QUICK SCAN GHANA

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The Quick Scan for Ghana is commissioned by the Netherlands Space Office (NSO) within the framework of the Geodata for Agriculture and Water (G4AW) program. The following organizations have contributed to this document:

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INTRODUCTION

Within the framework of food security policy, the Ministry of Foreign Affairs of The Netherlands is implementing the programme **'Geodata for Agriculture and Water (G4AW) Facility'**[1]. The G4AW Facility aims to increase the agricultural sector output in G4AW partner countries. This is achieved by providing food producers with relevant information, advice and/or (financial) products through operational information chains using satellite data.

In the summer of 2014, a new call for tenders will be opened. In this call, the Ministry of Foreign Affairs of The Netherlands calls for good quality project proposals from viable partnerships.

Goal of the Quick Scan

The Quick Scan serves as input for preparing the country visit and the G4AW information and matchmaking workshop in Ghana. In the workshop, the local context, constraints and challenges in agriculture will be discussed. Furthermore, the background and details of the G4AW Facility is provided and the development of partnerships is promoted.

This Quick Scan provides an up-to-date information assessment on agricultural and associated activities. It provides information from different perspectives and in a wider context (climate, water management). Additional, stakeholders from different types of organizations are identified and reported. The document is initially supporting the country visits and workshop, but the provided information can also contribute to the development of partnerships that are intending to bring forward a proposal in the second call of the G4AW Facility.

[1] Source: http://www.spaceoffice.nl/en/G4AW-Facility/

1 ASSESSMENT OF GHANA WITH A FOCUS ON AGRICULTURAL ISSUES

Pressure on the agro-eco production systems caused by increased (overpopulation), climate changes and extreme weather conditions lead to a lack of natural local resilience. In this section, the most important challenges in the agro-eco systems in Ghana are given as well as an overview of (governmental) efforts to address the food security situation.

1.1 MAIN CHALLENGES IN GHANESE AGRO-ECO SYSTEMS

Ghana is located in West Africa and shares borders with Togo on the east, Burkina Faso to the North, La Cote D'Ivoire to the west and the Gulf of Guinea to the south. The country covers a land area of 238, 500sq. km. It is extensively endowed with water bodies, including the Lake Volta and Bosomtwi which occupy 3, 275sq. km while seasonal and perennial waters occupy 23,350sq km.[2]

Ghana's population is estimated at 25.37million (2012)[3] which is increasing at a rate of 2.1% per annum. Life expectancy at birth is 61years[4] and infant mortality rate is 2 per 1per thousand births. The World Bank classifies Ghana as a lower middle income country with a per capita income of $1,550(2012).

Political

Ghana is divided into 10 administrative regions subdivided into 216 distinctive metropolitan, municipal and district assemblies. The country has been relatively stable politically over the last decade and affirmed its democratic credentials following the peaceful outcome of an 8-month legal challenge to the legitimacy of the election of the sitting President John Mahama in 2013. In spite of significant work carried out by Civil Society Organizations (CSOs), women remain underrepresented in public life, with 29 out of 275 proportion of seats held by women in parliament.

Ghana's press enjoys a high degree of freedom, with a very active press able to criticize government policy and performance without significant restrictions.

Climate

Ghana has a tropical climate with three hydro-climatic zones:

- The Volta Basin System – covers the northern part of the country with mean annual rainfall of about 1000mm in the savanna area and 1500mm-2000mm in the forest area.
- The Coastal basin system –the driest, with mean annual rainfall of about 900mm,
- The South-Western system – the most humid, with mean annual rainfall between 1,500mm and 2,000mm

There are two rainfall regimes identified in Ghana –8a) the double maxima regime occurring south of latitude 8º30`N, with two maximum periods occurring from May to August and from September to October; and b) the single maximum regime found north of latitude 8º30`N, where there is only one rainy season from May to October, followed by a long dry season from November to May.

Rainfall patterns and temperature in Ghana are significantly influenced by the tropical rain belt (also known as the Inter-Tropical Conversion Zone (ITCZ) and the West African monsoon winds. In northern Ghana, the wet season occurs between May and November when the ITCZ is in its northern position and the prevailing wind is south-

[2] Source: http://countryadaptationporfiles.gfdrr.og

[3] Source: World Bank Country reports-Ghana

[4] Source: ibid

westerly, and the dry season occurs between December and March, when the 'Harmattan' wind blows north – easterly. The southern coastal strip is dry and different from the north and south.

Seasonal variations in temperature is greatest in the north, with the highest temperatures in the hot, dry season April, May and June at 23-30°C , in the south 22-25°C (June, August, September). Temperatures in the north have sometimes exceeded 40°C.

Agro-ecological zones

Ghana has 5 main agro-ecological zones defined on the basis of climate, and reflected in the natural vegetation and soils. These are Rain Forest, Deciduous Forest, Transitional Zone, Coastal Savanna and Northern Savanna (Guinea and Sudan Savanna). The relative coverage of these zones and agriculture activity periods are indicated in the table below[5]:

Agro-ecological Zone	Mean annual Rain (mm)	Growing Period (Days)	
		Major season	Minor season
Rain Forest	2,200	150 – 160	100
Deciduous Forest	1,500	150 - 160	90
Transitional	1,300	200 - 220	60
Coastal	800	100 – 110	50
Northern Savanna:			
Guinea Savanna	1,100	180 - 200	*
Sudan Savanna	1,000	150 - 160	*

TABLE 1.1: AGRO-ECOLOGICAL ZONES[6]

* Rainfall distribution is bimodal in the Forest, Transitional and Coastal Zones, giving a major and minor growing season; elsewhere (Guinea Savanna and Sudan Savanna), the unimodal distribution gives a single growing season.

Climate Change

Ghana already experiences extreme weather conditions, with higher incidences and longer periods of flooding and drought. From 20year observed data, temperatures in all zones are rising, whereas rainfall is reducing and becoming increasingly erratic. Temperatures have warmed by 1°C over the last three decades[7]. Ghana's climate future, based on the World Bank study[8] (covering a 50year period to 2050) and UN's 2000 projection for the 2060-2090 period indicate that a projected increase in mean annual temperature by 1-3°C by 2060. Temperature increases are expected to average 1.4°C in most of the country except the north where they are expected to increase by 2.1-2.4°C. Total annual rainfall is projected to decline by 1.1% and 20.5% in 2020 and 2080 respectively. The forecast for precipitation gives a cyclical pattern for all regions, with high rainfall levels followed by drought almost every decade. Changes in run off and stream flow are expected to worsen incidences of floods and drought in both rural and urban areas. Irrigation water demand and hydropower generation could be affected considerably. The Government of

[5] Source: 'Agriculture in Ghana – Facts and Figures 2012' -Published by the Statistics, Research and Information Directorate (SRID) of the Ministry of Food and Agriculture (MOFA), August 2013

[6] Source: Meteorological Services Department, Accra.

[7] Source: Ghana 2nd National Communications to the UNFCC, Feb. 2011 in Cameron 2011.

[8] Source: 'Economics of Adaptation to Climate Change –Ghana country study', December 2010'

Ghana has recognized that this will affect river levels in upstream areas outside the country and thus identified the need for regional dialogue in the management of shared water sources.

The anticipated climate changes are expected to have adverse social and environmental impact on human well-being, food security and water availability. This is particularly so for a country highly dependent on agriculture especially the cocoa sub-sector which contributes more than 30% to annual GDP. The potential adverse effects were experienced in 2007 floods when 112mm of rain fell in 24hours in one town in northern Ghana – 20% of the annual average in one day. 317,000people were affected, 1,000km of roads were destroyed 210schools affected, 45 health facilities damaged and 630 drinking water facilities were damaged or contaminated. Thousands of people were displaced in the north were displaced by floods that killed more than 30people[9]. More than 80% of the disasters in Ghana are thought to be the result of climate-related impacts: flooding, drought, pests, disease outbreaks, wind storms and extreme weather events that contribute to climate-induced migration.

The Government of Ghana has taken significant steps in addressing climate change adaptation by setting up a cross-sectoral National Climate Change Committee (NCCC) that has guided the development a National Climate Change Adaptation Strategy. The Ministry of Environment, Science Technology and, Innovation (MESTI) that hosts the NCCC announced in May 2014[10] that a National Climate Change Policy has been developed and a master plan for its implementation is almost completed. The strategy had already outlined key priority climate change adaptation projects to build resilience, including (specific to agriculture and Water)[11]:

- Increasing resilience through identifying and enhancing early warning signals
- Alternative livelihoods: minimizing impacts of climate change for the poor and vulnerable
- Adapting to climate change through enhanced research and awareness creation
- Managing water resources to enhance productivity and livelihoods
- Minimizing climate change impacts on socio-economic development through agricultural diversification
- Adaptation to climate change: sustaining livelihoods through enhanced fisheries and resource management.

Ghana is very active in international fora and a signatory to major climate change protocols. There are ongoing collaborative efforts with its development partners – neighboring, bilateral and multilateral agencies to address vulnerability reduction and Disaster Risk Management.

To achieve the intents of its climate change strategy though, Ghana has to address significant research, data and information gaps, specifically:

- The quality and coverage of available information varies in Ghana, both in terms of hydro-metrological data and in respect to the analysis of biophysical and socioeconomic implications.
- While there are many institutions carrying out research, there is a lack of educational programs that directly address Disaster Risk Management (DRM) particularly at secondary and tertiary school levels.

[9] Source: Ghana goes for Green Growth' National engagement on climate change – Discussion Document 2010

[10] At the 'Meet the Press' session, as published by the 'Daily Graphic' newspaper – 21/05/2014

[11] National Climate Change Adaptation Strategy as quoted in 'Vulnerability, Risk Reduction and Adaptation to Climate Change; Country briefs. Source: http://countryadaptationprofiles.gfdrr.org.

- The outputs of research need to be shared in appropriate forms for various social categories and across many sectors, including the private sector, the media, non-governmental organizations and communities.

Land use, Economic activity and its development

An estimated 16% of Ghana's land area is used for tree crops, and 14% for cash crops with forest reserves occupying only 7%. Wildlife reserves cover another 5% and unreserved forest 2%. The largest portion of the country's land (26%) is covered by savanna woodland, bush fallow and other uses (17%) and unimproved pasture (11%)[12]. This is based on 1991 data provided by recent publications of MOFA and may have changed significantly, reflecting the challenge of updated information in public institutions. Specifically for agriculture, the table below indicates how land is utilized:

Type of Land Use	Hectares	%
1.0 Total Land Area (T.L.A.)	23,884,245	100.0
2.0 Agric. Land Area (A.L.A.)	14,038,224	58.8
2.1 Area under cultivation (2012)	7,847,300	55.9
2.2 Total area under irrigation (2012)	30,345*	0.4
2.3 Area not under cultivation (2012)	6,190,924	44.1
3.0 Area under inland waters	1,100,000	4.6
4.0 Others (forest reserves, savannah woodland, etc)	9,125,721	38.2

TABLE 1.2: TYPE OF LAND USE [13]

Note: Percentages will not add up to 100, because percentages of areas under cultivation, irrigation and inland waters are of the Agricultural Land Area (ALA).

Irrigation is expected to expand significantly under the Government's irrigation development scheme and this should also have an effect on the area under cultivation.

Economy

The agricultural sector continues to be a key sector in ensuring food security and poverty reduction .As at 2012, Agriculture accounted for 50% of national employment and a little over 22% of its GDP[14]. The overall growth of the sector was 1.3% in 2012, compared to 0.8% in 2011, but well below the target growth rate of 4.8% envisaged in the year, significantly surpassed by the services sector that formed about 50% of GDP in 2012. The agricultural sector

[12] Source: SRID, August 2013, with data from Medium Term Agric. Development Program (MTADP) Document (1991).

[13] Sources: The Ghana Survey Dep't and MOFA, Accra

[14] [15] Source: The State of the Ghanaian economy in 2012' Institute of Statistical Social and Economic Research, University of Ghana, Legon.

has seen a gradual decline in its share of total GDP from a peak of 31.8% in 2009[15]. The main sub-sectors of agriculture as classified by MOFA are Crops, Cocoa, Livestock, Forestry/Logging, and Fishing.

Over the last decade to 2008 Ghana has achieved a solid economic rate of 5.2% on average and reaching an unprecedented 14.4% in 2011 which has gradually reduced to 7.2% (2012) but further decelerated to 4. 4% in 2013. Growth has been driven largely by service-oriented sectors and industry, which on average have been growing at a rate of 9.0% over the five years up to 2013. Over the medium term, the economy is expected to register robust growth of around 8%, bolstered by improved oil and gas production, increased private-sector investment, improved public infrastructure development and sustained political stability. Perhaps the most significant challenge facing Ghana will be the management of oil revenue following the initiation of oil extraction in 2010 which is expected to increase annual growth rates up to 12%[16].

Food

The main issues concerning Food can be classified in the following broad categories:

- *Food security and Emergency preparedness: 2*009 nation-wide study confirmed[17] that although generally, Ghana is considered to be food sufficient, especially in its main staple crops (cassava, maize, yam, sorghum and millet), food accessibility is not optimal, leading in some areas to high malnutrition. 5% of the population or 1.2 million people have very limited access to sufficient and nutritious food for an active and healthy life and are thus considered food insecure. Regional disparities exist however, with the three northern-most regions experiencing levels of food insecurity between 15-34% of their populations. Another 2 million people are vulnerable to food insecurity, as their diets are inadequate and negative changes in seasonal factors or shocks from food price increases as occurred in 2007/8, or poor harvests would make them food insecure. Most of these are in the rural areas of Brong Ahafo, Ashanti, Eastern and Volta regions. One of the livelihood categories considered most vulnerable to food insecurity are food crop farmers who have the lowest per capita income in the country.
- *Human resources and Managerial skills*: Agriculture engages more than 60% of the population including farmers, traders, processors, transporters. The farmer population is ageing (average age 53yrs) and yet the sector is unable to attract the youth. High illiteracy among producers means a constant need for facilitating their access to information on new approaches, opportunities and policies. High incidence of poverty among farmers limits their ability to respond to opportunities due to lack of capacity and risk aversion.
- *Sustainable Natural Resource Management:* Agriculture in Ghana is based on natural resources with extensive crop and livestock production systems, hunting, rain-fed agriculture and fish from natural-water bodies. Traditional practices such as bush burning, the improper use of technologies do not engender the sustainability of resource use. 69% of the land surface is considered prone to severe erosion coming at a cost of 2% of GDP. Communal ownership of land and absence of demarcated grazing lands result in over-grazing and conflicts between livestock-keeping and crop farming. There is a general lack of awareness among many farms of the link between inappropriate tillage and water management on one hand and environmental degradation on the other. Additionally, rules and regulations on environmental

[16] Source: Catherine Cameron 'Climate Change Financing and Aid effectiveness – Ghana Case Study' -revised April 2011 commissioned by OECD/DAC

[17] Source: 2009 WFP 'Food Security and Vulnerability analysis of Ghana'

management for agriculture land use, although existing, have not been optimally enforced by responsible public agencies.

- *Technology Development and Dissemination:*
    - With average farm sizes of about 1.2 hectares and low adoption of improved technology, crop yields are about 60% of achievable levels. Low productivity of crops is also due to the inadequate use of fertilisers, improved seeds and planting materials, as well as appropriate insecticides and other disease preventing chemicals. Agriculture is mainly rain-fed with low level and performance of irrigation, low levels of mechanization in production and processing. Many crops in Ghana experience high post- harvest losses as a result of poor post- harvest management. The use of traditional processing technologies is prevalent, resulting in low yields or poor quality. The absence of labour-saving technologies and imbalances in the delivery of extension services to disseminate information has had negative impacts on the productivity of farmers and local processors alike.
    - Livestock breeds are of low quality there are limited interventions that effectively address problems of lack of feed and water, particularly in the dry season.
    - The low application of technologies to alleviate these problems is also attributed to supply driven approach to technology generation and dissemination (top-down planning).
- *Infrastructure:*
    - The road and transport infrastructure for the movement of agricultural commodities and inputs are still inadequate although a significant boost to this sector was given by the feeder road developed under US Government's MiDA[18] project. Poor feeder roads linking farms to villages not only affects the cost of important inputs such as fertilizer, but leads to drudgery as mostly women head-load foodstuff to markets.
    - The rate of expansion of irrigation infrastructure has been slow due to the high capital cost and private sector investment has been limited, due to the lack of incentives. Similarly, infrastructure for aquaculture development is limited.
    - Physical markets for farm produce are characterized by decrepit infrastructure, appropriate storage and hygienic premises. Most stakeholders, including the District assemblies lack capacity to effectively manage markets.
- *Market Access:* There is a general lack of market orientation among producer and processors. With increasing levels of multiplicity of standards (food safety and phyto-sanitary) in international trade Ghana is yet to step up to the challenge of competitiveness in high value agriculture export commodities. Domestically, there is low consciousness o majority of consumers and producers about food safety and this does not engender a culture of good agricultural and manufacturing practices in food value chains.

Water[19]:

- *Water Resources* - Surface water resources are mainly from three river systems that drain Ghana - Volta, Southwestern and Coastal systems covering 70%, 22% and 8% respectively of Ghana's total land area. In addition to these, the only natural freshwater lake in Ghana is Bosomtwi, which is a meteoritic crater located in the forest zone, with a 5 area of 50 km', and a maximum depth 78m.
- The main consumptive uses of water in Ghana are water supply, irrigation and livestock watering. On the basis of surface water resources alone, the consumptive water demand for 2020 has been projected to be

[18] The Millenium Development Authority managed the The Millenium Challenge facility of $547million

[19] Source: Water Resources Commission website

5 billion m3, which is equivalent to only some 12% of the total surface water resources. Notwithstanding the availability of water to meet water supply, there are however deficits in coverage. The main non-consumptive uses are inland fisheries, water transport and hydropower generation. Impoundments and reservoirs have been constructed for hydropower generation, potable water supply and irrigation.

- Variability of amount of water from season to season and its distribution in the different climatic zones, with the south western part being better watered than the coastal and northern regions.
- Decreasing availability of water due to the effects of climate change, rapid population growth, increased environmental degradation, pollution of rivers and draining of wetlands. The extent and locations of these are not always known, due to limited accurate data.
- Significant pressure on The Volta River, with a catchment area within Ghana of nearly 70% of the country, and by far the largest river draining the entire north, center and east of the country. The remaining rivers, all in the south and southwest, drain about 30% of the country. The Volta River basin is shared with Cote d'Ivoire, Burkina Faso, Togo, Benin and Mali. The Bia is shared with Cote d'Ivoire, while the lower reaches of the Tano River also form part of the boundary with Cote d'Ivoire. Impoundments and reservoirs have been constructed for hydropower generation, water supply and irrigation. At Akosombo, 100 km from the mouth of the Volta, the first Volta hydroelectric dam was constructed in 1964, which has created one of the largest man-made lakes in the world, covering an area of about 8,300 km2. The river is dammed in several other areas.
- Due to significant small scale illegal mining activities, locally called ‘galamsey’, urban and industrial pollution as well agricultural development, surface water quality considerations are becoming increasingly important.
- Data needs include reliable data on water quality for proper management, protection and development of surface water resources for the future. Appropriate hydrological data is required for the current and future development of urban drainage in a number of Ghana's major cities, for which flood and storm runoff data is needed for proper planning and design.

When looking at the interface of water and its relation to agriculture in Ghana, soil fertility and nutrients for the crop growth are of main concern. These nutrients are transported by groundwater and soil water flows in the saturated and unsaturated parts of the soil matrix. In Ghana there is a structural loss of nutrients due to chemical and physical degradation of the soil and with that a decrease of the natural soil fertility of agricultural grounds.

Due to climate change more extreme weather changes induces erosion processes with serious loss of organic matter (either oxidation or surface runoff in dry and flooding situations). The organic matter is the regular basis of soil minerals in the soil matrix after normal decomposition and with that the soil fertility when the system is in balance. The soil water balance plays a crucial role in this sensitive equilibrium. When the water balance is disrupted and fertility decreases, harvests of crucial crops in Ghana are decreasing too (especially Cacao, see below the trend in Cacao production in 2010)[20].

[20] Source: http://ghana.opendataforafrica.org/tawpnve/ghana-fao-stat-water-resources-agriculture-production-and-trade

Production quantities for selected commodities

		1995	2000	2005	2010
(1000 t)	Cereals	1,797	1,711	1,948	2,907
	Oilcrops	215	246	320	355
	Coarse grain	1,595	1,462	1,661	2,415
	Paddy rice	202	249	287	492
	Coffee	4	2	1	1
	Cocoa beans	404	437	740	632

Source: Production Statistics - Crops and Crops Processed , 2012

TABLE 1.3: PRODUCTION QUANTITIES

Food industries like MARS have a direct interest in sustainable growth of cacao and continuity in performance and harvest each year. In the North of Ghana the most important agricultural activity is Cacao (is almost 1/3 of world's cacao provision!). In that region the cacao suffers from the increasing droughts which have serious impact on the growth performance. Knowing that new cacao plants need about 10 years before significant productive levels are reached and the fact that most agriculture is rain fed and climate dependent, a few bad seasons can cause already structural problems. NGO's like Solidaridad are well networked in this sector and have an interest in improving the conditions of the smallholder farms active in Cacao production.

Other important crops are Cassave, Sorghum and especially Pineapple (with large contract farms)

Beside Cacao (smallholders mostly organised in cooperatives) there is also an important activity in Palmoil plantages. These crops together with Pineapple are important and large scale agricultural activities for input to large food concerns (like MARS)

The above (lack of water and nutrients) trend in Ghana's agricultural sector creates increased dependency on industrial fertilizers (NPK of which phosphate is the most important decreasing base nutrient in agriculture) which need to be imported with enormous costs involved[21].

[21] http://ghana.opendataforafrica.org/rdogje/ghana-fao-stat-land-use-and-agricultural-inputs

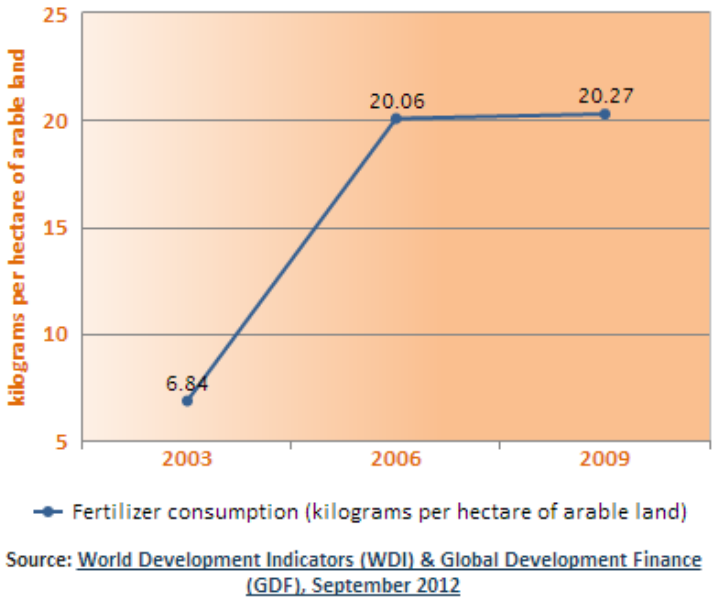

FIGURE 1.1:KILOGRAMS PER HECTARE OF ARABLE LAND

The FAO is also active in advising the agriculture sector in improving the crop performance (Rapid Appraisal Irrigation performance, Cropstat, Aquastat).

There are water boards in the various basins of Ghana and they are centrally organized (parastatal) under the Ministry of water. There is policy on integrated Water Resource Management (Water Resource Commisison).

As far is known there are no Dutch Water boards involved in Ghana. In Ghana there are drinking water concerns active (WASH sector) like Vitens and WereldWaterNet has also interest in Ghana.

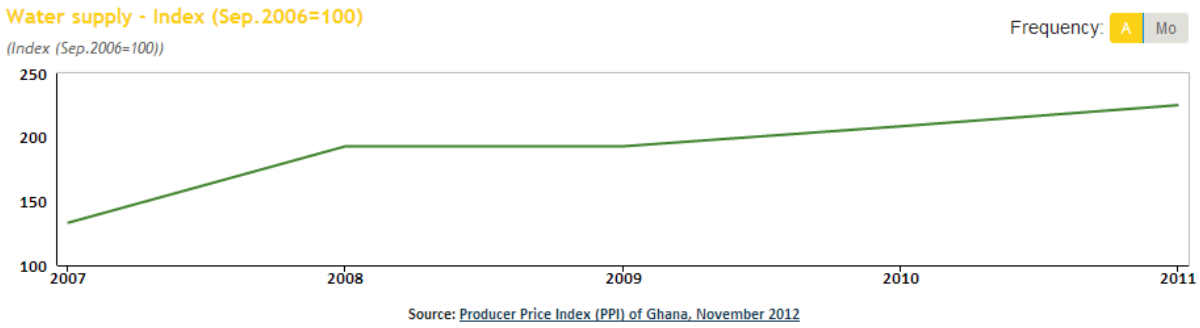

FIGURE 1.2: WATER SUPPLY INDEX

From the general water supply statistics, it can be concluded that water supplies increased since 2006 almost 200%, which illustrates the increase in consumption in agriculture (irrigation), which is one of the most important water users.

1.2 GOVERNMENTAL EFFORTS AND POLICY ON FOOD SECURITY

The overall operating policy framework for Ghana's Medium Term Development is the Ghana Shared Growth and Development Agenda (GSGDA) – 2010-2013. All other sector policies are guided by the broader objectives of the GSGDA. The key strategic thrust of the GSGDA is to lay a foundation for the structural transformation of the economy through industrialization, especially manufacturing, based on modernized agriculture and sustainable exploitation of natural resources, particularly mineral, oil and gas. Within this framework, agriculture is expected to lead the growth and structural transformation of the economy. The GSGDA devotes a chapter to Climate change with an evolving institutional architecture to support it.

Agriculture Policy

The Food and Agriculture Sector Development Policy (FASDEP II) is the comprehensive policy framework for modernizing Ghana's agricultural sector. The policy envisions that the food and agricultural sector is modernized to bring about structural transformation to the economy, evidenced by food security, employment and poverty reduction. This is linked to the GSGDA vision to achieve accelerated growth propelled by a modernized private sector-led agriculture. Six key policy intervention areas are outlined in the FASDEP II as follows:

- Food security and emergency preparedness
- Increased growth in incomes
- Increased competitiveness and enhanced integration into domestic and international markets
- Sustainable management of land and environment
- Science and Technology applied in food and agriculture development
- Improved institutional Coordination

To make good its intentions, the Ministry of Food and Agriculture (MOFA), lead government agency for the agriculture sector facilitated the development of a Medium Term Agricultural Development Plan (METASIP) 2011-2015 to implement the programmes under the FASDEP II. The plan is the result of a consultative, technical and budgetary process that identifies results and resource requirements, as well as roles that stakeholders in the sector will play in its implementation. It was intended to adopt a Sector Wide Approach (SWAp) in its implementation, to ensure inclusion of other sectors in effective coordination and participation.

Some of the significant programmes being carried out by government to realize its vision are:

- Agricultural Mechanization – establishment of mechanization sectors in 62districts (2012) equipped with tractors, maize shellers and water pumps to offer services to smallholder farmers. Capacity building is provided for operators.
- Fertiliser and Seed Subsidy Programme – making fertilisers and improved seeds, accessible and affordable to smallholder farmers
- Irrigation development – to reduce the reliance on rainfall in selected areas – Tono Irrigation Scheme in Northern Ghana, Accra Plains. The rehabilitation of the Tanoso Weir and Ave Afiadenyigha projects have restored 64ha and 20ha arable land under cultivation. Breached dams in three northern regions are being restored.
- Youth in Agriculture (YIAP) – to promote food security and alleviation of youth unemployment. Initiated in 1999 to support 80,000 youth in crop/block farming, fisheries/aquaculture and agribusiness.
- Extension services – To encourage the adoption of technology by farmers. In collaboration with the World Bank and the West Africa Agriculture Production programme (WAPP) piloted in 2013 an e-Agriculture and e-extension programme that provides a free multi-lingual interactive voice response system and audio

conferencing and messaging service to agricultural producers. It currently attracts over 40,000 active subscribers and an average daily usage of 2,000 accessing via mobile phones in 5 different local languages. Up-scaling is underway to cover the entire country and include 11 languages. A toll-free multi-lingual call centre is also on the cards at the MOFA resource centre.

Water Policy

Ghana's Water Policy (2007) is the overall strategic framework for the sector. The overall goal of the Policy is to "achieve sustainable development, management and use of Ghana's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations"[22].

The key focus areas of the policy are:

a) Achieving efficient Integrated Natural Resources Management
b) Ensuring access to Water without discrimination to all residents
c) Ensuring availability of water for food security for all seasons
d) Managing demand, availability and efficient use of water for non-consumptive purposes.
e) Financial sustainability in water resource management through equitable pricing and alternative funding mechanisms

Information and Communication Technology (ICT) Services

ICT services have seen significant development in Ghana, growing at 17% and 12.1% respectively in 2011 and 2012. The growth has been supported by government policies geared towards promoting and improving the delivery of services including the improvement in the fiber-optic base of the country, and opening up of ICT market to the private sector. The mobile telecommunications industry has been expanding considerably from a subscriber base of about 383,000 in 2002 to 27.5 million in 2013(National Communications Authority) with 6 cellular phone operators, over 280 authorized radio stations, and more than 130 authorized service providers. As at August 2013, MTN held the largest share of the market (45.8%), Vodafone (21.2% and Tigo (13.76%), Airtel (12.2%) and Glo (5.92%) and Expresso (0.57%). In the fixed telephone sub-sector, Ghana Telecom/Vodafone have the largest market share (96%) followed by Airtel (3.6%).

ICT services are not evenly distributed in the country as only the largest providers have national coverage. However in every region of the country the full range of services is available. According to Ghana's National Communication Authority (NCA) by August 2013 internet penetration rate in the country reached 40.7%.

Spatial Information

Since the early 1990s various efforts have been made by the Government of Ghana, World Bank and other development partners to establish a legally mandated Spatial Data Infrastructure (SDI) to strike a balance between economic development and sustainable management of renewable resources. These efforts led to development of National Framework for Geospatial Information Management (NAFGIM) in 2000, as part of a National Environmental Action Plan (NEAP). NAFGIM is no longer functional, however consultancy services have currently been procured to develop the National SDI (NSDI) vision, mission statements and objectives for Ghana[23].

[22] Source: Ghana Water Policy, of the Ministry of Water Resources Works and Housing

[23] Source: Wiafe, Owusu-Banahehe et al: 'A Description of Spatial Data Infrastructure Stakeholders in Ghana Using the ICA Model' 2013.

Most spatial information is procured through local agents from oversees principals as there is no ground receiving station for spatial information in the country. Significant interest however exists to achieve this, notable of which are:

a) West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL): funded by ECOWAS- member countries with the support of the German Federal Ministry of Education and Research (BMBF) to enhance resilience of socio-ecological systems to climate change and increased volatility. It achieves this through three components: Competency centre (Research and capacity development & Climate Service). The Climate Service Centre will organise an observation network in member countries to provide consistent on weather and the hydrological cycle as well as changes in land use, human coping strategies and biodiversity loss. It will also accommodate the infrastructure for data reception, maintenance and access and interpretation. A Graduate Studies Program has been initiated in Ghana consisting of six doctoral and four masters' programmes around Climate Change.
b) Ghana Space and Technology Centre (part of the Atomic Energy Commission): This is a government initiative still in its nascent stage with the ambition to harness space technology for development. Has been operational for two years during which it has been carrying out sensitization largely with public institutions to garner support for making budgetary allocations for investment in a ground receiving station for spatial information. It current challenge is to raise the needed funds (estimated at $7million) to put up the station that it believes is necessary

There is however a general interest expressed especially from government agencies for high resolution spatial data for planning and monitoring land use and impacts of climate change and human actions on the environment. For the private sector there are only a few large agricultural companies that appear to be interested in spatial information (particularly those investing in the cocoa sector that have to meet deforestation regulations and new investors into Ghana). Procurement of spatial information is often done on individual basis and there is thus no shared database for such information to be accessed by interested parties.

2. ASSESSMENT OF STATUS AND PROBLEMS OF INFORMATION SUPPLY IN THE AGRICULTURAL SECTOR

For food (and water) security programs, actual and accurate (spatial) information is crucial for land and crop production systems to provide quick indicators on the context (e.g. water availability), status (e.g. biomass, crop type, acreage, etc.) and trends (within and in between seasons, years) of local farming practices/performance. In this section, the main challenges in information supply in Ghana are summarized as well as the institutional capacity to support viable information services.

2.1 MAIN CHALLENGES IN INFORMATION SUPPLY ENCOUNTERED IN AGRICULTURAL ACTIVITIES

National Level

- There is as yet no national legal framework to guide the collection, storage, analysis and regulation of the quality of (spatial) information. There is thus no coordinating body to provide a central point of access to metadata about available data sets, although it is envisaged that the World Bank's Land Administration Project (LAP-2) would provide a technological framework which will enhance access to spatial data, its use and sharing. As a result, information, even on national land, water and crop systems are incoherent and conflicting sometimes from the various sources. Efforts are underway to establish a Standard Data Infrastructure, however. Also with the establishment of WASCAL's regional service centre in Ouagadougou to provide infrastructure and expertise for data reception, maintenance , interpretation and scenario analysis there is good potential to support Ghana's needs.
- Most (spatial) information is outdated. The most recent national land use/cover maps for Ghana were done in 2003 and in the main public institutions information for planning are sought on an independent basis as needed. For instance, since the last district re-demarcation exercise in 2012, new maps have not been produced to reflect the changes.
- Inadequate expertise and capacity in public institutions for the processing (analysis) of digital data.
- Limited budgetary provision for procurement of timely, accurate (high resolution) and relevant spatial information.

Regional Level

- Limited use made of spatial information in development planning processes, often due to lack of appreciation (awareness) of the added value of spatial information for planning and monitoring.
- Inadequate human resource capacity in decentralised units of government for effective use of information
- Insufficient budgetary funds for acquisition of information (often considered expensive from private sources)
- Spatial information more used in large crop (mostly perennial crop e.g. cocoa and cash crop) plantations and acquired on individual basis by investors. There is thus no opportunity to develop database in public institutions.

Local Level

- Limited sharing of information among value chain actors – most information is generated by NGOs supporting projects and kept in their own databases. The efforts of the IFDC mFARMS and USAID's ADVANCE projects' online platforms are new initiatives in this regard.
- High illiteracy level require appropriates and innovative packaging of information for food producers (farmers) and micro level processors, traders, transporters in the value chains.
- Significant lack of awareness of spatial information and use in agricultural practices.

- Low coverage of public extension services – Extension Officer: Farmer ratio is about 1:1,300, thus limiting direct technical information access by many small scale farmers. The introduction of e-extension services, accessed by smart-phones is a new initiative by MOFA. This is yet to be up-scaled to all the districts in Ghana.

2.2 Institutional capacity to support viable information services

2.2.1 General information suppliers active in agriculture domain

In Ghana there is not a centralized Cadastre, however landownership is organized locally for each kingdom and local chiefs in various ways causing a dual infrastructure (traditional and modern)[24]

As agricultural investments on longer term, the information infrastructure on landownership is of utmost importance to grow sustainable business. When building partnerships with local organizations it is important to involve local kingdoms and chiefs.

In the main cities also the ministries (agriculture, water) are represented and active in the region. So are the related extension services for advising farmers in the region.

In general Ghana has a unique open data system[25], however it still lacks databases with spatial information and certainly satellite data. However most data of the national census statistics is published and very informative in case of agriculture and somewhat less water sector issues.

Governmental Agencies

a. Ministry of Food and Agriculture's Statistical, Research & Information Department (SRID) – Crop Production and Yield Data, geo referencing coordinates (acreages), marketing data, commodity transport cost build up, food Supply and Demand data, food security and nutrition analysis. Introduction of e-Agriculture and e-extension services indicated above.
b. Environmental Protection Agency (EPA) – distribution of environmental information to public
c. Ghana Meteorological Services Agency – rainfall data (trends & forecasts)
d. Survey and Mapping division of the Lands Commission– topographical maps –Land cover Atlas for Ghana-1998; Land cover/land use data – 2003
e. Forestry Commission (Resource Management Department) – land use maps and imagery to track deforestation, Impacts of natural disasters, monitoring movement of animals in game reserves.
f. Water Resources Commission

PPP

g. CERSGIS Limited – Initiated under a World Bank loan by Government in the 1990's to maintain a digital database of land use, now an autonomous company limited by guarantee with EPA and University of Ghana as guarantors. Currently the key provider of precision satellite information to the National Development Planning Commission(NDPC), World Bank, UNDP, Ministries and private sector on request for a fee. Services include Remote Sensing (Natural Resource Monitoring, Satellite Image Analysis, Land Cover/Land Use Mapping, Image Map production, Agricultural risk mapping); GIS & GPS (GIS/GPS data integration, spatial

[24] Source: http://www.ajol.info/index.php/just/article/view/33085

[25] Source: http://ghana.opendataforafrica.org/ and http://en.wikipedia.org/wiki/Ghana_Open_Data_Initiative

analysis, geo database development, customized GIS applications, Web GIS);Training (GIS, Remote Sensing, Global Positioning Systems (GPS) applications

Private Service Providers

h. ESOKO – A private company initially providing market price information via mobile phone introduced the first farmer helpline to provide expert agricultural advice to farmers in 2014. Helpline available in 12 local languages at regular call rates under partnership with MTN, Vodafone and Airtel with plans to sign on other telecom companies. Cost of usage subsidized for small scale farmers by INGOs like IFDC (international Fertiliser Development Company).
i. IGNITIA Limited – High technology company from Sweden providing weather forecasting and climate data based data obtained from space-born and land-based technology and advanced mathematical models[26]. Services are also delivered in pictures and text via mobile phones for farmers.
j. IMAGEAD Ghana – Host farms, an integrated and customized module based platform designed to help stakeholders in agricultural value chain communicate with each other, establish and maintain business relationships.

INGOs /Projects

k. ACDA VOCA – implementers of USAID's ADVANCE (Agriculture Development and Value Chain Enhancement) project in partnership with CERSGIS – Online GIS platform for agriculture[27].
l. Publications of International Organizations (World Bank, FAO,UNDP, AGRA)
m. IFDC (International fertilizer Development Centre) /Alliance for a Green Revolution in Africa – set up mFARMS platform - a web- and cell phone-based platform (www.mfarms.org) that provides affordable tools to build linkages and improve communications and operational efficiencies among actors along the agricultural value chain
n. Alliance for a Green revolution in Africa (AGRA) –provide grants for local agricultural development projects to enhance information delivery to farmers –eg mFARMS

Knowledge Institutes (Local, regional and international)

a. Agriculture and related faculties of Universities of Ghana, Legon and the Kwame Nkrumah University of Science and Technology and others) – training,
b. Soil Research Institute
c. Water Research Institute
d. IFPRI – Research publications
e. IMWI – Research – research publications
f. West African Science Service Centre on Climate Change and Adapted Land use (WASCAL) – Climate service (collection and analysis of data; policy advisory), Research and Capacity Development
g. Ghana Space and Technology Centre of the Atomic Energy Commission

[26] Source: www.ignitia.se

[27] Source: www.gis4agric.net

2.2.2 Specific agri-sector information supply and current mechanisms

a. Land Cover/Use maps – At national level, limited high resolution maps provided except by CERSGIS. Most access free satellite imagery products online-eg. LANSAT (often not the most recent versions) due apparently to high cost. Local Maps are otherwise provided at the district and community levels with GPS applications.
b. Production performance data (yield, volumes, crop types etc.) – statistical data collection via surveys (SRID distributed via Radio; mobile phones, newspapers
c. Market information (pricing at different markets, demand and supply data)collected through surveys – online interactive platforms e.g. (MFARMS), smart phones, market surveys
d. Rainfall data – Ground weather stations (collection);distribution via radio, mobile phones
e. Temperature and Humidity data – radio, newspapers,
f. Land and soil suitability data – through district and regional information systems (in respective decentralized department).CD-ROM, websites
h. Land ownership data –mainly through GPS applications - publication/print for users
i. Agronomic practices- appropriate use of fertilizer, technology, application of chemicals, other environmental protection practices – Television, MOFA's e-extension services via

2.2.3 Other sectors (and role of information) important for the Agricultural sector

a. Telecommunications: ICT applications for collection of accurate data, storage, analysis and dissemination via appropriate media to users. Innovations are required to package information that is also financially accessible for the large illiterate farming population.
b. Environment/Meteorology & Hydrology: Early disaster warning systems, climate change monitoring and forecasting, impact assessment of climate change, environmental risk profiling, for disaster management. More reliable weather forecast information for planning at all levels (national, regional and district).
c. Education: Capacity building (expertise) at secondary and tertiary levels for use of modern technology in data collection, analysis and information development for dissemination to users in agriculture. Also within public institutions responsible for the provision of agricultural information. General awareness creation and sensitization on use of modern technology for agriculture information gathering and sharing to improve adoption of new technologies.
d. Land and natural resources: Precision data on land use and cover, water bodies, soils and crop suitability for potential investors and development planning at national and district/regional levels.
e. Finance: Accurate & reliable data on land ownership, crop acreages, weather forecasts and associated perils to develop customized insurance products for agriculture value chain actors and support credit service delivery.
f. Roads and Highways: Mapping feeder road network to enable prioritizing of market access routes.

3. NEEDS ASSESSMENT OF IMPROVED ICT & INFORMATION SUPPLY IN THE AGRI SECTOR

In this section, an inventory of specific needs and problems in the information supply (and demand) in the Ghanese agri sector is provided. The most important local stakeholders represented in the identified problem domains are selected (short list). Furthermore, additional stakeholders in related domains need to be selected (e.g. water domain, nature, industry, etc.).

3.1 NEEDS ASSESSMENT WITH A FOCUS ON POTENTIAL USE OF SPATIALLY BASED INFORMATION SERVICES

Inventory of specific needs and problems in the information supply (and demand) in the agri sector:

- Needs assessment with a focus on potential use of spatially based information services (including micro insurance).
- High resolution satellite data for national level planning of land use, tracking of trends in climate, monitoring, and forecasting.
- Development of a national Spatial Data Infrastructure – setting standards on the generation, processing, storage and distribution of spatial data.
- For potential investors in agriculture, accurate data on forecast weather, soil suitability, land availability.
- Banks that lend to the agricultural actors require information on land ownership of agricultural producers especially small scale farmers and therefore more precise mapping of land. They also need full insurance cover for climate-related risks.
- More density of ground receiving equipment for met service data collection to improve reliability of weather data especially for weather-indexed insurance.
- Extensive public awareness creation/education on the added value of spatially based information services.
- Lack of effective demand for spatially based information across the agriculture value chains – need for improved appreciation of information. The largest consumer of spatially based information is the public sector.
- Limited expertise for the processing and interpretation of spatial data.
- Need for appropriate packaging and innovative distribution media for affordable information to achieve wide scale interest. Opportunities in provision of information in soil quality to improve agronomic practices related to seed broadcasting, appropriate use of fertilisers by local farmers.

3.2 PUBLIC AND PRIVATE PROBLEM STAKEHOLDERS AND INTERNATIONAL ORGANIZATIONS IN THE DOMAIN OF G4AW

In addition to the stakeholders list (see excel), contacts from the interviews with Gert de Bruijne NWP are:

- In Ghana several important industrial players in de food and beverage are active, like Cargill (cereals), MARS (Cacao), Unilever (PalmOil), Cocal Cola (Sugarcane), which depend on Ghana's agriculture and with that on Ghana's production environment
- IDFC (Andre de Jager) see above organisation on fertilisers in Ghana
- Solidaridad is an well networked NGO in the agricultural sector of Ghana
- GMB (located in Zutphen, The Netherlands) is an interesting partner organization on retrieving useful nutrients (like Phosphates) from solid waste for agriculture purposes (recycling). See also WASTE business model in the Dutch water program of NWPfor Ghana (and also Zambia and Kenya).[28]
- Cacoa Board[29],
- Palm Olive growers
- Pineapple growers
- Ghana Export Promotion Authority (GEPA)
- Solidaridad
- Thiery van Helden (EKN)
- University of Development Studies (Tamale)
- Insurance companies
- MARS
- Cargill
- Water Resources Commission of Ghana[30].

3.3 ONGOING G4AW RELEVANT ACTIVITIES AND/OR PROJECTS IN GHANA

The following activities are relevant for G4AW projects in Ghana:

a. USAID ADVANCE II Project/CERSGIS partnership to set up information platform
b. WASCAL Competency Centre – serving West African countries with geodata information and research outputs for policy advice
c. AGRA/NASA (United States Space Agency) partnership for the provision of satellite data information as part of AGRA's climate change support program – to be launched in Ghana in 2014
d. IFPRI partnership with MOFA

[28] For more information see: www.nutrientplatform.org or contact Wouter de Buck w.debuck@nutrientplatform.org

[29] Source: https://www.cocobod.gh/

[30] Source: www.wrc-gh.org/

3.4 REFERENCES TO PUBLIC DOMAIN PUBLICATIONS

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- Climate Change Financing and Aid Effectiveness Ghana Case Study:
- http://www.oecd.org/dac/environment-development/48458430.pdf
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4. INVENTORY OF POTENTIAL (CHAIN) SOLUTIONS DIRECTIONS USING GEO-ICT IN LOCAL AGRICULTURE ISSUES

4.1 BASE SOLUTION DIRECTIONS IN GHANA TAILORED TO LOCAL AGRICULTURAL PRACTICES

4.1.1. ACTUAL AGRI-SPATIAL INFORMATION SERVICES

In addition to earlier mentioned services with satellite and ICT capacity for agricultural application the following services could be solution directions:

Important to prevent nutrient losses in agriculture in general is to keep records of the intensity of agricultural activities of successive crops at a certain location. In this case monitoring of crop rotation (type of crops following up each other over the seasons) and the periods of rest (fallow land in between) is important in order to prevent exhaustion of the land. Also crop types and related to that the various crops specific treatments and diseases can be identified using remote sensing monitoring techniques.

Another issue is the monitoring of season duration and follow up. Due to climate change seasons do not have clear start and endings anymore, in this case planning and management requires spatial information management by farmer organizations or related organizations (food industry and commercial contracts)

Through this discontinuity water excess and shortage give additional impact and damage to agricultural sector/ Measures like planting instead of sowing seeds can prevent this kind of damage, but also planning and with that start of sowing the crops is important by using correct information (prediction and early warning mechanisms)

See also risk management using remote sensing assessments (and trends) can be input to insurance mechanisms to prevent unnecessary farm crop losses.

4.1.2. FARM INSURANCE AND RISK PREVENTION STRATEGIES

Ghana's Insurance regulation framework – The Insurance ACT 724 does not make provision for Agricultural (weather related) insurance. The GIZ (German Development Agency) initiated a project four years ago to set up the Ghana Agriculture Insurance Pool (GAIP) in partnership with the Ghana Insurers Association (GIA) which has membership of 19 insurance companies in the country. The intent was to assist the insurance industry to support smallholder farmers. The project ended in 2013 and GAIP is now a company registered by guarantee and has the exclusive mandate to carry out the business of agricultural insurance. It is expected however that the legal framework will be amended to include agricultural insurance. GAIP has developed three insurance products:

A. Weather-indexed insurance – only covers peril related to drought and provides risk cover on farms within 12miles/20km of weather stations. Risk is assessed in relation to expected rainfall pattern over the gestation of the crop and calculated average expected rainfall based on past trends. Farmer loss is the deficit between actual average rainfall over crop life span and expected rainfall. Product only covers selected cereals and legumes and only and in the 3northern regions.

   The initial period has faced challenges from low density of ground weather stations of the Ghana Met service. Most stations are located near met offices where security can be provided as stations originally were stolen. However Met offices are often in residential areas and thus are irrelevant for farm data

collection and accuracy of data collected. Basis risk was high. GAIP has had to supplement with satellite data.

B. Area yield index insurance – still at the pilot stage. Based on crop data provided by MOFA for average yields for last 20years, which is not always reliable. Also depends on accurate data on yields, farm performance records and monitoring.

   In 2011 GAIP signed on two large NGO projects including the ADVANCE projects and 2 rural banks in northern Ghana. Insurance cover was provided at the meso level –to nucleus farmers to cover their smallholders. 3000 farmers were covered. However in 2012 GAIP lost the Rural Banks as clients as their risks were realized, but the weather stations did not accurately read farmers data accurately to justify payout to the bank. Outreach reduced to 500farmers to date.

C. Indemnity-based insurance targeted at the commercial farmer (farm size 20-50acres) or clusters of smallholder farmers. This is a multi-peril crop insurance that offers protection against poor yields. Currently 2 commercial private rubber plantations have signed on.

GAIP uses satellite data from North Oceanic Atmosphere Administration (NOAA) and TAMSAT (UK). The company however finds local service providers of satellite information expensive. It expects to introduce other hybrid insurance products.

GAIP's main challenges are:

- How to achieve enough cover for perils in order to negotiate reduced interest rates from Rural Banks (The Base rate for lending in Ghana is 25% on the local currency, added to which a high risk premium is added for the agricultural sector). This depends on the reliability of weather data/forecasts & trends based on which risk assessment is made.
- Low publicity on the products as there is limited funding for advertising costs
- Need policy backing to oblige financial companies granting loans to have insurance cover. This is being explored with Stanbic Bank, Ghana.
- Currently take up the responsibility for both product development and marketing, whereas there is the expectation that they focus on design and deliver product to insurance companies to market.
- Inadequate receiving equipment for collection of weather data, but Met agency and public institutions are inadequately resourced so had to invest 40% of project funds to bring them up to speed. Need for additional equipment to make sample sizes for calculation of yield data more reliable.
- Research institutions and SRID rely on donor funding and thus the consistency of information for the future is not certain.
- Limited capacity of officers at district levels and GAIP has only 5staff, with inadequate equipment and logistics to carry out broad scope of activities. Inadequate resources to validate data provided by MOFA.

4.2 Differentiation of spatial solutions tailored to Agricultural practices/sector in Ghana

Differentiation of spatial solutions will come up after the mission results and country matchmaking meeting with the Ghanese and Dutch sectors. In above sections various challenges and solutions are discussed.

5. RECOMMENDATION FOR MATCHMAKING/MISSIONS

1. Invitees to stakeholder meeting separately provided.
2. Solution Directions suggested:

- Database of national geo data for planning and monitoring – structured partnership between coordinating public institution and strategic partners on how to set up spatial information infrastructure (public geodata library)
- Public sensitization and awareness creation on variations and applications of geodata – partnership to deliver practical, easily accessible information between geo data service providers , information brokers (ICT companies) and Educational institution
- Support the use of innovative, customized data collection technology to facilitate speed of collection, update and storage of geodata by e.g. extension officers – partnership between geodata technology providers and extension service delivery organisations (public, NGO, private)
- Innovative financial solutions to support credit delivery and insurance, relevant to Ghana context – Financial /insurance solution providers and GAIP/Insurance companies and other micro finance companies/Rural Banks
- Setting up of synoptic stations to improve data collection – partnership between meteorological service companies/organisations and equipment providers