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**UNDP Global Project:
Capacity Development for Policy Makers
to address Climate Change**

Final Report

**Assessment of Investment and Financial
Flows for Adaptation to Climate Change
In the Agriculture Sector in Gambia**

October 2011

Investment and Financial Flows to Address Climate Change UNDP Global Project

Climate Change poses significant challenges to development and policy makers are faced with complex tasks to respond to them and to ensure sustainable development. Particularly in Least Developed Countries decision makers have to balance poverty alleviation, economic development as well as social and environmental questions, while also questions of costs that occur with associated policies and measures play a vital role.

To better understand the magnitude of funds needed to tackle climate change now and in the long term, developing countries are undertaking assessments of investment and financial flows (I&FF) to address climate change for key sectors in a groundbreaking UNDP Environment & Energy Group project: Capacity Development for Policy Makers to Address Climate Change.

Gambia is one of 19 countries participating in this project, which was launched in May 2008 with the generous contributions of the Government of Norway, Government of Finland, Government of Switzerland as well as the UN Foundation and UNDP.

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Acronyms

AELP	Africa Emergency Locust Project
AfDB	African Development Bank
CCA	Climate Change Adaptation
FAO	Food and Agricultural Organization
FDI	Foreign Direct Investment
FF	Financial Flow
FMRIP	Farmer Managed Rice Irrigation Project
FNC	First National Communication
GALDEP	Gambia Lowland Development Project
GBOS	Gambia Bureau of Statistic
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Green House Gas
GMD	Gambian Dalasi
GNAIP	Gambia National Agricultural Investment Program
GOTG	Government of The Gambia
HIPC	Highly-Indebted Poor Countries
I&FF	Investment and Financial Flows
IDB	Islamic Development Bank
IF	Investment Flow
IFAD	International Fund for Agricultural Development
IRRIDEP	Irrigated Rice Development Project
KFAED	Kuwaiti Fund for Arab Economic Development
LHDP	Livestock and Horticulture Development Project
LPG	Liquefied Petroleum Gas
MDGs	Millennium Development Goals
MHC	Moukhtara Holding Company
NaNA	National Nutrition Agency
NAPA	National Action Plan for Adaptation
NDMA	National Disaster Management Agency
NERICA	New Rice for Africa
NGOs	Non Governmental Organizations
O&M	Operation and Maintenance
ODA	Overseas Development Agency
PIMIAP	Participatory Integrated Management of Invasive Aquatic Weeds Project
PIWAM	Participatory Integrated Watershed Management Project
PSIP	Peri-urban Smallholder Improvement Project
RFP	Rural Finance Project
ROC	Republic of China on Taiwan
UNFCCC	United Nations Framework Convention on Climate Change
USD	United State Dollar
WB	World Bank

1. Introduction to the Economy and the Agricultural Sector

The Economy

The Gambian economy is characterized by its small size, narrow base and a large re-export¹ trade comprising about 80% of the country's merchandise exports. Re-export trade contributes between 53% and 60% of domestic tax. Between 2004 and 2009 the country has had a stable macroeconomic performance and steady economic growth averaging 5-6% per annum. Economic growth was based on services (58%), agriculture (30%) and industry (12%). Real GDP growth at factor cost was 7.2% in 2009 and domestic debt 32.2% of GDP in 2008. The GDP per capita was estimated at USD 556 in 2009 while in the same year the annual average exchange rate was pegged at 26.64 Gambian Dalasi (GMD) per USD. Inflationary pressures accelerated by rising world market prices for food and fuels have largely been contained up to July 2008. Despite the economic rigidity experienced during the soaring food prices in 2008, rising costs of food and oil imports pushed the annual rate of inflation around 5 to 6% in 2007 and 2008 respectively. The Government has responded to the food price increase by reducing the sales tax on rice imports from 15% in July 2007, to 5% initially and eliminating it altogether in May 2008, GNAIP 2010².

The improvements in macroeconomic management were buttressed by a number of significant reforms on public financial management and Central Bank operations. These reforms have improved transparency and accountability in the use of public resources and reduced the opportunities for corruption. The main preoccupation of the Government is how to maintain the steady growth and macroeconomic stability achieved over the last five years and avoids policy reversals of effective reforms undertaken in particular during the volatile food prices and the world financial crisis.

Government's pursuit of a sustained fiscal and monetary discipline has been accompanied by significant improvements in public financial management. The performance of the fiscal sector has been driven mainly by higher than expected revenues and lower than expected expenditures. It significantly improved from a deficit of 7.8% of GDP in 2007 to a surplus of 0.5% (GNAIP 20110) in 2008 due to stringent monetary measures to reduce expenditures. The Dalasi appreciated by 32% (Ibid³) in the later part of the third quarter of 2007 and this has helped to reduce the Dalasi payments against debt service obligations and other international payment obligations.

The country qualified to access the Highly-Indebted Poor Countries (HIPC) debt relief initiative in December 2007 which consequently contributed to the fall in external debt from 133.6% to 50.0% of GDP. As a result, external debt payment declined from 1.4 percent of GDP to 0.4 percent in 2008. Consequently, Government has been able to fund significant public

¹ The Gambia re-exports imported commodities such as rice, sugar and flour to countries in the sub-region, mainly Senegal, Guinea Bissau and Mali

² All the citations in the paragraph were from the same source.

³ Ibid, means the same source of reference as the one just before.

investments notably the PRSP priority areas including education, health, agriculture, infrastructure and public sector capacity building, GANIP, 2010.

The Agricultural Sector

Agricultural production in The Gambia is heavily dependent on climate, water resources and soil conditions and is therefore very sensitive to climate change. The choice of agriculture as a priority sector of The Gambia in the implementation of adaptation to climate change are justified mainly because agriculture in the country is about 99% rainfed that makes it extremely vulnerable to climate change and also by its significant contribution to GDP (30%) and the share of the workforce (70%). To achieve the Millennium Development Goals (MDGs), and vision 2020; it is necessary to address a number of technological and management challenges for a better adaptation of agricultural production.

Although agricultural communities have a long history of adapting to climatic variability and extreme weather events, significant changes in climate and Carbon Dioxide (CO₂) concentrations are expected to affect agricultural yields and income levels, and could exacerbate existing problems relating to malnutrition and food security. Climate change has an impact on agricultural production through a variety of mechanisms affecting, for example, crop growth, development, yields, water needs, and nutritive value. Similarly it affects animal health directly as well as through its impacts on pasture availability, animal carrying capacity, and productivity. These mechanisms include but not limited to the following:

- Changes in temperature and precipitation,
- Increases in the atmospheric concentration of CO₂,
- Changes in the frequency and intensity of extreme events (heat stress, droughts, flooding events, fires, and wind storms),
- Altered weed, insect and disease incidence, and
- Sea level rise.

Climate change also affects agriculture indirectly through its effects on other sectors. These effects include, for instance, reductions in freshwater supply due to decrease in snowpack, increased evaporation from reservoirs or increased demand in other sectors (for instance, more fertilizers will be required, agro chemicals, and pesticides among others); loss of productive coastal acreage due to sea level rise and salt water intrusion, and reductions in labor supply due to the spread of human related diseases. The impacts of climate change on agricultural systems are highly site-specific. The vulnerability of any particular agricultural system depends on the character, magnitude, and rate of the climatic changes expected, the agricultural and socioeconomic systems' sensitivity to the climatic changes, their ability to cope with changing conditions (i.e., to adapt). In addition, the implementation of adaptation measures will also depend on the degree of active management employed and the value of adaptive management adjustments versus their costs. Agricultural systems that are already stressed due to limited water supply, biodiversity loss, land degradation, disease susceptibility and pest infestation, and/or air pollution, are particularly sensitive to climate change and least able to adapt; and many of the existing stressors are likely to be exacerbated due to climate change.

1.1 Objectives

General Objective

The overall objective of this assessment is to analyze Investment and Financial Flows (I&FF) and sources of finance needed to address climate change adaptation in the agriculture sector at the national level.

Specific objectives are:

- Analyze the current national efforts to address climate change in the agriculture sector,
- Estimate the volume of financial resources, medium and long term to address climate change in agriculture,
- Facilitate the integration of climate issues into national planning, while improving the sensitivity of policy makers on the implications for national development associated with climate change,
- Contribute to the development of positions for international negotiations on climate in the field of agriculture,
- To create awareness and build foundations for maximizing long term I&FF benefits,
- Determine the role that various technical and financial partners both national and international can play in mobilizing financial resources for agriculture.

The expected results are:

- The efforts necessary for national adaptation strategies and policy issues in force in the agriculture sector are determined,
- The need for additional financing for adaptation are estimated,
- The contributions of different stakeholders to identified adaptation measures are analyzed.

1.2 Background

Agricultural sector is no doubt a key sector in the country, for the reason that about 70% of the livelihoods of the population depends on it. NAPA, 2007 states that, changes in rainfall and temperature are expected to constrain productivity of some crops estimated that there will be about 40% drop in groundnut yields due to rising temperatures. Additionally, the disappearance of freshwater swamps and soil Salinization in lowland areas resulting from sea level rise is likely to impact negatively on rice production and the lives of women farmers in these areas. Elsewhere, intensive cropping and/or shorter fallow periods threaten soil fertility and the natural resource base. The dominance of heat- and drought-tolerant species could lead to further loss of agricultural biodiversity.

In a cattle-raising system largely based on extensive common land grazing, a decline in fodder availability and quality is expected to translate into loss of animal production. Higher temperatures and humidity have measurably adverse impacts on small ruminants (i.e., goats

and sheep), which make important contributions to household economies and food security, NAPA, 2007.

Another undoubted salient point is that agricultural production is heavily dependent on climate and water resources, and consequently is quite sensitive to changes in climate. Moreover about 70%, GNAIP 2010⁴ of Gambians rely upon agriculture for their livelihoods. Although agricultural communities have a long history of adapting to climatic variability and extreme weather events, significant changes in climate and Carbon Dioxide (CO₂) concentrations are expected to affect agricultural yields and income levels, and could exacerbate existing problems relating to malnutrition and food security. Climate change has an impact on agricultural production through a variety of mechanisms affecting, for example, crop growth, development, yields, water needs, and nutritive value. Similarly it affects animal health directly as well as through its impacts on pasture availability, animal carrying capacity, and productivity. These mechanisms include but not limited to the following:

- Changes in temperature and precipitation,
- Increases in the atmospheric concentration of CO₂,
- Changes in the frequency and intensity of extreme events (heat stress, droughts, flooding events, fires, and wind storms),
- Altered weed, insect and disease incidence, and
- Sea level rise.

Climate change also affects agriculture indirectly through its effects on other sectors. These effects include, for instance, reductions in freshwater supply due to decrease in snowpack, increased evaporation from reservoirs or increased demand in other sectors (for instance, more fertilizers will be required, agro chemicals, and pesticides among others); loss of productive coastal acreage due to sea level rise and salt water intrusion, and reductions in labor supply due to the spread of human related diseases. The impacts of climate change on agricultural systems are highly site-specific. The vulnerability of any particular agricultural system depends on the character, magnitude, and rate of the climatic changes expected, the agricultural and socioeconomic systems' sensitivity to the climatic changes, their ability to cope with changing conditions (i.e., to adapt). In addition, the implementation of adaptation measures will also depend on the degree of active management employed and the value of adaptive management adjustments versus their costs. Agricultural systems that are already stressed due to limited water supply, biodiversity loss, land degradation, disease susceptibility, pest infestation, and/or air pollution, vulnerable to climate change.

1.2.1 Previous Analysis Used

After The Gambia ratified the United Nations Framework Convention on Climate Change (UNFCCC) in June 1994; she prepared and submitted her First National Communication (FNC) on Climate Change in December 2003. This paper shows that the climatic deterioration is accompanied by a shift of seasons with a reduction in wet periods, an increase of evapo-

⁴ Gambia National Agricultural Investment Plan 2011-2015, September 2010

transpiration and soil degradation. The increase in temperature and decrease in rainfall would further affect the nutritional value of fodder and result in a reduced resistance to disease in animals. The NAPA document (National Action Plan for Adaptation) submitted to the secretariat of the UNFCCC in November 2007 and identified major risks faced by patterns and livelihoods in the agriculture sector. Another very important document referred to during the process was the Climate Change, Adaptation & Mitigation Strategy Paper 2007-2011.

Among other measures identified by previous analysis used include:

- Emissions due to fuel combustion mainly from Road Transport;
- Emissions from the agricultural sector mainly from livestock and rice production;
- Emissions from the land-use change and forestry due mainly to changes in forest and other woody biomass stocks;
- Emissions from waste management mainly from solid waste disposal sites and production and management of waste water from domestic and commercial sectors.

Although The Gambia is not a net emitter it is important to reduce these emissions as part of its contribution in the fight against global warming. During any period of time the performance of all the sectors mentioned above is almost entirely dictated by climatic events. The combined effect of increased atmospheric CO₂ concentration, sea level rise and the global warming are likely to have negative impacts on The Gambia in terms of its socio-economic development and protection of the ecosystems with serious health implications. Already climate change and climate variability in particular, best exemplified by a negative trend in rainfall in the late 1960s to present has placed tremendous pressure on the natural resources and the ecosystems of the country.

The Gambia's FNC examined the country's vulnerability to climate change and the main climatic hazards identified were:

- Increased climatic variability: Relative to baseline conditions, there have been observed changes in average, range, and variability of temperature and precipitation throughout the country;
- Recurring drought: The occurrences of dry spells, seasonal droughts and multi-year droughts are more frequent than in the past. The Gambia's meteorological records indicate that there has been a general tendency towards decreasing total annual rainfall over the last three decades. Studies also show that during the second half of this century, the country experienced erratic seasonal distribution of rainfall (Hutchinson & Sam, 1984; Hutchinson, 1985; Anyadike, 1993). Statistical analysis of rainfall patterns over Banjul based on a 102-year period (1886-1987) established that, among other things, there has been a consistently late onset of rainy seasons between 1968 and 1987, and an early end to the season between 1970 and 1976 (Anyadike, 1993).

Flooding: there has been a perceived increase in episodes of torrential rainfall with heavy runoff and flooding. With changing climate conditions, the frequency and intensity of floods and tides may increase and these together with drought can cause severe damage to crops,

reduce fish resources and cause considerable economic losses. Yearly variations in climatic conditions caused floods in 1999 and 2003 that affected 13.1 percent of the overall population. Over the past 60 years relative humidity has declined by approximately 6.4 percent and temperature has risen by 1.1degrees Celsius per decade. Rainfall dropped by roughly 30 percent over the last 30 years, resulting in a reduction of crop yields. Sea level rise may also affect the areas along the coastline, which already suffer from beach erosion and saltwater intrusion. Low-lying areas, including settlements such as Banjul, beach resorts, seaports, coastal fisheries, and mangrove forests, may become submerged with rises in sea levels. It is projected that 92 sq. km of land in the coastal zone will be inundated as result of 1m sea level rise. This means that the whole of the capital city of Banjul will be lost due to the fact that the greater part of the city is below 1m. The losses are estimated at 217 million US Dollars (First National Communication of the Republic of The Gambia to the UNFCCC, 2003).

The NAPA 2007 states that agricultural production about 98% of cropland in The Gambia relies on rainfall. Climate records indicate unequivocal negative changes in the last 40 years. A distance based analysis of rainfall at Jenoi (15°34'W, 13°29'N), Yallal (15°50'W, 13°30'N), and Kerewan (16°13'W, 13°29'N), in the central part of the country shows that variability is even greater at smaller time scales (Nkomo and Gomez, 2005). Corroborating stakeholder perceptions, statistical analyses of rainfall (Alimi *et al.*, 1992) confirm a decline in rainfall; shorter season; and, increased inter-annual variability as the most important climate risks faced by farmers. To offset direct effects of these interdependent rainy season characteristics including: 1) loss of soil fertility, 2) lower production, and 3) loss of household income, farming households have evolved and still rely to some extent on the following strategies:

- a) operational changes in farming activities (mechanization, use of short-cycle cultivars, early planting, change in crops, shifting cultivation, use of organic fertilizer);
- b) spreading risks (crop diversification, mixed cropping, plot dispersal);
- c) sharing losses (kinship networks); and
- d) other risk management strategies (sale of assets, harvesting of natural forest food).

1.2.2 Institutional Arrangements and Collaborations

Projects and activities on climate change in the Gambia is not new, therefore the Investment and Financial Flow on climate change in the country will follow the same existing structures. I&FF is being implemented through the existing institutional arrangements for the Second National Communication in The Gambia. The following institutions, departments and NGOs are involved:

- Department of Agriculture
- National Agricultural Research Institute
- GBOS
- National Environment Agency
- Ministry of Finance
- Ministry of Health
- Department of Forestry
- Department of Water Resources

- Department of Energy
- Department of Livestock
- Department of Fisheries
- Department of Parks & Wildlife Management
- NGOs
- Private Sector.

The institutional setup of I&FF is not different from the previous climate related project (national document prepared) such as the First National Communication, and NAPA. The Ministry of Forestry and Environment which is the Policy Focal line Ministry for UNFCCC and Director, Department of Water Resources, the UNFCCC Focal Person is the same for the present assignment.

1.2.3 Methodology and Key Terminology

Methodology

Conceptually; the methodology employed is simple. Pertinent investment and financial flows are projected for selected scenarios in a baseline scenario that assumes no additional efforts to address climate change. Additionally an adaptation scenario is developed that includes additional efforts and scaling up of existing efforts to address climate change. The difference between those two scenarios will show the additional resources needed for adaptation in the sector. The analysis of investment and financial flows (I&FF) for greenhouse gas mitigation and climate change adaptation is an important activity for the development of effective and appropriate national responses to climate change. This methodology spells out clearly what each investment is and the related terminologies.

The 8 steps of the I&FF methodology are:

1. Set up key parameters of the assessment
2. Compile historical I&FF data and other input data for the scenarios
3. Define baseline scenario
4. Derive I&FF of baseline scenario
5. Define adaptation scenario
6. Derive I&FF of adaptation scenario
7. Calculate incremental I&FF needed to implement adaptation by subtracting baseline scenario I&FF values from adaptation scenario I&FF values
8. Evaluate policy implications.

Key terminology

An “**investment flow**” (IF) is the capital cost of a new physical asset with a life of more than one year, such as the capital cost of a new power plant, a new automobile, a new household appliance, or a new agricultural irrigation system. Investment flows are limited to new physical assets because such investments have climate change implications for the duration of the

operating lives of the facilities and equipment purchased. Purchase of an existing physical asset, such as an existing vehicle, is excluded because its remaining life and its implications for climate change are not affected by the change in ownership. However, investment flows to retrofit, or considerably expand, an existing physical asset such that the climate change implications of that asset are significantly altered, such as conversion of a traditional coal-fired power plant to a combined cycle gas turbine plant, would be included. Investments in financial assets (such as stocks, bonds and shares), and in physical assets that neither affect climate nor have climate impacts implications (such as metals and commodities), are also excluded because they are unrelated to climate concerns. Note that an investment flow captures just the initial cost of a new asset. The costs of operating and maintaining new assets (e.g., salaries of personnel, fuel costs) are covered in a separate category of monetary flows (O&M costs of new physical assets), which are discussed below.

A **“financial flow”** (FF) is an ongoing expenditure on programmatic measures; financial flows encompass expenditures other than those for expansion or installation of new physical assets. Examples of financial flows include expenditures for an agricultural extension program for farmers, a malaria prevention program to distribute mosquito treated nets, or the implementation of improved forest management techniques. These expenditures are “operation and maintenance” type costs, e.g., salaries and raw materials. Examples of several mitigation and adaptation investment types, and the IF and FF for each, are provided in Table 1 below. Note that some investment types can include both financial flows and investment flows.

Operation and Maintenance (O&M) Costs of New Physical Assets

The physical assets purchased with investment flows will have operation and maintenance (O&M) costs associated with them (i.e., ongoing fixed and variable costs such as salaries and raw materials). Operation and maintenance costs of new assets need to be included in I&FF assessments because these costs can vary considerably among investment flow types, and can have a significant effect on the total cost of an investment over its lifetime. For example, O&M costs are a much greater share of total costs (capital costs plus O&M costs) for gas-fired electricity generation than photovoltaic electricity generation.

O&M costs include the following categories of costs:

- Salaries or wages of personnel
- Fuel costs such as power and/or fuel for operations, fuel for production
- Public utilities such as telephone service, Internet connectivity, etc.
- Raw materials
- Maintenance and/or leasing of equipment
- Office supplies and consumables
- Advertising
- License or equivalent fees (such as Corporation yearly registration fees) imposed by a government
- Real estate expenses, including: rent or lease payments; office space; furniture and equipment; property taxes and equivalent assessments

- Operations fees, such as fees assessed on transportation carriers for use of highways, and production or operation fees, such as subsidence fees imposed on oil wells
- Insurance
- Damage due to uninsured losses, accident, sabotage, negligence, or terrorism.

Table 1. Examples of Mitigation and Adaptation Investment Types and Associated I&FF and O&M costs

Sector (type of climate change measure)	Investment Type	Investment Flows	Financial Flows	Operation and Maintenance cost
Agriculture (mitigation)	Implementation of improved livestock feeding program		Implementing costs including training	raw materials, e.g. fodder
Water (adaptation)	Construction of new desalinization plant	Capital costs of construction		
	Implementation of program to repair leakages from urban water distribution systems		Implementation costs (inspection and repair costs)	e.g. salary for mechanist
Forestry (mitigation)	Implementation of reduced impact logging operations	Capital costs of new equipment needed to implement reduced impact logging techniques		
	Implementation of improved, low-tech silviculture techniques to increase stand-level biomass densities in managed forests	Implementation costs, including raw materials (e.g., seedlings, soil amendments) and training		

An **“investment entity”** is an entity that is responsible for an investment. These are the entities that decide to invest in, for example, an array of wind turbines, a new household appliance, a public health program, a national park, or a sand dune stabilization program. This methodology utilizes three types of investment entities: households, corporations, and government. These are described below.

The **“sources of the I&FF funds”** are the origins of the funds invested by the investment entities, for instance, domestic equity, foreign debt, domestic subsidies, foreign aid. These are described below for each investment entity.

Identification of the entities responsible for the investment decisions, and the sources of the funds that are invested, is an important component of an I&FF assessment because this information is the starting point for the evaluation of policies to change those decisions. To design policies and measures to influence decisions about I&FF, the entities responsible for those decisions and the means by which they obtain their funds must be identified.

Government policies to influence investment decisions by households or corporations may include regulations or incentives. For example, households might be convinced to purchase high water efficiency appliances rather than less costly but lower-efficiency appliances if part of the additional cost was borne by the government via subsidies such as rebates on qualifying purchases. In cases in which public spending is needed to implement an adaptation measure, options for changing current government priorities and for raising additional funds from domestic or international sources need to be evaluated.

Note that mitigation and adaptation measures that are programmatic (i.e., outreach and education programs) and/or involve subsidies (e.g., tax credits, tax deductions, rebates) or cost sharing agreements are likely to involve more than one investment entity. With such measures, one investment entity, which typically is a government entity, is responsible for the costs of the program. The other investment entities, or entity, are responsible for the investment decisions that are being influenced by the program. For example, the water efficiency subsidy program mentioned in the previous paragraph involves both a government entity, which invests in the program, and households, which invest in high efficiency appliances.

Table 2 below presents the “taxonomy” of investment entities and sources of I&FF funds used in this methodology for compiling I&FF data. This taxonomy, and the definitions provided below, are derived from the investment flow taxonomy used in the UNFCCC (2007).

Table 2. Taxonomy of Investment Entities and Sources of I&FF Funds

Investment Entity	Source of I&FF Funds	
Households	Domestic	Equity and debt
Corporations	Domestic	Domestic equity (including internal cash flow)
		Domestic borrowing (bonds and loans)
	Foreign	Foreign direct investment (FDI)
		Foreign borrowing (loans)
		Foreign aid (ODA) ²
Government	Domestic	Domestic funds (budgetary)
	Foreign	Foreign borrowing (bonds and loans)
		Bilateral foreign aid (bilateral ODA)
		Multilateral foreign aid (multilateral ODA)

Households

Households are individuals or groups of individuals (e.g., families) who act as one unit financially. Households invest in assets, such as homes, farms, vehicles, and facilities for small unincorporated businesses. All of their investment funds, which include equity (savings), debt (loans from friends, relatives, or financial institutions), and government support in the form of subsidies (e.g., rebates, tax deductions, or tax credits on purchases), are assumed to be domestic to simplify the assessment of I&FF. Although remittances by family members working in foreign countries are substantial for some countries, and are likely to help fund household investments in the recipient countries, spending decisions are usually made by the recipients.

Also, whether funds are domestic or foreign is less important for households than for other investment entities when evaluating policies and measures to influence investment decisions.

Corporations

Corporations include both financial corporations and non-financial corporations, and can be either for-profit or not-for-profit organizations. Financial corporations are entities such as banks, credit unions, and insurance companies that provide financial services to non-financial corporations, households, and governments. Non-financial corporations produce goods (such as fossil fuels, electricity, food, and timber), and provide non-financial services (such as health care, private education, research, and hospitality services). Non-governmental organizations (NGOs) are a type of not-for-profit corporation. Corporations invest in both physical assets and programs. Their sources of investment funds are both domestic and foreign, and can be in the form of equity (equity in domestic financial markets and foreign direct investment), debt (loans provided by commercial banks and bond sales in the capital market), domestic government assistance (subsidies), or foreign aid (foreign assistance in the form of grants and concessional loans; also known as ODA or official development assistance). All foreign direct investment (FDI) in a country is assumed to go to corporations because FDI tends to be made by multinational corporations seeking to establish or expand operations overseas. However, only part of the FDI is invested in new physical assets or programs; some is used to purchase existing assets through mergers or acquisitions. Only the portion of FDI that is invested in new physical assets or programs should be included in the I&FF assessment.

Governments

Governments are the national, provincial, state, and local governments of a country. Financial and non-financial corporations owned wholly or in part by governments, such as public universities and research institutions, and publicly held oil companies, utilities, and water authorities, are included in this category. Government entities invest in long-lived physical assets and public programs and services that provide public benefits. Examples of such assets include water supply systems, hospitals, and coastal infrastructure; examples of such programs and services include health care, energy research, and agricultural assistance. Note that government entities also invest indirectly (via subsidies) in assets that private entities (households and corporations) purchase (e.g., appliances and vehicles). The funds governments invest include both domestic sources (revenues from taxes and fees, loans from domestic financial institutions, and bond sales in the domestic market) and international sources (debt in the form of foreign loans and bond sales, and foreign aid). In the taxonomy of government sources of funds used here (Table 2-2), foreign aid (or ODA) is divided into bilateral and multilateral components. Bilateral ODA is assistance provided by another country, either as a grant that does not need to be repaid, or as a loan with concessional terms. Multilateral ODA is assistance from an international financial institution (IFI) (such as the World Bank), usually in the form of a loan with concessional terms, but also sometimes in the form of a grant. ODA is an important, and growing, source of government funds for mitigation and adaptation in

developing countries, and strategies to seek additional ODA are likely to vary between bilateral and multilateral sources.

Scenarios

A **scenario** is an internally consistent and plausible characterization of future conditions over some specified time period. Each sectoral assessment of I&FF for mitigation requires that both a baseline scenario and a mitigation scenario be developed for that sector, and each sectoral assessment of I&FF for adaptation requires that both a baseline scenario and an adaptation scenario be developed for that sector.

The **baseline** scenario in both cases is a reflection of business-as-usual conditions, i.e., it is a description of what is likely to occur in the absence of new policies to address climate change. The baseline scenario describes expected socioeconomic trends (e.g., population growth and migration, economic growth), technological change, private sector and government plans for the sector, and expected business-as-usual investments in the sector (i.e., specific new assets and programs) given those trends and plans. If policies to address climate change are already being implemented, they should be reflected in the baseline scenario. The description of the plans or forecasts for investments should include information about the nature, scale, and timing of those investments; i.e., information that is needed to derive estimates of annual I&FF, and associated O&M costs.

The **mitigation scenario** incorporates new measures to mitigate GHG emissions, i.e., the mitigation scenario should describe expected socioeconomic trends, technological change (if relevant), new measures to mitigate GHG emissions, and the expected investments in the sector given implementation of the mitigation measures.

The **adaptation scenario** incorporates new measures to respond to the potential impacts of climate change. The adaptation scenario describes expected socioeconomic trends, technological change, new measures to respond to the potential impacts of climate change, and the expected investments in the sector given implementation of the measures to respond to potential impacts. Both the mitigation and adaptation scenarios should include information about the nature, scale, and timing of the investments. There may be sectors in which measures that reduce GHG emissions and/or increase resilience to climatic variability are already being taken, but are being implemented for reasons other than to address climate change. For example, a local government may be implementing water conservation measures for residential and commercial entities because of recent drought conditions. Such measures should be included in the baseline scenario because these measures reflect business-as-usual conditions, and because the costs of implementing such measures may be reflected in the I&FF for the base year (depending upon which year is used as the base year and the start date for implementation of such measures). Such measures may or may not be included in the climate change (i.e., mitigation and adaptation) scenarios, depending on the nature and scale of the mitigation and adaptation measures assessed. For example, if drought conditions are expected to intensify and increase in frequency with climate change, the adaptation scenario for this

example might include an expanded and more stringent water conservation program that would require a greater level of expenditure for implementation. In this case, the adaptation scenario would include the conservation measure that is in the baseline scenario, but at a modified scale.

Assessment Period and Base Year

The assessment period is the time horizon for assessment; i.e., the number of years spanned by the baseline and climate change scenarios and the associated stream of annual IF, FF, and O&M costs. The assessment period for I&FF assessment should be at least 20 years and not more than 30 years. About 20 to 30 years is a reasonable period over which to analyze alternative investment decisions. Also, most significant physical assets with GHG implications have lifetimes of 20 to 30 years, and many forestry mitigation measures require at least 20 to 30 years for the full effects to be realized. If models are used in the analysis, the choice of the assessment period may be dictated by the forecasting period of the models used. A single assessment period for all sectors is preferred; however, the assessment period could differ by sector, and between mitigation and adaptation within a sector, especially if models are used in the analysis. The base year is the first year of the assessment period, i.e., it is the first year of the baseline, mitigation, and adaptation scenarios. The base year should be set at a recent year for which I&FF and O&M information is available so that the IF, FF, and O&M costs for the first year of all the scenarios are historical data. This grounds the start of the streams of cost data for each scenario in reality. A base year of 2005 is recommended.

An end year of 2030 is recommended for the last year of assessment period since this year aligns with typical sector development plans, and results in a reasonable assessment period length. Therefore, an assessment period of 2005 through 2030 is recommended. An end year of 2030 is recommended for the last year of assessment period since this year aligns with typical sector development plans, and results in a reasonable assessment period length. Therefore, an assessment period of 2005 through 2030 is recommended and adopted by this team.

2. Scope, Data Inputs, and Scenarios

2.1 Sectoral Scope: The Rice Sub-Sector

The team has carefully considered the time frame and resources available and thought it wise to concentrate on the rice subsector rather than the entire agriculture sector. The reason is that about 81% (22.1 Gg) of the CH₄ emissions in the country is from rice production and related activities, and knowing the investment requirement in the area will go a long way. Another salient point is the contribution of the subsector to present and future staple food supply, food and nutrition security, and its contribution to the national economy and potential for economic growth are highest.

Out of the total cereal (early millet, late millet, sorghum, maize and rice) area of 317,079 hectares cultivated in 2010, about 27% was allocated rice cultivation, which is the highest land area under cereals. Another salient indicator why rice sub-sector is selected is the per capita consumption of cereals in the country which is about 175kg, and rice alone is about 67% of the 175kg, NASS, 2010. The government of The Gambia in line with the Millennium Development Goals (MDGs) and Vision 2020, is to transform the agricultural sector not only to establish peri-urban and urban enterprises but also to transform the subsistence farming system particularly the rice sub-sector to a surplus producing system that will free the small farmers from traditional institutional constraints and practices hence achieve the MDGs goal of eradicating extreme poverty, hunger, ensuring environmental sustainability, and food self sufficiency.

2.2 Data Inputs and Scenarios

Data inputs

A number of studies in The Gambia have been undertaken, thus will be a point of departure to filter out the major adaptation data with a more focused examination on I&FF assessments, modeling scenarios and the current climate change negotiation process. Certainly gaps still exists within the various institutions in terms of type of data available, as most data exist as raw and isolated data, which may be hard to find. It is anticipated that during the period of the assessment, information and data collected will be packaged in a user friendly format in which the various institutions and target groups will be able to access and use. The following are the key existing data sources for the Agriculture Sector in the country:

- Gambia Bureau of Statistic
- Ministry of Agriculture
- Ministry of Finance
- Ministry of Economic Planning and Industrial Development
- Ministry of Finance
- Ministry of Employment and Regional Integration
- Ministry of Forestry and Environment
- Ministry of Fisheries, Water Resources and National Assemble Matters

- Ministry of Health and Social Welfare
- Office of the Vice President (NDMA, NaNA, Women's Bureau)
- UN Agencies
- Ministries of both Secondary and Higher Education.

Scenarios

Scenarios are reflections of the future, or probable alternative of futures, rather than wished developments; and are neither predictions nor forecasts. Rather, each scenario is one alternative image of how the future might unfold. The study of past trends over long periods is hampered by the fact that most databases in The Gambia are either incomplete and or none existing if we go back much further than 50 years.

Given these gaps in our data, methods, and understanding, scenarios are the best way to integrate demographic, economic, societal, and technological knowledge with our understanding of ecological systems to evaluate sources and sinks of GHG emissions. Scenarios as an integration tool in the assessment of climate change allow a role for intuition, analysis, and synthesis that are features to aid the assessment of future climate change, impacts, vulnerabilities, adaptation, and mitigation. Since the scenarios focus on the century time scale, tools have been used that have been developed for this purpose.

To develop scenarios it is important to consider the main driving forces of development that influence greenhouse gas (GHG) emission sources and sinks, such as population growth, socio-economic development, technological progress, alternative structures of energy systems and land-use changes among others.

The analysis of investment and financial flows needed for adaptation to climate change was based on emissions scenarios for which climate change impacts could be inferred and responses to the climate impacts could be projected, so that the associated investment and financial flows could be estimated. The scenarios were selected based on their suitability for the analysis, the detail they provide on estimated investment and financial flows, and how representative they are of the literature. As mention earlier, existing scenarios had to be used because the time and resources needed to develop new scenarios were not available. There is no single scenario that covers all GHG emissions and sinks for which climate impacts have been modeled.

Any analysis of future investment and financial flows requires a reference scenario and a mitigation scenario that reflects an international response to climate change. The mitigation analysis uses a scenario that would return emission level in 2030 to 2005 level.

2.2.1 Assessment Period and Cost Accounting Parameters

The year 2005 was chosen as the base year for the assessment, and some historical data before the base year were also used. The assessment period for the exercise has also been 2005 to

2030. In the utilization of the currency in the exercise, the Gambian Dalasi (GMD) was converted to constant 2005 USD. The central bank policy rate of 19 per cent is used to compute the Present Value. The current value of the Dalasi was first deflated using the CPI and then converted to US\$. The exchange rate used is taken from the Central Bank of The Gambia and GBoS for the base year, 2005 was US\$ 1 = GMD 24.60, Table 3 below has the details.

Table 3. Discount Rate (12%) used for the Assessment

Dates	May 06-Dec 06	Jan- Dec 07	Jan-Dec-08	Jan-Dec-09	Jan-Dec-10
Rates	1.42	5.38	4.44	4.61	5.04

According to the proposed methodology, I&FF identified are translated into US\$ at 2005 constant. To do this, the figures are adjusted using price indices (CPI from GBOs) Gambia.

Table 4 below has the details of Harmonized Indices of Consumer Prices (HICP) for The Gambia and exchange rate during 2005-2010.

Table 4. Harmonized Indices of Consumer Prices

Year	2005	2006	2007	2008	2009	2010
HICP	15.78	33.35	37.18	52.4	59.5	44.4

This is the rate used by the public enterprises in The Gambia. Since the revision of this rate by the Central Bank, it is valid. The discount rate is applied for the conversion of I&FF into constant 2005 US\$ only and 2005 is used for the updates.

a) Cost Conversion from Current to Constant Dalasis

Investment and Financial Flows (I&FF) are first corrected by the technique of deflation, meaning the value adjusted at current cost of a given year, determine by the Harmonized Index of Consumer Prices (HICP) (2005=100) constant corresponding to this year. For example, if in 2008 has a flow, current cost value of 1500, this value must be divided by the HICP (2005=100) for the year 2008 (52.4) and multiplied by 100. The result is that the 1500 current cost correspond to 2862.60 constants costs.

b) Conversion from Constant Dalasis into US\$

Once the amounts in constant 2005 costs (in the example 2862.60), the values are divided by the dollar exchange rate adopted for 2005 (i.e. 24.60) for constant 2005 dollars as a result. In our example, the result would be a value of 116.34 US\$.

c) Conversion of current US\$ in constant US\$

If the numbers of I&FF obtained from one source are listed in US\$ today, to make the necessary correction to express them in constant 2005 US\$ will adjust the actual value in US\$ by the HICP

(2005=100). For example, if 2007 flow of investment in current dollars of 1000, this figure would be divided by 102.5, then multiplied by 100. The result is that 1000 US\$ correspond to 975.22 constant 2005 US\$.

2.2.2 Analytical Approach

All data on I&FF in the national currency has been obtained from existing documentation on the projects funded and implemented in agriculture and the environment which is cross cutting in all sectors. Information is also gathered by engaging the business organizations, civil societies, Non-Governmental Organizations (NGOs) and Government departments within the agriculture sector.

The data obtained from households, business and government agencies have been compiled in Excel spreadsheets.

In the compilation process, the difficulties are as follows:

- Missing historical data from 2000-2005
- Lack of information on the contribution of households and businesses to investment activities and financial flows identified
- The level of aggregates that does not allow to clearly identified and separates I&FF from activities.

With regards to the missing data, the assumption adopted is the minimum number of the series of entity flows.

Regarding the lack of information on the contribution of certain entities to flow, we relied on common practices observed in the financing of agricultural projects and rural development. With regards to households the contributions are between 6-20% depending on the projects. For this assessment, the rate of 10% was retained.

For the foreign direct investment, their estimates are based on assumptions provided by the Central Bank and Gambia Bureau of Statistic (GBOs) for the period 2004-2009.

The analytical method used to project historical data to 2030 is based on the Consumer Price Index (CPI) from GBOs sources were the trend was observed from 2004-2009 and used standard variances of 5% growth to project up to 2030. This trend can also be justified, for the economic growth is above 5% due the last five years and closely monitored by the International Monetary Fund (IMF).

2.2.3 Historical IF, FF, O&M Data and Subsidies

Agriculture Sector

The agriculture and natural resources sectors provide employment for about 75% of the labor force as well as being the major sources of food for the majority of Gambians, CCA, 2008⁵. The agricultural sector accounts for about 29% of GDP in 2009. It provides employment to 75 percent of the country's population and meets about 50% of the national food requirements. Its share of the country's total exports is 70%, thus constituting a substantial part of The Gambia's foreign exchange earnings. Agriculture is also the sole means of income generation for the majority of rural households below the poverty line. In The Gambia, about 91% of the extremely poor and 72% of the poor work in agriculture. The agricultural sector is regarded as the prime sector for investments to raise income, improve food security and reduce poverty. Notwithstanding the unimpressive performance of the agricultural sector over the recent past, The Gambia does enjoy comparative advantages for lowland rice, groundnuts, coarse grains, and cotton as well as for vegetable production. The livestock sector contributes 33% to agricultural GDP, groundnuts 23%, other crops 43%, fisheries 3% and forestry 2%, (GBOS⁶,2009).

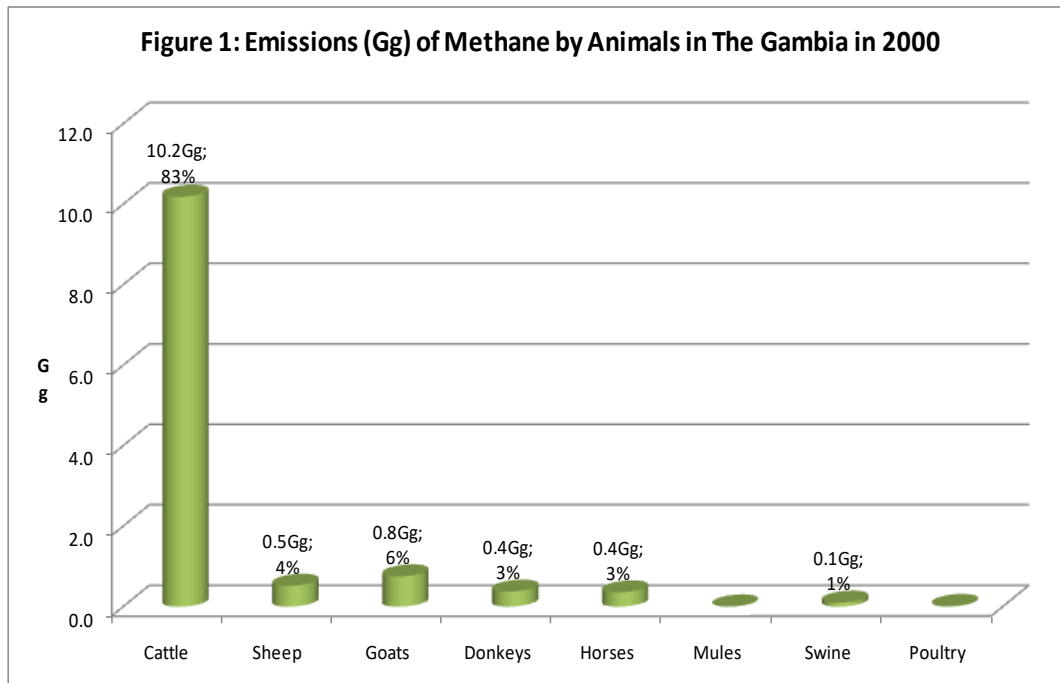
Agricultural activities contribute directly to emissions of GHGs through a variety of different processes. These include CH₄ emissions from enteric fermentation in domestic animals, animal waste management, rice production, and non-CO₂ emissions from savannah burning and field burning of agricultural wastes. Each of these activities is considered in this report and the results of analysis from the worksheets are also presented.

According to National Green House Gas (GHG) Report of 2007, about 83% (10.2 Gg CH₄) of total methane emissions from animal production was produced by cattle rearing. The other animal categories, (sheep, goat, donkey, horses, mules etc) combined produced the remaining 17% (2.1Gg CH₄) in The Gambia; and this is shown on the figure 1, below.

Animal production produced 12.3Gg CH₄ or 64% of the total emissions from agriculture, rice cultivation produced 6.40Gg CH₄ or 33% of the total methane emission from agriculture, 0.39Gg CH₄ or 2% came from crop residue burning and 0.25Gg CH₄ or 1% came from savannah burning.

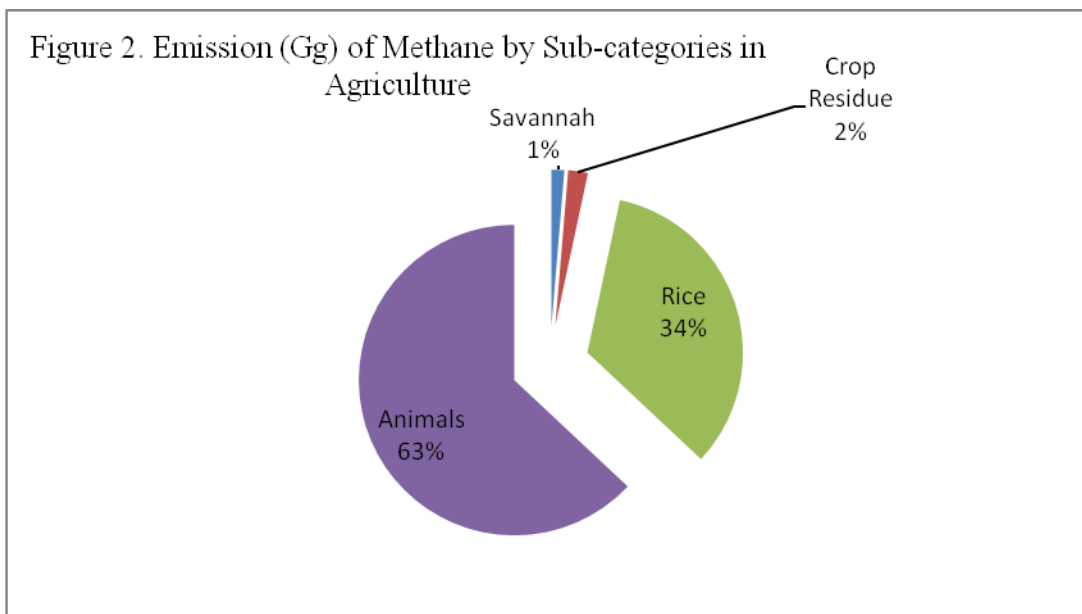
⁵ Climate Change, Adaptation & Mitigation Strategy Paper, The Gambia, 2008

⁶GBOS, means Gambia Bureau of Statistics



Source: National GHG inventory Report, 2007

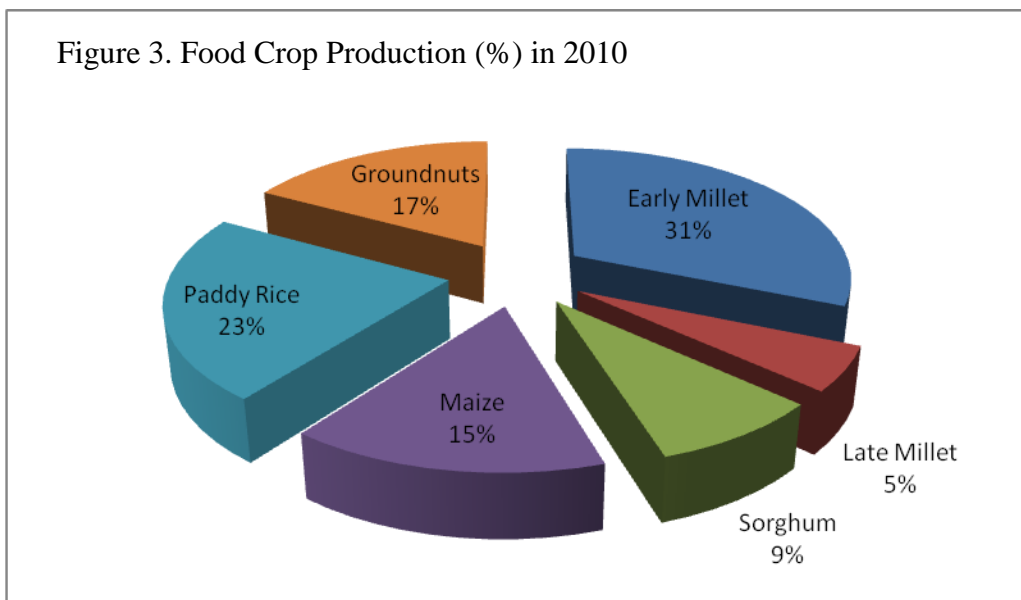
We have noted from the same source (National GHG, 2007) that CH₄ emissions from rice production activities as indicated on figure 2 below is about 34% (6.40Gg), 63% (12Gg) from livestock activities, crop residue 2% (0.39Gg) and savannah 1% (0.25Gg).



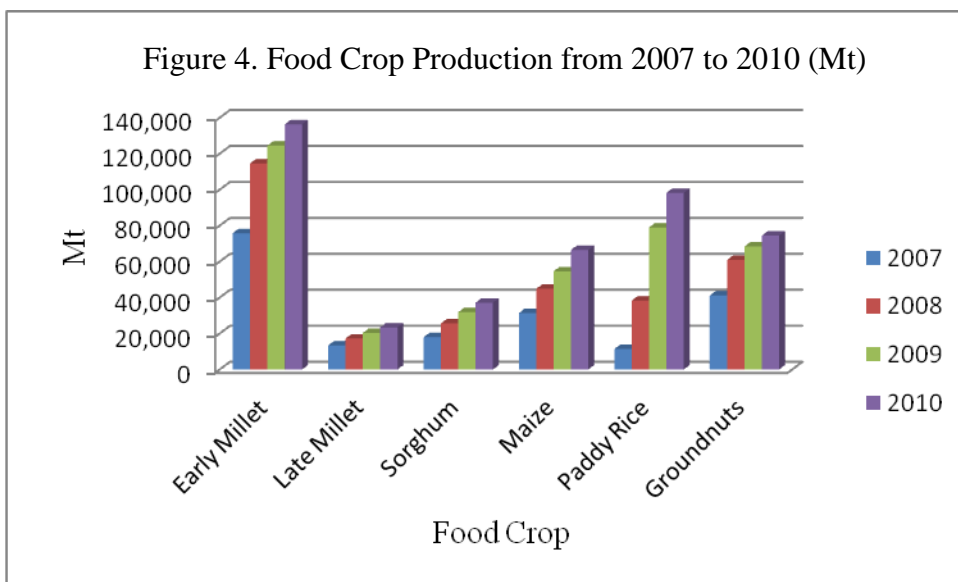
Source: National GHG inventory Report, 2007

Out of an arable land area of 555,000 ha (Pre-Harvest, 2010/2011), about an average of about 57% (Ibid) is cropped annually, by the producers in the country. There is an equal agricultural land area that requires some development before can be put under any meaningful production

in the country. The food crop production in 2010/2011 cropping season and 2007 to 2010 in the country are shown below.



Source: Pre-Harvest, 2010/2011



Source: Pre-Harvest, 2010/2011

The agriculture sector is characterized by small-scale, subsistence rainfed crop production (mainly groundnuts, coarse grains, rice), traditional livestock rearing, horticultural production, and small cotton. Agricultural output is generated by around 69,100 farm households (500,000 people engaged in farming) cultivating about 57% of total arable land as mentioned earlier. Of the total cultivated area, cotton is grown on land area averaging about 3,000 ha annually, while cassava, potato and horticultural crops occupy about 1,500 to 2,000 ha per year on average. Livestock production is carried out nationwide by almost all rural households. Cattle totaling

about 300,000 heads are the most valuable asset in the sub-sector, closely followed by small ruminants comprising sheep (160,000) and goats (230,000). Poultry meat is an important source of quality animal protein, especially because of the short production period. It is estimated that small-scale producers raise some 700,000 birds, representing 90 percent of the national poultry flock, GNAIP, 2010.

Despite the promising macro-economic situation, the budget allocated to the ministry of agriculture has steadily decreased since 2003 and reached a low of 2.5% in 2007. This is contrary to the Maputo Declaration which represents a commitment by member countries to allocate at least 10% to the agricultural sector. However, government's commitment to reversing this trend and increase investment in agriculture progressively resulted in an increase to 4.5% in 2009 and 2010, and 6% for 2011, GNAIP 2010. main causes of poverty have been reported as income insecurity resulting from weather-induced crop failures; shortages of cash forcing farmers to sell their produce immediately after harvest at low prices and then buy back grain at high prices during the hungry season (August – September); rising costs of living e.g. children's schooling and medical care; and lack of alternative income-generating opportunities.

Climate

The natural vegetation type of The Gambia is guinea savanna woodland in the coastal area that gradually changes into open Sudan Savanna in the east. the climate is Sudano-Sahelian characterized by a short rainy season from June to October and a long dry spell from November to May with scattered vegetation and forest cover. mean annual rainfall varies from 900 mm in the south-west to about 500 mm in the north-east. mean temperatures vary from 14^oc to 40^oc and generally higher in the eastern part of the country. the estuary basin of The Gambia river is a tidal inlet with a saltwater intrusion ranging from 180 km in the rainy season to 250 km in the dry season. Agriculture is mostly rainfed, and only about six percent of the irrigation potential has been used (pre-harvest assessment, 2010).

Agricultural Investment in the Rice and Cattle Sub-Sectors in The Gambia

Main Government of The Gambia, Donor and NGO Activities in the Agricultural Sector

From 2000 to 2007, donor assistance in the agricultural sector has overall decreased due to limited financial resources as a result of global economic crisis and the shift in policy on the part of donors towards funding mainly social sectors (education and health). However some donors have maintained high commitment to support the agricultural sector including the African Development Bank (AfDB) and the International Fund for Agricultural Development (IFAD) continue supporting the sector through the implementation of a number of projects/program\s. Many of these projects are on-going and include: (i) Participatory Integrated Watershed Management Project (PIWAMP); (ii) Rural Finance Project (RFP); (iii) Farmer Managed Rice Irrigation Project (FMRIP); (iv) Multinational NERICA Dissemination Project (MNDP); (v) Participatory Integrated Management of Invasive Aquatic Weeds Project (PIMIAWP); (vi) Peri-urban Smallholder Improvement Project (PSIP); (vii) Rural Finance and

Community Initiatives Project (RFCIP); (viii) Irrigated Rice Development Project (KFAED); (ix) Livestock and Horticulture Development Project (LHDP); (x) and NERICA Rice Project. Overall, these projects support food, nutrition and income security and poverty reduction through a range of interventions such as soil and water management and land development for rice irrigation, the eradication of aquatic weeds, support to income generating activities and rural livelihoods, and provision of rural microfinance and improved rice seeds.

Other main donors supporting the agricultural sector include: Islamic Development Bank (IDB), World Bank (WB), EU and the Kuwaiti Fund for Arab Economic Development (KFAED) funding: (i) the Gambia Lowland Development Project (GALDEP); (ii) Africa Emergency Locust Project (AELP); and (iii) Irrigated Rice Development Project (IRRIDEP) respectively. Furthermore, the third co-financing components of the LHDP and PIWAMP are funded by IDB and the Global Environment Facility (GEF) respectively. Other key interventions carried out include: Taiwanese Agricultural Technical Mission providing NERICA (New Rice for Africa) seeds to farmers and the development of aquaculture for fish production and tidal irrigation for rice seed multiplication and dissemination; and the Italian-Government supporting food security through commercialization of smallholder agriculture. Egypt has pledged 0.5 million Egyptian Pounds for fertilizer and irrigation pumps.

National Sources of Finance and Investment for the Agriculture Sector

For viable investment in The Gambia; there are not many options to finance investment in the agriculture sector. This is also based on the level of economic activities, and that of The Gambian Economy is based mainly on agriculture. As mentioned in 2.6.1 above, below are some of the investment options available in the country.

- Government of The Gambia (GOTG),
- Bilateral such as ROC, EC/EU, US Embassy, Iran, Venezuela, Spain, Kuwait, Kingdom of Saudi Arabia, British High Commission,
- Multi-lateral Cooperation, such as the UN System (UNDP, FAO etc.),
- Private Commercial Producers,
- NGOs.

Table 5. Projects in the Agricultural Sector in The Gambia

Projects	Financing Sources	Duration	Total Cost (USD)	Donor Contribution (USD)	Government Contribution (USD)
Irrigated Rice Development Project	GOTG / KFAED	2002-2007	3,592,831	3,347,500	245,331
Participatory Integrated Watershed Management Project (PIWAMP)	GOTG / IFAD / AfDB	2008-2012	17,500,000	14,200,000	3,300,000
Livestock and Horticulture Development Project	GOTG / IFAD / AfDB	2009-2013	15,900,000	14,000,000	1,900,000

Farmer Managed Rice Irrigation Project	GOTG / AfDB	2006-2011	9,500,000	9,000,000	500,000
Multinational NERICA Rice Dissemination Project	GOTG / AfDB	2004-2011	2,278,571	2,178,571	100,000
Gambia Lowland Development Project	GOTG / IDB	2008-2013	12,710,000	11,000,000	1,710,000
Participatory Integrated Management of Invasive Aquatic Weeds Project (PIMIAWP)	GOTG / AfDB	2005-2010	592,226	375,674	216,552
Rural Finance Project	GOTG / IFAD	2008-2014	8,725,072	6,500,000	2,225,072
Project for Sustainable Management of Endemic Ruminant Livestock	GOTG / GEF / AfDB	2009-2013	4,100,000	3,890,553	209,447
Gambia Emergency Agricultural Production Project	GOTG / EU / WB	2010-2011	6,873,000	6,773,000	100,000
NERICA Rice Project	GOTG / AfDB	200-2009	2,678,571	2,378,571	300,000
Food Security through Commercialization of Agriculture Project	GOTG / FAO / ITA	2010-2013	2,094,000	1,979,272	114,728
International NGOs	Action Aid International	2008-2012	10,000,000	8,000,000	N/A
	Concern Universal	2010-2012	3,978,020	3,978,020	N/A

Sources: GNAIP and MOFEA, 2011

Table 6. Historical Data 2000-2005 Cumulative Discounted (12%) IF, FF, and O&M Estimates, By Investment Type, Investment Entity, and Funding Source

Category of Investment Entity	Source of I&FF Funds		Cumulative Discounted IF, FF, & O&M Estimates For Adaptation Scenario (million 2005US\$)														
			Water management (irrigation etc)			Production of improved seeds			Improved Agro Meteorological information system and timing of crop calendars			Improved soil quality			Plant Protection		
			IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M
Households	Domestic	Equity and debt	1.28	0.04	0.01	0.34	0.15	0.03	0.01	0.00	0.00	0.12	0.00	0.12	3.22	0.05	0.01
	Total Household Funds (all domestic)		1.28	0.04	0.01	0.34	0.15	0.03	0.01	0.00	0.00	0.12	0.00	0.12	3.22	0.05	0.01
Corporations	Domestic	Domestic equity (including internal cash flow)	1.25	0.13	0.03	0.34	1.71	0.42	0.00	0.00	0.00	2.23	0.13	0.03	3.16	0.81	0.02
		Domestic borrowing (bonds and loans)	1.24	1.13	0.15	0.45	1.60	0.40	0.00	0.00	0.00	2.29	1.03	0.26	2.21	0.32	0.08
		Total Domestic Sources	2.49	1.26	0.18	0.79	3.31	0.82	0.00	0.00	0.00	4.52	1.16	0.29	5.37	1.13	0.10
	Foreign	Foreign direct investment (FDI)	1.28	0.71	0.17	0.41	1.83	0.45	0.00	0.00	0.00	2.44	1.15	0.28	3.82	0.36	0.10
		Foreign borrowing (loans)	0.81	0.66	0.16	0.42	1.74	0.42	0.00	0.00	0.00	2.48	1.08	0.27	3.92	0.35	0.08
		Foreign aid (ODA)	0.82	0.75	0.18	0.44	0.74	0.02	0.00	0.00	0.00	2.55	1.23	0.35	4.08	0.38	0.10
		Total Foreign Sources	2.91	2.12	0.51	1.27	4.31	0.89	0.00	0.00	0.00	7.47	3.46	0.90	11.82	1.09	0.28
	Total Corporation Funds		5.40	3.38	0.69	2.06	7.62	1.71	0.00	0.00	0.00	11.99	4.62	1.19	17.19	2.22	0.38
Government	Domestic	Domestic funds (budgetary)	1.30	2.35	1.08	0.44	2.21	0.55	0.01	0.00	0.00	2.62	1.14	0.28	4.19	0.35	0.08
	Foreign	Foreign borrowing (loans)	1.34	0.79	0.18	0.46	1.83	0.45	0.00	0.00	0.00	2.64	1.17	0.29	2.31	0.35	0.09
		Bilateral foreign aid (bilateral ODA)	1.30	1.13	0.20	0.47	0.44	0.11	0.00	0.00	0.00	2.71	1.36	0.33	2.42	0.41	0.10
		Multilateral foreign aid (multilateral ODA)	5.26	2.42	0.76	1.49	1.20	0.49	2.03	0.39	0.04	2.23	1.25	0.44	2.23	1.16	0.29
		Total Foreign Sources	7.90	6.69	2.22	2.57	5.68	1.60	0.04	0.39	0.04	10.19	4.92	1.34	11.14	2.28	0.57
	Total Government Funds		9.20	10.13	2.94	4.97	13.45	3.35	0.05	0.40	0.04	22.31	8.55	2.66	31.57	4.57	0.96
Total			15.88	10.11	2.92	5.26	13.45	3.34	2.05	0.39	0.04	22.31	9.54	2.65	31.56	4.54	0.95

Source: I&FF Calculations 2011

2.2.4 Baseline Scenario

As mentioned in section 1.2.5; in this situation, the **baseline** scenario is a reflection of business-as-usual conditions, i.e., it is a description of what is likely to occur in the absence of new policies to address climate change. The baseline scenario describes expected socioeconomic trends (e.g., population growth, migration, and economic growth), technological change, private sector and government plans for the sector, and expected business-as-usual investments in the sector.

Electricity consumption in OECD countries falls by 25 per cent, with motor system efficiency improvements being a prime contributor to the reduction. More than half of global industrial energy savings result from increased efficiency in the iron and steel, chemicals, and non-metallic minerals industries.

Socioeconomically, most Gambian consumers depend on fuel wood for their daily meal preparation, thus the high dependent on frost. Reducing CO₂ emissions from fuel wood consumption through large-scale introduction of liquefied petroleum gas (LPG) Moukhtara Holding Company (MHC), a major Gambian company with a brick factory and a sawmill, plans to switch 144,000 Gambian consumers to use LPG rather than fuel wood. MHC will import, distribute, and market the LPG to consumers in The Gambia who would otherwise have consumed fuel wood. Accordingly, MHC would target approximately 144,000 Gambians, or about 11% of The Gambia's total population of 1.33 million. According to MHC estimates, it is technically feasible for MHC to import, distribute, and market approximately 8,000t LPG per year in The Gambia. Based on current per capita consumption of 55.5kg of LGP in The Gambia, technically if implemented could switch at least 144,000 Gambians away from using fuel wood to using LPG instead; and could save about 782,070t of CO₂ in 30 years.

Table 7. Estimates of the Cumulative Amounts Discounted I&FF and O&M Costs from the Baseline Scenario from 2010-2030 (million 2005 US\$)

Category of Investment Entity	Source of I&FF Funds		Improve Agriculture Land & Water Management			Development of Agriculture Chain & Market Promotion			Sustainable Farm Development			Development of Livestock Species Resistant to Weather conditions			
			IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	
Households	Domestic	Equity and debt	4.35	0.77	0.12	7.02	1.65	0.80	7.02	0.93	0.80	4.62	0.95	0.93	
	Total Household Funds (all domestic)		4.35	0.77	0.12	7.02	1.65	0.80	7.02	0.93	0.80	4.62	0.95	0.93	
Corporations	Domestic	Domestic equity (including internal cash flow)	5.92	4.00	0.84	0.01	0.90	0.04	5.15	0.47	0.40	4.76	2.87	0.47	
		Domestic borrowing (bonds and loans)	10.82	8.06	0.86	2.98	0.96	0.04	6.66	0.47	0.04	4.84	6.70	0.47	
		Total Domestic Sources	16.74	12.06	1.70	2.99	1.85	0.08	11.81	0.94	0.44	9.60	9.57	0.94	
	Foreign	Foreign direct investment (FDI)	2.76	2.64	0.93	0.86	5.66	0.02	0.00	0.00	0.00	12.10	11.41	3.45	
		Foreign borrowing (loans)	1.57	1.15	0.43	0.42	1.33	0.01	0.00	0.00	0.00	6.65	6.66	2.48	
		Foreign aid (ODA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		Total Foreign Sources	4.32	3.79	1.36	1.28	6.98	0.02	0.00	0.00	0.00	18.75	18.07	5.94	
	Total Corporation Funds		34.02	27.24	7.15	4.27	8.84	0.10	11.81	0.94	0.46	28.35	27.65	6.88	
	Government	Domestic	Domestic funds (budgetary)	1.24	1.36	0.83	0.01	4.59	0.83	5.60	2.10	0.83	29.79	9.49	0.83
		Foreign	Foreign borrowing (loans)	5.03	6.66	0.84	0.47	2.86	0.84	4.69	6.64	0.84	13.28	6.64	0.84
Bilateral foreign aid (bilateral ODA)			2.10	6.70	0.84	0.42	2.47	0.84	2.87	6.36	0.84	5.69	3.80	0.84	
Multilateral foreign aid (multilateral DA)			4.65	7.97	0.84	0.55	3.24	0.84	4.65	7.17	0.84	15.18	9.49	0.84	
Total Foreign Sources		11.78	21.34	2.53	1.43	8.57	2.53	12.21	20.18	2.53	34.16	19.93	2.53		
Total Government Funds		13.02	22.70	3.36	1.44	13.16	3.36	17.82	22.28	3.36	63.95	29.41	3.36		
Total			51.39	50.70	10.63	12.73	23.65	4.26	36.65	24.15	4.62	96.93	58.01	11.17	

Source: GNAIP 2010 and I&FF Calculations 2011

Table 8. Annual IF, FF, & O&M Estimates for Baseline Scenario discounted at 12% per annum (million 2005US\$)

Year	Investment Type 1 Improvement of Agriculture Land &Water Management			Investment Type 2 Development of Agriculture Chain & Market Promotion			Investment Type 3 Sustainable Farm Development			Investment Type 4 Development of Livestock Species Resistant to Weather conditions			All Investment Types		
	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M
2010	3.53	3.23	0.72	10.53	1.7	0.34	2.94	1.69	0.36	6.83	3.97	1.63	23.83	10.59	3.05
2011	3.93	2.84	0.77	9.71	1.57	0.32	2.71	1.56	0.33	6.29	3.65	1.50	22.64	9.62	2.93
2012	3.83	2.50	0.74	8.94	1.44	0.29	2.49	1.43	0.31	5.79	3.36	1.39	21.06	8.74	2.73
2013	3.69	2.22	0.70	8.21	1.32	0.27	2.29	1.32	0.29	5.32	3.09	1.27	19.50	7.95	2.53
2014	3.53	1.97	0.67	7.53	1.22	0.24	2.10	1.21	0.26	4.88	2.83	1.17	18.03	7.23	2.33
2015	3.36	1.75	0.63	6.89	1.11	0.22	1.92	1.10	0.24	4.46	2.59	1.07	16.63	6.56	2.15
2016	3.17	1.56	0.59	6.30	1.02	0.20	1.76	1.01	0.22	4.08	2.37	0.98	15.30	5.95	1.99
2017	2.98	1.39	0.55	5.75	0.93	0.18	1.60	0.92	0.20	3.72	2.16	0.89	14.05	5.39	1.83
2018	2.79	1.23	0.51	5.24	0.85	0.17	1.46	0.84	0.18	3.39	1.97	0.81	12.88	4.88	1.67
2019	2.61	1.09	0.50	4.77	0.77	0.16	1.33	0.76	0.16	3.09	1.79	0.74	11.79	4.41	1.56
2020	2.43	0.97	0.46	4.33	0.70	0.14	1.21	0.69	0.15	2.81	1.63	0.67	10.78	3.99	1.42
2021	2.25	0.86	0.42	3.94	0.63	0.13	1.10	0.63	0.13	2.55	1.48	0.61	9.84	3.61	1.30
2022	2.08	0.76	0.39	3.57	0.58	0.11	1.00	0.57	0.12	2.31	1.34	0.55	8.97	3.25	1.18
2023	1.92	0.68	0.36	3.24	0.52	0.10	0.90	0.52	0.11	2.10	1.22	0.50	8.16	2.94	1.08
2024	1.77	0.60	0.33	2.93	0.47	0.10	0.82	0.47	0.10	1.90	1.10	0.45	7.42	2.65	0.98
2025	1.63	0.53	0.30	2.66	0.43	0.09	0.74	0.42	0.09	1.72	1.00	0.41	6.74	2.39	0.89
2026	1.49	0.47	0.27	2.40	0.39	0.08	0.67	0.38	0.08	1.56	0.90	0.37	6.12	2.15	0.81
2027	1.37	0.42	0.25	2.17	0.35	0.07	0.61	0.35	0.08	1.41	0.82	0.34	5.55	1.93	0.73
2028	1.25	0.37	0.23	1.96	0.32	0.06	0.55	0.31	0.07	1.27	0.74	0.30	5.03	1.74	0.66
2029	1.14	0.33	0.21	1.77	0.29	0.06	0.49	0.28	0.06	1.15	0.67	0.27	4.55	1.57	0.60
2030	1.04	0.29	0.19	1.60	0.26	0.05	0.44	0.26	0.06	1.03	0.60	0.25	4.12	1.41	0.54
Total	51.78	26.08	9.80	104.43	16.85	3.37	29.13	16.72	3.60	67.66	39.28	16.19	253.00	98.94	32.96

Source: I&FF Calculations 2011

2.2.5 Adaptation Scenario

The adaptation scenario will mainly depend on the following salient areas (quoted from GNAIP):

1. Improvement of Agricultural Land and Water Management

Improved agricultural land and water management aims to increase food security, income generating capacity and nutritional status of the farmer beneficiaries especially women and youth through the use of sustainable land and water management practice for the cultivation of 25,000 ha of land. The programme comprises three components: (i) lowland development for rice production; (ii) irrigation for horticulture and upland crops; and (iii) capacity building of support services institutions.

2. Development of Agricultural Chains and Market Promotion

Development of Agricultural Chains and Market Promotion aims to transform the agricultural sector from a traditional subsistence economy to a modern market-oriented commercial sector with well integrated food chains and a viable agro-processing private sector, resulting in increased incomes of agricultural value chain actors (including farmers, input suppliers, processors, traders and exporters). The Program comprises three components: (i) Development of Agricultural Marketing Chains (including food crops, groundnut, horticulture, agro-forestry food products, short-cycle livestock, dairy products and fisheries products); (ii) Strengthening of National Operator Support Services and Structures; and (iii) Development of Domestic, Intra-regional and Extra-regional Markets.

3. Sustainable Farm Development

Sustainable Farm Development aims to achieve increased and sustained agricultural production and productivity growth by introducing agricultural practices through people-centered learning processes that enhance and conserve local natural resources and the environment, and help smallholder farmers to adapt to climate change. The Program comprises three components: (i) Sustainable Farm Management; (ii) Land Use Suitability and Land Tenure Security; and (iii) Capacity Building of Support Services and Farmer Organizations.

4. Development of Livestock Species Resistant to Weather Conditions

Development of Livestock Species Resistant to Weather Conditions aims at production of short-cycle livestock expanded (small ruminants, poultry and pigs). These activities will appropriately manage so as to have no negative impact on the environment. It will increase dairy products, food security farm incomes and foreign exchange savings.

Table 9. Estimates of the Annual Discounted I&FF and O&M Costs from the Adaptation Scenario from 2010-2030 (million 2005 US\$)

Category of Investment Entity	Source of I&FF Funds		Improve Agriculture Land & Water Management			Development of Agriculture Chain & Market Promotion			Sustainable Farm Development			Development of Livestock Species Resistant to Weather conditions			
			IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	
Households	Domestic	Equity and debt	6.77	1.20	0.14	12.05	2.83	1.37	12.04	1.60	1.36	7.92	1.63	1.60	
	Total Household Funds (all domestic)		6.77	1.20	0.14	12.05	2.83	1.37	12.04	1.60	1.36	7.92	1.63	1.60	
Corporations	Domestic	Domestic equity (including internal cash flow)	6.77	0.60	0.07	6.02	1.42	0.68	6.02	0.80	0.68	3.96	0.81	0.80	
		Domestic borrowing (bonds and loans)	12.25	9.46	0.51	5.10	0.88	0.03	7.01	0.40	0.00	4.22	9.03	0.40	
		Total Domestic Sources	19.03	10.06	0.58	11.12	2.30	0.72	13.03	1.20	0.68	8.18	9.84	1.20	
	Foreign	Foreign direct investment (FDI)	4.31	4.37	2.88	0.33	7.72	0.01	0.00	0.00	0.01	10.89	8.11	3.40	
		Foreign borrowing (loans)	5.77	2.95	0.83	0.33	0.00	0.01	0.00	0.00	0.01	6.42	6.06	2.45	
		Foreign aid (ODA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
		Total Foreign Sources	10.08	7.31	3.71	0.65	7.72	0.01	0.00	0.00	0.01	17.32	14.17	5.85	
	Total Corporation Funds		29.11	17.37	4.29	11.77	10.02	0.73	13.03	1.20	0.69	25.50	24.01	7.05	
	Government	Domestic	Domestic funds (budgetary)	14.00	0.00	0.00	0.34	6.40	0.72	9.60	3.61	1.43	45.69	11.86	0.27
		Foreign	Foreign borrowing (loans)	0.00	9.34	0.50	0.80	0.96	0.72	3.23	9.59	0.72	0.00	3.25	0.72
Bilateral foreign aid (bilateral ODA)			0.00	5.25	0.50	0.31	1.78	0.72	0.90	5.21	0.72	0.00	0.81	0.72	
Multilateral foreign aid (multilateral DA)			5.61	7.21	0.50	0.57	2.11	0.72	5.51	6.85	0.72	21.15	13.01	0.72	
Total Foreign Sources			5.61	21.80	1.49	1.69	4.86	2.17	9.65	21.64	2.16	21.15	17.08	2.17	
Total Government Funds		19.61	21.80	1.49	2.03	11.26	2.89	19.25	25.25	3.59	66.84	28.94	2.44		
Total			55.50	40.37	5.92	25.85	24.12	4.98	44.32	28.05	5.65	100.25	54.57	11.10	

Source: I&FF Calculations 2011

Table 10. Estimates of the Annual Discounted I&FF and O&M Costs from the Adaptation Scenario from 2010-2030 (million 2005 US\$)

Year	Investment Type 1 Improvement of Agriculture Land &Water Management			Investment Type 2 Development of Agriculture Chain & Market Promotion			Investment Type 3 Sustainable Farm Development			Investment Type 4 Development of Livestock Species Resistant to Weather conditions			All Investment Types		
	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M	IF	FF	O&M
2010	3.7	3.38	0.76	11.03	1.78	0.36	3.08	1.77	0.38	7.15	4.15	1.71	24.96	11.08	3.21
2011	4.76	2.84	0.91	10.16	1.64	0.33	2.83	1.63	0.35	6.58	3.82	1.58	24.34	9.93	3.16
2012	4.19	2.50	0.80	9.33	1.50	0.30	2.60	1.49	0.33	6.04	3.51	1.45	22.16	9.01	2.87
2013	4.01	2.24	0.73	8.56	1.38	0.27	2.39	1.37	0.29	5.54	3.22	1.33	20.49	8.21	2.62
2014	3.81	1.99	0.69	7.83	1.27	0.25	2.18	1.25	0.27	5.07	2.94	1.21	18.90	7.45	2.42
2015	3.60	1.77	0.71	7.16	1.16	0.23	1.99	1.15	0.25	4.63	2.69	1.11	17.39	6.76	2.30
2016	3.39	1.57	0.63	6.53	1.05	0.21	1.82	1.04	0.22	4.23	2.46	1.01	15.97	6.13	2.07
2017	3.18	1.40	0.56	5.95	0.96	0.19	1.66	0.95	0.20	3.85	2.24	0.92	14.64	5.55	1.88
2018	2.96	1.24	0.53	5.42	0.87	0.18	1.51	0.87	0.19	3.51	2.04	0.84	13.40	5.02	1.73
2019	2.76	1.10	0.55	4.92	0.79	0.16	1.37	0.79	0.17	3.19	1.85	0.76	12.24	4.54	1.64
2020	2.56	0.98	0.48	4.47	0.72	0.14	1.25	0.72	0.15	2.90	1.68	0.69	11.17	4.10	1.47
2021	2.37	0.87	0.43	4.06	0.65	0.13	1.13	0.65	0.14	2.63	1.53	0.63	10.19	3.70	1.33
2022	2.18	0.77	0.40	3.68	0.59	0.12	1.03	0.59	0.13	2.39	1.38	0.57	9.28	3.34	1.22
2023	2.01	0.68	0.39	3.33	0.54	0.11	0.93	0.53	0.12	2.16	1.25	0.52	8.44	3.01	1.13
2024	1.85	0.61	0.34	3.02	0.49	0.10	0.84	0.48	0.10	1.96	1.14	0.47	7.66	2.71	1.01
2025	1.70	0.54	0.31	2.73	0.44	0.09	0.76	0.44	0.09	1.77	1.03	0.42	6.95	2.44	0.91
2026	1.55	0.48	0.28	2.47	0.40	0.08	0.69	0.39	0.09	1.60	0.93	0.38	6.31	2.20	0.83
2027	1.42	0.42	0.27	2.23	0.36	0.07	0.62	0.36	0.08	1.44	0.84	0.34	5.71	1.98	0.76
2028	1.30	0.38	0.24	2.01	0.32	0.07	0.56	0.32	0.07	1.30	0.76	0.31	5.17	1.78	0.68
2029	1.18	0.33	0.21	1.81	0.29	0.06	0.51	0.29	0.06	1.17	0.68	0.28	4.68	1.60	0.61
2030	1.08	0.30	0.19	1.64	0.26	0.05	0.46	0.26	0.06	1.06	0.62	0.25	4.23	1.44	0.55
All Years	55.56	26.39	10.40	108.34	17.48	3.49	30.21	17.34	3.74	70.18	40.74	16.79	264.29	101.96	34.42

Source: I&FF Calculations 2011

3. Results

3.1 Incremental Changes in IF, FF and O&M Costs, and Subsidy Costs

Table 11. Incremental Cumulative Discounted I&FF Estimates, By Investment Type, Investment Entity, and Funding Source from 2010-2030 (million 2005 US\$)

Category of Investment Entity	Source of I&FF Funds		Improve Agriculture Land & Water Management			Development of Agriculture Chain & Market Promotion			Sustainable Farm Development			Development of Livestock Species Resistant to Weather conditions		
			ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M
Households	Domestic	Equity and debt	2.42	0.43	0.02	5.02	1.18	0.57	5.02	0.67	0.57	3.30	0.68	0.67
	Total Household Funds (all domestic)		2.42	0.43	0.02	5.02	1.18	0.57	5.02	0.67	0.57	3.30	0.68	0.67
Corporations	Domestic	Domestic equity (including internal cash flow)	0.85	-3.40	-0.77	6.01	0.52	0.65	0.87	0.33	0.28	-0.80	-2.06	0.33
		Domestic borrowing (bonds and loans)	1.44	1.40	-0.35	2.12	-0.08	-0.01	0.35	-0.07	-0.04	-0.63	2.32	-0.07
		Total Domestic Sources	2.29	-2.00	-1.12	8.13	0.44	0.64	1.22	0.26	0.24	-1.42	0.27	0.26
	Foreign	Foreign direct investment (FDI)	1.56	1.73	1.95	-0.53	2.07	-0.01	0.00	0.00	0.01	-1.21	-3.30	-0.06
		Foreign borrowing (loans)	4.20	1.79	0.40	-0.09	-1.33	0.00	0.00	0.00	0.01	-0.23	-0.61	-0.03
		Foreign aid (ODA)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		Total Foreign Sources	5.76	3.52	2.35	-0.62	0.74	-0.01	0.00	0.00	0.01	-1.43	-3.91	-0.09
	Total Corporation Funds		-4.91	-9.86	-2.86	7.51	1.19	0.63	1.22	0.26	0.23	-2.86	-3.64	0.18
Government	Domestic	Domestic funds (budgetary)	12.77	-1.36	-0.83	0.34	1.81	-0.11	4.00	1.50	0.59	15.89	2.37	-0.56
	Foreign	Foreign borrowing (loans)	-5.03	2.67	-0.35	0.33	-1.90	-0.12	-1.46	2.94	-0.12	-13.28	-3.39	-0.12
		Bilateral foreign aid (bilateral ODA)	-2.10	-1.45	-0.35	-0.11	-0.68	-0.12	-1.96	-1.16	-0.12	-5.69	-2.98	-0.12
		Multilateral foreign aid (multilateral DA)	0.96	-0.76	-0.35	0.03	-1.13	-0.12	0.86	-0.32	-0.12	5.97	3.53	-0.12
	Total Foreign Sources	-6.17	0.46	-1.04	0.25	-3.71	-0.36	-2.56	1.47	-0.37	-13.01	-2.84	-0.36	
Total Government Funds		6.59	-0.90	-1.88	0.59	-1.90	-0.47	1.43	2.97	0.23	2.89	-0.48	-0.92	
Total		4.11	-10.33	-4.72	13.12	0.46	0.73	7.67	3.90	1.03	3.33	-3.44	-0.08	

Source: I&FF Calculations 2011

Note: Negative values mean net savings.

Table 12. Incremental Annual Discounted IF & FF Estimates by Investment Type from 2010-2030 (million 2005 US\$)

Year	Investment Type 1 Improvement of Agriculture Land &Water Management			Investment Type 2 Development of Agriculture Chain & Market Promotion			Investment Type 3 Sustainable Farm Development			Investment Type 4 Development of Livestock Species Resistant to Weather conditions			All Investment Types		
	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M
2010	0.17	0.15	0.04	0.50	0.08	0.02	0.14	0.08	0.02	0.32	0.18	0.08	1.13	0.49	0.16
2011	0.83	0.00	0.13	0.46	0.07	0.01	0.12	0.07	0.02	0.29	0.17	0.07	1.70	0.31	0.23
2012	0.36	0.00	0.05	0.39	0.06	0.02	0.11	0.06	0.02	0.25	0.15	0.06	1.11	0.27	0.15
2013	0.32	0.02	0.03	0.35	0.06	0.01	0.10	0.05	0.01	0.22	0.13	0.05	0.99	0.27	0.10
2014	0.29	0.02	0.02	0.30	0.05	0.01	0.08	0.05	0.01	0.20	0.11	0.04	0.87	0.23	0.09
2015	0.25	0.02	0.08	0.26	0.04	0.01	0.07	0.04	0.01	0.17	0.10	0.04	0.75	0.20	0.15
2016	0.22	0.02	0.04	0.23	0.04	0.00	0.07	0.04	0.00	0.15	0.09	0.04	0.67	0.18	0.08
2017	0.19	0.01	0.01	0.20	0.03	0.01	0.06	0.03	0.00	0.13	0.08	0.03	0.58	0.16	0.06
2018	0.17	0.01	0.01	0.18	0.03	0.01	0.05	0.03	0.01	0.12	0.06	0.03	0.52	0.13	0.05
2019	0.15	0.01	0.05	0.16	0.03	0.00	0.04	0.03	0.01	0.10	0.06	0.03	0.45	0.12	0.08
2020	0.13	0.01	0.02	0.14	0.02	0.01	0.04	0.02	0.00	0.09	0.05	0.02	0.40	0.11	0.05
2021	0.12	0.01	0.01	0.12	0.02	0.00	0.03	0.02	0.00	0.08	0.05	0.02	0.35	0.09	0.04
2022	0.10	0.01	0.01	0.11	0.02	0.00	0.03	0.02	0.00	0.07	0.04	0.02	0.31	0.08	0.03
2023	0.09	0.01	0.03	0.09	0.02	0.00	0.03	0.02	0.00	0.06	0.04	0.01	0.27	0.07	0.05
2024	0.08	0.01	0.01	0.08	0.01	0.00	0.02	0.01	0.00	0.06	0.03	0.01	0.24	0.06	0.03
2025	0.07	0.00	0.00	0.07	0.01	0.00	0.02	0.01	0.00	0.05	0.03	0.01	0.21	0.06	0.02
2026	0.06	0.00	0.01	0.06	0.01	0.00	0.02	0.01	0.00	0.04	0.02	0.01	0.19	0.05	0.02
2027	0.05	0.00	0.02	0.06	0.01	0.00	0.02	0.01	0.00	0.04	0.02	0.01	0.16	0.04	0.03
2028	0.05	0.00	0.01	0.05	0.01	0.00	0.01	0.01	0.00	0.03	0.02	0.01	0.15	0.04	0.02
2029	0.04	0.00	0.00	0.04	0.01	0.00	0.01	0.01	0.00	0.03	0.02	0.01	0.13	0.03	0.01
2030	0.04	0.00	0.00	0.04	0.01	0.00	0.01	0.01	0.00	0.03	0.01	0.01	0.11	0.03	0.01
Total	3.77	0.31	0.60	3.91	0.63	0.13	1.09	0.62	0.13	2.52	1.46	0.61	11.29	3.02	1.46

Source: I&FF Calculations 2011

The I&FF assessment shows that between 2010 and 2030 US\$15.78 million are necessary to implement the measures of the adaptation scenario compared to the baseline scenario. It is noteworthy that there is significant potential for net savings from the implementation of the measure 'improving agriculture land and water management', which would lead to savings of US\$10.33 million of financial flows and US\$4.72 million of operation and maintenance costs, as well as from the measure 'development of livestock species resistant to weather conditions', which would lead to savings of US\$3.44 million in terms of financial flows and of US\$0.08 million in terms of operation and maintenance costs. Balancing savings against additional I&FF needed, each measure will need:

- Improving agriculture land and water management: Savings of US\$10.94 million(!), much of the savings will happen for corporations, but also for households and government.
- Development of agriculture chain and market promotion: 14.31 million, mainly as investments from corporations.
- Sustainable farm management: US\$ 12.60 million, much of which as investments from corporations, while decreasing needs for domestic borrowing and government expenditures.
- Development of livestock species resistant to weather conditions: Savings of US\$0.19 million(!), decreasing expenditures of all government, corporations and households and therefore freeing up important funds for other purposes.

Looking at the different types of funds needed it can be seen that most will be needed for investments in improved and more efficient equipment, while financial flows and operation & maintenance costs will decrease as a consequence and even lead to savings.

Looking at the time horizon gives further important information on the necessary investment scenario to realize these savings together the associated effects of adaptation: The main share of the investment is needed immediately, within the two first years of the projection horizon: All four measures should receive their peak investments immediately, while in the later years the amounts of needed I&FF and O&M decrease. In the first two years, it is needed as I&FF and O&M:

- Improving agriculture land and water management: US\$1.32 million
- Development of agriculture chain and market promotion: US\$1.14 million
- Sustainable farm management: US\$0.46 million
- Development of livestock species resistant to weather conditions: US\$1.11 million.

This I&FF assessment reviews and analyses existing and projected investment flows and financing relevant to the development of an effective and appropriate national response to climate change. It provides an assessment of the investment and financial flows that will be necessary in 2030 to meet the country's requirements for mitigating and adapting to climate change under different scenarios of social and economic development, especially as they impact the well-being of populace.

The additional estimated amount of investment and financial flows needed in 2030 to address climate change is large compared with the funding currently available within the country. In

many sectors the lifetime of capital stock can be thirty years or more; and the fact that total investment in new physical assets is projected to be too huge between 2000 and 2030 provides a window of opportunity to direct the financial and investment flows into new facilities that are more climate friendly and resilient. The investment decisions that are taken today will affect the country's emission profile in the future.

When considering means to enhance investment and financial flows to address climate change in the future, it is important to focus on the role of private-sector investments as they constitute the largest share of investment and financial flows in the assessment. However, improvement in, and an optimal combination of, mechanisms, such as the carbon markets which The Gambia stands a chance to benefit particularly the private sector will be active in this area. The carbon market, as mentioned earlier is already playing an important role in shifting private investment flows, would have to be significantly expanded to address needs for additional investment and financial flows.

Appropriate national policies and/or incentives, can assist in shifting investments and financial flows made by private and public investors into more climate-friendly alternatives and optimize the use of available funds by spreading the risk across private and public investors. Certainly additional external funding for climate change mitigation and adaptation will be needed, particularly for sectors that will require more I and FF by 2030.

Based on all the analysis and investment categories indicated that, Development of Agricultural Chain and Market Promotion will have the highest cumulative investment cost. This is estimated to be incurred in the year 2030.

3.2 Policy Implication

Given these results of the I&FF assessment, the need for immediate action is most obvious: Acting now to implement the analyzed measures will not only be needed to adapt to climate change in the agriculture sector, but lead to decreased expenditures and even in some cases to savings. Realizing these savings will be important to free up scarce resources to implement the remaining measures. Once the investments are realized as described in the adaptation scenario, financial flows and operation and maintenance costs will consume less of the national budget as well as from households and corporations. To achieve this, it will be important for decision makers to know the figures provided above, that mobilizing an average of US\$1 million for each of the four analyzed measures will not only lead to a significant contribution of adaptation to climate change in the agriculture sector and therefore increase people's well-being, but also convert daunting amounts of future costs into less costs, savings, and more efficient appliances.

First and foremost, the Agriculture and Natural Resource Policy (ANR) which is about to be ready has not lost sight of climate variability and has been treated fairly in the policy. The ANR Policy has spelt out clearly the implication of the climate and the strategies to be used one of which is the GANIP. The GNAIP has indicated lots of the policy activities to be implemented to cope with climate change among others.

There should be specific policy on the following among others:

- Improvement of Agricultural Land and Water Management
- Development of Agricultural Chains and Market Promotion
- Sustainable Farm Development
- Development of Livestock Species Resistant to Weather Conditions
- Appropriate policies
- Quality control
- Enforce tax incentives
- Strengthen public-private partnerships
- Reinforce awareness raising campaigns.

Based on the forgoing analyses of the huge I&FF needs of The Gambia for mitigating against and adapting to the impacts of climate change, a huge burden of responsibilities are placed on the shoulders of the of country's policy makers to introduce radical and sweeping new priority investment initiatives such as the Gambia National Agricultural Investment Program (GNAIP). Consequently, the political class must be won over to appreciate the gravity of the problem. Here is a quite a ray of hope in that currently, there exists an active a dynamic Environment and Sustainable Development Sub-Committee of the National Assembly whose members are mainly people with backgrounds in agriculture and natural resources discipline. This, and the fact that top appointees to positions of environmental management such as the current Minister of Forestry and the Environment (Ex Head of the Forestry I&FF Team), are strong enablers for a sustained positive policy environment for national budgetary support towards climate change investments.

Given the potential severe consequences of a 'business as usual' scenario, huge public sensitizations on both the causes, consequences and mitigation/adaptation options required to save the country from the calamities of climate change. This is necessary because a lot o the CC problems are attitudinal and/or cultural in nature and hence, demand painstaking education, training and mentoring of broad strata of society. Civil Society Organizations (CSOs) are particularly suited for these grassroots forms of this program component and would prove critical to its successful implementation.

3.3 Key Uncertainties and Limitations of the Methodology

There are institutional, economic, social and technological challenges to accomplishing a high quality analytical product. Institutionally, relevant data are scanty at best in such lead institutions like GBoS, MOFEA, and even the Central Bank of the Gambia, DOP, or often times, totally absent in these sources.

Such human factors like the loss of institutional memory arising out of the departure of experienced staff, unwillingness to divulge information to others, and perhaps, hidden envy to the consultants, are social causes of the analyses.

Another significant uncertainty over the program is that there is no clearly identifiable and willing sources for the huge I&FF outlay. Governments may be willing, but simply lacks the revenue base to provide the needed resources. Similarly, as recently established by the international NGO, Oxfam the industrialized countries are not just failing to meet their commitments made at all global level. Although the GNAIP is a very good start which is program base and will certainly go a long way in alleviating some of the uncertainties cited above.

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