water stress on woody plants and general land degradation. This will further increase the long hours women and girls spend every day collecting wood, agricultural residues and dung for use as fuel.
149. According to the Strategic National Energy Plan (2006-2020) developed by the Energy Commission, future energy security will be secured/increased by diversifying sources of supply. Access to renewable energy technologies will be strengthened, so as to achieve 10% penetration in terms of installed capacity by 2020, and 30% penetration of rural electrification via renewable energy technologies (both through grid extension and decentralised mini/micro-grid energy systems) by the same date. It is also expected that the government will create incentives to attract



private sector investment into the energy generation market, encouraging District Assemblies to provide electricity services to rural communities via mini/micro-grid through alternative generation sources such as biomass generation plants (including agriculture waste). Recent financial feasibility studies developed by IFAD (see Annex 10) on the use of agriculture waste biomass for energy production are very encouraging and demonstrate, among other things, that gasification and biogas plants fed with cassava waste and sawdust can generate energy (under the forms of electricity, hot air and gas) at a competitive price.

150. **Farmer's perceptions on recent changes in climate in Ghana:** Although rural communities may not have a clear understanding of global warming or climate change, they live close to natural resources and are the first in perceiving and reacting to environmental changes. A survey based on semi-structured questionnaires, focus group discussions, interviews and field observations in 20 rural communities from the Offin river basin (semi-deciduous Forest Zone) in Ghana assessed local strategies to cope with climate change and variability (Gyampoh et al, 2009). Local people in the studied area observed and felt the effects of decreasing rainfall, emphasizing changes in the regularity, length, intensity and timing of precipitation, increasing air temperature, increasing sunshine intensity and seasonal changes in rainfall pattern. Their observations were concordant with the registered reduction in mean annual rainfall of 22.2% and a gradual rise in average maximum temperatures of 1.3 °C (4.3%) from 1961 to 2006. Moreover, local people are aware of the interacting effect between bad management practices and changes in climate. For instance, deforestation and clearing of riparian vegetation is considered a major factor increasing soil erosion and siltation of rivers, which eventually reduces stream flow; the use of agricultural chemicals close to the rivers and streams create hazards for the environment and ultimately for the people of the region.
151. In the Volta basin there is anecdotal evidence from farmers that the onset of rainy season has been shifting forward in the year. Farmers claim to sow 10-20 days later than their parents.
152. In the cocoa vulnerability assessment to climate change farmers from major producing areas were interviewed. The majority (96%) of the farmers perceived climate change in terms of changes in rainfall pattern. They indicated that rainfall pattern over the past 10 years have been unstable and that a year with good rainfall was accompanied by good growth and yield of cocoa. They also indicated that excessive rainfall was accompanied by high incidence of black pod disease and yield losses just as drought conditions also gave rise to poor yields and high seedling mortality.
153. The people in the surveyed communities have re-adopted traditional practices and developed several strategies to adapt to changes in climate: reuse water, for example from washing clothes or utensils, to irrigate backyard gardens and nurseries; rationing water; reviving rainwater harvesting, a traditional way of collecting and storing rainwater in big barrels placed under the roofs of houses; shifting from cocoa cultivation to drought-resistant crops such as cassava that thrive well under the current prevailing conditions; moving vegetable crops into the river plains where they can get more water; having trees on their farms to shade their crops from intense sunshine. These strategies need to be part of a behavioural change and not applied only during periods of water shortage. This requires the implementation of awareness raising campaigns inform rural farmers of their rights and to empower them to protect their farms, sensitizing the communities about issues like prevention of bush fires, promotion of agro-forestry, restoration of riverbanks, etc. Moreover, an effective relationship between scientific and traditional knowledge is desirable, and technological

support is required so that farmers can harvest enough rainfall under the current climate.

### C. ROOT CAUSES FOR VULNERABILITY TO CLIMATE CHANGE

154. A number of root causes can be identified which exacerbate the effects of climate change:
155. **Population Growth:** Rapid population growth is putting land resources under pressure because it is often accompanied by unsustainable agriculture intensification, shifting cultivation to marginal areas, deforestation, and overgrazing. Population almost tripled over the last 40 years in Ghana, from 6.7 million in 1960 to 18.4 million in 2000 (Ghana Statistical Service 2000). Based on current population growth rates (2.7%), the World Bank estimated a population of 25.8 million in 2015. It is estimated that 63% of the total population lives in rural areas, and that 51.4% of the total population lives in the zones most vulnerable to land degradation (Coastal, Guinea, and Sudan Savannahs). Population density has significantly increased (i.e. from 36 persons/km<sup>2</sup> to 77 persons/km<sup>2</sup> in last 3 decades of the 20<sup>th</sup> century, Ghana Statistical Service 2000), which has significantly increased pressure on land resources, and will likely continue to increase in the coming years. The availability of agricultural land per capita has already decreased from 1.56 ha/person in 1970 to 0.74 ha/person in 2000. In the absence of a change in the current farming system, and in an economic system where the agriculture sector employs the majority of the population, and in which the majority of the rural households depend almost entirely on land resources for their livelihoods, population growth will result in increased land degradation, mainly from unsustainable intensification, shifting cultivation to marginal and fragile areas, deforestation, and overgrazing. Moreover, the small margins between overall growth rates of the agriculture sector vis-à-vis the annual population growth rate may well undermine the attainment of food security, employment generation, and improvement in rural incomes and national economy.
156. **Poverty:** in Ghana the incidence of poverty is higher in rural areas. About 50% of the rural population in 1998-99—which constitutes 63% of the total population, 59% of food crop farmers, and 55% of people employed in agriculture—lived below the poverty line. Poverty is significantly high in the three northern regions, which are the regions more vulnerable to land degradation. An analysis from Osgood and Lipper (2001), which combined the use of spatially referenced GIS with socioeconomic data in Ghana, observes that increased soil degradation is associated with higher incidence of poverty. Although these results do not necessarily prove a causal relationship between poverty and land degradation, they nonetheless suggest that poverty could be a determinant in soil degradation. According to the Ghana Poverty Reduction Strategy I, the majority of rural households depend on small-scale agriculture for their livelihoods. In a situation of rapid population growth, these farmers may lack the incentives, the means, or the options to diversify their type of livelihood, or to adopt new technologies. Therefore they may be forced—for their short-term survival—to unsustainably exploit their natural resources, or, in the absence of access to the best or equally productive lands, to move to new, marginal, fragile areas. The reduction of crop yield because of soil erosion and nutrient depletion will in fact reduce the poor's source of income or increase the costs to maintain the same crop yield, which, in many cases, they cannot afford.
157. **Gender:** Even though women in Ghana have been identified as a category that suffers disproportionately from poverty, the sectors where women are in the

majority are not prioritized in both GPRS I & II. There are also no measures in place to address women's experience of poverty in a systematic way. About half of the total female population (48.7%) in Ghana is active in the agriculture sector and yet they remain invisible to extension services, formal credit institutions. Women farmers are usually self-employed, with the majority being engaged in food production and trading of food crops. Trading activities, however, are not covered by most official credit programmes.

158. Based on Ghanaian tradition women generally do not enjoy ownership over any significant or valuable assets, specifically productive agriculture assets, which in turn prevents them from applying for any formal credit, unable to offer the valuable collateral (FASDEPII). Micro-credit is useful for women but it has proved led to any marked changes in women's experience of poverty and inequality. Even though women have been noted as reliable in paying back loans, the dynamics of gender relations in the household has tended to limit women's ability to control monies received. There is evidence that credit facilities given to women are sometimes controlled by men in their capacity as heads of households and husbands.
159. Without secure land rights climatic changes are likely to affect women's ability to use available land. In Ghana there are different categories of land users who face problems of access and control to land. Women are an especially vulnerable group in this regard and experience discriminatory cultural practices. Particularly in agriculture, women's contributions are devalued. Their interests in family lands are limited by marital residence. They are also often given land of poor quality and size. The clearing of land is customarily assigned to men. These practices afford men the opportunity to use and control land and has prevented the majority of women from securing control over virgin land belonging to their lineage (Kotey and Tsikata, 2000).
160. Ghana has many laws, policies and programs aimed at preserving and protecting the quality of the environment. But gender responsiveness is unfortunately limited. At the level of conception, process or implementation, many of such policies have failed to sufficiently acknowledge and take into account women's multiple responsibilities, alternative uses of environmental resources or their vulnerabilities.
161. The changes in the climate coupled with the precarious socio-economic conditions of women in Ghana mean that any disaster is likely to have the worst impacts on women. As has been noted before, women are not sufficiently represented in high decision-making levels and structures. Their participation in the scientific disciplines and in the structures in place for environmental and climate change issues is also limited. This is likely to limit the ability of women to articulate their specific concerns to affect mitigation and adaptation measures.
162. **Policy gaps and fragmented sectoral approach:** Although the government in Ghana has developed a policy framework that seeks to address the issue of land management comprehensively, some gaps still exist. For example, The National Land Policy does not have neither an action plan nor an implementing strategy exists to set targets, activities, timeframes, funding, and implementation mechanisms. In spite of the fact that the National Action Program to Combat Drought and Desertification (NAP) provides a quite comprehensive set of detailed and well-budgeted action programs and action plans, it still remains un-implemented. In addition to this, no instrument is in place that stipulates the principles for agriculture land management.
163. Sustainable land management is still weakly integrated in most other key policies, strategies, and action plans. For instance, the Food and Agriculture Sector Development Policy (FASDEP) only marginally discusses the use of sustainable land management technologies and practices. Overall, the GPRS I

lacks a comprehensive strategy to address the many factors that in turn result in various forms of land degradation, and it only indirectly deals with the problem of land degradation through the government's reforestation program. Considerations on the impact of land degradation receive more attention in the Growth and Poverty Reduction Strategy (GPRS II, GoG 2005), but integration is still limited. The strategy acknowledges land degradation as a key challenge to the growth potential of the agricultural sector and to the country as a whole, gives more emphasis to natural resource management, and identifies a number of interventions that could—directly or indirectly—favour the wider adoption of sustainable land management practices. These practices include reforming land acquisition and property rights, improving access to rural credit, and increasing access to markets through improvements in farm roads, among others. However, sustainable land management does not clearly emerge as an agreed-upon strategy to improve agricultural productivity—instead, it is presented in a narrow way as an element for ensuring environmental sustainability. Moreover, the general focus of the strategy remains agricultural modernization rather than land productivity, and strategic interventions seem to favour the restoration of degraded resources rather than their sustainable management. In conclusion, although the GPRS II offers a number of possible entry points for integrating sustainable land management, the document's treatment of the results of sustainable land management is unfortunately weak. Because the GPRS serves as the reference framework for the government and development strategies, this is a major shortcoming.

164. **The Legal and Regulatory framework:** Various pieces of legislation that the government has enacted to address fundamental land issues overlap with the existing traditional system, which is recognized as an equally legitimate source of law in Ghana. The resulting framework is characterized by an intricate combination of numerous constitutional provisions, common law principles, enacted legislation, and traditional law. The plethora of land laws has resulted in the existence of outdated laws and, in some instances, inconsistencies and contradictions within the legislative framework. Furthermore, inconsistent and outdated legislative provisions make it difficult to determine which legislative provisions are operative, and by extension, weaken the framework that was created for administering lands.
165. **Weak enforcement and compliance:** The key issues that have impeded adequate implementation and subsequent compliance with the environmental laws include an overall weak capacity, including lack of adequate resources, to cover the operation costs. As a result, illegal activities that negatively impact on land, such as bushfires in forest areas, illegal logging and mining activities, or cultivation over riverbanks and hillsides, remain largely uncontrolled.
166. **Institutional barriers and Human Resource Capacity:** The existing institutional set-up, which is characterized by duplication of roles and responsibilities, does not provide a clear direction for land utilization and management. Land management and administration in Ghana is the responsibility of a number of ministries and governmental agencies. At least 10 agencies and institutions at the central level have—directly or indirectly—a mandate for land management and administration in the country. However, these institutions have mandates that are often not well defined and are sometimes conflicting. This makes it difficult to identify the right authority to deal with land issues, and to pin down the institutional accountability.
167. Different institutions, reporting to different ministries, manage land administration and land use planning. As a result, land use at the local level is not always consistent with that planned at the national level.

168. Coordination among government agencies is generally weak, especially at the national level. For instance, opportunities and forums for strategic dialogue between the MEST, MLFM, and MOFA are in fact limited. The MEST seems not to have either the resources or the political weight to play a coordinating role in the environment/NRM sector. The cabinet could and should play a key role in coordinating line ministries, but has not taken this initiative, because it lacks either the technical capacity or political commitment. A provision calls for each ministry to establish an "environmental desk." This provision would enhance cross-sectoral coordination. However, MOFA is the only ministry at the moment that has established such a desk. An inter-ministerial technical committee was established, but it is not functioning because of insufficient resources. A National Desertification Committee was also established in the framework of the NAP, but it has been dormant so far. Weak inter-sectoral coordination, particularly for such a crosscutting issue as land degradation, makes policy harmonization and coherence more difficult and reduces information flow; this leads to uncoordinated interventions and an inefficient or suboptimal allocation of resources.
169. An overall weak institutional capacity for dealing with land issues exists at all levels, specifically on planning/participatory planning, policy development, overall strategic thinking, data collection, and technical issues. Lack of capacity and limited staff is particularly serious regarding monitoring and enforcement activities, such as controlling illegal activities directly responsible for land degradation (illegal logging, illegal mining, bushfires, encroachment in forest reserves, and cultivation on river banks and hillsides).
170. **Land tenure and registration:** Private land, which represents the majority of the land in Ghana, is in most parts of the country held by the traditional authority ("stool" or "skin") in trust for the community. Stool/skin lands often have unclear boundaries, a problem that is directly related to the absence of legal and institutional mechanisms to provide accurate maps, data, or plans. This often results in litigation in the court, which often freezes the land for development and favours encroachments on the land, overgrazing and conflicts between livestock keeping and crop farming.
171. Land tenure problems do not provide adequate long-term security to resource users, and may reinforce the tendency toward short-term horizons in land management decisions. Land tenure rules are in fact generally unfavourable to primary users: The ultimate stewardship of the land is vested in the chief or in the state for public lands - not in the resource user/tenant- who has absolute freedom to deal with or dispose of the land. Consequently, because farmers may fear eviction from the land, they may refrain from adopting long-term investments to improve land management. Moreover, land tenure arrangements limit the farmers' ability to use land as collateral for loans, an issue that limit their ability to access credit. Moreover, many agricultural tenancies are based on oral agreements resulting in frequent disputes concerning the duration of the tenancies, which in most cases lead to eviction of tenants from the farms they lease, especially when the original landlord is deceased and the farm is taken over.
172. The provision by which the government has the power to acquire land once it is in the public interest (Article 20 of the Constitution) may reduce tenure security and discourage resource users from sustaining long-term investments on their land for fear of eviction or of insufficient compensation for their investments. The existing inheritance system may also obstruct or not provide the adequate incentive for adopting sustainable land management technologies. For instance, in the patrilineal systems (as in northern Ghana) land is divided among the male heirs of the family, which often leads to land fragmentation where soil conservation measures are more difficultly applied.

173. **Knowledge and Technology:** Generally limited knowledge of the extent, impact, and costs of land degradation, as well as on the economic benefits of sustainable land management, impede a comprehensive approach toward the problem. Most of the information is compartmentalized among various research institutions, ministries, and agencies, and the flow of information is very limited, as data are often made available only against payment. At the local level, access to information is virtually nonexistent. Capacity and the use of Spatial Data Information (SDI) and Geographic Information Systems (GIS) for assessing land degradation are still limited.
174. Due to lack of adequate information on the magnitude and costs of land degradation, it was not among the key development priorities for policy makers of the country. Sustainable land management elements were not adequately integrated into the Poverty Reduction Strategy, and the National Action Program to Combat Drought and Desertification was not implemented.
175. In general, research focused on the technological requirements for SLM rather than on what drives adoption of SLM and what are its constraints. Farmers' views are rarely captured in the present research, making it difficult to implement conclusions on the ground. Extensive reliance on rainwater renders the country's farmers highly vulnerable to droughts and dry spells, even if short, during crucial times of the cropping season. Furthermore, the endemic lack of irrigation facilities makes dry season farming almost impossible. It will be important to better understand the underlying reasons (i.e. lack of resources, lack of know-how, etc) why irrigation is so strikingly rare in Ghana, in order to best decide on potential interventions that could reduce farmer's vulnerability to adverse climate conditions.
176. In addition, the lack of harmonised information on the technical, social, and economic requirements for SLM practices, and on their applicability to diverse agro-ecological zones of the country, limits the wide-scale promotion and replication of these practices. Without such critical information, promotion and replication of these practices are problematic.
177. **Economic and Financial Issues:** Limited access to credit in the agriculture sector may limit most smallholder farmers' capacity to bear the initial costs associated with adoption of a new SLM technologies. In fact, access to financial services and credit support from commercial banks is very limited in Ghana's agriculture sector. Applying for credits to formal banks is impossible for most of smallholder farmers due to lack of collaterals, and lack of warranty (farm assets are often too poor quality and may not even be owned by farmers, which is often the case with women). For example, in 2002 the percentage of credit support from commercial banks to agriculture, forestry, and fisheries amounted to 2.1%, as opposed to 20.3% to the manufacture sector. The high interest rates for the agriculture sector (worsened by inflation) further deter farmers from obtaining commercial bank loans. The Agriculture Development Bank (ADB) is responsible for financing agriculture production and investments but most of their credits and loans go to the bigger traders, large farmers and processing units who are in the position to pay back in a short period of time.
178. Post harvest losses have been found to be 20-50% for fruits, vegetables, roots and tubers, and about 20-30% for cereals and legumes (FASDEPII). Due to insufficient storage and drying facilities, a lot of farmers are obliged to sell their products at post harvest time when prices are low and re-buy during lean season when prices are high. The combination of limited income opportunities with high dependence on markets during certain times of the year in the rural areas, household's purchasing power is stretched which in turns is likely to negatively impacts on the quality and quantity of food they consume.

179. Limited accessibility to and poorly functioning markets increase the transaction costs and discourage farmers from investing in and adopting SLM technologies. Increased land productivity does not necessarily represent an incentive for farmers to adopt new technologies if they don't have the means to control the price of their products. Moreover, market centres for food are not well integrated into rural areas because of limited road access, poor road conditions. Although market chains for high value cash crops, such as cocoa and timber, have been established or expanded, the food crop chain has been largely neglected. IFPRI recommends strengthening the food crop chain, which is large in volume and involves a significant number of smallholders, because it has strong linkages to economic growth and poverty reduction. The inefficient market infrastructure, which is an endemic problem in the country, further supports traditional, low risk farming practices that leave productivity stagnant. According to IFPRI even the latest technologies and machineries do not bring the expected high returns if markets are not provided, and these limited commercialization opportunities and farmer's participation in the market chain and contribute to the higher incidence of poverty among crop farmers.
180. Fiscal and trade barriers and price subsidies may act as disincentives to SLM by hampering agricultural and economic growth. Agricultural products suffer from having to compete with lower prices in other developing countries, countries that may enjoy agricultural subsidies. To lower cost of production, opportunistic and non-sustainable practices are in fact often adopted.
181. Inappropriate pricing of resources may encourage overexploitation. If the market price of a natural resource is below the economic value of the resource, overexploitation and depletion of the resource may result. For instance, the market price of timber is relatively low in Ghana, and this provides an incentive for overexploitation of the resource. The prices of firewood and charcoal do not take into consideration the opportunity cost of wood, making their pricing fall below the real cost and serving as an incentive for depletion of forest resources.

### III. BASELINE ANALYSIS

182. The Agriculture is still the backbone of the Ghanaian economy as it contributes well over 36% of GDP and accounts for over 55% of foreign exchange earnings. A number of strategies have been envisaged to make Ghana a leading agro-based industrial economy. Among others, the governmental strategy focuses on: (i) increasing the production base and availability of targeted raw materials for processing; (ii) increasing the percentage of value addition to agricultural raw materials; (iii) aggressively applying yield enhancing, yield protecting and nutritionally enhanced technologies sustainability to agricultural practice; (iv) developing infrastructure to support agro processing; (v) ensuring private sector involvement and linkages; and (vi) sustainable long-term financing.
183. R&T crops account for the largest share of the AGDP. It is conservatively estimated at about 46%. Cocoa follows with a share of about 13%, while forestry and the cereals contribute 11% and 7%, respectively, livestock, fisheries, and fruits and vegetables account for 5%, 4% and 3%, respectively, of the AGDP, while other agricultural activities take up the remaining 2%. Value-added activities in the agricultural economy are limited.
184. Cassava is the most important food crop in Ghana. Clearly cassava production has increased steadily each year since 1992 when it was quoted at 5.7 million MT of national production and also in productivity. Prior to 1991, the area under cassava never exceeded 415 000 ha while it was 660 000 ha, 726 000 ha, 794 000 ha and 759 340 ha in year 2000, 2001, 2002 and 2003 respectively.
185. Cassava is prepared and consumed in a variety of ways, namely *gari*, *fufu*, *banku*, *konkonte* (dried chips) and *agbelima* (fermented cassava flour). MoFA estimates per capita intake of cassava at 151.4 kg/annum (MOFA, Facts and Figures 2003). Per capita consumption in Ghana makes cassava the most important consumed food in Ghana over the last 20 years. In 2000, cassava consumption in Ghana was a whopping 33% of the per capita consumption of the major staples in Ghana. The nearest other crop was 18% while yam was just 9%.
186. In Ghana, cassava is mostly grown on small farms, usually intercropped or put in rotation with other crops. The crops vary: vegetables, yam, melon, maize, rice, groundnut, or other legumes. Even tree crops (such as coconut, oil palm, and coffee) could be inter-planted. The application of fertilizer remains limited among small-scale farmers due to the high cost and lack of availability. Roots can be harvested between 9 and 12 months but farmers vary these between 6 months and 15-18 months and sometimes even up to 2 years and beyond due to unfavourable market conditions.



Table 4 - R&T crop statistics in 2003 by region (a-production; b-cropped area; and c-yield)

Crop Unit	Western	Central	Eastern	G. Accra	Volta	Ashanti	Brong Ahafo	North	Upper-West	Up-East
<u>Cassava</u>										
a. '000t	792,162	1,597,14	2,199,60	51,880	1,235,1	1,322,320	2,489,990	551,150	-	-
b. '000 ha	74,290	0	0	7,750	00	122,780	171,030	66,060	-	-
c. t/ha	10.66	110,030	183,300	6.69	72,000	10.77	14.56	8.34	-	-
<u>Yam</u>										
a. '000 t	93,060		648,320	-	17.15	225,850	1,809,900	461,170	309,280	-
b. '000 ha	10,240	24 260	36,000	-	241,000	17,790	118,870	83,050	26,560	-
c. kg/ha	9.09	4 800	18.01	-	24,100	12.70	15.23	5.55	11.64	-
<u>Cocoyam</u>										
a. '000 t	240,740		412,000	-	10.00	672,570	351,440	-	-	-
b. '000 ha	38,210	92,900	59,700	-	35,000	101,870	50 330	-	-	-
c. kg/ha	6.30	18,560	6.90	-	8,000	6.60	6.98	-	-	-

Source: from 'Regional and District cropped area, yield and production statistics', Statistics research and information directorate. Annual sample survey of agriculture, Ghana, 2003, Statistics Unit

187. Since 1988, IFAD has financed 12 interventions in Ghana that have covered community and commodity-based approaches to agricultural development, rural finance and microenterprise development, rural infrastructure, and support to decentralized and pro-poor delivery mechanisms. Total loans amount to USD 136.8 million on highly concessional terms, and about USD 1.0 million has been provided in grants and debt relief for about USD 18 million in end-2000 net present value terms. Five projects (USD55.2million) are ongoing, among which the Root and Tuber Improvement and Marketing Programme (RTIMP). The programme supports small-scale operators in the R&T subsector to become full actors in R&T commodity chains, to increase value-formation upstream and negotiate prices and contracts along the chains. It also facilitates the access of small R&T farmers to improved planting material and knowledge for improved crop husbandry practices, soil fertility management and integrated pest management techniques. For small R&T processors it promotes various lending instruments, including matching grants and micro-leasing, in order that they may access improved processing technologies and upgrade their skills at different stages of the chain. Poor farmers' and processors' access to markets is being increased by improving their marketing and bartering skills and by strengthening the capacity of farmer-based organizations and other trade organizations. The combined effect of these activities will be higher productivity of R&T crops and added value through improved processing, which will lead to enhanced food security and incomes. The programme also fosters beneficiary participation in policy dialogue through their organizations and through the creation of an R&T apex body, which is expected to carry on many of the development activities after programme closure.

188. The beneficiaries are involved in participatory planning process through a number of participation mechanisms such as district stakeholders' forums for farmers, business forums for R&T processors, farmer-field forums to exchange knowledge and experience and set a pro-poor research agenda.

189. An interim evaluation of RTIMP found that the programme was innovative in concentrating on poor people's crops; over 120 000 farmers already had access to improved varieties in 2003, and RTIMP was set to reach 720 000 farmers by

2005. Promising technical results had been obtained (i.e. development, testing, multiplication and distribution of improved planting materials; improved management of soil fertility and integrated pest control; creation of 17 farmer-field schools and training of over 1,500 line department staff).
190. RTIMP has undertaken upgrading of cassava processing facilities into Good Practices Centres (GPCs). These GPCs are serving as demonstration centres for clients of RTIMP, who are adopting some of the technologies by accessing the Micro-Enterprise Fund (MEF) and other innovative financial services. In line with technology transfer to processors, a number of exposure visits were organized for other processors to the GPCs. By virtue of the larger number of females in the small scale agro-processing activities, participation in the exposure visits was undoubtedly dominated by women 719 out of 1,022 participants (representing 70.3%). The centres are now attracting high patronage because of the expanded capacities. The upgrading has impacted positively in terms of income, profit and general productivity of the GPCs. The participants are exposed to accepted standards of equipment, hygiene and processes. Processors who took part in exposure visits indicated their satisfaction of the concepts. They have applied the knowledge gained. The GPCs at Apesika, Asueyi and Woraso near Mampong-Ashanti are serving as a model to processors. Most entrepreneurs in the GPCs and other processors have started keeping proper records that help to determine profitability more accurately.
191. After 4 years of implementation, the various platforms (FFF, exposure visits to GPC, business development training and planting material distribution) on which clients are equipped to respond to the "demand pull" created by increased access to MEF, were well developed. Commodity chains developed included HQCF, Gari, Yam and Agbelima chains. On a chain by chain basis, the Gari chain is the most developed while the least developed chain was that of agbelima in the communities with a female dominance.
192. The Programme is supporting the development of commodity value chains in the country. Small producers and processors were linked to larger scale processors and to markets in the operational zones. Formal arrangement in the form of simplified MoUs which enjoins the producers or processors to see the other player as the first point of call when the producer has roots to sell or the processor needs roots to buy were signed by the farmers and processors. The traders and farmers involved in the chain were provided with business training and technical support to improve profitability and general trading conditions. The value chain actors have been linked to the GPCs such as those in Jenefal, Asueyi, JOSMA, Aworowa and Hansua for possible supply of gari whenever the need arises.
193. The IFAD supported Rural Enterprises Programme (REP) aims to build a viable and competitive rural micro-enterprise sector, supported by relevant, good quality and sustainable services. This programme is also targeting rural families living in poverty with special attention for the most vulnerable but entrepreneurial households, including socially disadvantaged women, unemployed and underemployed youth involved in cassava growing and processing. REP consists of the following components: (i) business development services provided by business advisory centres (BACs), (ii) technology promotion and dissemination provided by the Rural Technology Facility centres (RTFs), (iii) rural financial services, (iv) policy dialogue and institutional capacity building, and (v) programme coordination and management.
194. BACs will be responsible for: i) the identification of MSE needs and opportunities; ii) the delivery of training and counselling services through out-contracting; iii) the dissemination of information; and iv) the monitoring of Programme activities. RTFs functions are: i) ensure skills training of master craft

persons and apprentices; ii) ensure the testing, replication and promotion of prototypes in close collaboration with clients; iii) provide installation of and training on the use of equipment and after sales services; and iv) organize occupational safety & health and environmental management seminars. BACs and RTFs are integrated into the District Assembly structure.

195. The Phase II of REP, which will be completed in 2011, covers sixty-six districts across the different geographical zones of the country from the deciduous forest in the south to the drier guinea savanna in the north. Key rural enterprises benefiting from the REP are dealing with bee keeping, agro-processing of cassava and other crops, grasscutter, snails, and poultry rearing, etc. A phase III of REP is under preparation and will be expanded to the whole country.
196. Institutional Collaboration with RTIMP is being promoted to provide complementary services that will upscale the achievement of their respective project objectives and make the desired impact on their common clients. Both REP and RTIMP have participated in each other's programmes and workshops to ensure appreciation and understanding of their common grounds. At the field level, the RTF of REP at Mampong and Techiman are working with GRATIS<sup>6</sup> to provide maintenance and repair services to the cassava processing enterprises established by RTIMP as good practice centres.
197. Ghana's National Climate Change Adaptation Strategy (NCCAS) proposes a number of adaptation measures that need to be urgently adopted to build the necessary ecological, social and economic resilience of the country's agro-ecosystems and rural communities.
198. **Adaptive management in agro-forestry:** The government of Ghana seems to have a strong interest in revenue-generating agro-forestry activities with high financial returns and has given a high priority to the implementation of tree plantations with a climate change adaptation focus in its forest policy strategy. Effective and genuine involvement by all stakeholders, with clearly defined roles, clearly understood tree ownership (by farmers and local communities), and the integration of immediate livelihood concerns to ensure food and energy security are important for agro-forestry-related adaptation measures and are key to their short- and long-term success.
199. For instance, the traditional *taungya* agro-forestry practice was reviewed and re-launched in 2002 in the transitional zone of Ghana (Offinso District) in the form of a modified *taungya* system (MTS). The government of Ghana, through the Forestry Commission, came up with this new approach that integrates an objective for climate change adaptation, takes into account financial benefits for farmers and other stakeholders involved, and transferred ownership of the trees from a single entity (the government) to multiple owners (farmers, local communities, government and land-owners). MTS encompasses not only the planting of food crops and economic trees on a piece of land, but requires continuous care and application of necessary inputs throughout the project life. Tree-ownership agreements between the government and other stakeholders should be legalized by means of written consent by communities as stipulated in the Timber Resources Management Act of 2002, and required by the voluntary partnership agreement (VPA) signed between Ghana and EU in September 2008 in the framework of FLEGT. This will help prevent illegal logging and future disagreements about sharing benefits from the sale of the timber products. Clear ownership will also support farmers' adaptation to stresses, including climate change.

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<sup>6</sup> Ghana Regional Appropriate Technology Industrial Service (GRATIS) Project, which was established by the Government of Ghana in 1987 and mandated to promote small-scale industrialisation in Ghana.

200. Results from the implementation of the MTS in the Offinso District demonstrates the important contribution that adapted traditional agro-forestry systems have to reducing the vulnerability of the socio-ecological system to both human and climatic stresses. The formulation by the government of Ghana of a clear adaptation policy objective or legislation to match the already supportive features of MTS should also incorporate its mitigation potential, so that it will provide a holistic and comprehensive approach to the various adaptation and mitigation roles of agro-forestry as a climate change strategy.
201. **Adaptive land management practices:** Sustainable options that can reduce soil erosion are currently adopted in Ghana. In fact, several low-input practices and/or technologies -known as sustainable land management (SLM)- that are used in the country are socially acceptable and technically feasible, and can substantively reduce land degradation while enhancing productivity. For instance, the practice of zero-tillage with herbicide application in various ecological zones has demonstrated its potential to reduce soil erosion by more than 80 percent and increase yields by more than 50 percent, compared with the traditional slash-and-burn system. Among the various SLM systems, *conservation agriculture* (involving techniques like cover crops, strip cropping, zero-tillage with weedicide, mulching, composting) seems to represent a viable option to reduce soil erosion and improve productivity in the country. *Inter-cropping* also reduce runoff and soil erosion and are commonly adopted in Ghana, particularly in the Northern Region.
202. Despite the existence of a significant number of technological solutions for sustainable land management practices, and potential benefits at both farmer and aggregate level, large-scale adoption of these practices continues to be limited in Ghana. The Crop Service of MOFA has embarked upon the development of a policy that would help to guide land use planning. The development of the policy provides an opportunity to better integrate sustainable land management into the existing policy framework. At the same time, the revision of the National Environmental Action Plan (NEAP) plus the ongoing process of reviewing the Food and Agriculture Sector Development Policy (FASDEP) represent two important opportunities to mainstream sustainable land management in the country's policy framework.
203. The ongoing processes of revision of the Food and Agriculture Sector Development Policy (FASDEP), design of the second phase of the Agricultural Services Sub-sector Investment Project (AgSSIP or AgSWAp—Agriculture Sector-Wide Approach), and formulation of the Agriculture Land Management Policy and of a National Land Use Plan, represent concrete and immediate entry points for SLM mainstreaming. However, in the medium term, this process should be extended progressively to any national policy, strategy, or action plan (starting from the next GPRS). The adoption or non-adoption of sustainable land management technologies and practices is influenced by many factors that go beyond the mere profitability of the technology. These factors include, among others, tenure security, access to credit, access to markets, and price of resource. Therefore, to be successful, policy and regulatory interventions in the land sector must be accompanied by specific interventions aimed at improving tenure security, facilitating access to credit, supporting upfront investments, and facilitating farmers' access to markets.
204. **Adaptive water management:** The Water Resources Commission has recently embarked in the development of a number of climate change adaptation actions, based on the integrated water resource management (IWRM) approach. Adaptation in water conservation, flood control and irrigation are being tested with the full involvement of local stakeholders in the Northern and Upper East regions. Moreover, successful farmer initiatives in small-scale irrigated agriculture are implemented in the Dayi river basing within the Hohoe Municipality in south-

eastern Ghana.

#### **IV. STAKEHOLDER ANALYSIS, TARGET GROUPS AND PROJECT AREA**

##### **A. STAKEHOLDER ANALYSIS**

205. The main beneficiaries of the project activities will be those already involved in the RTIMP programme that is: asset-poor, food-insecure and labour-deficient small-scale cassava farm households; small-scale cassava processors, both individually and in groups, whose incomes are depressed by lack of access to improved technologies, skills, capital and markets; and traders with interest and dynamism to become viable micro/small entrepreneurs. The project will put particularly strong focus on the most vulnerable groups -women and youths- who will face higher difficulties in coping with climate change impacts. Women represent over 95% of the cassava processing operations and are especially vulnerable due to a number of factors, such as land tenure constraints (i.e. only 10.3% of women possess their own lands in comparison with 51.7% of males), lower education and access to extension services, and higher difficulties in accessing to financial credits.
206. The vast majority of cassava processors are affected by poverty because of: (a) the use of low-yielding planting materials; (b) the significant lack of means to combat soil fertility problems, pests and diseases; (c) weak access to knowledge and extension; (d) weak access to land, markets and capital; (e) physical isolation - vulnerable communities live in remote areas, with poor road networks preventing adequate marketing opportunities; (g) weak grassroots institution. However, with climate-proofed agriculture, also the enabling land management, economic, good governance, decentralization, equity and gender-balanced strategy being developed by RTIMP and other programmes and projects like REP, the agricultural sector offers potential both for sustainable development and for reducing rural poverty in the long-term.
207. At local level, the project will involve modern community leaders (i.e. Regional Coordinating Councils and District Assemblies) and traditional community leaders, including Chiefs (with a major stake in land tenure issues), as these key members of communities will be influential in engaging land users. The project will also involve the other key stakeholders including RCC and DA staff (officers, extensionists, etc), research institutes and universities, NGOs, health centres, commission for civic education, staff of the Department of Meteorology, radio/newspapers managers.

##### **B. TARGET GROUPS**

208. In line with IFAD's mandate and based on the fact that it is the poorest people in societies who will be most affected by climate change impacts, the target groups for IFAD/SCCF project activities will be smallholder farming households. The SCCF project will be fully aligned with the RTIMP in terms of targeting and will strictly follow the targeting criteria for RTIMP (focusing on small-scale farmers and most vulnerable groups). Geographical targeting criteria will be guided by the aim of strengthening and complementing the ongoing IFAD

interventions, maximising impact and exploiting synergies. Within the selected districts, geographical targeting will take into account: (a) social, poverty and demographic indicators, (b) sites where environmental stressors (i.e. land and water pollution by cassava waste disposal; land degradation; irrational firewood wood-fuel collection; health problems due to pollution) are important and are affecting the ability of the ecosystem, the cropland productivity, and the rural households to be resilient to climate change effects, and (b) complementarities with ongoing and planned RTIMP initiatives.

209. B

210. The SCCF project will target all stakeholders who play a major role in the cassava value chain:

- (i) Region and District level governmental agents (i.e. extension, agriculture, forest, district planning, education, health, etc), researchers/academic staff, NGOs, and media operators. The project will build their capacity to incorporate climate change adaptation needs into their daily work and to become trainers/disseminators of climate change adaptation for the rural population –small scale cassava producers, processors and traders- who are most likely to be affected by climate change impacts. The project will work will all the regional and district beneficiaries of the RTIMP programme.
- (ii) Asset-poor, food-insecure and labour deficient cassava farm households will be targeted to jointly identify and apply climate change adaptation measures in the selection of crop varieties and production techniques, as well as in sustainable land and water management. The SCCF project will identify beneficiaries in complementarity with the ongoing and planned RTIMP initiatives, who will receive equipment and training from the disseminators/trainers mentioned in the previous point;
- (iii) Small-scale cassava processors and traders. The SCCF project will focus on individual/groups of women and youth (mainly involved in cassava processing activities) and men farmers (mainly involved in cassava production activities, processing and marketing) living in fairly remote rural areas. These target beneficiaries are most prone to food insecurity because of the difficult access to markets. This group will be sub-divided in two sub-categories: (a) Those with poor access to advanced processing technology, low labour productivity and low turnover. The project will provide these beneficiaries with more efficient processing equipment, in order to help reduce environmental impacts (i.e. excessive consumption of firewood) and unhealthy working conditions while at the same time increasing cassava derivatives production and quality. (b) Those with a demonstrated higher technology level, productivity and turnover, selected as Good Practices Centres (GPCs) by the RTIMP programme, and serving as a model to other processor groups. The project will target 5 to 7 GPCs around the town of Asueyi. Because of the above-average skills acquired by these particular centres, the project considers that they are best positioned to run the innovative plant and guarantee high-quality results.

211. The proposed project target rural communities will be selected among those already involved in RTIMP at the project start-up. Selection will take place in a participatory way, involving the SCCF Project Officer, the RTIMP team, and regional/local partners (research/universities, DAs, GPCs, etc), on the basis of the previously mentioned criteria.

212. Component 1 "Awareness raising on climate change and capacity building to address its impacts along cassava chain" will have a wide-regional scope. Individuals from District level divisions (i.e. Agriculture; Forest Service;

Environmental Health; Municipal Planning; Civic Education; Information Service; BCAs; RTFs; etc), and regional RTIMP and REP staff, Research/University centres, Radio centres, Health centres and NGOs in the 4 regions will benefit from capacity building activities to become trainers and incorporate climate change adaptation knowledge in their work with local community groups. The awareness raising and capacity building materials produced will be largely disseminated in the 4 regions and the targeted districts.

213. Component 2 "Support adaptation to climate change in cassava production" will be fully integrated in the RTIMP work with research/university centres in the 4 regions supporting cassava farmers to adopt good land and water management practices. The SCCF project will provide knowledge about climate change adaptation methods and techniques in SLWM to be applied in 64 pilot field plots in the 7 districts. Farmers' pilot plots will be selected in a participatory way with the assistance of RTIMP team, on the basis of the previously mentioned criteria.
214. Component 3 "Promote innovative adaptation solutions along agriculture value chain" will have as its major focal area the Techiman Municipality. Innovative sustainable energy technologies will be applied in a model processing unit in Asueyi (Techiman Municipality), initially grouping between 5 to 7 processing groups, with the aim to increase environmental, social and economic resilience to climate change and improve food security. The selection of Techiman is based on the fact that this area accounts for a high accumulation of cassava waste peels and wastewater – a major environmental/health impact that may be reversed and become a resource as biomass for the new energy plants- and on the fact that a feasibility study was carried out here by IFAD in 2010. The new production unit will be geared to the following, 3,000 direct beneficiaries: about 750 family members depending on the 150 processors working in 5 cassava production centres (Asueyi Biakule; Asueyi GPC, Odifour; Nanaba Adjei; Tiwa) around the Asueyi community in the Municipality of Techiman, and about 2,250 cassava growers and processors from the four surrounding districts of Wenchi, Kintampo, Nkoranza and Offinso North, where most of the raw cassava processed at the Asueyi area is grown. Moreover, the new production unit will support income-diversification for the family groups of the 5 processing centres, which combine the production of cassava with other agriculture activities (i.e. production of vegetables, plantain, cashew, mango, honey), and will benefit from the cooling chambers and the honey processing facilities to improve the quality and longevity of their products, and thus their chances of marketing and income generation. About 50 beekeepers will be organized, trained and equipped to help them improve and increase honey production and marketing. Improved technologies for an efficient use of firewood for roasting gari will be applied in 11 pilot RTIMP Good Practices Centres (GPCs) selected in the 4 project regions, benefiting about 1,650 family members depending on the 330 direct processors and about 4,950 growers and processors more who provide raw cassava and/or may hire the improved technologies. 15 direct beneficiaries will benefit from a pilot model mushroom production initiative, based on an efficient use of wood-fuel and the use of cassava waste peels for mushroom production.
215. As far as possible, a one programme approach will be employed for the project, thus where possible the range of project activities will be targeted at the same communities in order to guarantee optimal and sustainable outcomes for the project, as farmers in Ghana typically have diversified farming systems which include several food crops and some agro-forestry practices.
216. Women and young people will be the primary beneficiaries of SCCF project because they are the main workforce in the cassava processing sector. IFAD gives priority to women and youth because: (a) these groups are most directly reliant on natural resources, as they cannot take advantage of the same social mobility,

employment and educational opportunities as men; (b) adaptation to climate change requires planning for the long term, but the most vulnerable are particularly tied to daily survival tasks and dependent children. In this sense it is necessary to assist and empower women and other vulnerable groups with making strategic and long-term adaptation decisions; (c) health, nutrition and water provision are the three core areas, which a changed climate in the target areas will endanger. At the grass-roots level, these domains are predominantly controlled by women as they are primarily responsible for children’s healthcare, subsistence agriculture, manual food processing and fetching water; (d) Young people have also traditionally been at a disadvantage in rural institutions in Ghana, therefore they are often particularly vulnerable; (e) Women and children are particularly prone to malnutrition and disease.

### C. PROJECT AREA

217. The IFAD/SCCF project will work in 3 agro-ecological zones (Inner savannah, Transition Forest-Savannah, and Semi-deciduous Forest), 4 regions (Ashanti, Brong-Ahafo, Northern, Volta) and 7 districts of the country where the co-financing partner MOFA/RTIMP operates. The selection was based on a number of criteria, including environmental and social vulnerability, cassava agricultural potential, geographical spread, RTIMP presence, and avoidance of overlap with other donor operations.

	Semi-Deciduous Forest Zone	Transitional Forest-Savannah Zone	Inner Savannah Zone
Ashanti Region	Offinso North		
Brong-Ahafo R.	Techiman Wenchi Nkoranza	Kintampo	
Northern R.			Gonja
Volta R.			Krachi



## **V. PROJECT STRATEGY**

### **A. PROJECT RATIONALE**

#### **CONSISTENCY WITH GEF POLICIES AND STRATEGIES FOR SCCF, AND THE SCCF ADDITIONALITY**

##### **Baseline Scenario**

218. Root and tuber crops are the most important agriculture produce in Ghana, contributing 40% of the country's AGDP, with cassava accounting for 22% of the AGDP. Annual production has been rising consistently over the last decade and currently is estimated at approximately 6 million MT of fresh roots per annum, supporting numerous small-scale farmer and processor groups. Cassava supplies a major source of daily carbohydrate intake to the majority of Ghanaians and it also has an important role as a food security crop, due to its ability to grow on poor quality land and its tolerance to drought. With an estimated per capita consumption of 151.4 kg/year, cassava alone accounts for 34% of food crop consumption in Ghana.
219. Roots and tubers are most likely to be significantly impacted by climate change, with an expected reduction of cassava productivity or yields of 3%, 13.5% and 53% in 2020, 2050 and 2080 respectively. Because of the crucial role that cassava plays in food security and the rural economy of Ghana and the serious threat posed by climate change to this crop system, it is very urgent to incorporate adaptation measures in the future development of this agriculture sector.
220. IFAD is supporting the Government of Ghana through the RTIMP programme to enhance the food security and income of poor rural households in Ghana, with special emphasis on women and other vulnerable groups, such as youth, whose economic activity is mainly based on R&T production, processing and marketing. The RTIMP specific objective is to build up competitive, market-based and inclusive commodity chains for roots and tubers (R&T), supported by relevant, effective and sustainable services that are accessible to the rural poor. The IFA's supported Rural Enterprises Programme (REP) compliments and strengthens RTIMP to provide complementary services that will upscale the achievement of viable and competitive micro-rural enterprises linked to the cassava marketing sector.
221. The main purpose of the RTIMP programme is to build a competitive and market-based Root and Tuber Commodity Chain (RTCC) supported by relevant, effective and sustainable services that are available to the rural poor. RTIMP is implemented through 3 components along the value chain: A) support to increased commodity chain linkages; B) support to root and tuber crop production; C) upgrading of root and tuber processing and marketing. The Programme has focused largely on establishing and consolidating the services on which the rural poor rely to ensure effective participation in the value chain through the improvement of R&T production. These include: availability and access to improved planting material; mass-production and release of biological agents to control pests of root and tuber crops; capacity to facilitate *Farmer Field Fora* to test and adopt sustainable land management and production techniques. The programme also addresses the identification and promotion of more efficient processing technologies, the establishment of Good Practices Centres (GPCs) with business development & marketing skills, and facilitation of access to the Micro-

enterprise Fund (MEF) for retooling. Commodity chain linkages are developed to connect small producers and processors to larger scale processors and to markets in the operational zones around four products (HQCF, Gari, Yam and Agbelima). District Stakeholder Fora (DSFs) have supplied the value chain actors (Bankers, Researchers, Farmers, Processors, Traders, Fabricators, MoFA staff, NGOs and Transporters) with a platform to interact, build relationships and even make trade deals. These fora have become the think-tank on root and tuber development in the operating districts. DSFs have also educated and provided technical information to a wide range of stakeholders in the R&T industry.

222. Under RTIMP, development activities are carried-out without considering the additional costs incurred due to the impacts of climate change. In particular, the RTIMP programme does not seem to consider that the productivity of cassava and other crop yields are expected to decrease because of environmental disruptions caused by climate change and variability, and that the current environmental problems related to cassava production and processing will be exacerbated by climate change. This implies the need to expand the scope of the activities under RTIMP, which otherwise might end up being insufficient on the long term. Moreover, climate change calls for a better understanding of the phenomenon and its impact by all stakeholders, if timely and appropriate adaptation measures are to be taken. The costs to support climate change adaptation activities are not reflected in the design of the RTIMP.

223. Most of the activities in the RTIMP offer an entry point for SCCF intervention in support of the Ghana's NCCAS implementation, as many of them are complementary with the NCCAS priorities (see Table 7). Indeed, the activities in the baseline focus on: (i) support sustainable R&T crop production, in terms of crop varieties, land and water management techniques; (ii) Upgrading of R&T processing and marketing; (iii) Increase commodity chain linkages.

### Lessons learned from the baseline (RTIMP and REP) and implications to SCCF project

<b>Project Component</b>	<b>Lessons Learned (RTIMP and REP)</b>	<b>Implications to SCCF project</b>
Commodity Chain Linkages for smallholder farmers and processors	<ul style="list-style-type: none"> <li>-Significant number of chain actors are involved in 4 commodity chain development (Gari, HQCF, bonding cassava flour and fresh yam).</li> <li>-Partnership deals between market-led commodity chain segments (smallholder entrepreneurs and key off-takers) have increased trade volumes.</li> <li>-Enterprise record books have been developed and introduced to all actors (farmers and processors) to mainstream financial analysis and record keeping in the value chain business.</li> </ul>	<ul style="list-style-type: none"> <li>- SCCF will take advantage of the fact that linkages among actors through cassava commodity chains have been established by RTIMP. The work of adaptation will build on these links.</li> </ul>
Cassava production improvement	<ul style="list-style-type: none"> <li>-Healthy disease/pest-free planting material multiplied and efficiently distributed to more than 100,000 farmers (male and women) in all 10 regions of Ghana.</li> <li>-Informal farmer organizations (FFF) established in 60 districts as a platform for innovation, learning and sharing of know-how on new technologies for cassava production, land and water management.</li> <li>-Bio-agents to control cassava pests produced and realized in more than 200 localities to prevent the use of chemicals.</li> </ul>	<ul style="list-style-type: none"> <li>- Thanks to RTIMP several varieties of cassava with a stronger resistance to climate change and bio-agents for pest control are now available and can be used by SCCF.</li> <li>- SCCF will rely on existing organizations and on tested learning-by-doing mechanisms set up by RTIMP.</li> </ul>

Cassava processing	<ul style="list-style-type: none"> <li>-More efficient and cost-effective equipment (17 prototypes) for R&amp;T processing have been tested and, manufactured, promoted and made available to MSE processors.</li> <li>-124 local artisans have been equipped and skilled to fabricate and maintain/repair prototype equipment.</li> <li>-MSE have significantly grown thanks to the facilitation role of REP and RTIMP providing business orientation, financial services, training and technology development at the district and community levels.</li> <li>-A significant number of processing centres have been upgraded as Good Practices Centres (GPCs), also acting as demonstration centres visited by several thousands of small-scale processors who learned about good manufacturing practices.</li> </ul>	<ul style="list-style-type: none"> <li>- SCCF will take advantage of equipment, skills and know how introduced by RTIMP, and on the favourable environment generated by MSE proliferation.</li> <li>- SCCF will bring an opportunity for upscaling of GPCs and their conversion to clearinghouses for CC adaptation knowledge.</li> </ul>
Cassava marketing	<ul style="list-style-type: none"> <li>-High emphasis on marketing, introducing beneficiaries to trade firms.</li> <li>-Higher quality products with more attractive packaging/labelling have increased access to external markets (i.e. exports from Asueyi region to Niger, Burkina Faso, Gambia, Nigeria, USA and UK)</li> </ul>	<ul style="list-style-type: none"> <li>- SCCF will take advantage of improved environment for marketing and existing trade channels and will entail higher quality and diversification of produce (positive feedback mechanism)</li> </ul>
Access to financial assets	<ul style="list-style-type: none"> <li>-GPCs new technologies developed thanks to the access to Micro-Enterprise Fund (MEF).</li> <li>-Greater access to credit and knowledge for rural women, enabling them to undertake income-generating activities and to manage micro-enterprises.</li> <li>-Substantial increased access to financial assets for smallholders thanks to the preeminent role that IFAD has provided to credit and rural finance (i.e. building up of the Apex Bank of rural banks).</li> <li>-Funds management agreement has been signed with Ecobank-Ghana as a step to expand participating financing institutions to commercial banks.</li> </ul>	<ul style="list-style-type: none"> <li>- Efforts made by RTIMP have laid a good basis for the replication of the model set up through third component of SCCF. - The interest of Ecobank is a positive indicator for future magnification of the project.</li> </ul>
Awareness raising and Capacity building	<ul style="list-style-type: none"> <li>- A wide spectrum of the society has been reached by the messages conveyed by RTIMP thanks to the efficient use of local media. Thousands of farmers have been trained on good production and SLWM practices.</li> <li>- Thousands of local entrepreneurs have been trained in business development and marketing skills.</li> </ul>	<ul style="list-style-type: none"> <li>Existing base of knowledge is a positive asset that shall multiply the chances of success of SCCF. More fresh knowledge will be brought by the project.</li> </ul>

224. The SCCF project will adopt the same value chain approach of RTIMP and will address climate change adaptation needs and options along the value chain linkages –land and water management, crop production, processing and marketing- to increase resilience to climate change. The project will become a platform for the value chain actors (researchers, farmers, processors, traders, fabricators, transporters, bankers, governmental staff, educators, health staff, NGOs and media staff) to jointly understand the cassava value chain vulnerability to climate change impacts and implement effective adaptation measures.

225. Over the past years, RTIMP has tested and put in practice a learning approach that has proved effective and successful. Such approach has been based on the combination of awareness raising and the provision of information

through learning by doing and field testing, and on the continued knowledge inputs to very targeted audiences, over a long period of time. Decisions on changes in production patterns have been taken in a participatory way, and with the consent of most stakeholders. The set up of multi-stakeholders fora has been encouraged, so as to promote debate and cross-fertilisation, and to reach a common understanding of needs and solutions. The capacity of extension workers, trainers and media operators has been strengthened, in order to guarantee an optimum flow of information to the users at the end of the knowledge chain.

226. SCCF will build on this approach and achievements to introduce new and complementary knowledge focused on CC adaptation and more efficient and sustainable use of natural resources.
227. The SCCF project will mainly focus on the Brong Ahafo and Ashanti Regions, which are among the largest producers of cassava in Ghana (i.e. Brong Ahafo produced 22.7% and Ashanti 13.4% of Ghana's cassava production in 2002, with a continuous increase in both cultivated surface and quantity produced). In the region of Brong Ahafo, the Techiman Municipality has the largest food crop market in Ghana and its strategic location makes it a commercial hub between the northern and southern parts of the country, with good opportunities to support food security adaptation measures in the cassava value chain. On the other hand, cassava processing causes serious environmental impact in the region – especially health problems; soil/water pollution and uncontrolled fire from cassava waste; deforestation and uncontrolled fire from slash-and-burn agriculture and firewood collection - which are being magnified by climate change. Because of this, the Techiman Municipality, is considered a priority target area to address climate change adaptation within the SCCF project.
228. The SCCF project will build on the positive results of a study prepared by IFAD in the Techiman Municipality, and presented at IFAD's "Global Consultation on Cassava as a Potential Bio-energy Crop" workshop (Accra, October 2010). This study demonstrates the climate change adaptation benefits - in socio-economic and environmental terms - of using cassava waste products (peels and wastewater). The biomass of such waste products can provide the energy needs to upscale cassava processing (in terms of diversification of cassava and other agriculture derivatives and higher quality products) while at the same reducing environmental stressors. The Municipality of Techiman will play a central role in the project. Additionally, the neighbouring districts of Wenchi, Nkoranza, Kintampo (Brong Ahafo Region) and Offinso North (Ashanti Region), where a significant part of the raw cassava processed in Techiman Municipality is produced, will be targeted by the SCCF, in order to fully address the value chain approach to climate change adaptation, by targeting at the same time producers, processors and traders along the value chain.
229. Climate change will cause spatial shifts between agro-ecological zones in Ghana, leading to significant agriculture production changes. Without sufficient adaptation measures, such shifts may enhance the land degradation impact of current agriculture practices, eventually causing a dramatic decrease of cassava yields and accelerating the migration of rural population into urban slum areas. The SCCF project also aims to compare climate change impacts and vulnerabilities in the different agro-ecological zones where cassava is mainly produced in Ghana, addressing adaptation needs and introducing appropriate measures. The project will target seven districts covering a gradient between the Semi-deciduous Forest, Transitional and Inner Savannah agro-ecological zones. In addition to the previously mentioned districts in Brong Ahafo and Ashanti, located in the ecotonal area between the Semi-deciduous Forest and the Transitional Zone, the project will target two neighbouring districts in the Northern Region (Central Gonja) and in the Volta Region (Krachi East), located in

the ecotonal area between the Inner Savannah and the Transitional Zone.

230. As the IFAD/SCCF project will be a blended project, fully integrated into the IFAD-supported RTIMP and co-financed by IFAD, it will benefit from the synergies generated by sharing resources and structures. This partnership will undoubtedly boost the cost-effectiveness of both interventions, notably because of the joint management structure and M&E framework. Other expected benefits are the improved coordination and communication, the application of common procurement and supervision procedures (reducing costs), and the implementation of complementary project interventions in the seven project districts. Furthermore, lessons learnt through the work of RTIMP have, and will be constantly integrated in the course of project implementation.
231. The proposed IFAD/SCCF operation focuses on investment and impact on the ground. Because of this, the project has been carefully designed to attain an optimum level of investment that ensures maximum impact per SCCF dollar. The project will particularly focus on targeted capacity building and on improving the necessary technologies (i.e. adaptive management techniques for sustainable land and water management; innovative technologies for sustainable energy uses and improved food processing, in terms of quality and diversified products) to better streamline the adaptation investment.
232. The project will use proven mechanisms for community participation, such as farmer field fora, district stakeholder fora and exposure visits, as well as other capacity building tools and actions (i.e. training trainers from all concerned stakeholders at the regional and district levels), and government's involvement and technology transfer - particularly regarding SLWM and sustainable energies.
233. SCCF funding for Ghana is designed to be catalytic for scaling-up adaptation to climate change. The input of SCCF funding will translate into: (i) more sustainable land and water resources management through conservation agriculture techniques; (ii) improved water resource management in agriculture and drinking water; (iii) improved access to weather and climate information; (iv) improved food processing techniques based on sustainable energy sources - thanks to the positive impact of targeted technical and institutional capacity development, and the implementation of on-the ground activities (including demonstrations). The project will work with existing community structures such as the Good Practices Centres (GPCs) established by RTIMP, and will aim at strengthening them, so as to magnify their impact and further empower them in the marketing and high quality processing of their products.

Table 5 – Climate change impacts to the cassava value chain, CC adaptation measures proposed by the SCCF project and their CC mitigation potential.

<b>Cassava Value Chain</b>	<b>Current scenario</b>	<b>Climate change impacts</b>	<b>CC Adaptation measures</b>	<b>Additional CC Mitigation Effects</b>
<b>Cassava Production</b>	<ul style="list-style-type: none"> <li>- Low cassava yields (17 T/ha average).</li> <li>- Low soil fertility.</li> <li>- Soil erosion.</li> <li>- Significant pests/diseases and weed infestation problems.</li> <li>- Scarce/low</li> </ul>	<ul style="list-style-type: none"> <li>- Yield reduction due to lower water availability and higher erosion risk.</li> <li>- Higher risks of pests /diseases and weeds.</li> <li>- Higher risk of intense and frequent fires from</li> </ul>	<ul style="list-style-type: none"> <li>- Development, access and wider use of nutrient efficient, drought-tolerant, high-yielding, disease-resisting, early maturing crop varieties.</li> <li>- Adoption of SLM</li> </ul>	<ul style="list-style-type: none"> <li>- Soil carbon storage in agriculture land.</li> <li>- Reduction of emissions from prevented burning of agriculture and</li> </ul>

	<p>accessible water resources.</p> <ul style="list-style-type: none"> <li>- Slash and burn deforestation, erosion and nutrient deficiency problems.</li> <li>- Tenure problems mainly for women.</li> <li>- Unreliable production patterns and levels.</li> <li>- Production losses due to storage and post-harvest problems.</li> </ul>	<p>deforestation and bad agriculture practices.</p> <ul style="list-style-type: none"> <li>- Higher cyanide contents in raw cassava.</li> <li>- Higher unreliable production patterns and levels.</li> <li>- Lower revenues and capacity to access/rent farm land.</li> <li>- Increased storage and post-harvest problems due to higher temperatures.</li> </ul>	<p>techniques that increase soil fertility, water retention and crop production/ha (targeting up to more than 20 t/ha).</p> <ul style="list-style-type: none"> <li>- Efficient use of scarce water resources and higher availability in dry periods (i.e. during harvesting season).</li> <li>- Farmers enabled to predict CC impacts and plan/decide best options to cope with changes.</li> </ul>	<p>forestland.</p>
<b>Cassava Processing</b>	<ul style="list-style-type: none"> <li>- High soil and water pollution problems from cassava waste peels and wastewater.</li> <li>- Accidental and provoked fires in waste disposals.</li> <li>- Health problems from pollution and inappropriate processing techniques.</li> <li>- Water scarcity for processing contributing to low quality derivatives and sanitary problems.</li> <li>- Inadequate processing technologies resulting in low quality cassava derivatives.</li> <li>- Low revenues and savings to invest in adequate processing technologies and complementary agriculture/off farm activities.</li> </ul>	<ul style="list-style-type: none"> <li>- Increased surface/ underground water pollution from cassava waste due to higher temperatures and water scarcity.</li> <li>- Higher risk of accidental fire linked to waste disposals of cassava processing.</li> <li>- Higher risk of cyanide content in cassava processed products and related health problems.</li> <li>- Lower availability of wood-fuel to process cassava due to fire-related impacts and growth reduction CC-effects on forests.</li> <li>- Lower production rates and products with less quality.</li> <li>- Lower workforce due to migration.</li> </ul>	<ul style="list-style-type: none"> <li>- Use of sustainable energy production technologies that reduce environmental stressors exacerbated by CC (effective use of waste as bio-energy to prevent soil and water pollution and health problems; significant reduction and efficient use of wood-fuel to prevent deforestation and CO2 emissions).</li> <li>- Improved post-harvesting technologies that increase quality and diversify products.</li> <li>- Increase revenues from a wider range of products, and the capacity of savings to investment in new opportunities</li> </ul>	<ul style="list-style-type: none"> <li>- Significant reduction of deforestation and forest degradation (REED) due to lower dependence on wood-fuel and</li> <li>- Reduction of CO2 emissions due to efficient energy uses of wood-fuel and waste biomass.</li> </ul>

			and obtaining bank loans.	
<b>Cassava Marketing</b>	<ul style="list-style-type: none"> <li>- Difficult access to markets.</li> <li>- Scarce capacity to negotiate prices.</li> <li>- Scarce capacity to invest in complementary products to open new markets.</li> </ul>	<ul style="list-style-type: none"> <li>- Less accessibility to markets due to CC impacts in infrastructures.</li> <li>- Higher unsecured markets due to highly variable and less predictable production linked to CC and climate variability.</li> <li>- Lower capacity to negotiate prices due to lower production of less quality products.</li> <li>- Minimised capacity to invest in complementary products/markets.</li> </ul>	<ul style="list-style-type: none"> <li>- Higher and new market opportunities for a wide range of products.</li> <li>- Higher capacity to negotiate prices due to high quality products and less perishable products.</li> <li>- Improved organization and governance of food producers with higher marketing knowledge and capacities.</li> </ul>	

234. In line with the climate change policy objectives of the government of Ghana, the SCCF proposed adaptation measures also incorporate their mitigation potential, so that the project will provide a holistic and comprehensive approach to the various adaptation and mitigation roles of agriculture and agro-forestry as a climate change strategy.

## **B. PROJECT CONSISTENCY WITH REQUIREMENTS FOR THE SCCF FUNDING**

235. In line with the SCCF criteria for project proposal, the IFAD-supported project was developed in compliance with the principles of country ownership and drivenness. The project team engaged in extensive consultations with the Government to ensure that these principles were fully taken into account. Also, the activities supported through the project have been identified as priorities in the Ghana's National Climate Change Adaptation Strategy (NCCAS). In view of the above, the proposal fully addresses the national priorities in its field. Furthermore, GEF and SCCF criteria for project design and financing have been respected. Project management costs represent less than 10% of the total SCCF budget requested and co-financing ratio fulfils SCCF criteria. Finally, the project was developed in coordination with other ongoing activities, namely RTIMP and REP.

236. **SCCF Added Value Compared to the baseline:** Given the importance of agriculture in the national economy, the goals of economic growth and poverty reduction in Ghana will only be met if a modern and competitive agricultural sector is in place. The Government of Ghana, with the support of a wide range of partners, is engaged in a wide range of programmes and agricultural development projects. However, the agriculture sector, both at the national and the local food security level, is highly vulnerable to climate change. Currently, subsistence crop- and cash crop farmers are unable to adapt to the impacts of climate change, which are already being felt across the country, without external

support. Climate change is acting as a “multiplier” of existing threats to sustainable development. National development and progress towards food security could be stalled unless the adaptation measures outlined in the Ghana’s NCCAS and addressed in this proposal are implemented.

237. Sustainable land and water management (SLWM) is a deliberate human process through which land users can mitigate the impact of climate change on their agricultural practices. The successful promotion of SLWM requires an understanding of: (a) the natural resource characteristics of individual agro-ecosystems; (b) the socio-economic characteristics of the land users (population numbers, household composition, cultural beliefs, livelihood strategies, income/poverty levels, vulnerability, education levels etc); (c) the environmental functions and services provided to society by healthy ecosystems (watershed protection, maintenance of soil fertility, carbon sequestration, micro-climate amelioration, bio-diversity preservation etc); and (d) the constraints to and the opportunities for, rural communities to sustainably utilise the natural resources to meet their welfare and livelihood needs (e.g. for food, water, fuel, shelter, medicine, income, recreation).
238. The SLWM approach recognizes that people (the human resources) and the natural resources on which they depend, directly or indirectly, are inextricably linked. Effective SLWM requires multi-stakeholder partnerships to bring together indigenous and scientific knowledge. A multi-sectoral approach is essential as no one institution has all the disciplinary experts required to help those who directly use the land to solve the multi-dimensional problems. This requires coordination and cooperation between different government agencies (at the national, district, chiefdom and village levels), especially those responsible for agriculture, livestock, forestry, land and water resources, environment, science and technology, finance and planning.
239. The SCCF project also contributes to the GPRS II objective to encourage farmers to shift from subsistence agriculture to more-oriented production using simple but relatively more advanced technologies in processing. The use of new technologies for high quality and more diversified cassava processing and food production will represent a major contribution to climate change adaptation, responding to multiple measures and recommendations proposed by the NCCAS and by the SNEP and bio-energy policy, among others: (i) support education, training and awareness creation as well as incentives for the use of improved technologies, sustainable supply, production and utilisation of wood-fuel; (ii) monitor the health impact of wood-fuel production and use especially, on women and children; (iii) investigate innovative capital subsidy arrangements and micro-financing to assist rural communities acquire renewable energy technologies and provide decentralised renewable energy systems for individual and commercial needs; (iv) support the promotion of local manufacturing of renewable energy devices and equipment in the medium-to-long term; (v) promote the use agricultural waste as bio-fuel feed stock, as well as provide incentives for use of waste and promote more efficient conversion technologies, and efficient and adequate pricing of energy produced from waste. The use of sustainable energies to upscale cassava processing and food production will not only respond to the adaptation food security objectives (i.e. diversification of poor farmers’ livelihoods and increase of market opportunities) but will also significantly reduced a number of cassava-related environmental stressors that will be exacerbated by climate change (among others, soil and water pollution; health problems; irrational use of firewood).
240. In addition to the adaptation benefits required under the SCCF, the project will contribute a number of other environmental co-benefits at the local to global levels. Notably, any improvement in agriculture land management and sustainable agro-forestry management for wood-fuel production will protect



above and below ground carbon stores, contributing to climate change mitigation. The use of waste as bio-energy in addition to a more efficient use of wood-fuel will significantly reduce deforestation and CO<sub>2</sub> emissions to the atmosphere, thus contributing to climate change mitigation and to the reduction of soil and water pollution at local level. This will furthermore protect biodiversity in agro-forestry ecosystems, and reduce the risk of desertification. The project will also raise awareness on the win-win benefits between environmental benefits and socio-economic development among land users.

241. The SCCF funding will complement the government and community level capacity building and field level agricultural development activities of RTIMP and REP. While RTIMP currently works on improving and increasing R&T crop production and upgrading R&T processing and marketing, it does not specifically address the adaptation needs that cassava value chain actors will need to incorporate in their work to cope with climate change impacts. The SCCF project will support RTIMP to develop, test and disseminate adaptive land and water management practices, to incorporate climate change adaptation criteria in the selection of crop varieties and cropping systems, and to set up effective early warning systems for better agricultural and enterprise planning and decision making. The SCCF project will also incorporate climate change data and modeling in the RTIMP daily work (i.e. information system to support farmers decision-making and planning; applied research; awareness raising and education; etc).
242. The REP effort to upgrade the technical and entrepreneurial skills of rural micro and small enterprises indirectly addresses and promotes rural income diversification, which is a very relevant option for climate change adaptation. Nevertheless, REP does not consider adaptation needs to address the risk of farm-level income loss associated with climate-related risk. The additional value brought by SCCF to REP will build the capacity of the Business Advisory Centres (BACs) to facilitate ways for MSEs to understand how climate change will affect their businesses, especially in the agricultural sector, assess climate-related risks and opportunities in business development, and build adaptation strategies to allow vulnerable entrepreneurial households to keep a competitive edge by accounting for emerging climate risks in decision-making. Moreover, the project will support technological innovation for adaptation in the agro-business operations through pilot interventions, and will transfer know-how to the Rural Technology Facilities (RTFs) for their promotion and dissemination. The SCCF intervention will cover the additional costs that are relevant to these activities, and benefiting the same target groups along the cassava value chain. Building on the specific contribution of the RTIMP and REP and detailing the SCCF additional reasoning will be a prerequisite for the approval of the final project design.
243. The seven project districts (Gonja, Kintampo, Krachi, Nkoranza, Offinso North, Techiman, Wenchi) are an area where the SCCF project can successfully intervene using multiple approaches to help cassava producers and processors adapt to the impacts of climate change, making their cassava farming systems more resilient to the various current and predicted future impacts of changing rainfall patterns and rising temperatures. Key entry points will be the adaptation technologies for SLWM and for the high quality processing of a wider range of food products. The project will also encourage farmers to maintain a diversity of crops on their land. This criterion is widely accepted as a key adaptation to food security, as it reduces the impact of a crop's failure under climate change impact.
244. Agricultural productivity and the conservation of natural resources (particularly forests and tree crop areas) will be improved, allowing climate-proofed food security, which will lead to improved economic and social stability.
245. Awareness raising and action research will help land users to plan, test and validate alternative crop varieties to increase yields under a climate change

scenario, and adaptive land and water management practices to cope with changes in climate and enhance the agro-ecosystem's diversification and resilience. The project will raise awareness and capacity among local land users on climate change impacts and adaptation through co-learning.

246. Within Component 3 of the project, a considerable amount of facilities will be set up – namely two bio-energy plants, a new building with processing machinery, two cooling chambers and a honey processing room- to run a new processing centre that should become operational soon after project start-up. This considerable investment should be regarded as key pilot initiative, which could be eventually replicated elsewhere in the country and the region. The successful completion of this part of the project will require significant input and support in terms of CB, the enduring commitment of decision makers and administrations at all levels, and the contribution of highly-qualified national and of international consultants.

### C. COUNTRY ELIGIBILITY, OWNERSHIP AND DRIVENNESS

247. **Country Eligibility:** The Government of Ghana has ratified all three global environment conventions (UNCCD, CBD and UNFCCC).

Table 6 - UN Environmental Conventions signed and Ratified by Ghana

UN Convention	Signed	Ratified	Enter into Force
<b>UNFCCC</b>	June 1992	06/09/1995	05/12/1995
<b>UNCCD</b>	17/06/1994	27/12/1996	December 1996
<b>CBD</b>	June 1992	29/08/1994	09/1994

248. The Government of Ghana further demonstrates its full commitment to environmental protection by being part of the Kyoto Protocol (16 February 2005), the Convention on International Trade in Endangered Species (CITES) (Enter into force in March 1973), the Ramsar Convention on Wetlands (enter into force on February 1971) the World Cultural and Natural Heritage Convention (ratified in November 1972), the Cartagena Protocol on Biosafety (entry into force in January 2000), and the International Treaty on Plant Genetic Resources for Food and Agriculture (signed in March 2001).

249. In line with the Ghana's National Climate Change Adaptation Strategy (NCCAS), the proposed project aims to stress the linkages and benefit from the synergies between these environmental programmes and policies.

250. **Country Ownership and Drivenness:** Ghana's economy is predominantly based on agriculture. The need to give explicit recognition to the vital role a transformed agriculture can play in accelerating the rate of Ghana's overall Economic Growth and Development has now been fully recognized by the Government. Ghana's agriculture and irrigation policies are expected to contribute significantly to the achievement of the MDGs. The key to achieving the stated targets is improving Ghana's competitiveness in the production, processing and marketing of agricultural products both at home and in the world market. If Ghana keeps finding new inspiration, and learns to adopt new research results (approaches), the country will be able, over the long term, to attain its targets and raise its current standard of living and quality of life.

251. Nevertheless, Ghana's economy will suffer severe economic consequences

from climate change. Although there will be considerable variation in real gross domestic product (GDP) growth, the overall trend over 2006–50 clearly indicates a downward trajectory in the absence of adaptation to climate change. Toward 2050, annual real GDP is projected to be 1.9 to 7.2 percent lower than in a dynamic baseline scenario without anthropogenic climate change. Adverse agricultural productivity impacts become more pronounced over time - for the middle of the 21st century, agricultural GDP is estimated to decline by 3 to 8 percent relative to baseline scenario.

252. Ghana therefore urgently needs to keep up the momentum of positive change, look increasingly around for new ideas, new attitudes, new technologies and new approaches to support adaptation action. According to the EACC study, there is a need to: (a) increase investment in agricultural R&D, backed by extension services, to produce new crops and livestock, as well as early-maturing varieties; (b) improve water storage capacity to utilize excess water in wet years and use it when it is needed during dry years; (c) improve agricultural and livestock extension services and marketing networks; (d) construct small to mid-size irrigation facilities; (e) improve entrepreneurial skills to generate off-farm income (alternative livelihoods); and (f) improve access to loans and microcredit. A pro-poor approach to climate change adaptation is needed not only to look at reducing shocks to households, but also engage in transformative adaptation strategies that increase resilience and overcome past biases in sub-national investment. Ghana also needs a long-term national plan that takes climate change factors into account. Currently, Ghana only has a medium-term development plan covering 2010–13. The long-term plan also needs to be integrated into the plans of the regional coordinating councils and the district development plans to provide a coherent and integrated approach to development planning.
253. The proposed project is designed to implement the agriculture and food security elements of the NCCAS of Ghana. The idea to prepare a national strategy for adaptation to climate change was began in 2006 as part of the Netherlands Climate Assistance Programme (NCAP). The Environmental Protection Agency (EPA), held numerous zonal and district consultation workshops as well as national climate change fora, to solicit views and inputs from the citizenry. The NCCAS is therefore a culmination of expert views as well as views from civil society groups, governmental organizations, the private sector and non-governmental organizations both national and international and some development partners. It is expected that the NCCAS will also be reviewed by the National Climate Change Committee (NCCC) before submitting to the Cabinet and finally seek Parliamentary approval.
254. One of the major driving forces behind the development and finalization of the NCCAS was the acceptance of the national adaptation strategy as a trigger for sector budget support by the Ministry of Finance and Economic Planning under the Natural Resource and Environmental Governance (NREG) programme. The criteria for the selection and prioritization of the adaptation interventions were developed during stakeholder consultation workshop. The five criteria used covered (a) resilience of the adaptation intervention, (b) how sustainable the intervention will be, (c) the potential to have multiplier effects (co-benefits) as a result of the implementation of the adaptation intervention, (d) extent of replicability of the intervention, and (e) how feasible the whole intervention is.
255. Based on the above criteria, the NCCAS proposed the following priority adaptation activities/options that are relevant for the project:

Table 7 – Climate change adaptation measures proposed by the NCCAS that are relevant for the SCCF project.

<b>Adaptation Strategy</b>	<b>T/ O</b>	<b>R<sup>7</sup></b>
<b>Agriculture</b>		
Research/promotion of nutrient efficient, drought-tolerant, high-yielding, disease-resisting, early maturing crops and plant varieties	█	█
Diversification of crops & livestock, and livestock/crop integration	█	█
New crop mixtures and crop rotation	█	█
Agriculture expansion onto natural areas ad moist valley bottoms.	█	█
Adjustments to planting dates to meet seasonal rain changes.	█	█
Improved irrigation (i.e. shallow wells and slow-drip irrigation)	█	█
Promotion/adaptation of traditional agro-forestry practices	█	█
Tree planting and forest restoration	█	█
Controlled use of chemical fertilizers	█	█
Integrated pest control	█	█
Conservation agriculture (contour bunding and ploughing, zero tillage, non-burning, mulching, composting, use of manure, dynamic kraaling, green hedges and buffers) to increase soil water retention and reduce erosion risk	█	█
Research/training on post-harvesting and processing technologies	█	█
Promotion of marketing policies to encourage production	█	█
Development of food insurance schemes	█	█
Alternative livelihoods/off-farm jobs	█	█
Research on geographic changes requirements for the production crop types under future climate conditions	█	█
Mainstreaming adaptive agriculture land and water management strategies into policy and extension	█	█
Promotion of land zoning, mapping and support local communities for the production of land resource management plans	█	█
Policy changes to encourage farmers to adopt adaptive farming practices (i.e. effective policies on credit acquisition, pricing, land tenure, farm insurance and early warning information systems, efficient irrigation, SWLM, incentives for economic diversification, agro-forestry)	█	█
<b>Water Resources – Supply</b>		
Artificial recharging of groundwater	█	█
Promotion of Improved traditional/new rainwater harvesting and water conservation practices (i.e. storage of water in more improved and simple surface facilities such as ponds, tanks, and small reservoirs) for its use in the dry months	█	█
Good land-use practices along river-banks and protection of watersheds	█	█
Promotion of the central role of district assemblies, traditional rulers, landlords and earth priests (Tindanas) in mobilizing communities and farmers for water harvesting and integrated water management	█	█
<b>Water resource and energy demand</b>		
Development of alternative and efficient energy sources (biomass, solar, wind)	█	█
Development of woodlots	█	█
Promote efficient irrigation systems	█	█
<b>Social issues – Gender</b>		
Promote awareness programmes for different social groups on climate change impacts, vulnerability and adaptation options	█	█
Promote preventive measures on community development and community education for diseases reduce risk	█	█

<sup>7</sup> T=Traditional; O=Ongoing; R=Recommended

Research on spatial variations of diseases incidences, early warning programmes and monitoring tools		
Sanitation programmes/clean water and improve water & food storage initiatives		
Local income generating activities and programmes targeting women and youth		
Financial partnerships to facilitate access to credit for women		
Land tenure reforms		
Extension services to women on technological innovation on resource management, production, post-harvesting storage and processing		
Awareness and education, mainly for women on the advantages of forming groups (i.e. facilitate access to financial resources, improve production, processing and marketing)		

256. The project will implement directly and indirectly support the implementation of most of the activities mentioned in the preceding table.

## **VI. PROJECT DESCRIPTION**

### **A. PROJECT GOAL AND OBJECTIVES**

#### **PROJECT GOAL**

257. The overall project goal is to reduce the vulnerability of the food supply system and rural livelihoods to the deleterious impacts of climate change.

#### **PROJECT OBJECTIVE**

258. Contribute to the reduction of climate-induced risks to the achievement of food security and income generation objectives for the rural communities in Ghana, by focusing on the improvement and adaptation of the cassava value chain in pilot areas of the country.
259. The IFAD/SCCF project will complement the activities undertaken under RTIMP and those planned for REP III. The SCCF components are fully embedded in the RTIMP in a synergetic manner that would ensure that the SCCF funding is covering additional costs associated with the adaptation needs that were identified in the NCCAS and further discussed at all levels (national, regional and grass-roots) during the project formulation phase. This SCCF intervention will be articulated around four components: (i) Awareness raising to climate change and capacity to address impacts along the cassava value chain; (ii) Support adaptation to climate change of cassava production; (iii) Promote innovative adaptation solutions along agriculture value chains and (iv) project management and M&E.
260. The planned duration of the project is 3 years starting in 2012. The time frame of SCCF has been designed in order to guarantee full overlapping with RTIMP, and thus take advantage of the institutional and management framework in place. In case of possible delays in the work plan of SCCF, GEF/SCCF funding has been allocated within the project budget to specifically cover project management costs and avoid gaps.

### **B. PROJECT COMPONENTS**

261. **Component 1: Awareness raising to climate change and capacity to address impacts along the cassava value chain (SCCF: USD 544,300– Co-financing USD 640,000)**
262. This project component was designed to increase the capacity and understanding of all cassava-related stakeholders (government, research/academic, health sector, NGO, media) and project beneficiaries to address climate change impacts and implement adaptation measures. More specifically, this component entails three Outcomes: (a) Increased awareness and capacity of small producers, formal/informal organizations of growers, processors, and traders about climate change impacts and adaptation on agriculture value chains and related livelihoods; (b) Meteorological information is made available to inform agriculture investments and planning. The overall objective of the capacity building efforts are to ensure that all concerned stakeholders (at the regional, district and community level) have the necessary understanding of climate change impacts, vulnerabilities and adaptation options, and become able to integrate climate change adaptation as a new dimension in the sustainability of

livelihoods, food security and food safety. The training will provide regional and district stakeholders and local communities with the required decision-making, planning, implementation and monitoring skills in a manner that allows them to become more resilient to climate change impacts on their production, processing and marketing activities, and their livelihoods at large.

263. Meteorological services at the local level are very scarce, and the provision of weather information is very limited and very much restricted to the basic information provided by media. The capacity building efforts will also target local community groups with the provision of basic meteorological stations and the required knowledge and skills to use them and support their daily work. Moreover, the regional governmental meteorological staff will be trained on the use of meteorological data for climate change modelling on agriculture-related issues and provide adequate information to support farmers' decision making processes.
264. Semi-structured and individual interviews organised during the project preparation phase with male and female cassava producers and processors, scientists from research/academic institutions, MOFA/RTIMP staff, and District Assembly staff from the Ashanti and Brong-Ahafo regions, resulted in the general conclusion that awareness raising and education on climate change issues are relevant and highly necessary. In line with results from other climate change vulnerability assessments in different regions of Ghana, small holders in the project areas are conscious of weather changing patterns (i.e. changes in the onset of the rainy season and precipitation reduction; higher temperatures; drying river beds; higher floods and drought periods; soil degradation) and can attribute some of this changes to past and current human-induced disturbances (i.e. deforestation, inadequate land management practices, etc). Nevertheless, they do not understand well the phenomenon called "climate change" and the complex interrelations among different human-induced and environmental factors. Moreover, some of the respondents attested to being asked similar questions several times by previous vulnerability assessment exercises but have never known what this information was used for. The governmental staff and scientists reported to have a generic understanding of climate change issues but not enough knowledge to incorporate risk-reduction and adaptation measures in their daily work.
265. In conclusion, all respondents considered that awareness raising and capacity building activities at the regional, district and community level are highly needed as a major precondition to support the adoption of climate change adaptation in decision-making and management. The proposed activities will target in particular women and youths, as they play a major role in subsistence food production and are particularly vulnerable due to the existence of non-climate stress factors. Training activities will be organized at different levels: training for trainers, involving regional and district governmental and non-governmental organizations, and focus groups learning activities involving small householders and all concerned stakeholders supporting cassava production, processing and marketing operations. Considering the potential increase of cassava cyanide-related health disorders (i.e. higher drought conditions may increase the cassava cyanide concentrations; bitter cassava varieties with higher cyanide may better adapt to drier climate conditions) and the more unbalanced diet (i.e. poor cassava producers are more vulnerable to climate change and will have less means to complement their diet) that may result from the climate change predictions, it will be a major need to raise awareness of the staff from health centres to warn the local population about the increase of cassava-related potential health disorders due to climate change.
266. The most important source of connectedness and information for local communities is the radio. The majority of the rural population has access to a

radio and regularly listens to community radio that represents trusted sources of information for local communities. During fieldwork in the project preparation, evidence was collected that community radio, information vans and community announcers are an invaluable resource for farmers helping them in planning activities, knowledge exchange and information gathering. For this reason, radio represent a main tool for carrying out the awareness raising activities proposed in the project. Building the capacity of radio managers on climate change adaptation is therefore taken into account to ensure an effective role of radios in climate information dissemination. In addition, culturally adapted musical and pictorial tools, as well as info kits in local languages, will be promoted to increase awareness on climate change among the rural population.

267. **Outcome 1.1: Increased awareness and capacity of small producers, formal/informal organisations of growers, processors, and traders about climate change impacts and adaptation on agricultural value chains and related livelihoods. (SCCF: USD 445,400 – Co-financing: USD 523,000)**

268. This outcome will focus on building the capacity of agriculture practitioners, and empower them to take proactive measures towards the adaptation of their professional activities to climate change. It will also spread awareness among the wider society on climate change and adaptation needs and mechanisms. After building a critical amount of baseline information- including an analysis of local perceptions and the identification of transferable lessons - the project will develop and implement a tailor-made capacity building and awareness raising programme with the support of national and local actors, including the media. The programme will be culturally sensitive and will strive to mainstream new knowledge into local and traditional cultural tools and practices.

269. **Output 1.1.1:** this output will entail the **design of a climate change capacity building programme and an awareness raising campaign.** A ground-mapping exercise will be carried out, in order to: (a) explore perceptions and attitudes of all stakeholders to climate change risks and vulnerability; (b) analyze traditional culture and knowledge and assess their “permeability” to innovation and the introduction of new practices, and (c) review and analyze existing initiatives and lessons learned on the adaptation of cassava-related agro-ecosystems. This exercise will enable the project team to shape a capacity building and awareness raising programme that can best suit the local social and cultural environment, and to identify the best tools for its implementation. All such tools will be produced in the local languages, and with the most appropriate format, in order to increase chances of successful learning and assimilation.

270. **Output 1.1.2: The training programme** will cater for trainers from regional and district institutions, and shall include representatives of the administration (agriculture, forestry, planning, environment, water management, information services, health, business and any other relevant field of work), the civil society, and the media (radio, newspapers). The programme will consist of regular thematic workshops. At a more grassroots level, group discussions will be organised with farmers and processors (women, men, youth groups). As a result, at least 80% of the beneficiaries from the project’s targeted groups will gain awareness of climate change impacts, implications on their livelihoods, and adaptation options.

271. **Output 1.1.3: Awareness raising campaign.** Special attention will be devoted to the empowerment of local NGOs, in order to reach students and teachers through non-formal education programmes, building on the practice of environmental clubs for extra-curricular work. The engagement of the local media will be sought through collaboration with community and commercial radio stations, which will be supported in the development and broadcast of brief radio



programmes on climate change environmental-, social-health-, and economic-related issues. Finally, information vans and community announcers will be used to spread awareness on the implication of climate change on livelihoods, by organising periodical announcements in rural cassava-producing areas. As a result, at least 80% of targeted people in the value chain target groups will gain awareness of climate, and its implications on their livelihoods.

272. **Output 1.1.4: The scaling up of the new technologies** and the promotion of the adaptation benefits derived from the project component 3 will be achieved through the organisation of study visits and learning tours for participants from West and Central African countries to the model-processing unit of Asueyi. It is foreseen that at least 40 people representing different stakeholder groups will have attended learning tours by the end of the project.
273. **Outcome 1.2: Climate meteorological information is made available to inform agricultural investments and planning (SCCF: USD 98,900 – Co-financing: USD 117,000)**
274. This outcome will support farmers in the project area and the meteorological staff from the national and regional/district meteorological stations, with the purpose of increase the availability of reliable meteorological information at the local level, and support the development of weather based forecasting of crop operations, pests and diseases to better inform local decision makers on the adaptation of agricultural practices to climate change.
275. **Output 1.2.1:** In each target area, farmers and processors will be equipped with basic meteorological stations, and will be trained on the correct use of the devices, so that they can collect reliable data and information. National/regional meteorological staff will be trained on advance weather based forecast modelling techniques to support local farmers' decision-making. At least 200 beneficiaries will receive relevant meteorological forecasts on a regular basis and in a timely fashion. Also, culturally sensitive and user friendly leaflets will be produced in local languages and distributed to farmers and processors during farmer field fora and assembly meetings, explaining the relation between meteorological conditions, production calendars, and crop varieties.
276. **Component 2: Support adaptation of cassava production to climate change (SCCF: USD 863,000 – Co-financing: USD 4,266,000)**
277. The rationale for this component relies on the recognition that integrated, sustainable land and water management (SLWM) contributes to build environmental and social resilience, and helps reduce the impacts of climate change on agricultural production and food security.
278. Agricultural production in Ghana is mainly rainfed and thus is particularly vulnerable to increasing climatic variability and climate change. Cassava is not only a major part of the staple diet in Ghana and in the tropic countries as a whole (the third most important source of calories in the tropics and the sixth most important food crop) but also has the potential to be an important component of food security in a time of climate change, due to its high tolerance to periodic and extended periods of drought, low requirements of agriculture input and soil conditions. Nevertheless, climate change scenarios in Ghana predict a reduction in cassava productivity or yields, so that farmers will need to adapt their production systems. Ghana's NCCAS emphasizes the following land and water management adaptation options to minimize impacts on farmers' livelihoods and food security: (i) promote the use of nutrient efficient, drought-tolerant, high-yielding, disease-resistant, early maturing crops and varieties; (ii) diversify and mix/rotate crops, and integrate livestock/crop management; (iii) promote and adapt agro-forestry practices, including hedging around cropland and river-banks/watershed protection; implement conservation agriculture land

management practices (i.e. contour bunding and ploughing, zero tillage, non-burning, mulching, composting, use of manure, dynamic kraaling, green hedges and buffers) to increase soil water retention and reduce erosion risk; (iv) promote improved water conservation practices (i.e. storage of water in more improved and simple surface facilities such as ponds, tanks, and small reservoirs) for its use –including irrigation– in the dry months; and (v) promote complementary agriculture livelihoods. All this will require significant efforts in terms of research/training to promote the use of well-adapted crop varieties, and to implement innovative land and water management practices.

279. The rapid field assessment undertaken during the preparation of the project, and other previous vulnerability assessments in different regions in Ghana, revealed that farmers acknowledge the vital role of SLWM to reduce people’s vulnerability against environmental disturbances and increase food security. There are a number of good practices on land and water management already developed and tested in different regions and agro-ecological zones where cassava represent a major component of local livelihoods, that can be tested and adapted to the project target areas. The project will support farmers in collaboration with scientists and extension workers for developing plots to demonstrate the applicability of a range of SLWM approaches, climate-adapted cassava varieties, and integrated agriculture and agro-forestry systems, to sustain and increase the productive capacity and protective functions of their lands.
280. The aim will be to enable land users to assess the environmental problems affecting their lands, understand the interaction of the natural resource base and climate variability and prepare their land management plans. The local plans will take increasing climate variability into account. This component will specifically support ecosystem-based adaptation in the targeted areas by coupling the local planning exercise with physical investments in soil and water conservation (on a pilot basis) and the promotion of sustainable land management practices (including conservation agriculture) in a number of districts within three agro-ecological zones where cassava represents a major crop: the inland savannah in the Northern region (Gonja district), and in Volta region (Krachi district), the transitional zone in Brong-Ahafo region (Kintampo district), the semi-deciduous forest zone in Brong-Ahafo (Techiman municipality, Wenchi district, Nkoranza district) and in Ashanti region (Offinso North district).
281. This component includes three Outcomes: (i) Cassava production is more resilient to climate change impacts and its quality is maintained despite risk of deterioration associated to climate impact (ii) Risk to cassava production associated with water scarcity mitigated and (iii) Agro-ecosystem resilience to climate change strengthened.
282. ***Outcome 2.1: Cassava production is more resilient to climate change impacts and its quality is maintained despite the risk of deterioration associated to climate impact (SCCF: USD 465,200 – Co-financing: USD 2,656,000).***
283. This outcome will strive to protected cassava-related agriculture from the threat of climate change by strengthening the production and improving techniques, capacity, and means through a variety of activities, which shall be put in practices in several farm plots from four pilot regions (Ashanti, Brong-Ahafo, Northern and Volta) of the country. The desired final outcome will be an increase in the resilience of cassava production, through the introduction and testing of climate-change resilient varieties and practices. This outcome will be achieved through a mixture of training and capacity building, learning from best practices, scientific research, and field and experimental work.
284. **Output 2.1.1:** This output will be achieved by working on 32 pilot plots

identified in the four regions addressed by the project. In the initial phase, rural appraisal meetings will be organised in 20 community groups to record and understand the farmers' perception and attitudes towards the climate-change related factors that have an impact on cassava yields. Farmers, extension workers and researchers will be engaged to put in place 32 plots where good practices aimed at increasing the yield will be put in place. The fieldwork will be monitored, and its results will be spread and discussed through regular workshops. In order to spread the results and the techniques, culture-sensitive education materials will be produced and distributed among farmers. It is foreseen that these new practices will not only increase the resilience of cassava cultivation, but will also contribute to decreasing the environmental impact of agriculture, by introducing practices related to organic farming (i.e. composting, rotation, use of manure) and abate the input of chemicals and water. As a consequence of this, it is calculated that at least 80% of cassava plots will have adopted climate change resilient cassava varieties with higher yields than the baseline by the end of the project.

285. **Output 2.1.2:** Climate-change resilient cassava varieties –selected among the already existing varieties developed by national and regional research centres- will be the focus of this output, which will combine training and field testing/dissemination. A regional workshop for Central and West African countries will be organised to discuss adaptation options from cassava varieties and their environmental, health, social, and economic implications. Subsequently, 16 demonstration sites will be established with the engagement of local farmers, for testing and learning about the use of the selected varieties. Plant material of CC resilient varieties of cassava will be distributed to project beneficiaries for growing in the demonstration sites. Training for local farmers will be organised, with a special focus on gender balance (at least 30% of women participants), while the results of the research will be available on the web in local languages. By the end of the process, at least 200 farmers will be trained on the use of CC-resilient cassava varieties to address adaptation to changing climatic patterns.
286. **Output 2.1.3:** It is forecasted that climate change will increase the impact of pests and diseases on cassava yield. This output will aim at achieving a higher level of forecasting and prevention of such threats. Training on downscaling methodologies to gain local CC scenarios and estimate future impact of pests and diseases will be implemented, and followed by promotion and support to the integration of such scenarios in the local knowledge and decision-making, at the level of local communities. By the end of the project, 80% of beneficiaries will be empowered to integrate local knowledge, climate scenarios and agro-meteorological data in decision-making at the community level. The foreseen impact of this acquired capacity will be a 70% increase in secured crops in communities that use the data provided for crop-related decision making.
287. **Outcome 2.2: Risk to cassava production associated with water scarcity mitigated (SCCF: USD 109,200 – Co-financing: USD 990000)**
288. One of the forecasted consequences of climate change will be decrease and variation in the distribution pattern of precipitation, which is most likely to lead to decreased amount of water available for the crops. The project will gather information and look at existing best practices within the country in order to support adaptive management of local farmers to decreased availability of water, and improve the harvesting and use of this resource.
289. **Output 2.2.1:** Small-scale harvesting of surface and underground water resources will be reviewed and analyzed in the three agro-climatic zones addressed by the project, in relation to climate change predictions. Good examples of CC adaptive water resource management will be spread among users through study tours in the northern regions of Ghana, and demonstration pilot

projects on adaptive water management will be implemented in two targeted areas, after a participatory process to identify the best options. Water harvesting equipment, already tested and proofed as effective in storing water during drought periods by the Water Resources Commission in the Northern regions, will be selected, provided and installed in the two pilot areas. At the end of the process, 40 trainers will have been trained on CC-adapted water harvesting systems and techniques. The final objective is to decrease the water vulnerability of project beneficiaries by 50%.

290. **Outcome 2.3: Agro-ecosystem resilience to climate change strengthened (SCCF: USD 288,600 – Co-financing: USD 620,000)**

291. Adaptive land management practices, and notably agro-forestry, can effectively increase the resilience of crops to climate change. This outcome will look at available practices in the project targeted areas, and set up a participatory process aimed at selecting pilot farms for the testing and demonstration of sustainable land management practices. The implementation of these actions will be supported by training, study tours, and the provision of equipment.

292. **Output 2.3.1:** Adapted land management practices will be successfully implemented in at least two farms in each targeted district within the project's three agro-climatic zones. The process will include a phase of inventory and review of available practices, the selection of pilot demonstration farms, bimonthly training sessions for at least 100 farmers, and the provision of equipment. The final aim is a substantial improved of soil and water moisture conditions in the 64 demonstration sites, through techniques such as composting, mulching, ridging, fallow, etc. Local research and academic institutions will be involved in the development of a monitoring system to assess soil and water moisture conditions. At least 200 farmers will be involved, of whom at least 40% will be women, and soil and water moisture conditions will have improved in at least 100 hectares of land by the end of the project.

293. **Output 2.3.2:** This output will focus on the active promotion of agro-forestry in the project area. The environmental, social, and economic values of agro-forestry will be identified through workshops and surveys, and a study tour will be organised to visit pilot experiences about the restoration of the "taungya" agro-forestry system in the Offinso district. This experience will be subsequently adapted to the project target areas, and participatory process will be held in at least one site in each district, in order to test and demonstrate a modified "taugya" system for the diversification of agriculture and forest goods production. At least 32 agro-forestry plans will be developed and implemented, and market opportunities for the goods (forest goods and crops obtained through the new system). The objective is, to increase revenue diversification of at least 60% of the beneficiaries, and decrease the impact of unusual climate event on the crops of at least 50% of the beneficiaries.

294. **Component 3: Promote innovative adaptation solutions along the agriculture value chain (SCCF: USD 821,700 – Co-financing: USD 3,270,000).**

295. The Ghana's NCCAS proposes a number of adaptation options along the agriculture value chain: support income diversification activities and programmes, especially targeting women and youth; Research/training on post-harvesting and processing technologies (Annex 11); Promote local marketing opportunities and policies to encourage production; Development of alternative and efficient energy sources (biomass, solar, wind).

296. Cassava processing has a significant environmental impact due to a number of factors: the important demand for wood-fuel, which in turn is used in a

very inefficient way; the production of significant amount of polluting waste materials (cassava peels and wastewater) with cyanide-contents causing pollution on superficial and groundwater systems and serious health problems. The use of new technologies for a more efficient and healthy use of wood-fuel and the production of energy from cassava waste products (peels and wastewater) will not only improve working conditions for poor women and youth population, but will also help diversify production (i.e. a wider range of cassava products and other food products like mushrooms) and increase the quality of product and the potential for food preservation, which in turn will open better and new market opportunities. In this sense, the 2006-2020 SNEP developed by the Energy Commission includes a number of policy recommendations on the sustainable management of agro-forestry land for wood-fuel supply, on the use of agriculture waste for energy production and the development of improved technologies for wood/waste-fuels.

297. The clear adaptation objective of this project component also incorporates significant climate change mitigation potential (i.e. reducing CO<sub>2</sub> emissions from inefficient wood-fuel burning, and from cassava waste burning) so that it will provide a holistic and comprehensive approach to the various adaptation and mitigation strategies.
298. This project component will put special focus in the Techiman Municipality, where cassava waste represents a major environmental and health problem. The project will support a number of cassava producer groups operating in/nearby Asueyi to work together in a new, more advanced processing plant fed with renewable energy from cassava waste and saw dust products (one gasifier and one biogas plant), for the production of high quality cassava products. The project will target 5 to 7 GPCs around the town of Asueyi. Because of the above-average skills acquired by these particular centres, the project considers that they are best positioned to run the innovative plant and guarantee high-quality results.
299. Moreover, the project will support 15 cassava processing groups from the four targeted regions to increase efficiency in the use of wood-fuel and reduce environmental and health impacts. A pilot experience to use cassava waste peels for mushroom production, and improve energy efficiency in their production, will also be implemented in Techiman Municipality.
300. This component includes 2 outcomes: (a) Successful adoption of innovative solutions that contribute to adaptation in the targeted area and sub-sector and (b) Diversified livelihoods and socio-economic impacts of climate change mitigated.
301. ***Outcome 3.1: Successful adoption of innovative solutions that contribute to adaptation in the targeted area and sub-sector (SCCF: USD 716,000 – Co-financing: USD 2,825,000)***
302. The successful adaptation of cassava and other agriculture crops to the challenge posed by climate change implies the adoption of a full set of innovative practices and solutions aimed at increasing energy consumption, decreasing the impact of agricultural on the environment and the natural resources, improve health and social issues related to the production, and introduce appropriate technology and state-of-the-art equipment. This outcome will look at this whole range of options, and will support the adoption of efficient and environment-friendly technologies for energy production and use, as well as adaptation techniques for food safety and food security along the cassava value chain. This will be achieved through the setup of a new producing plant and facilities, including bio-energy producing plants, which are meant to become a reference of climate change adaptation in agriculture for the whole region. The provision of

equipment will be coupled with the training needed to guarantee adequate and sustainable use.

303. The diversification of cassava processing into several derivatives, demanded by the market is an interesting challenge/opportunity for the target farmers/processors groups of Asueyi in the Techiman Municipality. High quality cassava dried products are the best-selling cassava items, and for instance Ghanaian traders have shown interest in increasing the quantity and improving the quality of the dried "agbelima". This requires the introduction of improved technologies to reduce environmental hazards associated with traditional cassava processing and improve living conditions of workers, farmers and small entrepreneurs by securing/increasing their revenues.
304. The new processing pilot plant proposed will introduce, among other improvements, mechanized operations and flash drying technology to scale up and control production along all steps of the operation. Improved service facilities will include: buildings, one borehole and one overhead tank for water, toilets, store-rooms. A continuous supply of efficient sources of energy (electricity, hot air and gas) is required by the new pilot plant. The suitability of cassava peels to be converted into energy has been evaluated by a preliminary study already undertaken in Nigeria with the financial support of IFAD/RCPMI initiative. A new study prepared for Ghana and presented in Accra in October 2010 at the IFAD "Global Consultation on cassava as a potential bio-energy crop" gave positive indications on the profitable utilization of cassava peels together with other available biomasses. (i.e. sawdust).
305. The Asueyi cassava processing pilot plant needs primarily 90-100 kWh of electricity (at the top of consumption) for hot air to dry cassava derivatives and biomasses (cassava peels and sawdust). Energy will be generated from both gasification and biogas systems.
306. Gasification pilot plant: Considering the energy required to make the proposed Asueyi cassava pilot plant self-reliant (to both produce electricity and for biomasses/cassava derivatives drying), a gasifier (power generating system) capable of using surplus gas for hot air generation and heat recovery from engine exhaust is recommended. The system will have a 120 kW gas engine to produce 120 kW of power to meet the peak power requirement of 100 kW, with an average consumption of 90 kW for 10 hours and 60 kW for the remaining 10-12 hours in addition to meeting the requirement of 15-20 kW as captive power. Exhaust heat will be used for drying the biomass required for the system. The excess gas generated by both gasifier and biogas systems will be used to produce hot air for drying cassava derivatives with flash drying technology or to supply heat for roasting gari.
307. Biogas pilot plant: The Asueyi cassava processing pilot plant will be processing 16,000 kg/d (1<sup>st</sup> year) up to 25,000 Kg/d (5<sup>th</sup> year) cassava roots. The average production of wastewater is estimated will be about 0.8 to 1 L/kg of raw cassava roots. Thus, the unit is expected to produce 25,000 liters/day of wastewater containing organic load of 3,400 – 6,000 mg/L as BOD. The wastewater can be processed through a high rate anaerobic digester to convert ~80% of BOD to biogas in 24-48 hours to generate 48–73 m<sup>3</sup>/day (average 60 m<sup>3</sup>/day) of biogas depending upon the organic load. Biogas from effluents normally has 65-70% methane and its calorific value is 5,800-7,200 kcal/m<sup>3</sup> (6,500 Kcal/m<sup>3</sup>). The energy production will be 60 m<sup>3</sup> x 6,500 Kcal/m<sup>3</sup> = 390,000 Kcal/day. The new processing pilot plant and the traditional processing facilities will require potable water to improve the quality of finished products and avoid environmental pollution. An estimated amount of 25,000 liter/day of waste processing water will be available for bio-methane production.
308. The analysis of the technical feasibility based on the energy generated by

the system and purchased by the new and traditional processing operations, shows positive outcomes. The system can generate energy at a competitive price and the gasification/biogas systems are able to generate energy under the forms of electricity, hot air and gas. The energy generated by gasification will be utilized directly (it cannot be stored); however, the energy generated by the biogas can be stored and utilized when required.

309. The technical feasibility of the new processing pilot plant, as already said, shows positive outcomes. The pilot plant will purchase energy from the gasification/biogas systems at the agreed price. The technology of the pilot plant is a mix of improved traditional and new technologies. These latter relate to mash centrifugation and flash drying (required in some of the product lines). Flash drying technology, already known in the country, is now under testing by RTIMP program. The new technology will allow a scale up of the production, the introduction of Good Hygiene-and-Manufacturing Practices (GHP and GMP), thus improving the quality and shelf-life of finished products. The pilot plant will produce a range of high quality cassava dried derivatives (cassava dough, in particular, but also flour or dried fufu, according to market demand. Cassava fiber may be sold as feed meal).
310. The bio-energy plants of the Asueyi innovative processing centre will be owned by the Techiman Municipality. The SCCF project will hire a consultant to provide guidance on all legal aspects and to identify the best governance options to reach a satisfactory agreement between Techiman Municipality and local users (i.e. long-term lease and equitable payment mechanism). The consultant will outline the institutional and legal context that govern the implementation of this type of investments and will identify the possibility of further investment opportunities/linkages of the plant at the local level. Finally, the consultant will assess, define and describe the possible modalities for this investment that would guarantee equitable benefit sharing for the participating communities (public; private; public-private; pay-off the investment in case of considering banking loans, build operate/transfer, shareholding etc). The specific TOR for this consultancy are available.
311. **Output 3.1.1:** The organisation of a study tour for 5 participants to India to learn about transferable option for environmentally friendly energy production will mark the take-off of this output. Subsequently, a model-processing unit based on sustainable energy sources that replace firewood will be established, and shared by several cassava-processing groups in the project area. The project will also replace traditional/inefficient firewood systems for roasting gari or for the sterilisation of the mushroom medium, using small gasification stoves. A model processing centre will be built in the pilot area of Asueyi, in the Techiman Municipality of the Brong-Ahafo region, equipped with a biogas pilot plant and all the necessary equipment for cassava derivatives processing. These technological innovations will lead to the almost complete substitution of fossil fuel and firewood in 3200 households, to the saving of up to 265,000 litres of diesel fuel/year and to a sharp reduction of environmentally damaging disposal of cassava peels. On the production side, 5,000 to 8,000 MT of raw cassava per year will be processed with sustainable energy sources, into high-quality derivatives with 10% moisture content and free of impurities. The improvements will also imply a substantial reduction of CO<sub>2</sub> emissions.
312. **Output 3.1.2:** This output will focus on increasing the sustainability of underground water consumption along the cassava value chain. A preliminary assessment of current and future underground water availability according to climate change scenarios will lead to the definition of sustainable consumption levels, and the design and provision of state-of-the-art equipment for water extraction and use will lead to an increase in wastewater treatment for bio-gas generation up to 8,250 m<sup>3</sup>/year (25 m<sup>3</sup> x 330 days/year), and an abatement of

soil and groundwater pollution in Asueyi.

313. **Outcome 3.2: Diversified livelihoods and socio-economic impacts of climate change mitigated (SCCF: USD 105,000 – Co-financing: USD 445,000)**
314. This output will boost complementary income sources in cassava producing and processing communities, through the improvement of technologies and practices for mushroom and honey production. These improvements will lead to better production and storage, reduced consumption of firewood, and more efficient use of cassava by-products. The outputs will imply both an increase in high quality mushroom and honey production and food conservation opportunities, and a decrease in environmental impacts (reduced pollution caused by cassava peels; reduced deforestation caused by irrational firewood collection; increased vegetation protection and tree planting to improve honey production; increased number of pollinators, pollination levels and crop yields). Young entrepreneurs, especially women, will be the main target of the work. The MOFA/Rural Enterprises Programme will provide support in terms of training needs and micro-finance opportunities for farmers to acquire the honey production input package (beehives, protecting cloths, and basic tools) The results of these actions will be disseminated through a report geared at national and international research centres.
315. **Output 3.2.1:** Improving storing facilities to extend the life and maintain the quality of perishable food products and diversifying food production will both contribute to increase marketing opportunities and improve food security under a climate change scenario, thus becoming an important part of the SCCF project adaptation strategy. The storing of perishable food products produced by cassava farmers will be improved through the establishment of a refrigerated room in the cassava model-processing unit. The output will also address mushroom production, introducing CC adaptation practices (i.e. using cassava waste for energy generation and reducing firewood consumption) and installing gasification technology to cut by 2/3 the consumption of firewood during the medium sterilization process. The use of cassava peels mixed with animal manure will be tested for the production of straw mushrooms, as well. By the end of the project, this output will have achieved the production of 100kg of straw mushroom per demonstration site, and at least 15 young entrepreneurs will have been trained in growing this produce in an environmentally sustainable fashion.
316. **Component 4: Project management and M&E (SCCF: USD 271,000 – Co-financing USD 809,000)**
317. Project Management and M&E functions will be fully co-ordinated and integrated within the management structure of the RTIMP, with a joint planning process and sequencing. The SCCF project will be managed as part of the RTIMP components touching in a mainstreamed nature across all supported activities of the baseline to cover the additional costs that are associated with adaptation to climate change. The same approach to M&E will be adopted but the SCCF will have its own log-frame/indicators and reporting systems as per GEF/SCCF requirements.
318. The IFAD/SCCF project M&E system will be made particularly effective as it will include participatory elements, ensuring that local communities (including project beneficiaries) and partners are involved in the process. This is designed to advance local stakeholder participation and assist them to take ownership of the activities and results of the project. A part of the participatory M&E will be devoted to women's focus groups, to ascertain the extent of women's participation in programme activities, constraints faced, benefits gained, aspirations met and impact on women's status in the family, their involvement in community affairs and the climate-proofing of their agriculture.



319. The M&E system will optimize prospects for sustainability following the eventual termination of the IFAD/SCCF interventions, by using indicators that are straight forward to collect and/or have been identified as critical to track.
320. An SCCF project officer (PO) that will be responsible for the supervision of the implementation of SCCF project component will be recruited. S/he will be working under the overall supervision of the coordinator of the RTIMP in a fully integrated manner within the RTIMP personnel. The project will also recruit a project assistant and a driver to provide the necessary administrative and logistical support to the PO. An element of the SCCF funding will be dedicated to the purchase one vehicle, to facilitate the coordination of the SCCF fieldwork.

## VII. PROJECT COST AND FINANCING

321. Total project costs are estimate at U\$D 11,485,000 covering the SCCF grant of U\$D 2,500,000 and an estimated co-financing sources of about U\$D 8,985,000 that are mainly estimate from the investments of RTIMP (U\$D 8,521,000) and in-kind contribution of government (U\$D 314,000) and beneficiaries (U\$D 150,000). The SCCF grant is except from taxes and duties.

322. The following table provides the project cost by component and sub-component by sources of funding

	SCCF	IFAD	Government	Beneficiaries	Total Co-\$
<b>C1. Awareness raising to climate change and capacity to address impacts along the cassava value chain</b>					
Increased awareness and capacity of small producers on climate change and adaptation in value chains	445400	470000	20000	33000	523000
Climate meteorological information made available to inform investment	98900	95000	20000	2000	117000
Sub-total	544300	5650000	40000	35000	640000
<b>C2. Support adaptation of cassava production to climate change</b>					
Cassava production and quality more resilient to climate change impact	465200	2600000	31000	25000	2656000
Risk to cassava production associated with water scarcity mitigated	109200	950000	20000	20000	990000
Agro-ecosystem resilience to climate change strengthened	288600	580000	20000	20000	620000
Sub-total	863000	4130000	71000	65000	4266000
<b>C.3 Promote innovative adaptation solutions along the agriculture value chain</b>					
Successful adoption of innovative solutions that contribute to adaptation	716500	2770000	30000	25000	2825000
Diversified livelihoods and socio-economic impacts of climate change mitigated	105200	400000	20000	25000	445000
Sub-total	821700	3170000	50000	50000	3270000
<b>C.4 Project Management and M&amp;E</b>	271000	656000	153000	0	809000
<b>Total</b>	<b>2500000</b>	<b>8521000</b>	<b>314000</b>	<b>150000</b>	<b>8985000</b>

## COST-EFFECTIVENESS

323. The IFAD/SCCF project will be fully integrated into the IFAD-supported RTIMP and it will build on the knowledge, information, and experience accumulated by RTIMP over the past years. The project will also benefit from the synergies generated by sharing existing resources and structures, including the management and M&E frameworks, the communication services, the application of common procurement and supervision procedures (reducing costs), and the implementation of complementary project interventions in the seven project districts. The National Project Coordination Unit will share premises, equipment and facilities with RTIMP, thus helping reduce overhead and project management costs.

324. The IFAD/SCCF project is mainly investment-oriented with a view to maximize the impact per SCCF dollar. Project design is based on a number of technical and financial feasibility studies, which were carried out by experts during the project formulation phase based on existing, similar work in Nigeria and Ghana, in the framework of the Regional Cassava Processing and Marketing Initiative (RCPMI). The primary and secondary data for the feasibility studies were collected during field visits in 2011. The outcomes of these studies provide a solid justification to the project approach, compared to alternative approaches (see annex 10).
325. The IFAD/SCCF proposal was developed with the aim to ensure sustainability beyond project completion: the recommended approach allows for highly efficient performance of the bio-energy plants with low maintenance costs, and it ensures significant environmental - reduced used of fossil fuel and wood; reduced cassava peels and wastewater pollution; reduced soil erosion - and social benefits (i.e. improved health conditions; improved livelihoods).
326. The successful track record of RTIMP in developing partnerships with a wide range of stakeholders and creating effective organizational mechanisms for local groups is a significant added value that will be made available to the new project. Also, the broad consultations with different stakeholders during project design helped raise awareness about the new initiative, and allowed the team to collect views in terms of technical and institutional issues.
327. The IFAD/SCCF initiative will be implemented through the establishment of operational agreements with several national and district-level branches of the administration, research and education institutions, non-governmental organizations, local community groups and enterprises, and the media. Each partner will be required to bring contributions to the project in terms of expertise, in-kind contributions, or co-financing. This approach is an additional guarantee of cost-effectiveness for the project.
328. Cost-effectiveness of the proposed technological solutions was undertaken during the PPG. A specific financial feasibility study on the use of cassava waste to produce energy was undertaken. The timeframe of the financial analysis is 15 years. Its main outcomes are summarized here below:
- a. Net profits after corporate taxes are positive already starting from Y1 at USD 60 693. They constantly increase from Y2 to approximately USD 94 500 in Y3 and Y4 and up to USD 110 700 from Y5 onwards. Net profits could be higher if the savings in terms of non-use of fossil fuel for the same amount of energy production would be added. However, these savings were not taken into consideration with this paper;
  - b. Annual cash flows remain positive over the entire life of the investment. More specifically, the annual cash flow is approximately USD 92 500 in Y1 and USD 142 500 at Y15. Also the analysis of discounted annual cash flows confirms satisfactory outcomes throughout the entire life of the investment;
  - c. The financial internal rate of return (IRR) of this investment results to be 23%, - higher then the opportunity costs (10%);
  - d. The payback period of the investment is 6 years;
  - e. A sensitivity analysis has been carried out using three different scenarios:

(i) a +10% variation of the investment costs<sup>8</sup> and (ii) a  $\pm 10\%$  variation of the revenues. In all three scenarios considered, all profitability indicators remain quite encouraging. More precisely, under the first scenario, where total investment costs are increased a 10%, net profit after taxes results to be positive already from Y1 and cash flow at Y1 already reaches USD 93 000. While IRR results to be equal to 21% (higher than the opportunity cost), the pay-back period is less the 6 years. Under the second scenario, two hypotheses have been made. Initially, a 10% reduction of revenues has been considered (annual revenues being USD 147 000 at Y1). Also under this negative assumption, net profit after taxes is expected to be positive as from Y1 (equal to USD 47 600 USD), while annual cash flow (already at USD 79 300 in Y1) remains positive till Y15. IRR is equal to 14% and the payback period is 6 years. With a 10% increase of the annual revenues (USD 180 000 at Y1), net profit after taxes becomes USD 74 000 already in Y1 (and approximately USD 130 000 at Y15). The annual cash flow, which is approximately USD 105 500 in Y1, constantly increases over the years. IRR is 26% and the investment is paid back in less the 5 years.

329. Other benefits which have not been quantified in this financial feasibility study include the following: (i) Environmental benefits: reduced use of fossil fuel and wood and climate change adaptation benefits<sup>9</sup>; (ii) improved livelihood: time savings for collecting traditional sources of energy (i.e. wood) and improved health conditions; and (iii) increased value of land due to better soil fertility and reduced soil erosion. Furthermore, it is important to highlight that the investment in such technology is not affected by drought, soil degradation and climate change.

330. Replicability of the investment: In order to assess the profitability of replicating the investment in other areas of the country, it has been assumed that the total investment cost is borrowed from local banks at a 22% interest rate, to be paid back through equal installments (plus interests on the remaining debt) over a period of 7 years<sup>10</sup>. The average passive interest rate applied in Ghana is equal to 23% (including administrative fees<sup>11</sup>) for industrial investments; however, for the agricultural investments<sup>12</sup> it decreases to 22% - which is the rate adopted in this study. Considering the total amount of the investment, a 3-year period of grace has been also taken into account before starting the repayment. Under this scenario, two options have been taken into account: (i) 100% of the total investment value is borrowed from local banks and (ii) 60% of the total investment value is borrowed from banks, being the remaining 40% available from other sources (donors, private investors etc.). Under the first scenario, estimated yearly repayments of capital for implementing the investment (purchase of equipment and construction of facilities) and on working capital, along with related interests, range from USD 184 000 in Y1 to USD 88 000 in Y7. Annual cash flow is positive from Y1 (USD 92 500) to Y4, when it suddenly becomes negative only in Y4 when the largest portion of debt repayment is made. However, it becomes positive again as from Y5 onwards, being approximately USD 2 200 in Y5 and USD 142 000 at Y15. Estimated IRR (11%) is higher than

<sup>8</sup> Debt repayment costs have been derived accordingly.

<sup>9</sup> See Main Project Report.

<sup>10</sup> This assumption is built on the lending terms currently enforced in Ghana.

<sup>11</sup> As of August, 2010, Ghana Commercial Bank.

<sup>12</sup> As per information provided by the Agricultural Development Bank, which specifically finances investments in the rural areas of Ghana.

the opportunity costs, while the payback period is 13 years. Under the second scenario, a total of USD 304 200 is borrowed from the bank. Estimated yearly repayments of capital for implementing the investment range then from USD 110 000 in to USD 53 000 in Y7. Annual cash flow shows to be positive right as from Y1 (USD 92 400); it becomes USD 106 000 at Y15. The IRR of 12% confirms the profitability of the investment and a paid back period of 11 years.

331. Both scenarios, confirms the profitability of replicating the investment in other regions of Ghana where there is the availability of cassava peels and barks, sawdust and water waste from cassava processing. Furthermore, given the positive results mentioned above, the possibility to replicate the investment in other countries of the WCA region appears to be, in principles, financially feasible and sustainable – although a financial analysis is strongly recommended to adapt the market prices and the other parameters to local circumstances.

## PROCUREMENT

332. Procurement of goods, works and consulting services financed by the Grant shall be subject to IFAD's conditions and will strictly follow the RTIMP modalities. The provisions of the procurement regulations of the Republic of GHANA will be used, to the extent that such are consistent with IFAD's "Procurement Guidelines" approved by the IFAD Executive Board in December 2004 (the "Procurement Guidelines") as such guidelines may be amended from time to time by IFAD.
333. To the extent possible, the goods, works and consulting services shall be bulked into sizeable bid packages to permit the optimal use of competitive bidding.
334. Before the commencement of procurement and annually thereafter, the Republic of Ghana shall furnish to IFAD for approval, a Procurement Plan as described in the Appendix 1, paragraph 1 of IFAD's Procurement Guidelines. The Procurement Plan shall specify, inter alia, the method of procurement for each contract to be financed from, and thresholds, ceilings and preferences to be utilized in the implementation of procurement under the Project; the Procurement Plan shall also specify any additional requirements as may be set out in the Procurement Guidelines with respect to certain methods of procurement.
335. The methods which are permitted for the procurement of goods and works are the following:

Table 8 – Procurement methods

<b>GOODS AND WORKS</b>	<b>SERVICES</b>
International Competitive Bidding	Quality and Cost Based Selection
National Competitive Bidding	Quality Based Selection
International or National Shopping	Selection under a Fixed budget
Direct Contracting	Selection Based on consultants' qualifications

Procurement from commodity markets	Least Cost Selection
Work by force account	Single-source selection
Procurement from UN agencies	Selection of individual consultants
Inspection agents	Commercial Practices
Procurement by financial intermediaries	
Procurement with community participation	

336. Three Categories of procurement expenditures are used: (a) Category 1: Goods; (b) Category 2: Works and (b) Category 3: Services. Procurement thresholds are provided in Table 9 below.

Table 9 - Procurement Thresholds

Procurement category and thresholds		Procurement modality	Selection basis	IFAD review requirements
in millions of Leones	in thousands of USD			
<b>GOODS</b>				
< 25 M	< 8.3	National shopping	RFQ (3 quotes)	Post review
≥ 25 M - < 60 M	≥ 8.3 - < 20	National shopping	RFQ (5 quotes)	Post review
≥ 60 M - < 600 M	≥ 20 - < 200	NCB	ITB	Prior review if ≥ \$ 30,000
≥ 600 M	≥ 200	ICB	ITB	Prior review
Farm inputs		Community Procurement	Quotations / Direct Contracting	Post review
<b>WORKS/TECHNICAL SERVICES</b>				
< 25 M	< 8.3	National shopping	RFQ (3 quotes)	Post review
≥ 25 M - < 150 M	≥ 8.3 - < 50	National shopping	RFQ (5 quotes)	Post review
≥ 150 M - < 900 M	≥ 50 - < 300	NCB	ITB	Prior review
≥ 900 M	≥ 300	ICB	ITB	Prior review
<b>CONSULTING SERVICES</b>				
< 25 M	< 8.3	Shortlist	CV comparison (individuals) or RFQ (firms)	Post review
≥ 25 M	≥ 8.3	Shortlist	RFP (QCBS)	Prior review if ≥ \$ 20,000
National institutions, MAFFS departments, UN agencies		Sole-Source selection	Direct Contracting	Prior review

337. Any arrangement for subcontracting should be included in the original submission and financial proposal for works and services. The scope of work of the sub-contractor should be disclosed with the conditions provided meeting the same requirements as the main contractor. The sub-contracting arrangements will be part of the bid evaluation. No sub-contracting will be allowed after contract award.

338. The Government shall ensure that all bidding documents and contracts for the procurement of goods, works and services financed by the SCCF shall include a provision requiring bidders, suppliers, contractors, sub-contractors and consultants to permit IFAD to inspect their accounts, records and other documents relating to the bid submission and contract performance and to have them audited by IFAD-appointed auditors and investigators. This provision will require bidders, suppliers, contractors, sub-contractors and consultants to: (i) maintain all documents and records related to the Project for three (3) years after completion of the work contemplated in the relevant contract, and (ii) require the delivery of any document necessary for the investigation of allegations of fraud or corruption and the availability of employees or agents of the bidders, suppliers, contractors, sub-contractors or consultants with knowledge of the Project to respond to questions from the personnel of IFAD or any properly

designated auditor, investigator, agent or consultant relating to review or audit of the document. If the bidder, supplier, contractor, sub-contractor or consultant fails to comply with IFAD's request, or otherwise obstructs IFAD's review of the matter, IFAD, in its sole discretion, may take appropriate action against the bidder, supplier, sub-contractor or consultant.



### VIII. RISKS AND ASSUMPTIONS

339. The NCCAS of Ghana recognises the limited capacity of both professionals at the national level and community level to understand and assess climate change impact. For this reason, capacity building and training will be a key success factor and will be promoted to overcome this risk. The NCCAS also indicates that isolation and remoteness of people in the rural areas is an additional constraint, which could impede the full involvement of the local communities in the project activities. However, the blended nature of the project, benefiting of the activities undertaken in the RTIMP with its good outreach, should reduce this risk and ensure adequate participation rate. This should be also ensured by the strong participatory philosophy of the baseline activities.
340. Project design has taken into account the strong commitment by the GoG at the national level, and by the local stakeholders, to undertake adaptation measures and implement the NCCAS priorities through concrete investments. The implementation of the project will be undertaken through community-based approaches that address local cultural, socioeconomic and ecological concerns. In this regard the project will be implemented as an integral component of the RTIMP to which authorities have also demonstrated their full commitment to implementing its components in effective manner.
341. The project will significantly depend on the strength and commitment of local stakeholders at the village and community level that are identified as the key participants. The project will ensure that these individuals and organizations are mobilized and empowered with sufficient commitment, finances, jurisdictions, and backstopping to enable them to provide the leadership, guidance, and entrepreneurship necessary to implement and manage the planned initiatives within the project.
342. The project is providing incentives for farmers to engage in various activities that target climate change adaptation at: (i) a capacity building and awareness level and (ii) at the investment level. This will provide a comprehensive approach to couple the activities of the RTIMP and the SCCF intervention to guarantee a buy-in by the local communities. Risks assumptions and suggested mitigation measures are reflected in the table below.

Table 10 - Risks assessment and potential mitigation measures

Risks	Risk rating*	Risk mitigation measures
On-ground implementation slowed by bureaucratic constraints	<b>M</b>	Use of the project participatory approach associated with sufficient institutional strengthening provided under the project and the RTIMP will allow adequate remedial measures to this risk
Decentralization policies not effective	<b>M</b>	Sufficient institutional strengthening of DAs, and policy statement on roles and responsibilities of local authorities and communities as well as technical backstopping to securing communities engagement is targeted through many project activities and is a major component of the baseline RTIMP and REP.
Insufficient staffing for backstopping	<b>M</b>	In addition to the line ministries departments and services, the project will involve national and regional institutions and local service providers for

		backstopping. Furthermore, RTIMP and REP are investing in capacity building and technical backstopping and this will provide further support to local government institutions and services, research/academic institutions, NGO and communities in particular). The SCCF funding will empower all them for dealing with climate change adaptation.
Inadequate staffing for backstopping	<b>L</b>	The project will put efforts into a comprehensive training/awareness raising program for technical staff that will be responsible for project implementation, to ensure that the project strategy and its objectives are fully integrated by the local project implementers.
Institutional memory loss	<b>M</b>	The project will ensure all project activities and achievements are well documented (soft and hard copies of all documents will be kept). Information on the project will be made available to research, university, and school teachers – who will be encouraged to include this in formal and/or extra-curricular activities (e.g. eco-clubs). Furthermore, record of the project’s achievements will be publicised at national / international meetings and on websites.
Land tenure issues impact on implementation of project activities and sustainability of achievements, with special attention to gender issues.	<b>M</b>	The Project will pay a particular attention to land tenure security and issues in the vulnerability mapping efforts as well as in the design and the implementation of the management/adaptation plans. The awareness raising efforts will also focus on land tenure as a key factor for adaptation to climate change. The land tenure issue that may be connected with the establishment of new cassava processing plant and bio-energy plants will be handled by the government, namely by the District Assembly of Techiman Municipality.  Sensitization workshops have been held (and will held) to ensure the participations of all concerned partners.
Insufficient application of targeting procedures	<b>L</b>	Targeting will be aligned with IFAD’s targeting policy and the targeting approach of the RTIMP. Effective monitoring and evaluation procedures will be established to ensure that targeting is adequate.
Capacity of local service providers and implementation partners to provide high quality services in relation to the implementation of the specific outcomes of the SCCF and climate change adaptation activities.	<b>M</b>	The selection of service providers will be subject to rigorous selection processes. The project will establish clear criteria to ensure that the best service providers and partners are engaged. The project also entails adequate allocations for TA (local and International) to ensure that the specific technical adaptation aspects benefit from further technical support to minimize risk and consolidate project interventions. Also IFAD will be involved in identifying the service providers to ensure that all specific technical criteria are met for each activity.  The project will establish performance-based contracts with sub-contractees on a yearly basis in order to monitor compliance with the project work plan.
The lack of access to financial services	<b>M</b>	Increased availability of MEF is being experienced in the project area thanks to the removal of some of the

and poor functioning of the markets related to low and medium value food crops discourages innovation and technological improvement.		main bottlenecks hampering access to funds. The subsequent improvement in the quality and safety of the products is increasing market opportunities thanks to boost of exports.  Ecobank-Ghana is interested to support the multiplication of the project's achievements and results.
Weak political will to streamline and consolidate the institutional framework and enforce laws.	<b>M</b>	The Government of Ghana is showing commitment to improve the situation. MEST set up National Committee on Climate Change to review/improve existing policies and programmes. Environmental, agricultural and other sectoral policies and strategies increasingly reflect sustainable management concerns. The Government has initiated a new land policy and a land administration project that seeks to address land issues comprehensively.
Governance issues, including "Elite capture" with the "plausible recurrent risk" of deviation and capture of the benefits accrued from the project by the "better off".	<b>L</b>	One of RTIMP's achievements is the increased capacity obtained by upgrading micro/small processing enterprises into GPCs. Thanks to this, the GPCs are now serving as key hubs around which several farmers sell their cassava roots as well as small processors utilizing the facilities in the communities, with subsequent boosting of economic activities and wealth creation in the poor rural areas. Such benefits have a multiplying effect and facilitate the increase in number of MSE upgraded and ready to become GPCs.
<b>Overall risk rating</b>	<b>M</b>	
* Risk rating – H (high risk), S(Substantial risk), M (Moderate risk), and L (low risk). Risks refer to the possibility that assumptions, defined in the logical framework may not hold		

## **IX. SUSTAINABILITY AND REPLICABILITY**

343. The project intends to integrate a comprehensive approach that combines development efforts with the additional adaptation needs. The project's development objective is to reduce climate-induced risks to the achievement of food security and income generation objective, in line with the objective of the SCCF to make increase resilience to climate change impacts.
344. To ensure the long-term implementation of this integrated approach to adaptation, the project will adopt a project financial and institutional sustainability strategy. The strategy entails strong participatory elements to address issues that affect the long-term sustainability of natural resources and the welfare of local communities. The strategy will be based on major lesson learned from similar implementation experiences of projects mainstreaming climate change adaptation and lessons from other projects in Ghana and other countries of West and Central Africa.
345. The sustainability of the project is also guaranteed by the full involvement and empowerment of smallholders throughout the various component of SCCF. Smallholders will be the target of the awareness raising and capacity building programme, as well as the main beneficiaries of the components on production/processing improvement and the provision of new technologies. This means that this category of stakeholders will be at the centre of all the actions foreseen along the value chain. The project will build on the already existing, informal farmer organisations established through the FFF and with the MSE of cassava processors, with a special focus up-scaling GPCs.
346. The project builds on the existing effort by agricultural and energy authorities to encourage the use of alternative energies in rural areas, namely through the sustainable use of natural resources (biomass, water). SCCF will support this effort by enabling the put in place and testing of a high-impact pilot project which can entail clear benefits to the local private sector and thus increase its buy in. Another added value of SCCF will be the facilitation of linkages between the bank sector and the small enterprises, which should translate into increased financial resources available to rural entrepreneurs.
347. Institutional risks identified include the lack of coordination and integration of activities within public institutions and stakeholders involved in addressing climate change and the weak institutional capacities to deal with a complex issue like adaptation. Financial risks are seen in the lack priority and allocation of funds in the area of adaptation across institutions, in general, and after the termination of the SCCF funding, in particular.
348. The financial and institutional strategy, reflected in project, will encourage local initiative to address adaptation targeting the most vulnerable groups and households. The project will enable them to have better understanding of adaptation and to integrate project activities in a sustainable and culturally-sensitive manner that is driven by interest and benefits from the proposed activities. The project will also contribute to capacity building for government institutions to help them gaining experience and competencies in a gradual fashion to increasing deal with climate change adaptation in a sustainable and systematic manner even after SCCF project closure.
349. The SCCF project addresses the adaptation priorities identified by the National Climate Change Adaptation Strategy (NCCAS) in terms of awareness raising, capacity building, field implementation measures and mainstreaming adaptation needs into sectoral policies, namely agriculture, forestry, water and energy. The SCCF project will implement several demonstration actions to

incorporate climate change adaptation into sustainable land and water management in cassava-related agro-forestry systems. It will also focus on sustainable and renewable energy and water uses to upscale the processing of cassava derivatives and the diversification of high quality food crop production by well-organized rural householders, taking into consideration the climate change gender concerns. The lessons learned and good practices developed by the SCCF project will help guide the implementation of the National Water Policy, by demonstrating effective groundwater and rainwater harvesting techniques that may eventually be incorporated into the building code and enforced by the government.

350. In a similar way, the project will contribute to the implementation of the Strategic National Energy Plan (SNEP 2006-2020) and the Bio-energy Policy of Ghana. It will strive to provide cost-effective and practicable options to increase access to modern energy services for poverty reduction in off-grid rural areas, promoting the use of agriculture waste as bio-energy, encouraging the participation of women in energy programmes, and increasing future energy security through diversified sources of energy supply, while minimizing environmental impacts of energy production, supply and utilisation. The pilot model cassava processing centre based on the use of sustainable energy produced from agriculture/forestry waste in the Techiman Municipality will help accelerate the development and utilization of renewable energy and energy efficiency technologies in remote rural areas in Ghana, and it will favour private sector participation in energy infrastructure development and service delivery. In fact, the Ghanaian Energy Commission has shown strong interest in this project, as a learning process to help guide the Commission's implementation measures, such as the Energy Fund created to support socio-economic and technology energy projects in Ghana.

351. The possibility to replicate the SCCF project investment in bio-energy production from cassava peels and sawdust in other areas of the country has been analyzed (see Annex 10). It has been assumed that the total investment cost is borrowed from local banks at a 22% interest rate, to be paid back through equal installments (plus interests on the remaining debt) over a period of 7 years<sup>13</sup>. Considering the total amount of the investment, a 3-year period of grace has been also taken into account before starting the repayment. Under this scenario, two options have been considered: (i) 100% of the total investment value is borrowed from local banks and (ii) 60% of the total investment value is borrowed from banks, being the remaining 40% available from other sources (donors, private investors etc). Under the first scenario, estimated yearly repayments of capital for implementing the investment (purchase of equipment and construction of facilities) and on working capital, along with related interests, range from USD 184 000 in Y1 to USD 88 000 in Y7. Annual cash flow is positive from Y1 (USD 92 500) to Y4, when it suddenly becomes negative only in Y4 when the largest portion of debt repayment is made. However, it becomes positive again as from Y5 onwards, being approximately USD 2 200 in Y5 and USD 142 000 at Y15. Estimated IRR (11%) is higher than the opportunity costs, while the payback period is 13 years. Under the second scenario, a total of USD 304 200 is borrowed from the bank. Estimated yearly repayments of capital for implementing the investment range then from USD 110 000 in to USD 53 000 in Y7. Annual cash flow shows to be positive right as from Y1 (USD 92 400); it becomes USD 106 000 at Y15. The IRR of 12% confirms the profitability of the investment and a paid back period of 11 years.

352. Both scenarios confirm the profitability of replicating the investment in other regions of Ghana where there is the availability of cassava peels and barks,

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<sup>13</sup> This assumption is built on the lending terms currently enforced in Ghana.

sawdust and water waste from cassava processing. Furthermore, given the positive results mentioned above, the possibility to replicate the investment in other countries of the WCA region seems financially feasible and sustainable – although a financial analysis is strongly recommended to adapt the market prices and the other parameters to local circumstances. The SCCF project will provide a concrete example for the Bio-energy Policy to address the governmental objective to provide incentives for the use of waste as bio-energy and promote more efficient conversion technologies, and efficient and adequate pricing of energy produced from waste.

353. The SCCF project will collaborate with the MOTI/Rural Enterprises Programme (REP) to build the capacity of the Rural Technology Facility Centres for the local manufacturing of the gasification and biogas plants. The project will also investigate innovative capital subsidy arrangements and micro-financing options to help cassava processing groups acquire the renewable energy technologies developed by the project, as decentralised renewable energy systems to upscale cassava processing and food production. This will contribute to the SNEP objective of increasing the use of renewable energy sources to 10% of the national energy mix by 2020 and of supporting the local manufacturing of renewable energy devices and equipment in the medium-to-long term.
354. The pilot model processing centre will increase the capacity of small cassava processor groups to increase quality and diversify products, reducing their vulnerability to climate change and opening new market opportunities where processors may have a higher negotiation power. This may encourage longer-term and more equitable commercial agreements between processor groups and traders, providing an example that can eventually be replicated in other regions of Ghana and in other agriculture sectors.
355. The project will also encourage and assist local community groups to develop and introduce improved technologies and higher levels of efficiency in the production and consumption of wood-fuels. This assistance could be further extended to all the 60 districts where the Roots and Tubers Improvement and Marketing Programme (RTIMP) is active.
356. Results of the pilot adaptation actions will be disseminated widely within and outside the project area. Moreover, the project will be linked to ongoing regional and global programmes to ensure exchanges and dissemination of information at a wider scale using the IFAD website, FIDA-Afrique, UNFCCC, GEF and other platforms for experience sharing.
357. The proposed project will also address the criterion of replicability by promoting cross-sectoral coordination mechanisms (involving Meteorology Department and other stakeholders in line Ministries) that will be involved in the implementation and monitoring of the project.

## **X. INSTITUTIONAL FRAMEWORK AND MANAGEMENT ARRANGEMENTS**

358. **The SCCF project** will be fully integrated to be implemented within the institutional arrangements of the RTIMP. In order to maximise synergy and ensure full integration between programmes, the PIM related to RTIMP will be updated with the operational elements of the new SCCF project during the inception phase. Coordination of the implementation and monitoring of the SCCF components will be ensured by a dedicated Programme Officer (PO) at and under the supervision of the overall RTIMP coordinator. The ToRs for this position are provided in Annex 5. Annual work programs and budget of the SCCF Component will be fully integrated with RTIMP (integration will be done in terms of processes and structure). The PO will ensure full harmonisation and integration between the AWPB of the SCCF and those of the RTIMP while coordinating the preparation of the SCCF AWPB at the national and district/community levels.
359. **National Project Coordination Unit (NPCU):** The NPCU will consist of the overall RTIMP coordinator, the programme officer (PO), the RTIMP subject matter specialists (commodity chain linkages; production; processing/post-harvest; business development training; M&E; gender; and financial administration), the IFAD Programme Manager for GEF/LDCF/SCCF operations in Western and Central Africa, and support staff. The role of the NPCU will be overall coordination, supervision and monitoring, while most activities in the field will be carried out by Implementing Partners (contractors, NGOs, CBOs, local media and government agencies) on the basis of performance-based contracts and MOUs. The main responsibilities of the NPCU will include: (i) Ensuring harmonisation of approaches and activities of the various interventions in the Districts; (ii) preparing the AWPBs; (iii) operating the management information system, M&E and reporting systems; (iv) contracting out, on a competitive basis, the implementation of various project activities to implementing partners, service providers and technical assistance experts; (v) monitoring the progress of project activities and evaluating the performance of the different contractors; (vi) coordinating and consolidating periodical reports from implementing units and implementing partners; (vii) providing logistical, administrative and technical backstopping to implementing partners and district level implementing agencies; (viii) serving as the secretariat to the National Steering Committee and keeping MOFA and other government partners informed on a regular basis on project progress and any relevant issues; (ix) establishing and maintaining linkages with all relevant government ministries, donor institutions and service providers; (x) carrying out financial management and procurement of goods and services; (xi) reporting regularly to the funding agencies and to the government; and (xii) disseminating information about the Project's rationale, concept, content and progress to the concerned stakeholders and all interested parties.
360. The **Project Steering Committee** will be the same as the National Steering Committee for the RTIMP. The SCCF project will have the same SC but will call upon its membership to include government officials from the Meteorological Department, Energy Commission, Water Resources Commission and the UNFCCC contact point for the government of Ghana. Annual Review and Planning Workshops will be conducted at national and district levels as a basis for preparing Annual Work Programmes and Budgets (AWPBs). Progress Reports will be generated periodically by the team. At district level, the already existing District Steering Committees will be the entry point of the SCCF project implementation as they will be responsible for the RTIMP.
361. The **National Country Programme Management Team (CPMT):** This team was put in place by MOFA to guide IFAD in the development of its portfolio

in Ghana. The CPMT consist of: (i) Oversight Committee (including members from the governmental institutions MOFEP, MOFA, MOWAC and Bank of Ghana; the local representatives of IFAD, AfDB, GIZ and WB; the coordinators of major Agriculture Value Chain Programmes, including RTIMP among others; National Financial Institutions; support institutions, such as research centres; farmers' associations); (ii) In-Country Technical Advisory Group, including governmental, intergovernmental, financial private sector and academic staff; (iii) IFAD In-House staff. It will also play a crucial role in Project monitoring and evaluation and this will also cover the implementation of the SCCF project. In recognition of the fact that the IFAD portfolio is entirely implemented by MOFA and managed by one PCU, it is envisaged to merge the National Steering Committee with the CPMT, in order to avoid duplication and increase harmonisation.

362. **Project Supervision:** The SCCF will be under direct supervision by IFAD and fully integrated in the supervision arrangements for the RTIMP. The SCCF project will be supervised as a component of the RTIMP. A separate project account will be established for the SCCF funds and IFAD will establish a separate Financial Agreement with the Government for the SCCF grant. The flow of funds will follow the modalities of the RTIMP.



## **ANNEXES**



## **ANNEX 1. MONITORING AND EVALUATION**

### **MONITORING AND REPORTING**

1. The objective of Monitoring and Evaluation is to assist all project participants in assessing project performance and impact, with a view to maximizing both. A key component of a project's monitoring system is the continuous and periodic review and scrutiny by management of the implementation of project activities, to ensure that all required actions are proceeding according to plan. Evaluation is a process for determining systematically and objectively the relevance, efficiency, effectiveness and impact of activities in light of their objectives.
2. The overall goal of the SCCF project is to reduce the vulnerability of the food supply system, and namely the cassava commodity chain, to the deleterious impacts of climate change through selected priority adaptation activities.
3. The main objective of the proposed IFAD/SCCF project will be to lessen the impact of climate change on vulnerable rural groups as well as on natural resources critical for sustaining agricultural production and increase food security. The IFAD/SCCF intervention will be linked to the Root and Tuber Improvement and Marketing Programme (RTIMP).
4. The SCCF project is consistent with GEF policies and strategies for SCCF and also in line with the IFAD-supported RTIMP which has been developed in compliance with the principles of country ownership and drivenness.
5. A number of organisations in Ghana are involved in monitoring and evaluation in different ways. In common with many countries, these organisations are undertaking efforts to establish or improve national monitoring, evaluation and assessment systems of project impacts. In line with the GEF/SCCF operational principles, the IFAD/SCCF M&E activities will be country driven and provide for consultation and participation. As a participatory country, GEF expects involved local institutions including Farmer Based Organizations (FBO's) to be fully consulted with, informed and briefed about the plans, implementation and the results of evaluation activities.
6. Members of staff of the executing ministries and co-operating ministries and institutions are expected to support evaluations by responding promptly and fully to requests for information relating to the activities of this project and for sharing relevant experiences. These secondary stakeholders have a particular responsibility in providing their views and perspectives. They will use monitoring and evaluations to assess progress, raise issues and confirm the achievement of results, to improve performance and learning.
7. The GEF and UNFCCC Focal Points will have a particular responsibility for the use of, follow-up to and action on project evaluation recommendations. The Focal Points will also play a key role in keeping stakeholders fully consulted with, informed on and involved in the plans, implementation and results of the project's M&E activities.
8. The IFAD/SCCF project M&E system will be made particularly effective as it will include participatory elements, ensuring that local communities (including project beneficiaries) and partners are involved in the process. This is designed to advance local stakeholder participation and assist them to take ownership of the activities and results of the project. A part of the participatory M&E will be

devoted to women's focus groups, to ascertain the extent of women's participation in programme activities, constraints faced, benefits gained, aspirations met and impact on women's status in the family, their involvement in community affairs and the climate-proofing of their agriculture.

9. The M&E system will optimize prospects for sustainability following the eventual termination of the IFAD/SCCF interventions, by using indicators that are straight forward to collect and/or have been identified as critical to track.
10. In line with GEF requirements, the IFAD/SCCF project will adopt criteria for its monitoring systems which are SMART i.e. Specific, Measurable, Achievable and Attributable, Relevant and Realistic, Time-Bound, Timely, Trackable and Targeted. These are duly reflected in the project logical framework.
11. The specific tools, methods and indicators for measuring the project impacts will be further defined during the inception workshop, to ensure adequate stakeholder participation in the design of the impact monitoring framework. Where possible, all indicators should be measured annually, although cost constraints and availability of data will limit the frequency possible for some indicators.
12. **Project Indicators: Well-defined** sets of indicators have been identified. They will be used in this project for both project monitoring and evaluation. Inputs, process, outputs, and outcomes indicators for each component are defined to ensure adequate monitoring. Where possible, all indicators should be measured annually, although cost constraints and availability of data will limit the frequency possible for some indicators.

## **REPORTING**

13. Each implementing partner will be required to submit quarterly progress reports covering all their activities in connection with the project to the Project Officer. The IFAD-SCCF team will prepare a comprehensive annual reports incorporating all the quarterly reports in a format acceptable to IFAD. This annual reports will be submitted to the National Steering Committee for review and approval before transmission to IFAD and GEF. The content of the progress report will include key qualitative and quantitative information, a descriptive and analytical account of achievements relative to original targets and project impact. The reports will also highlight implementation problems and actions to be taken to remedy them and by whom. Annual reports will reflect cumulative progress against annual targets and reflect conformity with the project implementation schedule, compliance with legal requirements and reconciliation of expenditures.
14. The National Project Officer / Manager, together with the IFAD-SCCF team, will be responsible for the preparation and submission of the following reports that form part of the monitoring process. These reports will include:
  - Inception Report
  - Quarterly Progress Report
  - Annual Progress Report
  - Technical Reports
  - Project Publications
  - Mid-Term Review Report
  - Project Completion Report
  - Post-Completion Project Impacts

## **INCEPTION REPORT**

15. A project inception report will be prepared immediately after the inception workshop. It will include a detailed First Year/ Annual work plan and budget divided in quarterly time frames detailing the activities and progress indicators that will guide implementation during the first year of the project. This work plan will include the dates of specific field visits, support missions from IFAD and/or consultants as well as time frames for meetings for the National Steering Committee. The report will also include the detailed project budget for the first full year of implementation, prepared on the basis of the Annual Work Plan, and including any monitoring and evaluation requirements to effectively measure project performance during the targeted twelve months timeframe.
16. The inception report will include a more detailed narrative on institutional roles, responsibilities, coordinating actions and feedback mechanisms of project related partners. In addition, a section will be included on progress to date on project establishment and start-up activities and an update on any changed external conditions that may affect project implementation. When finalized, the report will be circulated to project stakeholders who will be given a stipulated time in which to respond with comments and queries. Prior to the circulation of the report, the Steering Committee, MOFA, and IFAD will review the document.

#### ***QUARTERLY PROGRESS REPORTS***

17. Each implementing agency and implementing partner will be required to submit quarterly progress reports covering all their activities in connection with the project outlining updates in project progress to the project office. The Project Officer will be responsible for the coordination of this effort and the consolidation of progress reports.

#### ***ANNUAL PROGRESS REPORTS***

18. The NPO will prepare comprehensive annual reports incorporating all the quarterly reports in a format acceptable to IFAD. This annual reports will be submitted to the National Steering Committee for review and approval before transmission to IFAD/GEF. The content of the progress report will include key qualitative and quantitative information, a descriptive and analytical account of achievements relative to original targets and project impact. The reports will also highlight implementation problems and actions to be taken to remedy them and by whom. Annual reports will reflect cumulative progress against annual targets and reflect conformity with the project implementation schedule, compliance with legal requirements and reconciliation of expenditures.

#### ***TECHNICAL REPORTS***

19. The inception report will also include a list of proposed technical reports that are expected to be prepared on key areas of activity during the course of the project with tentative due dates. This reports list will be kept up-dated and included in subsequent Annual Project Reports. Technical Reports may also be prepared by external consultants and should be comprehensive, specialized analyses of clearly defined areas of activity within the project framework. These technical reports will represent, as appropriate the project's substantive contribution to specific areas, and will be used in efforts to disseminate relevant information and best practices at local, national and international levels.

## **PROJECT PUBLICATIONS**

20. Project Publications will form a key method of crystallizing and disseminating the results and achievements of the project. These publications may be scientific on the activities and achievements of the projects, in the form of journal articles, multimedia publications, newsletters, bulletins etc. The publications can be based on technical reports depending upon the relevance, scientific worth etc. of these reports or may be summaries or compilations of series of Technical Reports and other research.
21. Carefully designed materials will be produced to reach specific potential beneficiary groups, in the seven pilot districts of the four regions addressed by the IFAD/SCCF project. The project team will determine if any of the technical reports merit formal publication and will, in consultation with IFAD, the executing agencies and other relevant stakeholder groups, plan and produce these publications in a consistent and recognizable format.

## **EVALUATION**

22. Impact evaluation approaches will be developed. Variation in beneficiary revenues, improved resilience of cassava farming to climatic variability, improved farmers capacity in waste and water management and in the broadening of their base of revenue, reduced pollution and unsustainable natural resources use and improved public knowledge and awareness on climate change will be measured using baseline data from the baseline studies for each component and evaluation report at completion. Baseline studies on each component and completion reports will ensure that the required information is collected. Furthermore, household surveys will be carried out early in the project, around the mid-term review, and at completion which will be used to inform impact assessments. The M&E data will provide ready access to the project's activities and potential impacts through IFAD and other websites, periodic reports and radio programmes.
23. The Mid-Term Evaluation and the Mid-Term Review will be conducted as part of the one overall exercise to benefit from the economies of scale. The IFAD/SCCF project will be subjected to at least two independent external evaluations. The first will be an independent Mid-Term Review, two years after start-up. This will determine progress being made towards the achievement of outcomes and will identify course correction if needed, focusing on effectiveness, efficiency and timeliness of project implementation; highlight issues requiring decisions and actions; and present initial lessons learned about project design, implementation and management. The mid-term review will allow the PCU to make any modifications necessary to incorporate improvements or changes in the project activities for the remaining project period.
24. An independent Final Evaluation will take place at completion of the project period. The final Evaluation will focus on the same issues as in the mid-term review and any other issues that may have cropped up due to the mid-term review. The final Evaluation will also look at impact and sustainability of results, including contribution to capacity development and the achievement of global environmental goals.

## **M&E BUDGET**

25. Project M&E is integrated in the overall Project Management Structure, and will be directly co-financed through the baseline. The following table outlines M&E costing by activity (costs on the SCCF grant).

Table 1. M&E activities and indicative budget

<b>M&amp;E Activity</b>	<b>Responsible Person(s) Institutions</b>	<b>Total SCCF Funding</b>
Baseline Surveys	NPCU M&E Officer Procurement Officer	8,000
Impact Studies	NPCU M&E Officer Consultant	20,000
Start-up Workshop	NPCU M&E Officer	5,000
Mid-Term Review/ External Evaluation	NPCU M&E Officer Consultants	18,000
Final External Evaluation/ Terminal Reports	IFAD GEF Consultants	20,000
Yearly Progress Reports	NPCU M&E Officer	4,500
Dissemination of Project Information	NPCU M&E Officer IFAD	12,000
External Audits	NPCU IFAD	15,000
<b>Total Indicative Cost</b>		<b>102,500</b>

**ANNEX 2: RESULTS FRAMEWORK (PROJECT LOGFRAME)**

Hierarchy of Objectives	Key Performance Indicators	Means of Verification	Assumptions and Risks
<p><b>SCCF Goal</b> Reduce the vulnerability of the food supply system to the deleterious impacts of climate change</p>	<p>Contributions to the NCCAS objectives to increase resilience of key agricultural production systems to climate change impacts in Ghana</p>	<p>Project M &amp; E system Local and national assessments of food security mid term and project completion</p>	<p>Political and economic stability in Ghana.</p>
<p><b>SCCF Objective</b> To promote activities that reduce climate-induced risks to the achievement of food security and income generation objectives for the rural communities in Ghana.</p>	<p>At least 70 % of supported beneficiaries report ability to maintain or increase healthy food production in the event of harsh climatic conditions</p> <p>Climate resilient sustainable land and water management practices introduced to promote food security in 144 farm plots</p> <p>Innovative solutions along agriculture value chain for climate resilient diversified income sources for vulnerable households promoted in 34 community groups, and benefiting about 7,200 cassava growers and processors</p>	<p>Project M &amp; E system Progress reports Mid-term and final project evaluations Agreements and memoranda of understanding Feedback from users and stakeholders Media articles and footage</p>	<p>Strong commitments to address negative impacts of climate change on food security in Government, concerned Ministries and at involved district Assemblies in Ghana. Appropriate technology and means available Local capacity can be built adequately</p>
Output	Activity and Key Indicators	Means of Verification	Assumptions and Risks



<b>1. Awareness raising on climate change and capacity to address its impacts along cassava value chain/ other complementary food crop production</b>			
<b>Outcome 1.1: Increased awareness and capacity of small producers, formal/informal organizations of growers, processors, and traders about climate change impacts and adaptation on agricultural value chains and related livelihoods/ Contributes to CCA-1</b>			
<p>1.1.1. A climate change capacity building programme and awareness raising campaign are designed and tools produced</p>	<p>25 RTIMP, Extension, and Research staff are trained on participatory climate-risk assessment and vulnerability mapping</p> <p>12 consultation sessions (4 in PY1, 4 in PY2, and 4 in PY3) undertaken in 20 of communities.</p> <p>Climate-related risks and vulnerability mapping is undertaken with 20 local communities in the project targeted areas in PY1 and integrated in a GIS/Monitoring Information System.</p> <p>Equipment (GIS requirements, GPS, etc) are procured in PY1 and climate-related impacts and vulnerability assessment conducted annually.</p> <p>Set of materials (handbook cultural-adapted jingle (songs), pictorial materials, leaflets and posters, info kits) produced in local languages, and distributed to users.</p>	<p><b>Project M &amp; E system</b></p> <p>Progress reports</p> <p>Mid-term and final project evaluations</p> <p>Reports of field visits</p> <p>Enquiries and requests from target users</p> <p>Maps produced</p> <p>Tools produced</p> <p>Feedback from users and beneficiaries</p>	<p>Availability of good expertise, transferable lessons, and knowledge.</p> <p>Project team has access to information and data and is capable of using it to design effective programme.</p>
<p>1.1.2. The capacity of targeted groups to mainstream climate change adaptation into their professional activities is built.</p>	<p>10 trainers from 10 cassava-producing districts in 3 Agro-climatic Zones (Guinean Savanna, Transition, and Deciduous Forests) are trained to carry out community-workshops on climate change impacts and adaptation needs/options (50 in Yr 1; 50 in Yr 2).</p> <p>40 community capacity building workshops and 4 training sessions on climate change related issues undertaken to benefit 2,000 women, youth and men of vulnerable households, local/district/regional community and commercial radio stations.</p>	<p>Project M &amp; E system</p> <p>Progress reports</p> <p>Minutes of meetings and workshops</p> <p>Lists of participants</p> <p>Feedback from users and beneficiaries</p> <p>Increased attention of the media to the topic (articles, video</p>	<p>Trainees and users are willing and able to join the training programme.</p> <p>Local media are willing to support the programme and become involved.</p> <p>People perceive the weather as supernaturally</p>

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		footage) Mid-term and final project evaluations	determined so even good meteorological information may not be well utilised.
1.1.3. The awareness of the society in the project targeted areas is raised on climate change and adaptation needs and mechanisms.	<p>Pilot non-formal education activities in 2 pilot schools per each of the 3 agro-climatic zones organized.</p> <p>Radio campaigns on climate change and adaptation designed and launched in at least 1 community-radio station and 1 commercial radio station in 4 regions (Ashanti, Brong-Ahafo, Northern, and Volta) (i.e. every two months, right before key agriculture periods like planting season and harvesting season; etc).</p> <p>Equipment (10 community announcers, 1 info van, etc) is procured in PY1 and climate change-related announcements conducted every month (PY1, PY2, PY3).</p>	<p>Project M &amp; E system</p> <p>Progress reports</p> <p>Mid-term and final project evaluations</p> <p>Radio footage</p> <p>Equipment</p> <p>Feedback from target groups</p>	<p>Local NGOs and radio station and willing and capable of becoming involved.</p> <p>School authorities are cooperative and supportive.</p> <p>Radio programs are successful in capturing the attention and generating the interest of local communities.</p> <p>People perceive the weather as supernaturally determined so even good</p>

			meteorological information may not be well utilised.
1.1.4. Study visits to Congo, Cameroon, Nigeria, and Benin undertaken to promote adaptation benefits arising from the proposed approach and scaling up of the new technologies	At least 40 people representing different stakeholder groups have participated in learning tours in PY 2 and PY 3. 150 press news in Ghana and WCA participating countries highlighting the experiences of the model-processing unit.	Agenda and list of participants, trip reports. Pictures and video footage. Feedback from trainees. Project reports.	West and Central African partners are willing to cooperate and fine experiences available. Local stakeholders are happy to become involved in study tours and learning processes.
<b>Outcome 1.2: Climate meteorological information is made available to inform agricultural investments and planning decisions/ <i>Contributes to CCA-1</i></b>			
1.2.1. Meteorological staff, farmers and processors are empowered in the use of agro-meteorological information integrating CC through equipment and training.	By PY 1, 6 national/regional meteorological staff trained abroad on advanced agro-climatology management and climate change modelling. By PY 1, 4 basic meteorological stations purchased and installed in 16 districts (4 districts per region: Ashanti, Brong-Ahafo, Northern, Volta). By PY 2, 8 community groups of farmers and processors trained on the use of basic meteorological stations to help plan production decisions according to climate variability. At least 200 beneficiaries receive relevant meteorological forecasts (through mobile SMS or community announcements) on a regular basis and in a timely fashion.	Project M & E system Progress reports Mid-term and final project evaluations Educational records and university certificates Minutes and report from training sessions Agreements and memoranda of	Meteorological services are knowledgeable on climate change and fully involved in the project. Commitment and co-operation of the staff from the Department of Meteorology. Suitable staff in service.

		understanding Leaflets	Staff is willing and capable of spending 1 year abroad on study mission.
<b>2. Support adaptation to climate change of cassava production</b>			
<b><i>Outcome 2.1: Cassava production is more resilient to climate change impacts and its quality is maintained despite risk of deterioration associated to climate impact / Contributes to CCA-2</i></b>			
2.1.1. Probability of CC-associated yield losses reduced	<p>400 training materials on CC-adaptation cassava production guidelines produced and used by 200 beneficiaries.</p> <p>200 beneficiaries trained on CC-adaptation cassava production guidelines and 8 types of agricultural equipment purchased and distributed to 16 beneficiaries in PY1 and PY2.</p> <p>At least 80 % of cassava experimental plots have used climate resilient cassava varieties with higher yields than the baseline (equal or more than 20 MT/ha) by PY3.</p>	<p>Project M &amp; E system</p> <p>Progress reports</p> <p>Mid-term and final project evaluations</p> <p>Agreements and memoranda of understanding</p> <p>Pictures and video footage documenting the process</p> <p>Education materials</p> <p>Feedback from users and beneficiaries</p>	<p>The involvement of local farmers and communities is enthusiastic and unrestricted.</p> <p>Linkage of local farmers with SLARI and LWDD</p>
2.1.2. Adaptive research on drought-resistant and improved varieties undertaken	<p>One training visit per year with 15 participants (farmers, research and extension workers) from Ghana and other cassava producing countries with high expertise on CC adaptation and cassava varieties organized.</p> <p>200 (of whom, 30% women) farmers trained on the use of CC resilient cassava varieties to address adaptation to climate change (4X trainings x 200 farmers field fora x 3 years).</p> <p>Research results available in local languages on the web (project data-base), and translated into cultural-friendly web info</p>	<p>Project M &amp; E system</p> <p>Progress reports</p> <p>Mid-term and final project evaluations</p> <p>Feedback from users and target groups</p> <p>Reports, pictures and other material</p>	<p>Local actors are willing and capable to become involved.</p> <p>Good experiences and know-how available in other cassava producing countries.</p> <p>Stakeholders from</p>

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	<p>sections/leaflets.</p> <p>Plant material of CC resilient cassava varieties to cover 75% (50% in PY3) of the needs is distributed to project beneficiaries in PY2.</p> <p>64 Soil fertility test kits and 64 cyanide field kits are distributed to farmer groups in the targeted districts.</p>	<p>from training visits</p> <p>Agreements and memoranda of understanding</p>	<p>other countries of West and Central Africa are willing to cooperate.</p> <p>Material, equipment and plants are produced and/or purchased in a timely fashion.</p>
2.1.3. Higher level of forecasting and prevention of CC-related pests and diseases promoted (time bound with Outcome 1.2.2)	<p>Training provided to 10 staff from local/regional meteorological and agriculture research centers (PY 1)</p> <p>Local climate change scenarios for agriculture and pests/diseases developed (PY 1) and used in agriculture decision planning (national, regional, local) (PY 2 and PY 3).</p> <p>80% of project beneficiaries integrate local knowledge, climate scenarios and agro-meteorological data in decision-making at the community level by PY 3.</p>	<p>Dissemination tools</p> <p>Project M &amp; E system</p> <p>Progress reports</p> <p>Mid-term and final project evaluations</p> <p>Education records and university certificates</p>	<p>Commitment and co-operation of Department of Meteorology and Agronomic staff</p> <p>Suitable staff in service</p> <p>Staff is willing and capable of spending 1 year abroad on study mission.</p>
<b>Outcome 2.2: Risk to cassava production associated with water scarcity mitigated / Contributes to CCA-2</b>			
2.2.1. Adaptive water harvesting demonstrated and promoted successfully	<p>40 trainers (Extension workers; researchers; municipal planning; RTFs; RTIMP staff) trained on CC-adapted water harvesting systems and techniques.</p> <p>4 participatory sessions on integrated water resource management with local stakeholders held in PY1 and 2 in PY2.</p> <p>CC-adapted water harvesting equipment provided and installed in two pilot areas (PY 2).</p> <p>50% decrease of project beneficiaries in water vulnerability during the dry season (PY 3)</p>	<p>Project M &amp; E system</p> <p>Progress reports</p> <p>Mid-term and final project evaluations</p> <p>Agendas and lists of participants for the study tours</p> <p>Feedback from participants and</p>	<p>Full involvement of local farmers and communities enthusiastic and unrestricted.</p> <p>Local farmers are engaged with Water Resource Commission.</p> <p>Pilot projects are</p>

		beneficiaries.	properly implemented and structures maintained.
<b>Outcome 2.3: Agro-ecosystem resilience to climate change strengthened / Contributes to CCA-2</b>			
2.3.1. Adaptive land management practices implemented and successfully contributing to soil and water conservation	<p>Bimonthly training sessions on SLM and soil/water conservation techniques provided to 100 farmers (50 in PY1 and 50 in PY 2)</p> <p>64 sustainable land and water management demonstration plots promoted by 200 (of whom, 30% women) farmers in 16 districts over 100 ha (60 ha in PY2 and 40 ha in PY3).</p> <p>4 sets of equipment (i.e. mechanisation needs) for SLM provided to 32 farmer associations or community groups</p> <p>Soil and water moisture conditions improved in 100 ha of land by PY 3</p>	<p>Project M &amp; E system</p> <p>Progress reports</p> <p>Mid-term and final project evaluations</p> <p>Field monitoring surveys</p> <p>Agreements and memoranda of understanding</p>	<p>Full involvement of local farmers and communities enthusiastic and unrestricted.</p> <p>Local stakeholders appreciate "win-win" potential of SLWM approaches to adapt to impacts of climate change.</p> <p>Planning exercise carried out effectively and timely.</p>
2.3.2. Agro-forestry promoted in selected sites	<p>32 community environmental-sound agro-forestry plans agreed, developed and implemented..</p> <p>Increase in revenue diversification rate (80 % of beneficiaries participating in agro-forestry demonstration initiatives have increased their revenues by PY3)</p> <p>At least 50 % of beneficiaries participating in agro-forestry demonstration initiatives have reported reduced impact of unusual climate events on their crops.</p>	<p>Project M &amp; E system</p> <p>Progress reports</p> <p>Mid-term and final project evaluations</p> <p>Agenda and list of participants of the study tour</p>	<p>Involvement of local stakeholders and communities enthusiastic and unrestricted.</p> <p>Linkage of local farmers with agriculture research institutions.</p>

			Available experiences in other part of Ghana can be successfully adapted and transferred to the project areas.
<b>3. Promote innovative adaptation solutions along agriculture value chain</b>			
<b><i>Outcome 3.1: Successful adoption of innovative solutions that contribute to adaptation in the targeted area and sub-sector / Contributes to CCA-3</i></b>			
3.1.1. Environmental-friendly technologies for energy production and use to support CC adaptation for food safety and food security in the cassava value chain demonstrated and promoted	<p>5,000 MT (PY 1) to 8,000 MT (PY 3) of raw cassava per year are processed, with sustainable energy sources, into high-quality cassava derivatives.</p> <p>3,200 households (about 800 cassava farmers) have substituted fossil fuel and firewood is almost completely eliminated for the processing of cassava.</p> <p>Gasification and biogas pilot plants have replaced up to 265,000 l/y of "diesel" required to operate the new facilities equipment and the motorised roasters; 1,500 MT/y of fire wood to produce 500 MT/y of gari.</p> <p>Approx. 7,500 beneficiaries (cassava processors and producers) are applying sustainable firewood management practices and uses in cassava processing (PY 2 and PY 3), and 1,500 MT of cassava peels per year are no longer disposed in the environment causing pollution problems.</p>	<p>Report from study tour, agenda and list of participants.</p> <p>Memoranda of understanding and agreements.</p> <p>Mid-term and final project reports.</p> <p>Feedback from users and beneficiaries.</p> <p>Pictures and video footage.</p> <p>Building plans, reports.</p> <p>Environmental monitoring reports and assessments, chemical analyses.</p>	<p>Indian partners are willing to cooperate and local stakeholders are willing and capable to undertake study tour.</p> <p>Project team is able to successfully lead establishment of model processing units.</p> <p>Materials and technology are readily available.</p> <p>Permits and approval duly obtained from local and national authorities.</p>

			All stakeholders are willing to cooperate and play respective roles in a timely fashion.
3.1.2. Energy-operated water pumping system installed in the cassava model-processing unit, to supply the necessary water, based on the integrated water resources management approach.	8,250 m <sup>3</sup> /year (25 m <sup>3</sup> x 330 days/year) of wastewater treatment for bio-gas generation in Asueyi (Techiman Municipality). Water tests proving an abatement of environmental pollution (soil, groundwater, etc) in Asueyi (Techiman Municipality).	Assessment reports and studies Agreements with users/beneficiaries Feedback from users Pictures Evaluation reports from the activity Water tests and reports.	The required technology, information and data are readily available Users are willing and capable of collaborating
<b>Outcome 3.2: Diversified livelihoods and socio-economic impacts of climate change mitigated / Contributes to CCA-3</b>			
3.2.1. Climate-resilient complementary income sources created for cassava producing and processing communities	100 Kg/straw mushroom produced per demonstration pilot site by PY 3. 3 MT tones of total consumption of fresh cassava peels are consumed per year avoiding pollution to the environment. 15 young entrepreneurs (half of them being women) trained in growing local straw mushroom making use of cassava peels. 50 beekeepers equipped with input package and trained on improved honey production, extraction technology and marketing. 2,850 kg high quality honey (11.4 kg/bee hive/year x 250 beehives)	Project reports Agreements and memoranda of understanding with users Minutes from meetings Pictures and video footage	Materials and equipment are readily available The producing and processing communities are eager and capable of collaborating Technical capacity to design and



	produced per year (PY 2 and PY 3).	Publications on mushroom production Evaluation reports of the activities  Proves of purchase of materials  Minutes and reports from training sessions.	install equipment is found in the team  Reference experiences and data are available  The market is ready to absorb complementary produce
<b>4. Project Management and M&amp;E</b>			
Project Management	<u>Activities:</u> Project coordinator, assistant and driver in place and operational. Project vehicle purchased and operational. Written procedures and governance rules produced and available.	TOR and job postings Project M & E system Progress reports Mid-term and final project evaluations	SCCF component management officer has relevant expertise (good understanding of adaptation issues)  Efficient administrative processes are
Project M&E	SCCF M&E requirements are fully met. Project M&E system is fully aligned with RTIMP Good quality progress reports are produced. Key indicators: Positive input provided on M&E procedures and system. Progress reports available.	Project M & E system Progress reports Mid-term and final project evaluations	Data is captured and recorded regularly  Good flow of exchange with RTIMP  Timely evaluations and reports

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**ANNEX 3: PROJECT COST TABLES**

the full COSTAB is provided in a separate handout



**ANNEX 4. ADDITIONALITY OF THE SCCF FUNDING VIS-À-VIS THE BASELINE.**

SCCF Component	Cost Category	Expected outcomes	"Additionality"	Adaptation Benefits
<b>Component 1: Awareness raising on climate change and capacity to address the impacts along cassava value chain</b>	Baseline	<p>RTIMP will develop innovative activities to keep improving processes, structures and mechanisms – both institutionally and on an ad hoc basis – that can integrate/empower the organizations of small-scale R&amp;T farmers, processors and traders so that they increasingly manage their own development. The five subcomponents are: (i) information, education and communication campaign; (ii) linking small producers to larger markets; (iii) developing new uses for R&amp;Ts; (iv) strengthening formal/informal organizations of growers, processors and traders; and (v) support to R&amp;T commodity chain partners and policy dialogue. An R&amp;T apex body with a knowledge centre will be developed to take over most programme activities at closure (e.g. information dissemination, policy dialogue, capacity-building for empowerment). These efforts are expected to result in a functional R&amp;T apex body by the time of the mid-term review. Corresponding activities from the baseline will provide support to smallholder farmers to access irrigation, technical skills and access to markets. It will support agricultural development and commercialization. RCPEP-PLUS will promote inland valley swamps. The project will also support the installation of 80 boreholes for irrigation of non-perennial IVS. The baseline will also support young farmers in obtaining long-term leases for rice and tree crop productions. Feeder roads and trunk roads will be rehabilitated and maintained. Rice mills and oil mills will be installed</p>	<ul style="list-style-type: none"> <li>- Targeted capacity building efforts to mainstream climate change adaptation for sustainable agriculture management and food security in the extension work as well as in the planning and decision making processes.</li> <li>- Additional CC adaptation awareness raising and sensitization campaigns at the grassroots level (through participatory approach and community engagement using the rural radio and other innovative tools), addressing CC impacts, vulnerabilities and adaptation options on environmental, health, social and economic issues.</li> <li>- Technical capacity building for Meteorological staff on agro-metrology and integration of climatic change variables in the decision making processes (in relation to cropping and food security) is an additional investment that will not be covered by the baseline.</li> </ul>	<ul style="list-style-type: none"> <li>- Building the country's capacity to generate and use accurate agro-metrological data integrating CC scenarios and predictions</li> <li>- Awareness of climate change and its impacts at all levels (government officials, extension services and local communities)</li> <li>- Capacity to integrate CC adaptation measures in agriculture, agro-forestry and food production through a critical mass of experts/trainers, and a representative sample of local population enabled</li> <li>- Strengthening the planning and decision-making process at the local level to integrate climate change considerations</li> </ul>

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Promoting a Value Chain Approach to Climate Change Adaptation in Agriculture in Ghana

SCCF Component	Cost Category	Expected outcomes	"Additionality"	Adaptation Benefits
	SCCF	<p>The SCCF funding will support the baseline effort by incorporating a participatory mapping of the vulnerability of cassava producers and processors to climate change. This will be integrated in the RTIMP monitoring system and will be used for decision-making process.</p> <p>The SCCF project will provide training to local producers and processors on CC impacts, vulnerabilities and best adaptation practices. This will entail support to field extension workers (they will be trained through the SCCF on how to integrate and deal with climate change adaptation in terms of planning and implementation/monitoring), DAs sectoral staff, research and university staff, NGO, journalists, and health workers. The SCCF operation will train at least 35 persons over 3 years. SCCF will cover training sessions through the RTIMP FFF and other participatory mechanisms.</p> <p>SCCF will also provide support to capacity building activities on adaptation to CC for local communities and radio stations and promote the CC awareness raising efforts at the grassroots level (Radio campaigns, musical-based tools, etc).</p> <p>The Project will provide advanced training for 6 meteorological technicians on the integration of CC information in agro-climatology. Also the SCCF funding will establish 4 automatic weather stations and needed equipments to improve the country's ability to record climate/met data, and will ensure that at least 200 beneficiaries receive relevant meteo information on a regular basis.</p>		

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Promoting a Value Chain Approach to Climate Change Adaptation in Agriculture in Ghana

SCCF Component	Cost Category	Expected outcomes	"Additionality"	Adaptation Benefits
<b>Component 2: Support adaptation to climate change of cassava production</b>	Baseline	The RTIMP will consolidate and expand its services to further improve R&T production, yields and quality. The five subcomponents are: (i) agricultural research; (ii) multiplication/distribution of planting material;(iii) improved cultivation practices; (iv) soil fertility management; and (v) integrated pest management. The existing range of new and indigenous varieties will be expanded and private sector operators will be encouraged to take over service delivery. The main instrument will be farmer-field forums, where farmers and researchers can meet to exchange knowledge and experiences on cultivation practices, carry out varietal selection, etc. Efforts will be made to gradually involve the private sector (e.g. commercial seed growers) in the multiplication and distribution of planting material (including cassava), starting with areas of high R&T production.	The RTIMP covers the investment requirements to promote agriculture research on cassava drought-resistant varieties, distribute improved plant material to farmers, and support farmers in the field to apply sustainable land management practices and pest management. The SCCF will bring the adaptation additional element by improving the resilience of RTIMP efforts and incorporate adaptation needs in the selection of crop varieties, in the proposed sustainable land and water management practices, and in the recovery of traditional agro-forestry systems. The SCCF will be additional in the fashion it targets SLWM at large trying to target win-win-win options that ensure sustainability, increased income and better adaptation to climate change. This win-win-win adaptation solution is fully integrated in the development efforts of the RTIMP.	<ul style="list-style-type: none"> <li>- Climate-proofing of farming practices in the project districts and promotion of sustainable land and water management as well as cassava production activities responding to adaptation needs.</li> <li>- Adaptation benefits will accrue from diversification and better use and management of agro-forestry systems</li> <li>- Improved local capacity and community based planning for adaptation will bring additional adaptation benefits in short and long runs.</li> </ul>

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Promoting a Value Chain Approach to Climate Change Adaptation in Agriculture in Ghana

SCCF Component	Cost Category	Expected outcomes	"Additionality"	Adaptation Benefits
	SCCF	<p>To increase resilience of ecosystems and livelihoods, the project will support adaptation measures in cassava crop varieties and SLWM. In terms of CC adapted cassava varieties to improve yields the SCCF will cover a pilot of sustainable practices, the SCCF will cover a pilot of 16 demonstration plots in the project districts that will complement the efforts of the RTIMP. The 16 plots will demonstrate co-benefits in terms of adaptation, resilient cassava varieties and higher yields.</p> <p>In terms of adaptation measures for SLWM the SCCF will cover 64 demonstration sites in the project districts that will complement RTIMP efforts. At least 200 farmers will be involved in training by doing activities through the farmers field fora (FFF) and support from CC and agriculture experts. Moreover the SCCF will support the development of 32 agro-forestry plans aiming to re-establish a modified traditional taungya agro-forestry system incorporating CC adaptation needs.</p> <p>The SCCF funding will complement the efforts of the RTIMP by adding an adaptation dimension in the diversification of agriculture and agro-forestry income generating activities (to both increase income and reduce bad-management practices). This adds an important adaptation dimension to the development scenario.</p>		



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## Promoting a Value Chain Approach to Climate Change Adaptation in Agriculture in Ghana

SCCF Component	Cost Category	Expected outcomes	"Additionality"	Adaptation Benefits
<b>Component 3: Successful adoption of innovative adaptation solutions along agriculture value chain</b>	Baseline	RTIMP will provide support to upgrade processing technologies and the business skills of small-scale R&T processors, especially for existing and new cassava products. The component embodies the programme' s business development part, contributing to general, private sector development by building up the entrepreneurial and business capacity of small-scale rural operators. The four subcomponents are: (i) identification/transfer of improved technologies; (ii) peer demonstrations in good practices centres; (iii) business development training, including all-important marketing skills and business plan preparation; and (iv) a microenterprise fund to provide matching grants through credit and micro-leasing.	Costs associated with "climate-proofing" of cassava processing and food production systems will be additional. Promotion of efficient and environment-friendly technologies for energy production and use, as well as adaptation techniques for food safety and food security along the cassava value chain. This will be achieved through the setup of a new producing plant and facilities, including bio-energy producing plants, which are meant to become a reference of climate change adaptation in agriculture for the whole region. The provision of equipment will be coupled with the training needed to guarantee adequate and sustainable use. The SCCF will cover physical investment in setting up a new cassava processing and food production plant to be jointly run by at least 5 processing centers. The SCCF will support all the institutional development, and capacity building needs to	<ul style="list-style-type: none"> <li>- Use of sustainable energy production technologies that reduce environmental stressors exacerbated by CC (effective use of waste as bio-energy to prevent soil and water pollution and health problems; significant reduction and efficient use of wood-fuel to prevent deforestation and CO2 emissions).</li> <li>- Improved post-harvesting technologies that increase quality and diversify products.</li> <li>- Increase revenues from a wider range of products, and the capacity of savings to investment in new opportunities and obtaining bank loans.</li> </ul>

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## Promoting a Value Chain Approach to Climate Change Adaptation in Agriculture in Ghana

SCCF Component	Cost Category	Expected outcomes	"Additionality"	Adaptation Benefits
	SCCF	<p>The SCCF funding will support the baseline processing and marketing efforts by incorporating innovative technologies on sustainable energy production and new machinery to run a model cassava processing and food production centre. This will be integrated in the RTIMP work, by up-scaling its actions to build Good Practices Centers. The project will support 3,000 cassava farmers and processors directly or indirectly connected to 5 cassava processing centers in the districts of Techiman, Wenchi, Nkoranza, Kintampo and Offinso North, and will set up a new model of cassava processing and production center run by 150 processors. This centre will be equipped with a gasification plant, a biogas plant, two cooling chambers and one honey production room. High quality cassava derivatives and other food products will be produced with the possibility to store them in a longer-term and increase their negotiation marketing opportunities, as well as to be open to new markets.</p> <p>The SCCF project will also support around 7,000 cassava farmers and processors in the 7 project districts to benefit from gasification stoves making an efficient use of firewood to process gari. The project will provide funding to acquire 11 efficient gasification stoves and 5 mechanized rosters to equip the selected cassava processing centers.</p> <p>Sixting farmers from Brong-Ahafo region will benefit from a pilot initiative to produce mushrooms using cassava waste peels as substrate and efficient firewood gasification stoves.</p>	secure the good governance of the new centre and upscale the capacity of its member on high quality cassava processing and food production and marketing of a wider range of products.	
<b>Component 4: Project Management and M&amp;E</b>	Baseline	The baseline will cover the establishment of the NPCU and the DPCUs. It will be responsible for the overall program coordination and implementation (including logistical support). The main M&E function will be undertaken through existing M&E system.	Integrating climate aspects in the overall project management and monitoring.	<ul style="list-style-type: none"> <li>- Make the baseline intervention climate smart</li> <li>- Decision-making processes (at all level) in based on accurate data and</li> </ul>

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Promoting a Value Chain Approach to Climate Change Adaptation in Agriculture in Ghana

SCCF Component	Cost Category	Expected outcomes	"Additionality"	Adaptation Benefits
	SCCF	SCCF will cover the additional cost of a project officer and project assistant to ensure the overall coordination of the SCCF activities. M&E will be fully integrated in the RTIMP system.		integrates climate change elements.

## **ANNEX 5. TERMS OF REFERENCE OF THE SCCF PROJECT OFFICER**

SCCF funds will be used to recruit a full time national expert, with a strong CC and NRM background, to undertake the duties of the SCCF Project Officer. S/he will be based in the national RTIMP Coordination. S/he will take lead responsibility for the delivery of the SCCF programme of work under the overall supervision of the RTIMP coordinator and will ensure direct coordination with the stakeholders the RTIMP at the districts level.

### **HER/HIS SPECIFIC DUTIES WOULD INCLUDE:**

- i. Overall responsibility of the planning, implementation and monitoring of the SCCF activities (under the supervision and coordination with the RTIMP);
- ii. Manage the project in accordance with its annual work plans; With support from the RTIMP, coordinate SCCF and IFAD program activities on a regular basis, to ensure complementarities;
- iii. Propose selection criteria and supervise consultants/ subcontractors, maintaining strong quality control and providing advisory support as required;
- iv. Maintain close coordination/linkages with technical implementation partner (agencies, media companies, private service providers and NGOs);
- v. Oversee the design and establishment of channels for regular project information dissemination, sharing, and networking among stakeholder communities (from local to national levels);
- vi. Oversee the implementation of the daily SCCF project management activities , in close coordination with the national coordinator of the RTIMP, and the district level (providing them with guidance and coordinating all project activities according to joint AWPB);
- vii. Supervise the procurement and maintenance of project equipment and development of infrastructure;
- viii. Maintain close coordination/linkages with the other participating Ministries and relevant agencies; Work closely with the RTIMP and key stakeholders (meteorology department and others) to coordinate the overall implementation of project activities;
- ix. Oversee the needs assessment and provision of required skills training and capacity building of involved government officials, local authorities, and key stakeholders;
- x. Lead responsibility for organising the SCCF project -related meetings;
- xi. Provide support and guidance to the counterpart at the district level in planning, coordinating, implementing and monitoring project activities (As part of the overall AWPB of the RTIMP). This entails the preparation and monitoring of AWPB in direct manner with the districts (the AWPB of the SCCF will be fully integrated in the AWPB of the RTIMP);

The candidate should have a minimum of 10 years of experience with the following skills and knowledge:

- A first degree in a discipline related to Natural Resource Management, water management, or agriculture. A postgraduate degree would be an advantage;
- A strong background in and experience working on climate change issues (Adaptation in particular) is an asset;
- Be familiar and have strong proven experience in the implementation of development projects (Project management, M&E, good managerial and technical skills)
- Have a good knowledge of the different national, regional and local government level stakeholder institutions concerned with adaptation to climate change (within government, the private sector, civil society and international development partner agencies), and have the ability and readiness to communicate, and work with them.
- Have the ability to work in a multi-sectoral context and communicate effectively with other disciplinary specialists.
  
- Have the ability to supervise service providers

## **ANNEX 6: QUICK FACTS: GHANA**

### **PEOPLE**

Total population (millions): 20.67  
Life expectancy at birth: 54  
Population density (people per km<sup>2</sup>): 91  
Adult illiteracy rate (% age 15 and above): 26 a/  
Total labor force (million): 10.35  
Female labor force (as % of total): 50  
Per capita daily calorie intake: n/a  
Malnutrition prevalence, height for age (% of children under 5): 26 a/  
Malnutrition prevalence, weight for age (% of children under 5): 25 a/  
Child mortality rate (per 1000 live births): 59

### **LAND USE**

Land area (Km<sup>2</sup> thousand): 228  
Arable land (% of land area): 18a/  
Food imports: (% of merchandise imports): 20 a/  
Food production index (1999-01=100): 116  
Irrigated land (as % of cropland): 0.2 a/  
Forest area (% of total area): 28 a/

### **ECONOMIC**

GNI per capita (USD): 320  
GDP per capita growth (annual %): 3.3  
Agriculture as % of Gross Domestic Product: 36  
Agriculture distribution of GDP (%): 36  
Merchandise exports (USD million): 2498  
Merchandise imports (USD million): 3250  
Foreign direct investment net (USD million): 137

### **PRODUCTION**

Cereal yield (kg/ha1000): 1396  
Cassava yield: 79000 metric tons  
Surface of cassava cultivation: 760,000 hectares

Source: UNDP, WB and FAO (Year: 2003)

**ANNEX 7: LETTER OF ENDORSEMENT FROM GEF OFP**

**ANNEX 8: LETTER OF COMMITMENT FROM CO-FINANCIERS**



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**ANNEX 10: FINANCIAL FEASIBILITY STUDIES**

*Producing cassava dried products and fibers for  
animal feed meals making use of bio-energy produced  
from cassava wastes:  
outcomes of the financial feasibility  
in Aseuyi, Ghana.*

*Prepared by  
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*June, 2011*

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### **List of Acronyms and Abbreviations**

CPCB: Central Pollution Control Board

GHC: Ghanaian Cedi

GPC: Good Practices Centre

IFAD: International Fund for Agricultural Development

IRR: Internal Rate of Return

NHS: National Health Service

NEPAD: New Partnership for Africa's Development

RCPMI: Regional Cassava Processing and Marketing Initiative

R&T: Roots and Tubers

RTIMP: Roots and Tubers Improvement Marketing Programme

USD: United States Dollar

WB: World Bank

WCA: Western and Central Africa

**Exchange rate:** 1 USD=1,5 GHC (May, 2011)

## Executive Summary

This study assesses the financial feasibility to put in place in Asueyi, Ghana, a commercial production of cassava dried products and fibers for animal feed meals making use of the bioenergy produced from cassava wastes<sup>15</sup>. With specific reference to this financial feasibility, a comprehensive set of information and data have been taken into account, as detailed in paragraph 1.2 of this study.

Total investment costs for the investment are estimated at GHC 450 000 (equal to USD 300 000), including civil works, transport costs, spare parts and data tool. Recurrent costs include, among the others, raw cassava, administration and management fees, transport costs, labour (both skilled and unskilled workers), bags, Operation and Maintenance (O&M) and working capital (and related interests) needed at Y1 to cover short-term liabilities. As for the energy requirements, both electricity and hot air are supposed to be purchased from the gasification plant<sup>16</sup> as it follows:

- Energy as electricity: diesel: 180 l/d x 1.5 GHC x 330d;
- Energy as hot air: diesel or liquid gas: 246x1.5 GHC x330d;
- Energy as gas: equivalent fire wood: 23+47 kg x 1,5 GHC x 330d.

Shadow prices of diesel and fire wood have been used in the analysis. The reason why diesel and firewood have been chosen as shadow prices to estimate the energy costs is that in the project's region diesel is, at the moment, the fossil fuel mostly used for energy generation, as firewood is for heat production (especially in rural areas). Therefore, the domestic market price for diesel has been retained as the referential price for estimating the value of the electricity required for the processing activities, while the one for firewood has been retained for estimating the costs of the heat required. Total recurrent costs are estimated at GHC 1 088 000 (approximately USD 725 000) at Y1, decrease at GHC 870 000 (USD 580 000) in Y2 and increase

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<sup>15</sup> For further details on the latter, please refer to the technical and financial feasibility.

<sup>16</sup> For further details please refer to the technical and financial feasibilities of the bio-energy production.



up to GHC 1 327 000 (approximately USD 884 600) from Y5 when the plant works 22hours/day per 330 working days a year making use of 685 000 Mt/y of cassava a year. Total revenues have been derived based on the following assumptions: (i) a 50 kg bag of dried products is sold at 42.5 GHC/Kg (equal to USD 28); and (ii) a 50 kg/bag of fibers (animal feed meal) is sold at 7.5 GHC/Kg (equal to USD 5). It is assumed that the production of dried products as well as fibers will increase constantly over the years until Y5<sup>17</sup>. The analysis is over a time frame of 10 years.

The outcome of the financial analysis shows a good overall profitability of this investment, both in terms of annual cash-flows (both current and discounted) and of other key financial indicators, such as the financial IRR which is 36% much higher than the opportunity cost of capital<sup>18</sup>. In addition to that, in order to assess the profitability of replicating the investment in other regions of the country, it has been assumed that money is borrowed from local banks (at a 22% interest rate) to pay for the total investment cost. Money borrowed is expected to be paid back through equal installments plus interests on the remaining debt over a period of 7 years<sup>19</sup>. The average passive interest rate applied in Ghana is equal to 23% (including administrative fees<sup>20</sup>) for industrial investments; however, for the agricultural investments<sup>21</sup> it decreases to 22% - which is the rate adopted in this study. Also under this scenario, main financial indicators remain positive: the IRR decreases to 17% and the pay-back period remains around 6 years.

## 1. Introduction

### 1.1 Objective of the feasibility study

Objective of this financial study is to assess the financial feasibility of setting up a plant to produce dried cassava products and fibers (for animal feed meal)

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<sup>17</sup> For further details please refer to the technical feasibility.

<sup>18</sup> The average interest rate paid by local banks on deposits is approximately 10%.

<sup>19</sup> This assumption is built on the lending terms currently enforced in Ghana.

<sup>20</sup> As of August, 2010, Ghana Commercial Bank.

<sup>21</sup> As per information provided by the Agricultural Development Bank, which specifically finances investments in the rural areas of Ghana.

making use of the bio-energy produced from cassava wastes (i.e. peels, barks and water) through a gasifier and a biogas plant. All information presented in this study is real and based on data and figures collected in the country in May, 2011.

The feasibility is based on a real application for a pilot plant proposed to be set up in Ghana, more precisely in Asueyi, a main area for cassava production and processing of the country. However, it is worth highlighting that what presented in this report could be easily adapted to other similar African contexts where cassava is produced<sup>22</sup>.

## 1.2 Methodology used

This feasibility study builds on the technical feasibility for the production of cassava dried derivatives as well as on the financial feasibility to produce bio-energy from cassava wastes. All data and figures are real and based on the following: (i) field visits in the country for collecting primary and secondary data<sup>23</sup>; (ii) face-to-face meetings with local cassava producers and processors and traders; and (iii) working sessions with the IFAD specialists<sup>24</sup> involved in the IFAD-funded RTIMP.

With specific reference to the financial feasibility, the following information and data have been estimated:

- (i) Investment costs
  - Land and infrastructure cost;
  - Cost of equipments and depreciation<sup>25</sup>;
  - Transport costs (shipping) and related insurance;
  - Civil works.
- (ii) Operating Costs:
  - Cost of raw materials;
  - Cost of utilities (energy to be bought from the gasification plant);

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<sup>22</sup> For further details please refer to the Scaling up/replicability section in PDR.

<sup>23</sup> From national and international stakeholders like the National Bank.

<sup>24</sup> Vincent Akoto, post-harvest specialist RTIMP.

<sup>25</sup> Depreciation has been outlined in the investments costs but not included into the cash-flow analysis since it does not represent a financial out-flow.

- Wages of skilled and unskilled workers;
  - Operation and maintenance costs;
  - Transport costs;
  - Working capital requirements (and related interests);
  - Lube oil requirements.
- (iii) Revenues
- (iv) Annual cash flow and discounted annual cash flow analyses
- (v) Financial evaluation
- Internal Rate of Return (IRR);
  - Payback period.

The financial study begins with a detailed presentation of project cost items. These costs include both the investment costs and production costs divided into fixed and recurrent costs. The financial assessment is based on both discounted and undiscounted values, particularly the annual cash flow, the IRR and the payback period. In line with World Bank indicators<sup>26</sup>, inflation rate is currently estimated at 0.5%. However, price escalation is not taken into account as it is expected that any change in costs (increase or decrease) will equally affect benefits. Price and physical contingencies have been included and assumed to be equal to a 3% of the investment cost. As for the scaling up and out perspective, the possibility of financing the total amount of the investment through a loan at 22% interest rate has been taken into account in the final section of this study.

## 2. Financial aspects related to the technology

### 2.1 Investment costs

Investment costs for the technology to produce dried cassava products and fibers include the cost of equipments and materials, civil works (including land preparation and construction costs), transport costs of equipments and materials to the site in Asueyi and assembling and commissioning (including 15 working days hands-on training). The project cost estimates are calculated in real term-constant prices of April 2011 and are equal to GHC 450 000

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<sup>26</sup> WB website, indicators as of June, 2011. [www.worldbank.org](http://www.worldbank.org).

(equal to USD 300 000). These have been divided into two main categories as it follows: investment costs and operating cost. Depreciation costs have been considered for each item, ranging from 2 to 5 years for basic laboratory furniture, 10 years for other equipment and material and 20-25 years for civil work<sup>27</sup>. Total depreciation cost equals GHC 47 800/year (USD 20 000/y), which has been budgeted in order to anticipate the renewal of the investment but not included in the cash flow analysis.

## 2.2 Cost of land and civil works

The project requires land for setting up the plant, which would include an area for receiving raw materials (GHC 6 700, approximately USD 4 400) and others for processing cassava roots (GHC 80 200) and bagging the final products (GHC 17 200, approximately USD 11 400). Assembling and commissioning costs (of equipments) have been also included and estimated at GHC 20 000 (approximately 13 000 USD). Total civil works required to set up the improved facilities have been estimated at GHC 150 000 (USD 100 000), and depreciation timeframe estimated at 25 years (GHC 6 000, equal to USD 4 000)). Considering that the land belongs to the project's beneficiaries in Asueyi, renting costs have not been included in the analysis.

## 2.3 Recurrent costs and working capital

The plant is supposed to work for a total of 22 hours/day for 330 days/year. Yearly recurrent costs change depending on volumes produced. Here below, the detailed recurrent costs<sup>28</sup> over the 5 years<sup>29</sup>:

	<i>year 1</i>	<i>year 2</i>	<i>year 3</i>	<i>year 4</i>	<i>year 5</i>
<i>Raw cassava t/y</i>	438 240	438 240	547 800	547 800	684 750
<i>50 kg Bag/y for dried product</i>	29 700	29 700	37 125	37 125	46 406
<i>50 kg bag/y for fibres</i>	6 600	6 600	8 250	8 250	10 313
<i>50 kg Bag/y for pressing</i>	9 801	9 801	12 251	12 251	15 314
<i>Unskilled workers (peeling)</i>	46 200	46 200	52 800	52 800	66 000
<i>Peeling control, cutting</i>	16 500	16 500	16 500	16 500	16 500
<i>Washing, collecting, granting, collecting, transporting</i>	13 200	13 200	16 500	16 500	19 800
<i>Transport costs to breaking, dewatering</i>	9 900	9 900	13 200	13 200	13 200

<sup>27</sup> For further details please refer to the detailed spreadsheet in the technical feasibility.

<sup>28</sup> Detailed costs in GHC.

<sup>29</sup> From Y5 to Y10 intake of raw materials and outtake of final production will remain stable.

Drying and milling	12 375	12 375	12 375	12 375	12 375
Packaging and storage	9 900	9 900	13 200	13 200	16 500
Management (including marketing) and energy production	6 480	6 480	6 480	6 480	6 480
Administration	3 600	3 600	3 600	3 600	3 600
Foreman/production supervisor	7 200	7 200	7 200	7 200	7 200
Guardian	990	990	990	990	990
Energy as electricity (diesel: 180 l/d x 1.5 x 330d)	89 100	89 100	111 375	111 375	139 219
Energy as hot air (diesel or liquid gas: 246x1.5x330)	121 770	121 770	152 213	152 213	190 266
Energy as gas (equivalent fire wood: (23+47) x 1,5 x 330)	34 650	34 650	43 313	43 313	54 141
Maintenance	3 000	3 000	4 500	4 500	6 000
Transport to Accra	10 800	10 800	14 400	14 400	18 000
<b>Operating cost (in GHC)</b>	<b>870 006</b>	<b>870 006</b>	<b>1 074 071</b>	<b>1 074 071</b>	<b>1 327 053</b>
<b>Operating costs (in USD)</b>	<b>580 004</b>	<b>580 004</b>	<b>716 048</b>	<b>716 048</b>	<b>884 702</b>

Social security costs (10%) have been also included as part of employees' monthly gross salary. In addition to that, working capital has been also included in the analysis since the plant cash is needed to pay off daily operation costs at Y1. Hence working capital requirements have been estimated, including interests, at 22% interest rate to pay off short-term liabilities. This is equal to **GHC 218 500 (approximately 145 600)**, while it is expected that after Y1 day-to-day activities will be covered by the annual cash flow.

### 3. The profitability of the plant

This section provides for a detailed financial analysis of the profitability of the investment required to produce cassava dried products as per details previously provided. Timeframe of the analysis is 10 years and it is based on the assumptions described in previous sections.

#### 3.1 Outcomes of the financial analysis

As already mentioned above, the timeframe of the financial analysis is 10 years; both discounted and not discounted values have been analyzed. Key outcomes are summarized here below:

- Profits are positive starting from Y2 at GHC 131 500 (equal to approximately USD 87 000). They constantly increase up to Y5 at GHC 264 700 (approximately USD 176 000) and remain stable until Y10;
- Annual cash flows is also positive from Y2. More specifically, the annual cash flow is approximately GHC 180 000 (USD 120 000) in Y2 and GHC 312 000 (USD 208 000) at Y10. Also the analysis of discounted annual cash flows confirms satisfactory outcomes throughout the entire life of the investment, being GHC 163 000 (USD 108 500) at Y2 and GHC 132 500 (USD 88 300) at Y10;
- The financial internal rate of return (IRR) of this investment is 36%, - higher than the opportunity costs (10%);
- The payback period of the investment is just 4 years.

### 3.2 Additional unquantified benefits

Other benefits which could not be quantified in this financial feasibility study include the following: (i) Environmental benefits: reduced use of fossil fuel and wood and climate change adaptation benefits<sup>30</sup>; (ii) improved livelihood: time savings in collecting traditional sources of energy (i.e. wood) and improved health conditions; and (iii) increased value of land due to better soil fertility and reduced soil erosion.

### 4. Replicability of the investment

In order to assess the profitability of replicating the investment in other regions of the country, it has been assumed that the entire amount of money required to cover investment costs is borrowed from local banks at a 22% interest rate, to be paid back through equal installments (plus interests on the remaining debt) over a period of 7 years<sup>31</sup>. The average passive interest rate applied in Ghana is equal to 23% (including administrative fees<sup>32</sup>) for industrial investments; however, in the case of agricultural investments<sup>33</sup>, it decreases to 22% - which is the rate adopted throughout this study. Under this scenario, it has been assumed that 100% of the total investment costs (equal to GHC

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<sup>30</sup> See Main Project Report.

<sup>31</sup> This assumption is built on the lending terms currently enforced in Ghana.

<sup>32</sup> As of August, 2010, Ghana Commercial Bank.

<sup>33</sup> As per information provided by the Agricultural Development Bank, which specifically finances investments in the rural areas of Ghana.

450 000 or USD 300 000) is borrowed from local banks. Estimated yearly repayments of the capital required for implementing the investment and for working capital needs (including related interests), range from GHC 163 000 (USD 108 600) in Y1 to GHC 78 000 in Y7. Annual cash flow shows to be positive as from Y2 (GHC 30 000 equal to USD 20 000) to Y7, when the debt is totally repaid. Estimated IRR is 17%, higher than the opportunity costs (10%), and the pay back period results to be less than 6 years. This scenario confirms the profitability of replicating the investment in other regions of Ghana provided that the assumptions made for the pilot plan in Asueyi are met.

*APPENDICES*



Appendix 1: Financial feasibility

*(all values in GHC)*

	<i>1st year</i>	<i>2nd year</i>	<i>3rd year</i>	<i>4th year</i>	<i>5th year</i>	<i>6th year</i>	<i>10th year</i>
<b>Investment costs</b>	47 861	47 861	47 861	47 861	47 861	47 861	47 861
<b>Operating costs</b>	1 088 506	870 006	1 074 071	1 074 071	1 327 053	1 327 053	1 327 053
<b>Total costs</b>	1 136 367	917 867	1 121 933	1 121 933	1 374 914	1 374 914	1 374 914
<b>Total revenues</b>	1 049 400	1 049 400	1 311 750	1 311 750	1 639 688	1 639 688	1 639 688
<b>Profit</b>	-86 967	131 533	189 818	189 818	264 773	264 773	264 773
<b>Annual cash flow</b>	-39 106	179 394	237 679	237 679	312 635	312 635	312 635
<b>Discounted annual cash flow</b>		163 085	196 429	178 572	213 534	194 122	132 588
<b>IRR</b>	36%						
<b>Pay back period</b>	4						

Annex 2: Financial feasibility with debt repayment

	<i>1st year</i>	<i>2nd year</i>	<i>3rd year</i>	<i>4th year</i>	<i>5th year</i>	<i>6th year</i>	<i>7th year</i>	<i>10th year</i>
<b>Investment costs</b>	47 861	47 861	47 861	47 861	47 861	47 861	47 861	47 861
<b>Operating costs</b>	1 088 506	870 006	1 074 071	1 074 071	1 327 053	1 327 053	1 327 053	1 327 053
<b>Debt repayment</b>	163 286	149 143	135 000	120 857	106 714	92 571	78 429	
<b>Total costs</b>	1 299 653	1 067 010	1 256 933	1 242 790	1 481 628	1 467 485	1 453 343	1 374 914
<b>Total revenues</b>	1 049 400	1 049 400	1 311 750	1 311 750	1 639 688	1 639 688	1 639 688	1 639 688
<b>Profit</b>	-250 253	-17 610	54 818	68 960	158 059	172 202	186 345	264 773
<b>Annual cash flow</b>	-202 392	30 251	102 679	116 822	205 920	220 063	234 206	312 635
<b>Discounted annual cash flow</b>		27 501	84 858	87 770	140 646	136 642	132 203	132 588
<b>IRR</b>	17%							
<b>Pay back period</b>	5.5							

**Exploring the uses of cassava peels in Brong Ahafo Region, Ghana:  
a brief note**

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## 1. Introduction

### 1.1 Cassava-waste management: possible uses of peels, barks and wastewater

Cassava wastes include peels, barks and waste water. Cassava peels and barks constitute a substantial by-product of the cassava processing; they normally consist of the thin pericarp and the thicker rind as most processors manually remove both along with some pulp adhered to the peels. In the project area, it is estimated that cassava wastes constitute about 20-25% of total tuber weight. As of today, it appears that in the following wastes from cassava production are available<sup>34</sup>:

- Cassava peels and barks: 40 685 MT<sup>35</sup>. Both fresh or sun-dried, are either abandoned or burnt nearby processing places or cleared from production places only occasionally for small ruminants and cattle to eat part of them, as a systematic way of waste disposal does not exist yet. Being a highly polluting by-product, the way they are currently laid off poses a serious threat for the environment;
- Waste water: 184 887 000 liters<sup>36</sup>. Although it is polluting for the environment (due to its cyanide content), it is usually dumped into side drains, streams, rivers or spread over soils, thus contributing to the pollution of the soil and the water table.

Current practices for disposing off the cassava by-products in the country pose, therefore, many hazards with reference to soil's fertility, purity of table waters, the health of cassava processors and the general population, especially in rural areas where cassava is processed. Possible identified uses of the cassava wastes within the project area include: (i) animal feed production<sup>37</sup>, (ii) energy production and (iii) their use for the production of compost for mushroom production.

As for the animal feed production, cassava peels could be a potential source of energy and, as such, integrated into animal feed as a replacement for maize –the overall quantity depending on the animal species targeted. One drawback in using cassava peels as animal feed is their low protein content which makes necessary to fortify the feed meal with other sources of protein to meet specific nutritional requirements of the animals. However, taking into account the experiments conducted so far, a significant percentage of cassava peels in animal feed formulation is feasible with positive results only in the following cases: pigs (up to 40% of the animal feed composition) and fish (up to 40%). In Brong Ahafo region, aquaculture is not practiced on large scale and the same happens for pigs farms, thus making the commercial production of animal feed meals from cassava peels not a profitable option. Therefore, the use of cassava peels (up to a level of 40%) in animal feed formulas generates only a limited reduction in the utilization of maize, the most expensive component in feed meals. More precisely, the reduction of the total costs of the feed meal for the various animal feeds is the following:

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<sup>34</sup> Source: MOFA, 2010, Techiman municipality

<sup>35</sup> Source: Techiman municipality, 2010.

<sup>36</sup> Assuming that 1 liter of water is used for each kilogram of cassava roots processed.

<sup>37</sup> For a detailed analysis please refer to technical and financial feasibility study to set up an animal feed plant in Nigeria, published by RCPMI in 2009 and available on [www.fidafrique.org](http://www.fidafrique.org)

pigs' 10%, cattle' 20% and goats' 20%. Previous analyses carried out in Nigeria show similar results for the commercial production of poultry feed meal based on cassava wastes: experiments show a better performance on the birds' health when utilizing cassava pellets that are made out of cassava leaves only. Due to the high cyanide content the inclusion of cassava peels into the poultry diet is therefore not recommended. For this reason, it is not recommended to use cassava wastes for the commercial production at big scale of animal feed meal in the project area.

## 1.2 Cassava peels and barks for mushrooms' production

In Ghana, the following two varieties of mushrooms are currently grown (MUGREAG, 1994): Oyster (*Pleurotus ostreatus*) and Paddy Straw Mushroom (*Volvariella Volvacea*). As for the Oyster production, a mix of sawdust, lime and inorganic fertilizers are currently used by mushroom growers<sup>38</sup>. As for the commercialization of local mushroom varieties, REP III has elaborated a clear enterprise model through which detailed costs and benefits are outlined. However, on the basis of the discussion held with local producers and research centers, it would appear that the overall profitability of the mushroom business might change<sup>39</sup> when: (i) cassava peels and animal wastes are used as intakes to replace the currently used (thus reducing the operating costs) and (ii) the amount of wood used in the sterilization process is reduced by 2/3 through the use of small gasifier (hence operating costs decrease). Recurrent costs for mushroom's production include the following: fire wood (8MT/week at 250 GHC/MT, equal to approximately 33 USD/MT), plastic bags (GHC 0,36/each, approximately USD 0,24) and other inputs costs (fertilizers, sawdust etc). It is clear that by using only cassava peels and animal dung (as natural compost), thus eliminating any other cost for acquiring other inputs and fertilizers and consistently reducing the amount of wood utilised (from the current 16 MT/1 MT to an expected less then 6 MT/1 MT kg of mushroom produced), recurrent costs can be considerably decreased. In this regard, it is expected that there will be reduced costs in the purchasing of fire wood of approximately 45000 GHC/y, equal to 2800 USD/y. Fresh straw mushroom are expected to be sold at 8 GHC/kg<sup>40</sup> (approximately 5 USD/kg), hence total revenues are expected to be 115 200 GHC/y or 75 800 USD/y (assuming that 400 kg of fresh mushroom are sold every week as per preliminary market analysis<sup>41</sup>).

During the first year of the pilot project's implementation, 10-12 demonstration plots will be implemented to assess the optimal combination of cassava peels and animal wastes to be used for mushroom's production. These tests will also involve the use of private or public research institutions (including universities) and the private sector<sup>42</sup>. A total of 300 Kg of fresh

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38 Detailed costs in design document REP III.

39 As compared to the costs identified in the enterprise model developed by REP III.

40 Market price of straw mushroom, as of May 2011.

41 In line with data collected during fields analyses from market operators in the region as well as from the Head of BAC in Techiman.

42 In the Techiman region, 3 mushroom growers are currently supported by REP. One of them, the Bemcom Youth Enterprise, which is the largest in the region and in the country, functions as skills training and resource centre. From the investigations carried out during the mission and in line with BAC's recommendation, it would appear that Bemcom is in the best position to contribute to the pilot project's activities thanks to the equipment and the knowledge/skills acquired over the years. The centre

peels are expected to be used in each demonstration plot during PY1 to be collected from the nearest cassava processing GPC supported by RTIMP<sup>43</sup>. Results of the trials will be published and disseminated at national level. In PY2, 15 young entrepreneurs, out of which at least 50% will have to be women, will be trained on mushroom production through the use of the facilities available at Bemcom complex (detailed costs in Annex 1). Finally, in terms of adaptation to climate change benefits, the following are expected:

### **1.3 Cassava peels, barks and waste water for bio-energy production**

Previous research study conducted by IFAD in the WCA region, namely in Nigeria and Ghana, has shown the potential of using cassava wastes for energy production<sup>44</sup>. By mixing, cassava wastes with other bio-masses, bio-energy (in the form of both electricity and hot air) can be produced through the use of biogas and gasification technologies. It is estimated that this process could have the following impacts in terms of adaptation to climate change: Under this scenario, the following benefits are expected to accrue to cassava processors a: (i) reduction in the operating costs (due to the partial or complete reduction of fuel wood currently used for roasting gari), (ii) increase of the incomes (due to the reduction of operating costs and the increase in the value of final products sold), (iii) development of new income generating activities (due to the possibility of using the energy produced to use more performing processing equipments). The technical and financial feasibilities provided separately show a more exhaustive detail on benefits to be expected from the use of bio-energy generated from cassava wastes.

## **2. Replicability of the proposed pilot interventions (in component 3)**

Component 3 of the pilot project aims at testing pilot investments to support the adaptation to climate change through the production of bio-energy obtained from cassava wastes. In this regard, the initial investments and testing will be undertaken on a pilot basis in order to be further replicated and up-scaled to the national and regional levels if proved successful. These expected investments will include: no. 1 gasification plant with 120Kwh capacity making use of cassava peels and sawdust as feed intake, no. 1 biogas plant making use of cassava water waste to produce bio-energy and no. 1 gasification plant with 11 kwh for the production of straw mushrooms from cassava peels and animal wastes.

The different pilots will be implemented in selected sites of the Techiman Municipality, namely Asueyi for the bio-energy production and in Twimia Nkwanta for the mushroom production. Sites' have been selected based on the availability of bio-masses (i.e. cassava wastes, animal wastes and sawdust) and expected adaptation benefits (see also project rationale).

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is also specialized in providing training to farmers in the domain of mushroom production, among other areas. A co-financing from this center is also expected – as also explained in Annex 1.

43 Only transport costs from the cassava processing centre to the research site are expected to be covered – as detailed in Annex 1.

44 Please refer to the feasibility study in Ghana published by IFAD/RCPMI 2010 available on FIDAfrique.

However, it is worth noting that the sites' selection will be further validated during the project inception phase jointly with project stakeholders. Selection will be done through a participatory process closely involving: researchers from the Crop Research Institute, Soil Research Institute, the Food Research Institute and Faculties of Agronomy in Accra and Kumasi, cassava farmers, processors and traders, mushroom growers and traders and IFAD supported projects. The project in cooperation with the above mentioned public and private institutions and others to be identified in due course (i.e. Eco Bank) will also identify and assess alternative financing mechanisms to support replication of the new technologies piloted in PY1. The participatory process will strengthen the replicability perspectives of the pilot' activities

As for the commercial mushroom production, research trials to be carried in Y1 will assess the technical feasibility as well as the financial profitability of this activity. However, preliminary analyses confirm the following: (i) the technical feasibility to produce straw mushroom from cassava peels and animal wastes, (ii) the adaptation benefits deriving from this activity, and (iii) the profitability of this commercial activity when a small gasifier is used to reduce wood fire. Further details will be provided at the end of Y1 in a study which will be jointly prepared by researchers, mushroom growers and IFAD- projects.

As for the bio-energy production plant, the cost of the gasification technology is a major factor that would affect the up-scaling. However, as shown in the detailed financial feasibility, the internal rate of return (IRR) of this investment is 23%, while the pay back period is slightly less than 6 years. These two indicators clearly show the positive returns to be expected from this investment (when compared to the 10% opportunity cost of capital in Ghana). In addition to that, in order to assess the profitability of replicating the investment in other regions of the country, it has been assumed that the money required for covering the investment costs is borrowed from local banks at a 22% interest rate, to be paid back through equal installments plus interests on the remained debt over a period of 7 years<sup>45</sup>. The average passive interest rate applied in Ghana is equal to 23% (including administrative fees<sup>46</sup>) for industrial investments; however, for the agricultural investments<sup>47</sup> it decreases to 22% - which is the rate utilized in the financial feasibility. Under this scenario, two options have been taken into account: (i) 100% of the money required for covering the investment costs is borrowed from local banks and (ii) only 60% of the required amount is borrowed from banks, being the remaining 40% procured from other sources (donors, private investors etc). Under the first scenario, estimated yearly repayments of capital for implementing the investment (purchase of equipments and construction of facilities) and on working capital, along with related interests, range from USD 184 000 in Y1 to USD 88 000 in Y7. Annual cash flow results to be

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45 This assumption is built on the lending terms currently enforced in Ghana.

46 As of August, 2010, Ghana Commercial Bank.

47 As per information provided by the Agricultural Development Bank, which specifically finances investments in the rural areas of Ghana.

positive as from Y1 (USD 92 500) and it becomes negative only at Y4 when the largest portion of the debt has to be paid back to the borrower. However, it becomes again positive from Y5 onwards, being approximately USD 2 200 in Y5 and USD 142 000 at Y15. IRR is 11%, slightly higher than the opportunity costs (10%), while the payback period becomes 13 years. Under the second scenario, a total of USD 304 200 is borrowed from the bank. Estimated yearly repayments of capital for implementing the investment range then from USD 110 000 in Y1 to USD 53 000 in Y7. Annual cash flow is always positive, starting from Y1 (USD 92 400) up to USD 106 000 at Y15. The IRR equals 12% and confirms the profitability of the investment, which could be paid back in approximately 11 years. Both scenarios confirm the profitability of replicating the investment in other regions of Ghana where cassava peels and barks, sawdust and processing waste waters would be available. Furthermore, given the above mentioned positive results, the possibility to replicate the investment in other countries of the WCA region appears to be financially feasible – however, a financial analysis is recommended to adapt the market prices and the other parameters to local circumstances. Overall, the results in the use of the proposed pilot technologies and of the related lessons learned from the GEF funded activities are expected to be applicable in similar agricultural systems throughout the country and, more broadly, the WCA region where similar problems of cassava wastes disposals exist. Results of the pilots will be disseminated widely, within and outside the project area, through publications and other knowledge products, training courses and study tours (refer to component 1 and 2). To conclude, given the high positive effects on both the environment and workers' health that the use of cassava solid and liquid wastes have when they are used to produce energy and considering the positive outcomes of the financial feasibility, replicability is not expected to be a major issue.

**Appendix:**

**Detailed activity budget for mushroom production from cassava peels and animal wastes**

Detailed activity budget – Y1 (all values in GHC)

A PROFESSIONAL FEES					
		<b>Day s</b>	<b>Unit/person</b>	<b>U/Amount/da y</b>	<b>Total Amount GHC</b>
<b>Phase/Season 1 ( Month 1 to 4 )</b>					
Development of the experiment manual and concept*		1	2		-
Actual days of work on the experiment 15 per 3 month		45	1	200.00	9,000.00
Research assistant days of work 10 per 3 month		30	1	50.00	1,500.00
<b>Subtotal ( For three Months)</b>					<b>10,500.00</b>
		<b>Day s</b>	<b>Unit/person</b>	<b>U/Amount/da y</b>	<b>Total Amount GHC</b>
<b>Phase/Season 2 ( 5 to 8 Month )</b>					
Development of the experiment manual and concept*		1	2		-
Actual days of work on the experiment 15 per 3 month		45	1	200.00	9,000.00
Research assistant days of work 10 per 3 month		30	1	50.00	1,500.00
<b>Subtotal ( For three Months)</b>					<b>10,500.00</b>
<b>Phase/Season 3 (9 to 12 Month)</b>		<b>Day</b>	<b>Unit/person</b>		<b>Total Amount GHC</b>



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	<b>s</b>		<b>U/Amount/day</b>	
Development of the experiment manual and concept*	1	1		-
Actual days of work on the experiment 15 per month	45	1	200.00	9,000.00
Research assistant days of work 10 per 3 month	30	1	50.00	1,500.00
<b>Subtotal ( For three Months)</b>				<b>10,500.00</b>
<b>Total Professional Fees (For 12 Months )</b>				
				<b>31,500.00</b>
<b>B OTHER EXPENSES</b>				
	<b>Day</b>	<b>Qty</b>	<b>U/Amount</b>	<b>Total Amount GHC</b>
<b>Transportation, Fuel, Boarding &amp; Feeding</b>	<b>s</b>			
Uses of facilities tool& equipment at Bemcom premises	45	3	-	-
Transportation per month	1	12	50.00	600.00
Analysis for the nutritional content of the straw mushroom	1	3	200.00	600.00
Publication for research		1	3000.00	3000.00
<b>Subtotal ( For 12 Months)</b>				<b>4,200.00</b>
<b>Materials/ Tools</b>	<b>Qty</b>	<b>Participant</b>	<b>U/ Amount</b>	<b>Total Amount GHC</b>
Incubation (material wood poly sheed nails etc	1	1	240.00	240.00
Spawn (Lab tools and utilities)	1	1	350.00	350.00

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	Sterilization ( gas, drum, racks tube	3	1	100.00	300.00
	Bagging ( HD Poly bags ,additives , bands	1	1	500.00	500.00
	Data tools	1	1	170.00	170.00
	Fruiting room sprinklers , etc	1	1	200.00	200.00
	<b>Subtotal (For 12 Months)</b>				<b>1,760.00</b>
	<b>Total Reimbursable Expenses (For 12 Months)</b>				<b>6,960.00</b>
<b>C</b>	<b>Grand Total ( For 12 Months)</b>				<b>40,460.00</b>

**Detailed activity budget – Y2**

A PROFESSIONAL FEES					
		Days	Unit/Person	U/Amount/day	Total Amount GHC
<b>Phase/Season 1 (Actual training )</b>					
	Development of training manual	1	2		-
	Training of 15 people	5	1	200.00	1,000.00
	<b>Subtotal ( for actual training )</b>				<b>2,000.00</b>
<b>Phase/Season 2 ( Monitoring ) first 6 months</b>					
	<b>2 visits monthly for 6 months</b>				
	15 beneficiaries	12	1	200.00	2,400.00

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<b>Subtotal (for monitoring )</b>				<b>2,400.00</b>
<b>Phase/Season 3( monitoring) (7 to 12 Month)</b>			<b>U/Amount/day</b>	<b>Total Amount GHC</b>
<b>6 vist per 6 months</b>	0	0		-
15 beneficiaries	6	1	200.00	1,200.00
<b>Subtotal (for monitoring )</b>				<b>1,200.00</b>
<b>Total Professional Fees (For 12 Months )</b>				<b>5,600.00</b>
<b>B</b>	<b>REIMBURSABLE EXPENSES</b>			
	<b>Days</b>	<b>Qty</b>	<b>U/Amount</b>	<b>Total Amount GHC</b>
Hiring of hall	5	1	50.00	250.00
Transport costs	18	1	50.00	900.00
Refreshments	5	15	15.00	1,125.00
<b>Subtotal</b>				<b>2,275.00</b>
<b>Materials/ Tools</b>	<b>Qty</b>	<b>Units</b>	<b>U/ Amount</b>	<b>Total Amount GHC</b>
Actual training materal	1	1	300.00	300.00
Stationery /flip board/certificate etc	1	15	20.00	300.00
Fruiting room for farmers (estimated)	1	3	1,500.00	4,500.00
Harvesting tools and accesories	1	15	200.00	3,000.00
<b>Subtotal</b>				<b>8,100.00</b>

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	<b>Total Reimbursable Expenses ( For 12 Months)</b>				<b>10,375.00</b>
<b>C</b>	<b>Grand Total ( For 12 Months, training and set up of 15 people ) GHC</b>				<b>15,975.00</b>

*Total budget in USD (including the gasifier): 45 000 USD*

*The use of cassava wastes to produce energy:  
outcomes of the financial feasibility  
in Asueyi, Ghana.*

*Prepared by  
Chiara Calvosa, Economist<sup>48</sup>*

*June, 2011*

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## List of Acronyms and Abbreviations

CPCB: Central Pollution Control Board

GHC: Ghanaian Cedi

GPC: Good Practices Centre

IFAD: International Fund for Agricultural Development

IRR: Internal Rate of Return

NHS: National Health Service

NEPAD: New Partnership for Africa's Development

RCPMI: Regional Cassava Processing and Marketing Initiative

R&T: Roots and Tubers

RTIMP: Roots and Tubers Improvement Marketing Programme

USD: United States Dollar

WB: World Bank

WCA: Western and Central Africa

**Exchange rate:** 1 USD=1,5 GHC (May, 2011)

## Executive Summary

The study assesses the financial feasibility to put in place in Asueyi, Ghana, a gasifier and a biogas plant which make use of cassava wastes, namely peels, barks and water waste as feedstock to generate bio-energy (both in the forms of electricity and hot/cold air). The study builds on two similar studies in Nigeria and Ghana which the Regional Cassava Processing and Marketing Initiative (RCPMI) published during the 2010<sup>49</sup> aiming at assessing the technical and financial feasibilities of the bio-energy production. It also builds on previous laboratory analyses carried out in India to assess the both ignition and flow performances of the selected biomasses to be used as feedstock in the gasifier and biogas. This financial feasibility study is specifically tailored in Asueyi community within the framework of the GEF intervention. Primary and secondary data have been collected during field visits in the country in May 2011.

Although the outcomes of the analyses included in this study specifically refers to Asueyi, Ghana, similar results can be expected when the same investment is set up in other countries of the West and Central Africa region. Adaptation of financial parameters to local circumstances would however be required.

With specific reference to the financial feasibility, a comprehensive set of information and data have been taken into account, as detailed in paragraph 1.2 of this study.

Total investment costs for the investment (gasifier and biogas) are estimated at USD 507 000, including civil works, transport costs. Recurrent costs include biomasses, transport costs, labour (both skilled and unskilled workers), working capital (and related interests) needed at Y1 to cover short-term liabilities and O&M. Total recurrent costs are estimated at USD 56 000 at Y1 and USD 39 000 afterwards when the plant works 22hours/day per 330 working days a year making use of 1 706 Mt/y of cassava peels and barks and 835 Mt/y of sawdust.

Revenues have been derived by: (i) first converting their expected outputs (either electricity or heat) into liters of fuel or kilograms of firewood –which, in the targeted area of Ghana, are the feedstock most widely used to currently produce energy and heat, and (ii) then multiplying the resulting values for the respective current market prices as in May 2011. The gasification and biogas are assumed to work a total of 22 hours/day during 330 working days/year for a time frame of 15 years.

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<sup>49</sup> Both feasibility studies are available on internet at: [www.fidafrique.net](http://www.fidafrique.net) and [www.ifad.org](http://www.ifad.org)



Main results of financial analysis show a positive result in terms of annual cash-flows (both current and discounted) which is positive already from the first year of activities. The financial IRR is 23% much higher than the opportunity cost of capital which is the average interest rate (approximately 10%) paid on bank deposits in the country. The sensitivity analysis shows positive results also when conservative assumptions are taken into account, including a 10% reduction in the total revenues (IRR is 14%) as well as a 10% increase in the investment costs (IRR is 21%). Pay-back period is approximately 6 years, and it varies from 4.5 years to 6 years depending on the options considered in the sensitivity analysis. All financial indicators, whether they are discounted or not, show the overall profitability of the investment.

## 1. Introduction

### 1.1 Objective of the feasibility study

Objective of this financial study is to assess the financial feasibility of setting up a pilot plant to produce bio-energy from cassava wastes (i.e. peels, barks and water) through a gasifier and a biogas plant. All information presented in this study is real and based on data and figures collected in the country in May, 2011.

The feasibility is based on a real application for a pilot plant proposed to be set up in Ghana, more precisely in Asueyi, a main area for cassava production and processing of the country. However, it is worth highlighting that what presented in this report could be easily adapted to other similar African contexts where cassava is produced<sup>50</sup>.

### 1.2 Methodology used

This feasibility study builds on the methodology of a previous research work that the RCPMI has published, in October 2010: "The use of cassava wastes to produce energy: outcomes of a feasibility study implemented in Ghana<sup>51</sup>". The financial feasibility proposed for Ghana foresees the setting up of a pilot plant which makes use of cassava wastes and other biomasses locally available as feedstock for bio-energy production (both as electricity and cold/hot air) through the biogas and gasifier technologies. The methodology adopted is similar to the above mentioned one and includes: (i) field visits in the country for collecting primary and secondary

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<sup>50</sup> For further details please refer to the Scaling up/replicability section in PDR.

<sup>51</sup> The study is available on internet at: [www.fidafrique.net](http://www.fidafrique.net) and [www.ifad.org](http://www.ifad.org).

data<sup>52</sup>, (ii) laboratory analyses<sup>53</sup>, (iii) face-to-face meetings with local cassava producers and processors, and (v) working sessions with the IFAD specialists<sup>54</sup> involved in the IFAD-funded RTIMP.

With specific reference to the financial feasibility, the following information and data have been estimated:

- (vi) Investments Costs (gasifier and biogas):
  - Land and infrastructure cost
  - Cost of equipments and depreciation<sup>55</sup>
  - Transport costs (shipping) and related insurance
  - Civil works
  
- (vii) Total Operating Costs:
  - Cost of raw materials
  - Cost of utilities
  - Wages of skilled and unskilled workers
  - Operation and maintenance cost
  - Transport costs
  - Working capital requirements (and related interests)
  - Lube oil requirements
  
- (viii) Revenues
  
- (ix) Annual Cash Flow and Discounted Cash Flow Analyses
  
- (x) Financial Evaluation
  - Internal Rate of Return (IRR)
  - Payback Period
  
- (xi) Sensitivity Analysis

The financial study begins with the detailed presentation of project cost items. These costs include both the investment costs and production costs divided into fixed and recurrent costs. The financial assessment is based on both discounted and undiscounted values, particularly the annual cash flow. In line with World Bank indicators<sup>56</sup>, inflation rate is currently estimated at 0.5%. However, price escalation is

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<sup>52</sup> From national and international stakeholders like the National Bank.

<sup>53</sup> Laboratory analysis on the cassava samples were carried out by the Ankur Scientific Energy Technologies Pvt. Ltd., Vadodara, India.

<sup>54</sup> Vincent Akoto, post-harvest specialist RTIMP.

<sup>55</sup> Depreciation has been outlined in the investments costs but not included into the cash-flow analysis since it does not represent a financial out-flow.

<sup>56</sup> WB indicator as of June, 2011.

not taken into account as it is expected that any change in costs (increase or decrease) will equally affect benefits. Price and physical contingencies have been included and assumed to be equal to a 3% of the investment cost.

The sensitivity analysis deals with different scenarios, which could result from changes on certain assumptions or values for certain major variables as an answer to “what- if” questions. A  $\pm 10\%$  in revenues and a  $+10\%$  in investment costs have been tested.

As for the scaling up and out perspective, the possibility of financing the total amount of the investment through a loan at 22% interest rate has been taken into account in section 4 of this study.

## 2. Financial aspects related to the technology

### 2.1 Investment costs

Investment costs for the technology (gasifier and biogas) include the cost of equipments and materials, civil works (including land preparation and construction costs), transport costs of equipments and materials to the site in Asueyi and assembling and commissioning (including 15 working days hands-on training). The project cost estimates are calculated in real term-constant prices of April 2011 and are equal to USD 507 000; they have been separated into two main categories as it follows: investment costs and recurrent cost. As for depreciation, it has been considered over a period of 15 years for equipment and material and 25 years for civil works. Total depreciation cost equals USD 31 800 a year, which has been budgeted in order to anticipate the renewal of the investment but not included in the cash flow analysis. The plant is supposed to work for a total of 22 hours/day for 330 days/year. Start up costs, in terms of fuel requirements and annual operation and maintenance costs have been also taken into account as part of the recurrent costs. Further details on this are available in Annex I.

### 2.2 Cost of land and civil works

The project requires land for both the gasifier shed area and the cooling pond area. Considering that the land belongs to the project’s beneficiaries in Asueyi, renting costs have not been included in the analysis. Civil works and fencing (including gates) have been included and estimated at USD 40 000. As for the biogas, total civil

works have been estimated at USD 35 000. Depreciation timeframe for all civil works is estimated at 25 years.

### 2.3 Recurrent costs and working capital

Yearly recurrent costs change depending on volumes produced. In this feasibility, recurrent costs category includes the following:

- (i) Transport costs of raw materials (saw dust) from production sites to the plant site: estimated at 10 USD/Mt including both fuel and remuneration of the workforce (one driver and one unskilled worker) required to transport these biomasses from selected wood processors to Asueyi. Transport costs of cassava peels and barks have not been included since these materials are already available in the selected area;
- (ii) Costs for skilled (no.2 managers) and unskilled work force (no. 9) for the daily operations and management of the plant (for a total of 330 days/year) estimated to be equal to: 220 USD/y in the case of the salary of the manager and 110 USD/y for unskilled workers;
- (iii) Fuel for start-up: 1.5 USD/l for a total of 10 260 USD/y,
- (iv) Lube oil requirements for the various equipments and materials utilized by the biogas and the gasifier plants: USD 2 500/y;
- (v) Operations and Maintenance (O&M) costs to ensure the regular functioning of the plant: USD 7 500/y.

Furthermore, the plant cash needs to pay off costs such as wages and transport of wastes from wood processing plants Asueyi. In the light of this, working capital requirements have been estimated, including interests, at 22% interest rate to pay off short-term liabilities. This is equal to **USD 13 000**, during **Y1**, while it is expected that after that day-to-day activities will be covered by the annual cash flow.

### 3. The profitability of the pilot

This section provides for a detailed financial analysis of the profitability of the investment required to produce bio-energy from cassava bio-wastes as per details previously provided. Timeframe of the analysis is 15 years and it is based on the assumptions described in previous 2 sections. The comparison with the without project scenario is not done as the biomasses are currently not used for any other productive purposes. Along with the key information on the investment and recurrent costs previously provided, the following data have been also used to assess the financial profitability of the plant:

- i) Cost of diesel: 1 USD/liter;
- ii) Price of electricity (including taxes) available from the public grid: 0,33 USD/Kwh;
- iii) Annual revenues for hot/cold air (Kcal) and electricity (Kwh) estimated at:
  - Electricity (in kwh) from the gasifier: USD 89 100;
  - Heating (in Kcal) from the gasifier: USD 26 370;
  - Heating (in Kcal) from the biogas: USD 7 920.
- iv) Social security costs (10%) included in the employees' monthly gross salary;
- v) Taxes on profit: 20%.

In order to estimate revenues, it has been necessary to convert the total energy generated by the gasifier and biogas (in terms of electricity and heat) into liters of fuel (diesel) and tons of firewood. The reason why diesel and firewood have been chosen as shadow prices to estimate the revenues is that in the project's area market diesel is, at the moment, the fossil fuel mostly used for energy generation, as firewood is for heat production (especially in rural areas). Therefore, the domestic market price for diesel has been retained as the referential price for estimating the value of the electricity generated by target investments, while the one for firewood has been retained for estimating the value of the heat produced.

#### 3.1 Outcomes of the financial analysis

As already mentioned above, the timeframe of the financial analysis is 15 years. Its main outcomes are summarized here below:

- Net profits after corporate taxes are positive already starting from Y1 at USD 60 693. They constantly increase from Y2 to approximately USD 94 500 in Y3 and Y4 and up to USD 110 700 from Y5 onwards. Net profits could be higher if the savings in terms of non use of fossil fuel for the same amount of energy

production would be added. However, these savings were not taken into consideration with this paper;

- Annual cash flows remain positive over the entire life of the investment. More specifically, the annual cash flow is approximately USD 92 500 in Y1 and USD 142 500 at Y15. Also the analysis of discounted annual cash flows confirms satisfactory outcomes throughout the entire life of the investment;
- The financial internal rate of return (IRR) of this investment results to be 23%, - higher than the opportunity costs (10%);
- The payback period of the investment is 6 years;
- A sensitivity analysis has been carried out using three different scenarios: (i) a +10% variation of the investment costs<sup>57</sup> and (ii) a ±10% variation of the revenues. In all three scenarios considered, all profitability indicators remain quite encouraging. More precisely, under the first scenario, where total investment costs are increased a 10%, net profit after taxes results to be positive already from Y1 and cash flow at Y1 already reaches USD 93 000. While IRR results to be equal to 21% (higher than the opportunity cost), the pay-back period is less than 6 years. Under the second scenario, two hypotheses have been made. Initially, a 10% reduction of revenues has been considered (annual revenues being USD 147 000 at Y1). Also under this negative assumption, net profit after taxes is expected to be positive as from Y1 (equal to USD 47 600 USD), while annual cash flow (already at USD 79 300 in Y1) remains positive till Y15. IRR is equal to 14% and the pay back period is 6 years. With a 10% increase of the annual revenues (USD 180 000 at Y1), net profit after taxes becomes USD 74 000 already in Y1 (and approximately USD 130 000 at Y15). The annual cash flow, which is approximately USD 105 500 in Y1, constantly increases over the years. IRR is 26% and the investment is paid back in less than 5 years.

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<sup>57</sup> Debt repayment costs have been derived accordingly.

### 3.2 Additional unquantified benefits

Other benefits which have not been quantified in this financial feasibility study include the following: (i) Environmental benefits: reduced use of fossil fuel and wood and climate change adaptation benefits<sup>58</sup>; (ii) improved livelihood: time savings for collecting traditional sources of energy (i.e. wood) and improved health conditions; and (iii) increased value of land due to better soil fertility and reduced soil erosion. Furthermore, it is important to highlight that the investment in such technology is not affected by drought, soil degradation and climate change.

### 4. Replicability of the investment

In this section, the possibility to replicate the investment in bio-energy production from cassava-peels and other biomasses is analyzed. In order to assess the profitability of replicating the investment in other areas of the country, it has been assumed that the total investment cost is borrowed from local banks at a 22% interest rate, to be paid back through equal installments (plus interests on the remaining debt) over a period of 7 years<sup>59</sup>. The average passive interest rate applied in Ghana is equal to 23% (including administrative fees<sup>60</sup>) for industrial investments; however, for the agricultural investments<sup>61</sup> it decreases to 22% - which is the rate adopted in this study. Considering the total amount of the investment, a 3-year period of grace has been also taken into account before starting the repayment. Under this scenario, two options have been taken into account: (i) 100% of the total investment value is borrowed from local banks and (ii) 60% of the total investment value is borrowed from banks, being the remaining 40% available from other sources (donors, private investors etc). Under the first scenario, estimated yearly repayments of capital for implementing the investment (purchase of equipments and construction of facilities) and on working capital, along with related interests, range from USD 184 000 in Y1 to USD 88 000 in Y7. Annual cash flow is positive from Y1 (USD 92 500) to Y4, when it suddenly becomes negative only in Y4 when the largest portion of debt repayment is made. However, it becomes positive again as from Y5 onwards, being approximately USD 2 200 in Y5 and USD 142 000 at Y15. Estimated IRR (11%) is higher than the opportunity costs, while the pay back period is 13 years.

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<sup>58</sup> See Main Project Report.

<sup>59</sup> This assumption is built on the lending terms currently enforced in Ghana.

<sup>60</sup> As of August, 2010, Ghana Commercial Bank.

<sup>61</sup> As per information provided by the Agricultural Development Bank, which specifically finances investments in the rural areas of Ghana.

Under the second scenario, a total of USD 304 200 is borrowed from the bank. Estimated yearly repayments of capital for implementing the investment range then from USD 110 000 in to USD 53 000 in Y7. Annual cash flow shows to be positive right as from Y1 (USD 92 400); it becomes USD 106 000 at Y15. The IRR of 12% confirms the profitability of the investment and a paid back period of 11 years.

Both scenarios, confirms the profitability of replicating the investment in other regions of Ghana where there is the availability of cassava peels and barks, sawdust and water waste from cassava processing. Furthermore, given the positive results mentioned above, the possibility to replicate the investment in other countries of the WCA region appears to be, in principles, financially feasible and sustainable – although a financial analysis is strongly recommended to adapt the market prices and the other parameters to local circumstances.



*APPENDICES*

Appendix I: Financial Analysis Gasifier&Biogas

*(all values in USD)*

	1st year	2nd year	3rd year	4th year	8th year	9th year	10th year	15th year
Investment costs	31 800	31 800	31 800	31 800	31 800	31 800	31 800	31 800
Operating costs	53 949	37 639	37 639	37 639	37 639	37 639	37 639	37 639
Total costs	85 749	69 439	69 439	69 439	69 439	69 439	69 439	69 439
Total revenues	163 680	163 680	183 975	183 975	209 344	209 344	209 344	209 344
Gross Profit	77 931	94 241	114 536	114 536	139 905	139 905	139 905	139 905
Taxes	15 586	18 848	22 907	22 907	27 981	27 981	27 981	27 981
Net Profit after taxes	62 345	75 393	91 629	91 629	111 924	111 924	111 924	111 924
<b>Annual cash flow</b>	<b>94 145</b>	<b>107 193</b>	<b>123 429</b>	<b>123 429</b>	<b>143 724</b>	<b>143 724</b>	<b>143 724</b>	<b>143 724</b>
<b>Discounted annual cash flow</b>		<b>97 448</b>	<b>102 007</b>	<b>92 734</b>	<b>73 753</b>	<b>67 048</b>	<b>55 412</b>	<b>34 406</b>
<b>IRR</b>	<b>23.3%</b>							
<b>Pay back period</b>	<b>6</b>							
<b>Revenues</b>								
Revenues								
electricity from gasifier (in liters of diesel)	59 400	59 400	59 400	59 400	59 400	59 400	59 400	59 400
hot air from gasifier (in liters of diesel)	81 180	81 180	101 475	101 475	126 844	126 844	126 844	126 844
gas from gasifier+biogas (in tons of fire wood)	23 100	23 100	23 100	23 100	23 100	23 100	23 100	23 100
Tot revenues	163 680	163 680	183 975	183 975	209 344	209 344	209 344	209 344
Opportunity cost 10%								

Appendix II: Sensitivity Analysis

<b>Hp 1: Increased revenues 10%</b>								
	<b>1st year</b>	<b>2nd year</b>	<b>6th year</b>	<b>7th year</b>	<b>8th year</b>	<b>9th year</b>	<b>10th year</b>	<b>15th year</b>
Investment costs	31 800	31 800	31 800	31 800	31 800	31 800	31 800	31 800
Operating costs	53 949	37 639	37 639	37 639	37 639	37 639	37 639	37 639
Total costs	85 749	69 439	69 439	69 439	69 439	69 439	69 439	69 439
Total revenues	180 048	180 048	230 278	230 278	230 278	230 278	230 278	230 278
Gross Profit	94 299	110 609	160 839	160 839	160 839	160 839	160 839	160 839
Taxes	18 860	22 122	32 168	32 168	32 168	32 168	32 168	32 168
<b>Net Profit after taxes</b>	<b>75 439</b>	<b>88 487</b>	<b>128 671</b>	<b>128 671</b>	<b>128 671</b>	<b>128 671</b>	<b>128 671</b>	<b>128 671</b>
<b>Annual Cash flow</b>	<b>107 239</b>	<b>120 287</b>	<b>160 471</b>	<b>160 471</b>	<b>160 471</b>	<b>160 471</b>	<b>160 471</b>	<b>160 471</b>
<b>Discounted annual cash flow</b>		<b>109 352</b>	<b>90 582</b>	<b>90 582</b>	<b>82 347</b>	<b>74 861</b>	<b>68 055</b>	<b>46 483</b>
IRR	26%							
Payback period (years)	4.5							
<b>Hp 2: +10% increase investment costs</b>								
	<b>1st year</b>	<b>2nd year</b>	<b>6th year</b>	<b>7th year</b>	<b>8th year</b>	<b>9th year</b>	<b>10th year</b>	<b>15th year</b>
Investment costs	34980	34980	34980	34980	34980	34980	34980	34980
Operating costs	56 013	39 079	39 079	39 079	39 079	39 079	39 079	39079
Total costs	90 993	74 059	74 059	74 059	74 059	74 059	74 059	74 059
Total revenues	163 680	163 680	209 344	209 344	209 344	209 344	209 344	209343.75

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Gross Profit	72 687	89 621	135 285	135 285	135 285	135 285	135 285	135 285
Taxes	14 537	17 924	27 057	27 057	27 057	27 057	27 057	27 057
<b>Net Profit after taxes</b>	<b>58 149</b>	<b>71 697</b>	<b>108 228</b>	<b>108 228</b>	<b>108 228</b>	<b>108 228</b>	<b>108 228</b>	<b>108 228</b>
<b>Annual cash flow</b>	<b>93 129</b>	<b>106 677</b>	<b>143 208</b>	<b>143 208</b>	<b>143 208</b>	<b>143 208</b>	<b>143 208</b>	<b>143 208</b>
Discounted annual cash flow		96 979	88 921	80 837	73 488	66 807	60 734	37 711
IRR	21%							
Pay back period	5.5							

**Hp 3: -10% revenues**

	1st year	2nd year	6th year	7th year	8th year	9th year	10th year	15th year
Investment costs	31800	31 800	31 800	31 800	31 800	31 800	31 800	31 800
Operating costs	53 949	37 639	37 639	37 639	37 639	37 639	37 639	37 639
Total costs	85 749	69 439	69 439	69 439	69 439	69 439	69 439	69 439
Total revenues	147 312	165578	188409	188409	188409	188409	188409	188409
Gross Profit	61 563	96 139	118 970	118 970	118 970	118 970	118 970	118 970
Taxes	12 313	19 228	23 794	23 794	23 794	23 794	23 794	23 794
<b>Net Profit after taxes</b>	<b>49 250</b>	<b>76 911</b>	<b>95 176</b>	<b>95 176</b>	<b>95 176</b>	<b>95 176</b>	<b>95 176</b>	<b>95 176</b>
<b>Annual cash flow</b>	<b>81 050</b>	<b>108 711</b>	<b>126 976</b>	<b>126 976</b>	<b>126 976</b>	<b>126 976</b>	<b>126 976</b>	<b>126 976</b>
Discounted annual cash flow		98 828	78 842	71 675	65 159	59 235	53 850	33 437
IRR	14%							
Pay back period	6							

Appendix III: Replicability perspective: 100% debt repayment

	1st year	4th year	5th year	6th year	7th year	9th year	10th year	11th year	15th year
Investment costs	31 800	31 800	31 800	31 800	31 800	31 800	31 800	31 800	31 800
Operating costs	53 949	37 639	37 639	37 639	37 639	37 639	37 639	37 639	37 639
Debt repayment		183 969	168 034	152 100	136 166	104 297	88 363		
Total costs	85 749	253 408	237 473	221 539	205 605	173 736	157 802	69 439	69 439
Total revenues	163 680	183 975	209 344	209 344	209 344	209 344	209 344	209 344	209 344
Gross Profit	77 931	-69 433	-28 130	-12 195	3 739	35 608	51 542	139 905	139 905
Taxes	15 586				748	7 122	10 308	27 981	27 981
Net Profit after taxes	62 345	-69 433	-28 130	-12 195	2 991	28 486	41 234	111 924	111 924
<b>Annual cash flow</b>	<b>94 145</b>	<b>-37 633</b>	<b>3 670</b>	<b>19 605</b>	<b>34 791</b>	<b>60 286</b>	<b>73 034</b>	<b>143 724</b>	<b>143 724</b>
<b>Discounted annual cash flow</b>		<b>(28 274)</b>	<b>2 507</b>	<b>12 173</b>	<b>19 639</b>	<b>28 124</b>	<b>28 158</b>	<b>50 374</b>	<b>34 406</b>
IRR	11.2%								
Pay back period	13								
<b>Revenues</b>									
electricity from gasifier (in liters of diesel)	59 400	59 400	59 400	59 400	59 400	59 400	59 400	59 400	59 400
hot air from gasifier (in liters of diesel)	81 180	101 475	126 844	126 844	126 844	126 844	126 844	126 844	126 844
gas from gasifier+biogas (in tons of fire wood)	23 100	23 100	23 100	23 100	23 100	23 100	23 100	23 100	23 100
<b>Tot revenues</b>	<b>163 680</b>	<b>183 975</b>	<b>209 344</b>	<b>209 344</b>	<b>209 344</b>	<b>209 344</b>	<b>209 344</b>	<b>209 344</b>	<b>209 344</b>

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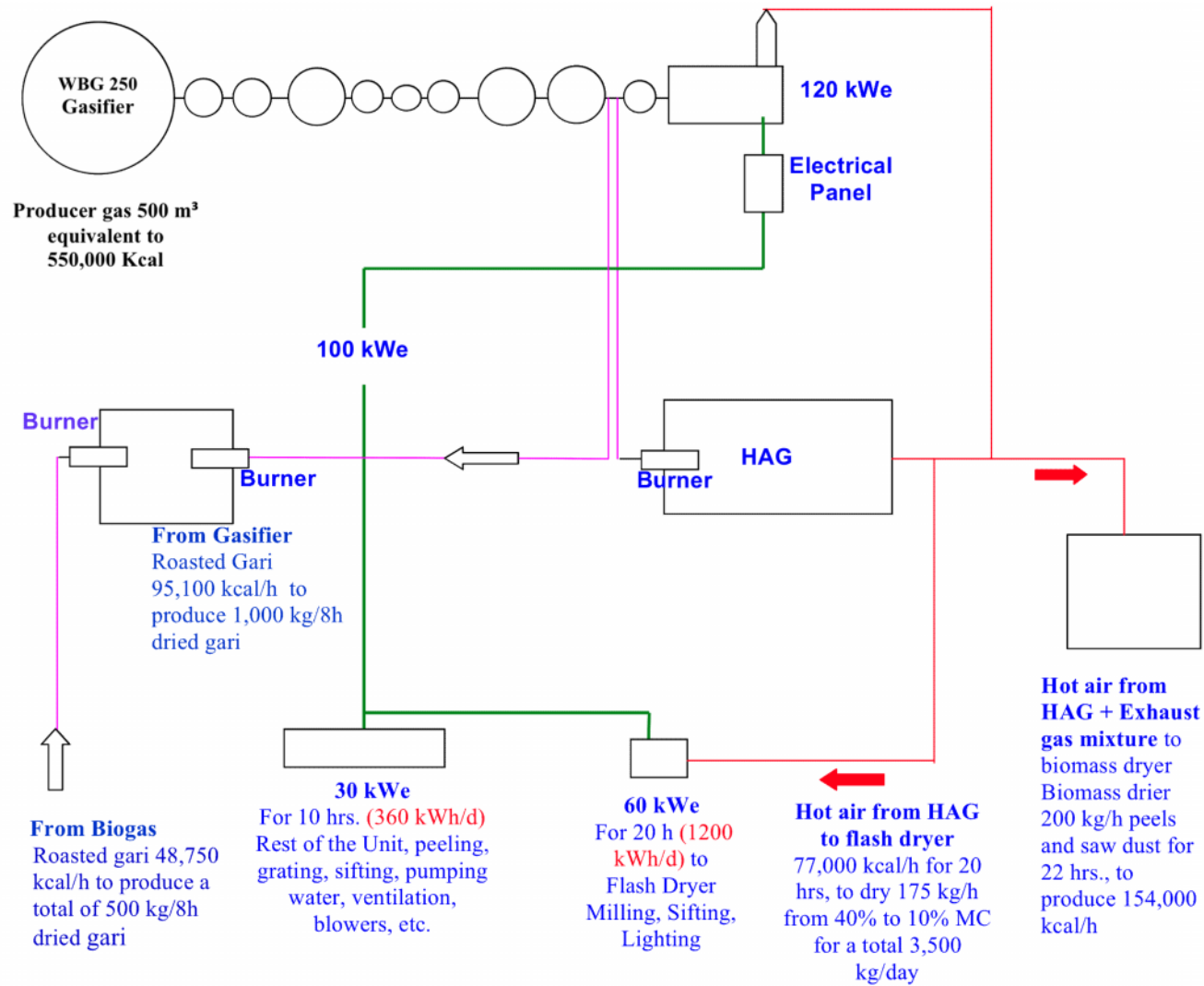
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Opportunity cost 10%									
<b>Debt repayment</b>									
Tot investment costs in 7 years									
	Y1	Y4	Y5	Y6	Y7				
Total Investment costs	507 000								
Instalment	72 429	72 429	72 429	72 429	72 429				
Remaining debt	434 571	217 286	144 857	72 429	0				
Interests (22%) on debt	111 540	63 737	47 803	31 869	15 934				
Total debt repayment	183 969	136 166	120 231	104 297	88 363				

Appendix IV: Replicability perspective: 60% debt repayment

	1st year	5th year	6th year	7th year	8th year	9th year	10th year	14th year	15th year
Investment costs	31 800	31 800	31 800	31 800	31 800	31 800	31 800	31 800	31 800
Operating costs	53 949	37 639	37 639	37 639	37 639	37 639	37 639	37 639	37 639
Debt repayment		100 821	91 260	81 699	72 139	62 578	53 018		
Total costs	85 749	170 260	160 699	151 138	141 578	132 017	122 457	69 439	69 439
Total revenues	163 680	163 680	163 680	163 680	163 680	163 680	163 680	163 680	163 680
Gross Profit	77 931	-6 580	2 981	12 542	22 102	31 663	41 223	94 241	94 241
Taxes	15 586		596	2 508	4 420	6 333	8 245	18 848	18 848
Net Profit after taxes	62 345	-6 580	2 385	10 033	17 682	25 330	32 979	75 393	75 393
<b>Annual cash flow</b>	<b>94 145</b>	<b>25 220</b>	<b>34 185</b>	<b>41 833</b>	<b>49 482</b>	<b>57 130</b>	<b>64 779</b>	<b>107 193</b>	<b>107 193</b>
<b>Discounted annual cash flow</b>		<b>17 226</b>	<b>21 226</b>	<b>23 614</b>	<b>25 392</b>	<b>26 652</b>	<b>24 975</b>	<b>28 227</b>	<b>25 661</b>
IRR	12%								
Payback period	11								
<b>Revenues</b>									
electricity from gasifier (in liters of diesel)	59 400	59 400	59 400	59 400	59 400	59 400	59 400	59 400	59 400
hot air from gasifier (in liters of diesel)	81 180	126 844	126 844	126 844	126 844	126 844	126 844	126 844	126 844
gas from gasifier+biogas (in tons of fire wood)	23 100	23 100	23 100	23 100	23 100	23 100	23 100	23 100	23 100
Tot revenues	163 680	209 344	209 344	209 344	209 344	209 344	209 344	209 344	209 344
Opportunity cost 10%									
<b>Debt repayment</b>									
60% investment costs in 7 years									
	Y1	Y5	Y6	Y7					
Total Investment costs	304 200								
Instalment	43 457	43 457	43 457	43 457					
Remaining debt	260 743	86 914	43 457	0					
Interests (22%) on debt	66 924	28 682	19 121	9 561					
Total debt repayment	110 381	72 139	62 578	53 018					

**ANNEX 11. FLOW DIAGRAM OF THE GASIFIER AND THE BIO-METHANATION TECHNOLOGY**  
**Gasifier Technology**





### Bio-methanation technology

Biogas diagram: anaerobic treatment system for the cassava processing effluent.

