Ghana:
Irrigation market brief

FAO INVESTMENT CENTRE

COUNTRY HIGHLIGHTS

Food and Agriculture Organization of the United Nations

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Irrigation market brief

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FOREWORD

In Africa, more than any other sector, agribusiness has the potential to reduce poverty and drive economic growth. Agriculture accounts for nearly half of the continent's gross domestic product (GDP) and employs 60 percent of the labor force. The World Bank estimates that by 2030, agriculture could develop into a USD 1 trillion market in Sub-Saharan Africa, up from USD 313 million in 2010. For the International Finance Corporation (IFC), a member of the World Bank Group, agriculture is a top priority. With USD 4 billion in agribusiness investments worldwide, the IFC believes that the private sector plays a crucial role in addressing agriculture's pressing challenges. Recognizing the importance of agricultural productivity for food security and the role of public-private partnerships to unleash the sector's production potential, Food and Agriculture Organization of the United Nations (FAO) supports its member states to ensure that investments in the agricultural sector improve the inclusiveness and efficiency of agrifood systems, in line with the Organization's new strategic framework.

Achieving Africa's agricultural growth potential will require a significant increase in historically low levels of productivity. This is an area where irrigation can play a critical role. Modern, efficient irrigation systems can substantially increase crop yields, resulting in improved livelihoods, reduced risk associated with drought, efficient use of limited water resources, and greater food production.

Currently, modern irrigation systems play a very limited role in Sub-Saharan Africa's agricultural sector. Food production in the region remains almost entirely rain-fed and only two percent of the total cultivated area is irrigated (FAO Aquastat, 2013). However, in some parts of the continent this situation is changing.

This report is the second in a series of five market briefs produced jointly by the IFC and FAO. It is targeted primarily at private sector investors and companies interested in expanding investment in irrigation in Sub-Saharan Africa, with particular focus on modern irrigation technologies, but may be of wider interest to all stakeholders engaged in irrigation development in the country. The report assesses the current state of the irrigation market in Ghana, recent performance, and opportunities for future growth.

In order to provide a wider regional perspective, subsequent irrigation market reports will be prepared for Ethiopia, Kenya and Senegal.

This market brief summarizes key findings in the FAO/IFC "Africa Irrigation Diagnostic Report" on Ghana. The full version of the report is available on request.

The IFC, a member of the World Bank Group, is the largest global development institution focused exclusively on the private sector. Working with private enterprises in more than 100 countries, we use our capital, expertise, and influence to help eliminate extreme poverty and promote shared prosperity. In FY13, IFC investments climbed to an all-time high of nearly USD 25 billion, leveraging the power of the private sector to create jobs and tackle the world's most pressing development challenges. For more information, visit www.ifc.org.

Achieving food security for all is at the heart of FAO's efforts – to make sure people have regular access to enough high-quality food to lead active, healthy lives. FAO's mandate is to raise levels of nutrition, improve agricultural productivity, better the lives of rural populations and contribute to the growth of the world economy. For more information, visit www.fao.org.

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This study was carried out under a FAO and IFC cooperation program, a joint initiative to promote responsible private agribusiness investment in lower income countries. The main authors of the study were Diogo Machado Mendes, Agricultural Specialist, Lisa Paglietti, Economist, Investment Centre Division, FAO and David Jackson, Commodity Market Specialist, LMC. Lisa Paglietti also was responsible for the coordination of the study team, while local support, data gathering and information was provided by Ms Ana Gonzalez, Agribusiness Specialist, Incatema Consulting. The study benefited from previous research conducted on irrigation aspects by FAO colleagues both at headquarters and in regional offices and substantial discussions and information exchanges with private sector actors engaged in irrigation development in country.

William Davies and Richard Colback, IFC provided leadership and coordination on behalf of the IFC agribusiness advisory team, as well as comments and technical input throughout the study. The IFC would also like to thank Brad Roberts and Ivan Ivanov who led the preparation of the concept, scope and funding for the study.

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ACRONYMS AND ABBREVIATIONS

AFD	Agence Française de Développement
AfDB	Africa Development Bank
BoG	Bank of Ghana
CF	Contract farming
DPs	Development partners
ECOWAS	Economic Community of West African States
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GADCO	Global Agri-Development Company Ghana Limited
GDP	Gross domestic product
GHS	Ghanaian cedi (currency unit)
GIDA	Ghana Irrigation Development Authority
GIPC	Ghana Investment Promotion Centre
GIZ	Gesellschaft für Internationale Zusammenarbeit (formerly GTZ) (German Society for International Cooperation)
GoG	Government of Ghana
IDE	International Development Enterprises
IFAD	International Fund for Agricultural Development
ITFC	Integrated Tamale Fruit Company
JICA	Japan International Cooperation Agency
KfW	Kredit für Wiederaufbau (German Financial Cooperation)
MFI	Microfinance Institutions
NGO	Non-governmental organization
PPP	Public-private partnership
SEND	Social Enterprise Development (Foundation)
SME	Small and medium enterprise
SNV	Netherlands Development Organisation
SSA	Sub-Saharan Africa
USAID	United States Agency for International Development
USD	United States dollar

Chapter 1 - Overview

Agriculture and the economy

Ghana has had three decades of strong economic growth. This performance, which helped the country achieve middle-income status in 2011, is due to increased direct foreign investment, political stability, and a relatively good investment climate compared with many other countries in Sub-Saharan Africa.

Between 2006 and 2012, Ghana's gross domestic product (GDP) growth averaged 8.1 percent. Agriculture has been a key contributor to the country's economy, averaging growth of more than 5 percent a year for 25 years, and contributing about 22.7 percent to the country's GDP in 2012.[1] Ghana is ranked among the world's top five performers in growth. In 2013, however, GDP was negatively affected by lower gold prices, high inflation, power and water shortages, and reduced consumer and business confidence[2].

Agriculture and mining dominate the country's export earnings. Cocoa alone accounts for 23 percent of the country's export value, and Ghana is the 6th largest exporter of cocoa and cocoa preparations in the world. Other major agro-exports include timber and wood products and horticultural crops (pineapple, pawpaw, and mango). With cocoa, these products account for 11.7 percent of Ghana's GDP.[3]

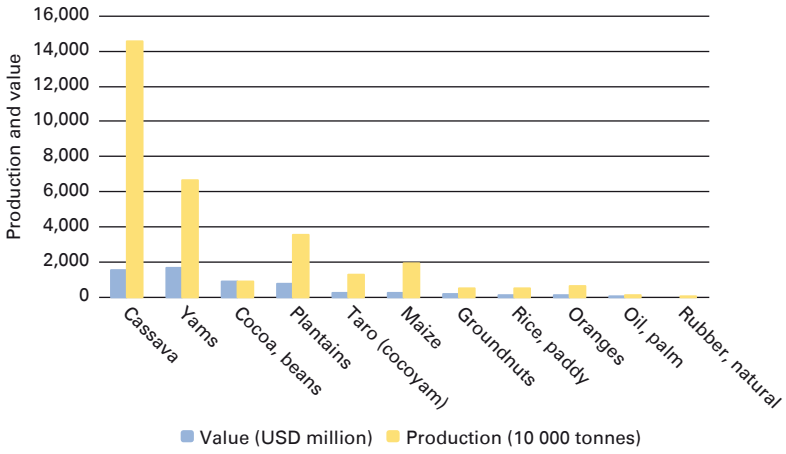
The recent performance of the agricultural sector is highlighted in the figure below.

1 Breadbasket Transformation of Ghana's Northern Region, Ministry of Food and Agriculture and Alliance for a Green Revolution in Africa, July 2010.

2 The Association of Ghana Industries had declared that business confidence in first quarter of 2014 was lowest for years, whereas the Bank of Ghana (BoG) confirmed low business and consumer confidence.

3 Facts and figures. Ministry of Food and Agriculture. Statistics, Research and Information Directorate, August, 2013. http://mofa.gov.gh/site/?page_id=6032.

Figure 1: Ghana's largest crops by production (metric tons) and value, 2012



Source: FAOSTAT, 2012.

The agriculture sector provides for the livelihoods of 56 percent of the country's workforce. About 85 percent of employed people living in rural areas work in this sector.

Land, water, and crop production

More than half of Ghana's land suitable for agricultural production is not being cultivated, and less than 1.6 percent of land suitable for irrigation has been developed.

The country's population density is relatively low, with 78 people per square kilometer, compared to 173 in neighboring Nigeria, 100 in Togo, and 86 in Benin. Ghana also has significant water resources – nearly 5 500 cubic meters of water per inhabitant, compared to 2 251 in Nigeria, 2 930 in Togo and 3 815 in Benin.

Cassava, yams, cocoa, and plantain are the dominant crops by volume and value. Taro (cocoyam), maize, and groundnuts are also substantial contributors. Most households generally eat cassava, yam, maize, and rice as staple foods. With the exception of rice, these crops are generally not irrigated.

Agriculture in Ghana is dominated by small-scale farms – about 3 million smallholder farmers, with an average farm size of

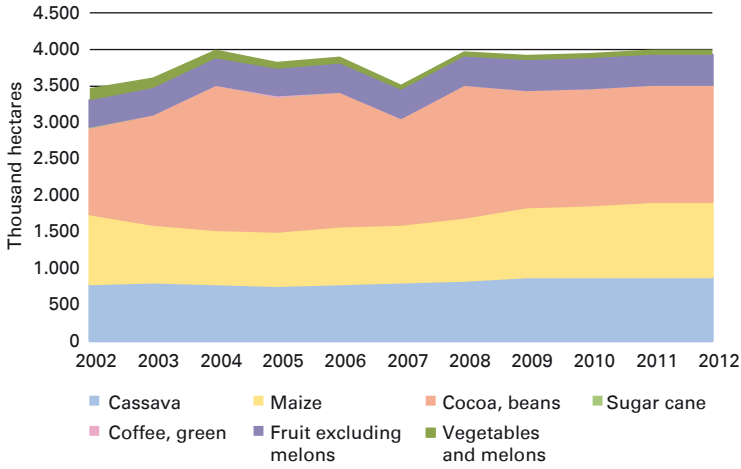
between 0.5 hectares and 2 hectares, currently produce 95 percent of the country's food crops. Large farms and plantations generally focus on rubber, palm oil, and coconut, and to a lesser extent rice, maize, and pineapple.

Production on small farms is primarily rain-fed, using traditional, subsistence methods. But this exposes farmers to significant risk when seasonal changes and droughts occur. The use of irrigation technology, although currently not widespread, has an important role to play in reducing risk and improving production.

Traditional farming systems in Ghana have adapted to the country's six major agro-ecological zones. In the two forest zones, the tree crops of cocoa, palm oil, coffee, and rubber are particularly important. Maize is the major crop in the south and middle belts, but progressively gives way to sorghum and millet in the north. Yam and grain legumes are important crops in the middle belt and towards the north.

The figure below shows the area for crops commonly produced in Ghana between 2002 and 2012.

Figure 2: Harvested area by crop in Ghana, 2002–2012

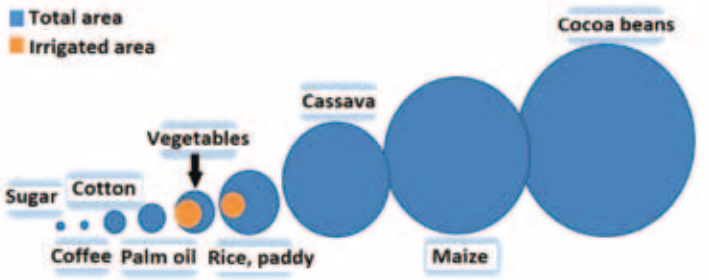


Source: FAOSTAT, January 2014.

Scope to grow irrigation

Ghana's vast available land, plentiful water supply, good soils, and suitable climatic conditions present significant potential to grow the commercial farming sector and introduce new irrigation technologies. The country is well placed to develop irrigation-based agricultural production, as shown in the figure below.

Figure 3: Relative size of area and irrigation by crop in Ghana, 2013



Source: FAOSTAT, 2013.

In Figure 3, the inner (orange) circles represent the estimated current irrigated area of crops in Ghana. Rice and vegetables dominate the small irrigated crop sector. The outer circles are proportionate to the relative total area sown to these crops, with close to 190 000 hectares of paddy rice and 77 000 hectares of vegetables.

About 11 percent of all paddy rice production is irrigated with flood irrigation (20 000 hectares), and over 50 percent of vegetable production is irrigated (40 000 hectares). However, much of this irrigation occurs on the same land. The irrigation installed for commercial rice production is used for vegetables as a second annual crop, while some vegetables under irrigation are double-cropped.

Major market players

The Ghana Irrigation Development Authority (GIDA) is the public organization primarily responsible for identifying irrigation opportunities and facilitating private investments in irrigation.

The donors actively engaging in the irrigation subsector are:

- The World Bank
- The Japan International Cooperation Agency
- The United States Agency for International Development (USAID)
- The Millennium Challenge Corporation
- The French Development Agency
- The International Fund for Agricultural Development
- The Food and Agriculture Organization (FAO).

Intermediary nongovernmental organizations (NGOs) are playing an increasingly active role in improving agricultural productivity and enhancing access to agricultural technologies. In Ghana, NGOs such as TechnoServe, the Social Enterprise Development (SEND) Foundation, International Development Enterprises (IDE), and ACDI/VOCA are fostering smallholder linkages and out-grower programs in irrigation.

There are few suppliers of irrigation pumps and equipment in Ghana because a very small share of the potential irrigable area is currently irrigated. The country has various irrigation companies involved in producing, transporting, and trading farm products. Large agribusiness companies sometimes support the development of small farmers by operating with out-growers (refer to Section 5 on effective business models).

Investment opportunities

Agriculture is a key driver of Ghana's economy and the sector is expected to continue to boost development for the next 10 years.[4] Ghana has many attributes that make it an attractive country for investment in agriculture and agribusiness. According to the Ghana Investment Promotion Centre, in the third quarter of 2011 alone, three new agriculture-related investments with a value of over USD 200 million were registered.[5]

The country's land and water resources make it ideal for commercial farming of key staple crops such as maize, soya, and rice. Agricultural growth can be achieved through expansion, by cultivating more land, or through intensification, by increasing the productivity of existing land, which requires effective irrigation

4 USAID, 2014.

5 Ghana Investment Promotion Centre Quarterly Report, Third Quarter, 2011.

techniques and systems. The irrigation sector provides investment opportunities directly, in commercial agricultural production, and indirectly, through supply chains to off-takers and processors. Ghana is a member of the Economic Community of West African States (ECOWAS), with a market of about 250 million people. The domestic market and the regional free trade bloc present significant opportunities for Ghana. Because of the freight costs associated with exporting in Sub-Saharan Africa, domestic markets generally offer the highest farm gate prices in most sectors.

The Accra Plains Irrigation Project, supported by the World Bank and the Japan International Cooperation Agency under the Ghana Commercial Agriculture Project,[6] will initiate a number of projects and partnerships in the irrigation sector, opening up new investment opportunities. The project is the first large-scale test operation in the country, where public-private partnership arrangements for the development and management of irrigation will be designed, contracted out, and implemented. For example, a gravity-based irrigation canal will be built under a public-private partnership to help boost agricultural production in the Accra Plains. It will feed about 11 000 hectares developed under the Ghana Commercial Agriculture Project.

6 The Ghana Commercial Agriculture Project is a USD 145 million five-year project for the development and expansion of commercial agriculture. USAID is providing a grant of USD 45 million, while the World Bank will provide USD100 million as a loan to Ghana for the project.

Chapter 2 - Market analysis

Untapped potential

FAO estimates that Ghana's potential irrigable land amounts to 1.9 million hectares. This potential, however, remains largely undeveloped. Only 1.6 percent, or 31 000 hectares, is under fully controlled irrigation – one of the lowest percentages in Africa.

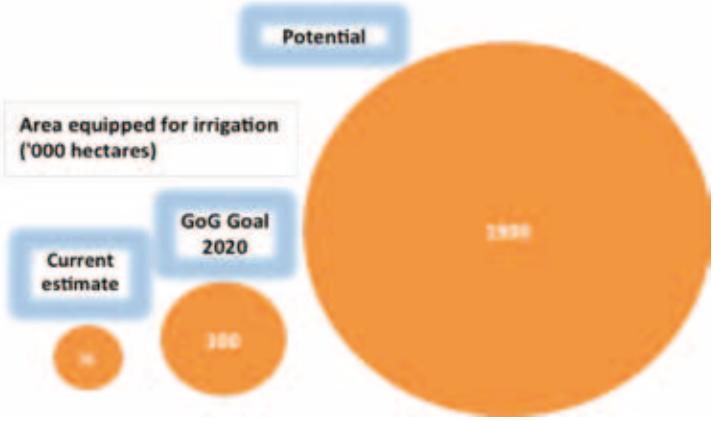
Although Ghana has an abundance of water from rainfall, this resource is very unevenly distributed, both geographically and seasonally. Irrigation is needed to ensure crops have water during the long dry season. If well managed, Ghana's surface water and groundwater systems are able to meet most domestic and irrigation needs. But the lack of installed water infrastructure provides a serious constraint to irrigation development.

Figure 4: Map of Ghana and its neighboring countries

Source: FAO Aquastat.

The figure below shows Ghana's current and potential irrigable land in hectares. Based on the assumption that in-field irrigation infrastructure costs on average USD 2 500 per hectare, if 70 000 hectares of land was developed with full control irrigation in the medium to long term, the market for irrigation equipment in Ghana would be worth an estimated USD 230 million, with an average annual value of USD 29 million.[7] This estimate does not include the market for bulk water capture and equipment.

Figure 5: Estimated irrigable land in Ghana



GoG Government of Ghana

Source: FAO Aquastat.

New commercial projects are increasing investment in irrigated agriculture in Ghana. This is reflected in the recent growth in the value of imports of irrigation equipment, discussed in the next section. This trend is expected to continue, as the country makes slow but steady progress in institutional reforms that will help tap its vast irrigation potential.

Technology trends

Ghana's imported irrigated equipment has increased substantially in recent years. The value of imports has more than trebled since 2010, from USD 17 million to USD 81 million in 2012.

7 This estimate is based on an average value of capital expenditure in full control irrigation schemes.

According to the UN Comtrade database, in 2012, the biggest equipment import was gate valves for water supply (64 percent), followed by reservoir lining and other centrifugal pumps. Although net imports of motorized pumps have decreased in relative terms, it is possible that imports of this type of smaller equipment are not entirely reflected in official statistics, which means that trade in these categories could be of a greater magnitude in reality.

The country increasingly acts as a conduit for imports that are re-exported to other regional markets. As a result, about 15 percent of the total import figure may not reflect imports used in Ghana.

Opportunities and challenges

Ghana has one of the most successful agricultural sectors in Africa, growing on average by more than 5 percent a year for 25 years. Public investment in the agriculture sector currently accounts for about 5 percent of the country's GDP. Donor-supported projects are also playing an increasingly important role in the commercialization of agriculture.

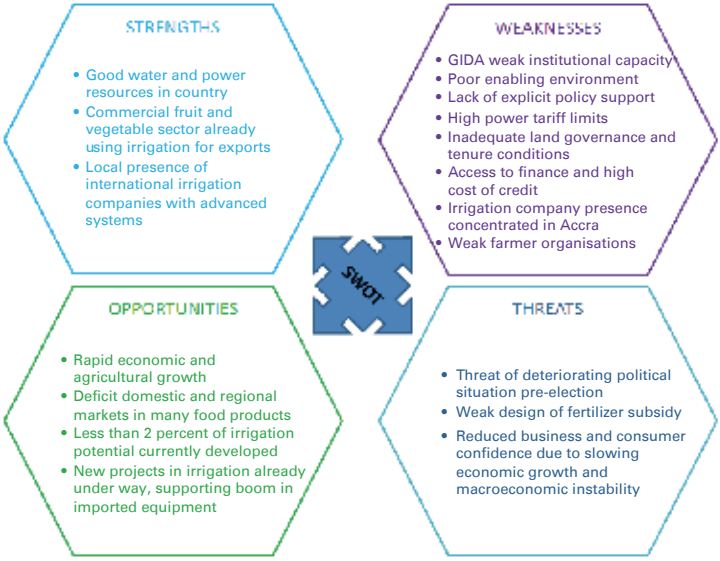
But, despite its impressive growth, Ghana's agricultural sector is underperforming. The sector's commercialization and modernization is severely constrained by a lack of financing. This is exacerbated by the following issues:

- Inadequate land rights and governance, including tenure conditions on customary land and state-owned land
- Lack of access to inputs and improved techniques
- Inadequate farming skills and a poor regulatory environment
- Poor service delivery, particularly for small-scale farmers
- The potential risk of a deteriorating political situation in the build up to the country's 2015 elections
- Lack of physical infrastructure.

Less than 2 percent of Ghana's cultivated land is irrigated. Irrigation is centered almost exclusively on rice and exportable vegetable production. This poor irrigation penetration is largely due to the huge investment required in bulk water infrastructure. The cost of modern irrigation systems alone, increased by the cost of water, could be prohibitive for many farmers. The weak institutional capacity of irrigation authorities and the country's legal framework is also hindering the irrigation sector's growth.

The figure below sets out Ghana's strengths, weaknesses, threats, and opportunities. These are explored in further detail in Sections 4 and 6.

Figure 6: SWOT analysis for irrigation development in Ghana

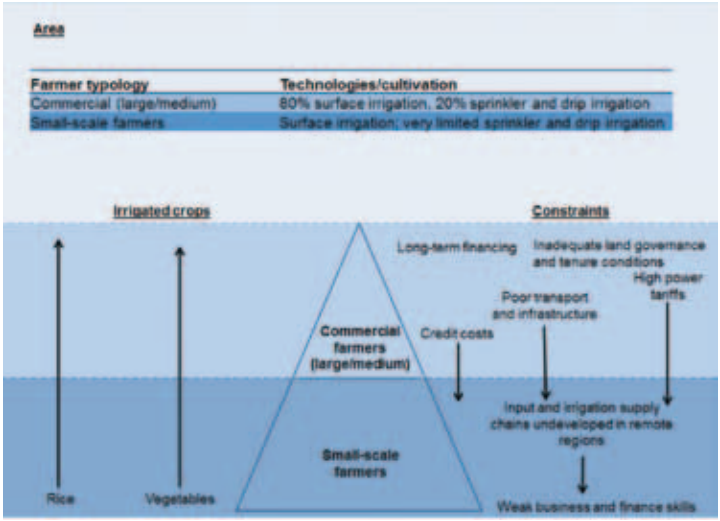


Source: Authors' compilation, 2013.

FAO/Roberto Faidutti.

The figure below sets out key data on the number of farmers operating at different levels of agricultural production.

Figure 7: Farmer typologies, irrigated crops, and constraints



Source: Authors' compilation, 2013.

Expanding the crop market

Expanding the irrigated crop market in Ghana will create more opportunities for private sector investment. The figure below shows the crops that present opportunities and threats to the domestic, regional, and world markets. The heat bar reflects the ease with which crops could be absorbed on these markets, with green representing the most easily absorbed crops.

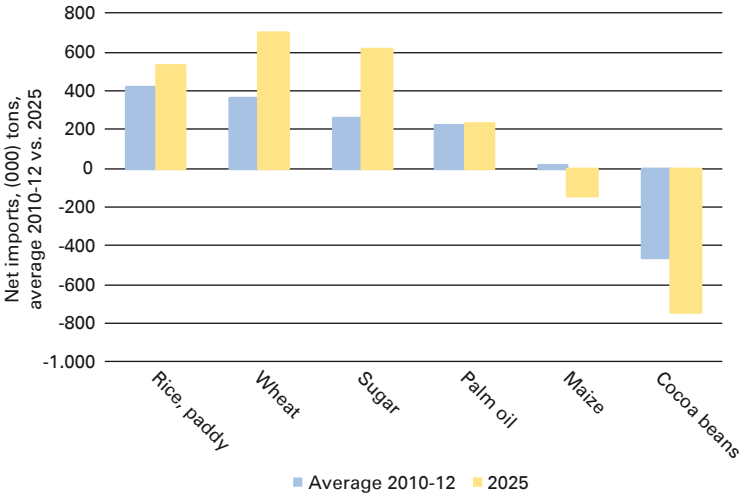
Figure 8: Market absorption of crops – opportunities and threats

	Domestic Market	ECOWAS	World
Opportunity	**Rice, wheat, sugar,** palm oil	**Maize, sugar,** cotton, coffee	**Cocoa beans,** fruit, vegetables
Threat	**Maize,** cocoa beans	**Cocoa beans, palm oil**	

Source: Authors' compilation, 2013.

In assessing whether the size of the market is likely to undercut the expansion of irrigated crops, the main consideration is whether there is likely to be demand for increased Ghanaian production on national, regional, and world markets. The figure below identifies Ghana's current net import and forecast import requirements for a range of important crops to 2025 (see Annex 2 for more detail).

Figure 9: Current Ghanaian net imports versus forecast import requirement in 2025



Source: Authors' estimates based on historic FAOSTAT data.

Increased production of rice, sugar, wheat, and palm oil could easily be absorbed in the domestic market. Expanded maize and cocoa production, and to a lesser extent coffee and cotton, would

saturate the domestic market, but these crops do present a good opportunity for the regional ECOWAS market. Maize could also provide commercial opportunities by double-cropping with newer crops like soybeans.

Despite the freight costs of accessing the ECOWAS market, this trade bloc – particularly the large Nigerian market – offers a relatively attractive option for expanded Ghanaian crop output.

The cocoa bean crop is expected to maintain its large export surplus, much of which is destined for the world market. Ghana's low costs of production and its good location for the European Union and United States markets mean it is likely to remain a major world cocoa exporter. But, because cocoa beans do not lend themselves to irrigation in Ghana, the crop is unlikely to drive the expansion of irrigation.

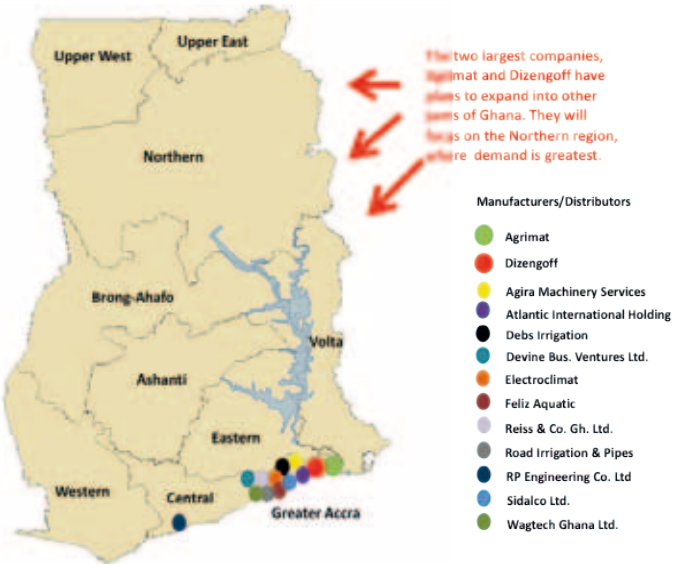
Fruit and vegetable crops are already a success in the world market, and increased production would be easily absorbed. It is likely that double-cropping vegetables with rice will drive the expansion of Ghana's irrigation market over the short term. To a lesser extent, sugar and palm oil could also contribute to the irrigation sector's growth.

Chapter 3 - Supply chain and services

Supply chain

Despite its vast potential, Ghana still has a relatively undeveloped market for irrigation equipment. As shown in the figure below, distributors are concentrated in Accra. These distributors do supply irrigation equipment in other areas of the country, but they tend to operate from their headquarters in the capital. Developing a wider distribution network will boost future increases in demand.

Figure 10: Location of major irrigation suppliers



Source: Authors' compilation, 2013.

Most of the large companies have in-house capacity workshops and technicians to maintain and service their irrigation equipment. The country has a stable supply chain for drip and sprinkler irrigation systems, which are generally used by larger farmers.

According to AgDevCo, commercial farmers in Ghana claim that suppliers only stock a limited selection of agro-chemicals and

fertilizers, and many inputs are simply unavailable. The supply chain faces the following challenges:

- Farmers often retain and reuse seeds because the country lacks improved and locally adapted seed varieties, especially in the northern areas. This contributes to a progressive loss of seed quality, which in turn leads to low yields.
- Distribution costs are high in the north due to its distance from the main import and distribution nodes of Kumasi, Tamale, and Wu. This is compounded by the lack of properly maintained feeder roads.

Most of the crops do not qualify for the government's fertilizer subsidy, and those that do qualify (such as rice) are only subsidized during the wet season. Improving subsidies for smallholder farmers will help prevent farmers becoming fertilizer traders to cash in on the subsidy.

Source: FAO/Roberto Faidutti.

For small private farms, the supply chain and service market remain obstacles to growth. For smallholder farmers, who tend to find the cost of irrigation equipment prohibitively high, hiring irrigation equipment is a viable option. Different companies have discussed with Government the creation of "Plant Pools", a place where farm equipment would be concentrated to be operated by specialized and authorized private contractors. Although the

government showed interest in this idea, no plant pools are currently operating, nor is agricultural equipment hiring an option much explored yet.

In Ghana, imported agricultural machinery, plant, apparatus, and spare parts are exempt from customs duties and value-added tax. However, irrigation equipment suppliers have to deal with a high level of bureaucracy when importing goods and some suppliers are made to pay duties on spare parts, contravening the existing legislation.

Manufacturers and distributors

There are few suppliers of irrigation pumps and equipment established in Ghana, largely because irrigation represents such a small share of the country's potential irrigable area. The two major suppliers, Agrimat and Dizengoff, have plans to expand their operations to other parts of the country, with a particular focus on the Northern region (see Figure 10).

The table below identifies major suppliers by type of equipment and origin.

Table 1: Summary of suppliers, the irrigation equipment supplied, and its origin

Suppliers	Main irrigation equipment supplied	Origin
Agrimat	High-density polyethylene pipes	Seroplus (Spain)
	Couplers	Heliflex (Portugal)
	Pumps	Idrofoglia (Italy), Antor (Turkey), Kipor (China), Honda (Japan)
	Filters	n.a
	Sprinklers	n.a
	Drip equipment	n.a
Dizengoff	Drip equipment	Netafin (Israel)
	Sprinklers	Jain (India)
	Center pivots	Zimmatec (US and South Africa)
	Pumps	Grundfos (Denmark)
	Filters	n.a

Source: Fieldwork, 2013.

Agrimat, one of the biggest agricultural input dealers in Ghana, focuses on sprinkler irrigation because it considers this technology to be easier for farmers to manage. Drip irrigation is best adapted to Ghana's conditions, in particular for the production of vegetables, but many farmers lack the knowledge and skills required to operate these systems and, as a result, opt for other systems.

Small farmers often start irrigating crops using tripod sprinklers. Two of these tripods are generally sufficient to irrigate 1 hectare of land, which farmers then move across the field.

A grid-electric pump is not an ideal irrigation method in Ghana because many farmers struggle to pay their electricity fees regularly. Diesel or petrol-powered pumps are more suitable options, allowing farmers to pay one liter at a time.

Dizengoff and Agrimat target different segments. Dizengoff supplies and maintains drip lines, sprinklers, micro-sprinklers, micro-jets, rain guns, and center pivots. The most popular product, accounting for about 70 percent of the company's irrigation equipment sales, is drip lines. Sprinklers, sold mostly for tree crops, account for 30 percent of sales.
There are also about 10 smaller companies selling irrigation equipment in Ghana, almost all of which are based in Accra.

Retail pricing

The table below summarizes the estimated retail prices for irrigation equipment supplied in Ghana, based on fieldwork conducted for this report.

Table 2: Irrigation equipment pricing, 2013

Main irrigation equipment supplied	Per hectare cost (USD)
Irrigation pumps (motorized and non-motorized)	180-1 000 (per unit)
Drip equipment	2 500-3 000
Sprinklers	2 000
Center pivots	1 500-3 000

Source: Fieldwork, 2013.

Dizengoff sells a small kit for farmers called the Family Drip System, which costs about USD 1 000. These kits irrigate between 500 square meters squared and 1 000 square meters, which suits

the Ghanaian market, because 80 percent of farmers farm less than 1 hectare of land. The supplier provides assistance to its customers for at least one year. Dizengoff also sells the Amiran Farmers' Kit, a USD 6 000 greenhouse kit[8] for all-season vegetable production, which uses special drip irrigation.

Agrimat supplies pumps, sprinklers, pop-up sprinklers, tripods, water hoses, irrigation pipes, and accessories. The company focuses on sprinklers, which cost about USD 2 000 per hectare. Drip irrigation, costing between USD 2 500 and USD 3 000, is well suited to the country's conditions.

Assistance and maintenance services

The two main equipment suppliers provide assistance to their clients, including equipment maintenance services and spare parts, at both wholesale and retail levels.

Source: Diogo Machado Mendes, December 2013.

8 The greenhouse kit consists of: a drip irrigation system to cover the growing area; a knapsack sprayer; vegetable seeds for one season; fertilizer and agro-chemicals for one season; a nursery set; personal protective equipment (overall, respirator, and gloves); training; and agronomic technical support for one season.

Table 3: Supplier services provided and coverage

Company	Services provided	Coverage
Agrimat	Assistance to clients	The whole country, from Accra
	Maintenance services and spare parts	
Dizengoff	Carries out surveys, and designs and installs irrigation equipment	The whole country, from Accra
	Irrigation specialists available to guide clients on the best systems for water management and irrigation	
	Trains farmers on how to clean drip lines, filters, and pumps.	

Source: Fieldwork, 2013.

Farmers close to Accra are generally happy with the assistance services they receive from manufacturers and distributors, but this assistance deteriorates the further the farmer is from the capital. Some commercial farmers reported that they do not receive appropriate and timely assistance from their suppliers, resorting to importing parts directly by airmail. The proper management of machinery parts stocks, including both irrigation equipment and all mechanized farm operations, is essential to prevent downtime.

Financial services

Access to credit is the biggest barrier to the irrigation sector's expansion in Ghana. Many small farmers access credit through informal loans from family members, because banks prefer to service commercially oriented farmers. And when they do make credit available for working capital, the interest rates are often prohibitively high – up to 33 percent in local currency.

Commercial and rural bank interest rates generally range between 28 percent and 33 percent, and microfinance institutions generally charge between 3 percent and 5 percent per month. Rural and community banks are the most important financial institutions for farmers, because these institutions are mandated to serve their, predominantly agriculture-based, communities. Rural and community banks typically charge interest at a flat rate on the initial amount for small working capital loans, making the effective annual percentage rate much higher.

According to the 2010 FinScope Ghana survey, 17.3 percent of farmers use commercial bank products, 5.2 percent use other

formal financial products, and 16.8 percent use informal financial products. Informal products include savings accounts and mobile money, and are likely to involve credit. Rural and microfinance institutions reported that only 7 percent of their loan portfolios were designated for agriculture.

There is a consensus among the country's agricultural stakeholders that farmers need soft loans. International donor agencies are already helping smaller farmers by underwriting loans to a given limit. For example, AgDevCo lends to small and medium agribusinesses, typically for a period of between five and seven years at 5 percent interest. NGOs working in Ghana are finding innovative ways to help small farmers access finance, with recourse to farmer trust groups and shared responsibility for credit repayments. Most financial NGOs lend money that they have raised from contributions, grants, and concessional loans. Some organizations have been able to access commercial bank loans and act as intermediaries.

The microfinance sector in Ghana is playing an increasingly important role in helping farmers access credit for irrigation equipment (see case study below).

Case study: The International Development Enterprise in Ghana

IDE is an NGO that works in partnership with the Gates Foundation, the Swiss Cooperation, the Canadian Cooperation, and the International Water Management Institute. IDE, primarily focusing on the north east and the north west of Ghana, has helped supply over 500 treadle pumps with drip irrigation kits to smallholder farmers.

It signed eight memoranda of understanding with microfinance institutions (MFIs) that provide loans for micro-irrigation technology. The MFIs provide group loans to farmers in groups of 20. On average, the group receives up to 6 000 Ghanaian cedis (USD 2 280).1 MFIs charge the farmers an average monthly interest rate of between 1.5 percent and 2 percent. The loan duration is six months (one farming season) and the grace period is between one and two months. To date, 98 percent of these loans are being repaid. Of the farmers receiving these loans, 38 percent are women.

Source: Fieldwork, 2013.

9 1 Ghanaian cedi (GHS) = USD 0.38 at the time of writing.

Advisory services

Farmers in Ghana receive advisory services from the Ministry of Agriculture, NGOs, and private firms. NGOs are the main providers of extension services for small-scale and emergent farmers.

The private sector and NGOs play an important role in mobilizing smallholder and emerging farmers to adopt irrigation. Most commercial agricultural businesses have private extension officers, although some also receive support from government extension services. A number of commercial agricultural projects provide advisory services to out-growers through NGOs. The services include advice and technical assistance on adequate planting dates, the use of good-quality seed, the correct use of fertilizers, and the promotion of new promising crops such as soybeans. Private advisory services include the training of farmers in basic business management.
Government extension services cover the whole country through the Directorate of Agricultural Extension Services' network of extension agents in all districts and operational areas. In spite of this, irrigation extension is poorly developed in Ghana and there is a shortage of production information for farmers. Extension services for appropriate water-management, agronomic, and crop-protection practices in irrigated agriculture are inefficient and almost non-existent for informal irrigation systems.

Chapter 4 - Barriers and constraints

Irrigation in Ghana is hindered by various systemic and market barriers. Systemic barriers include infrastructure (roads, power supply, and irrigation), land tenure, trade duties and taxation, labor availability, and water access. Market barriers include access to finance, lack of farmer knowledge, and supply chains.

Power costs

Power tariffs in Ghana are an impediment to the economic viability of irrigation systems that are not fed by gravity or close to perennial surface water sources. Due to the high cost of pumping, irrigation has generally developed in areas naturally endowed with readily available water, such as in the south along the Volta region. In many cases, gravity-based irrigation is the only option available for small farmers.

For small farmers, energy for lifting and distributing water is a problem. The price of petrol, diesel, and electricity is high. Electricity rates increased significantly in late 2013, with no specific tariffs for agriculture in place.[10] Annex 3 provides more detail on power supply in Ghana. In addition, in areas relying on electricity for lifting water, intermittent power supply poses a challenge.[11]

Irrigation infrastructure

According to a study by the SEND Foundation,[12] only 19.7 percent of smallholders have access to public irrigation programs, and 60 percent of these farmers use non-mechanized irrigation techniques.

To date, government budgetary allocations have been insufficient to maintain and operate public irrigation infrastructure, and irrigation service fees have not been able to cover maintenance costs. As a result, this infrastructure has deteriorated and most public irrigation

10 Electricity tariffs increased by around 79% in 2013. Following the increase, non-residential tariffs range from US$0.13-US$0.22 per KWh, depending on customer class.

11 Namara *et al*, 2011.

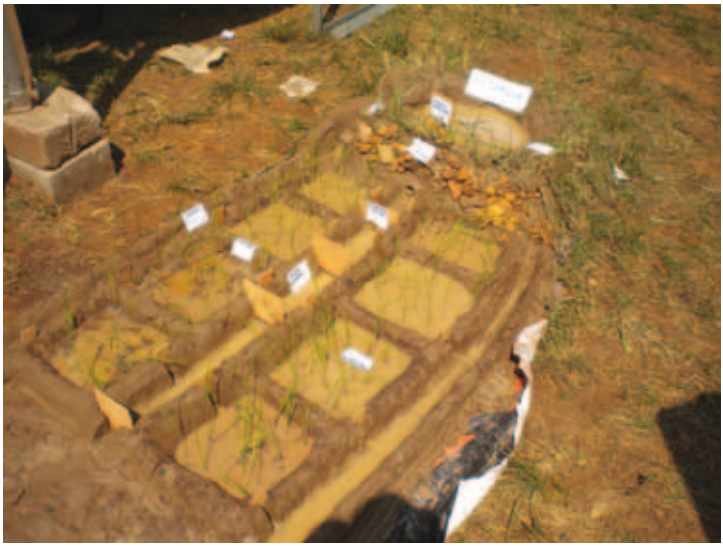
12 SEND Foundation Ghana, 2008. *Investing in Smallholder Agriculture for Optimal Results: The Ultimate Policy Choice for Ghana.*

projects have not been able to fully develop their potentially irrigable area. Many public irrigation systems are working as rain-fed systems, only allowing one production per year.[13]

Inadequate planning and faulty design have exacerbated the challenges facing Ghana's irrigation infrastructure and equipment. The design of most irrigation projects is standard, despite variations in topography, soils, crops grown, and the skills of the farmers involved. The multiple uses of water-conveying systems – like livestock watering, domestic use, crop production, and fishing – are often not properly considered. In addition, siltation of reservoirs and canals, as well as extreme flooding, can seriously affect the sustainability of some irrigation systems.

Land tenure and availability

Almost 80 percent of Ghana's land belongs to the community, entrusted to chiefs and family heads. This makes accessing land for farming a challenge.



Source: Diogo Machado Mendes, December 2013.

13 Namara *et al*, 2011.

Concession of government and communal land for commercial agriculture is a controversial issue. In addition, the land access process can be confusing and time-consuming, and there is no standard for lease rates. Despite these challenges, many commercial operators have accessed land through long-term leases of up to 50 years.

There is not enough available land in the intensive groundwater irrigation areas of south-eastern coastal regions. In coastal areas, most farms are located near townships, so there is little room for expansion. In the land-abundant northern regions of Ghana, the fact that public irrigation systems have been designed to benefit as many households as possible means a lower per capita and per household irrigated area. In some cases, farmers cannot make a living from irrigated agriculture, and they consider it a supplement to other livelihood strategies.[14]

Roads

Ghana has good-quality trunk roads and highways in comparison with many other countries in Southern Africa. The Tema-Ouagadougou road corridor connects the north and the south, but the lack of feeder roads makes it difficult to open up areas of agronomic potential unless they are close to the main road. As a result, many commercial investors are forced to limit their activities to areas near main roads, which places increased pressure on these areas while inland regions remain devoid of investment.

Water availability and access

Water availability is a challenge in the north, where the water table is low and the quality of groundwater for irrigation is often poor. In the Volta region, water availability is generally not an issue.

Labor availability

Lack of available labor can be a constraint to farmers' adoption of irrigation, especially in areas with low density population or when irrigation techniques are labor intensive. This is particularly a challenge in the north, where the ratio between the area of land and the number of people is greater, and farmers tend to focus on extensive agriculture. Southward migration of young people from the north further compounds this problem.

14 Namara *et al*, 2011.

Trade duties and taxation regime

Agricultural machinery and irrigation equipment are exempt from customs duties and value-added tax, but the system is hindered by a high level of bureaucracy. To avoid unexpected costs and delays, companies have to keep in close contact with the Ghana Revenue Authority and follow all the instructions available.

Access to finance

Access to credit is the biggest barrier to the irrigation sector's expansion in Ghana. Many small farmers access credit through informal loans from family members, because banks prefer to service commercially oriented farmers and their interest rates are often prohibitively high.

Farmer knowledge

Many farmers in Ghana lack the knowledge and skills to expand irrigation. They often do not have sufficient knowledge of cultivation techniques and they struggle to access quality inputs, such as certified seeds and fertilizer. This is particularly damaging to the efficient production of intensive crops like irrigated vegetables, which are cultivated up to four times a year.[15]

The sector would benefit from investments in practical schools for young farmers. Some initiatives are already contributing to spreading valuable information. For example, cocoa farmers have set up a system that provides information on their mobile phones, and a supplier that trains farmers on its premises in Accra is planning to build an irrigation institute near the capital.

Access to inputs and services

The limited availability of inputs and the high costs involved with procuring these are among the most important constraints to commercial agriculture in Ghana. Distributors cannot increase supply in remote areas while there is insufficient demand. In the short term, nucleus farmers[16] able to generate economies of scale in procurement are in the best position to provide small farmers with easier and more cost-effective access to inputs.

15 *Ibid.*

16 Small farmers are organized around selected local commercial farmers (nucleus farmers).

The development of groundwater irrigation is hindered by a lack of efficient water-lifting and well-drilling technologies. Most irrigation equipment suppliers are based in Accra and have only recently started to expand their operations to the north of the country. Irrigation equipment is often not available to farmers in the quantity or quality desired. However, when farmers do have access to equipment, they may not have the technical knowledge needed to use it effectively.

Land preparation is another challenge for the sector – the availability and maintenance of farm machinery is not widespread in Ghana. Farmers wanting to use tractors and power tillers generally have to hire these machines from private sources and government agencies. When these machines are publicly owned – as in the case of GIDA and the Irrigation Company of Upper Region – availability and maintenance is a problem.

Farmers report that extension services in the irrigation sector are inadequate, and extension personnel are often not familiar with the details of emerging irrigation systems.

Post-harvest and marketing issues

In addition to the challenges discussed above, there are a range of post-harvesting and marketing issues preventing farmers from maximizing the productivity of irrigated land:

- Most irrigated crops are perishable and need special storage and transportation facilities that are still limited in Ghana. This gives further leverage to intermediaries to influence prices.
- Poor threshing methods significantly reduce the quality of milled rice. As a result, farmers cannot compete with cheap, better-quality products from abroad, and they often have to sell their rice as paddy.
- Farmers who use irrigation tend to be market-oriented because of the nature of the crops they produce and the fact that they consume a small share of the final production. But there are limited marketing channels and market participants, which allows a few buyers to bid prices down. Crop purchases are often on a credit basis at extremely low predetermined prices.[17]

17 Namara *et al*, 2011.

AgDevCo has suggested that post-harvest losses from a lack of drying, processing, and storage equipment can be at least partially overcome if a large-scale commercial farmer is willing to commit contractually to providing certain services to small-scale farmers. This is discussed further in the next section.

Chapter 5 - Effective business models

This section identifies effective irrigation business models in Ghana that could address some of the barriers outlined in the previous section.

Many companies in Ghana have explored a range of business models to integrate smallholder farmers into their raw-material supply chains, including contract farming (centralized and out-grower models), management contracts, and joint ventures. Contract farming is the prevailing business model, ranging from informal models to out-grower programs with a nucleus estate. Table 4 presents the benefits and challenges of these business models.[18]

Land tenure is the first major hurdle agricultural companies need to overcome when investing in the country. The business models discussed here reflect the complexity of Ghana's land tenure. Large-scale land acquisitions by private investors constitute a threat to the land rights of poor farmers, while farmers' land rights limit investors' access to land and investment in commercial agriculture.[19] But Ghana does have success stories, with commercial operators gaining access to leases of up to 50 years and operating effective models that help develop the sector.

Out-grower programs

The Ghanaian government and its development partners have initiated a number of out-grower programs in the country (see Annex 1). In recent years, large-scale private companies have started to foster these arrangements, leveraging out-grower programs to secure their raw-material supply and overcome land constraints.

Vegpro Kenya Limited, Kenya's largest vegetable producer, processor, and exporter, expanded into Ghana and established Vegpro Ghana Limited in 2012, largely because of the country's potential to be a low-cost vegetable supplier to European markets. The government granted Vegpro a 50-year renewable land

18 Paglietti, L., Sabrie, R. (2013). "Review of smallholder linkages for inclusive agribusiness development", prepared under the FAO/World Bank Cooperative Programme.

19 Ibid.

lease, which the company has used to develop a 1 070-hectare commercial vegetable farm, equipped with 12 center pivot irrigation systems each covering 64 hectares. Vegpro has also built facilities for packing and processing vegetables for export to the United Kingdom and European Union markets.

Vegpro has developed a smallholder out-grower program next to the main farm, supported by the Millennium Challenge Account and the Millennium Development Authority. The program has 900 out-growers farming baby corn on a 450-hectare area, which could expand to 2 000 hectares in future. The main farm grows baby corn and chilies, and it is considering introducing mango, avocado, rice, maize, and soybeans. But this will take time – introducing new products requires extensive training to ensure the crops meet the specifications demanded by European supermarkets.

ACDI/VOCA is training the out-grower farmers, with a focus on the importance of staying within maximum pesticide residue limits and not over-irrigating land, as the heavy clay soils in the area are prone to flooding.

Vegpro aims to recover the money invested in funding the out-growers. It currently supplies the farmers with inputs, only charging for seed at this stage, and the Millennium Development Authority expects that the farmers will be able to pay the full costs of production after two years.

The nucleus farm estate and the out-grower areas will be served by an irrigation canal built by the Millennium Development Authority and maintained by the Scheme Management Company. The canal, which is not operational yet, will help lower the project's energy costs – one of Vegpro's main obstacles to expanding irrigation.

Another company operating a successful out-grower program is the Global Agri-Development Company (GADCO) Ghana Limited. GADCO operates a modern hub farm, with a focus on rice production, and a program that leverages the resources and infrastructure of the hub farm to provide smallholder farmers with critical production services, inputs (including high-yield seeds), and access to end-consumer markets in high-growth food categories. The company uses its command of the full value chain to process finished products for the domestic market under Copa, its own brand. GADCO sells jasmine rice, and it plans to launch affordable derivative products that meet local market preferences.

GADCO's revenue-sharing model for smallholder farmers in irrigated and dry-land areas is increasing farmers' incomes and skills, while strengthening national food security and contributing to economic growth.

Table 4: Benefits and challenges of nucleus and out-grower business models

Benefits	Challenges
• Increased yields and income of farmers. • Assured market outlet. • Allows for medium- and long-term planning. • Significant double-cropping possibilities and yield increases with irrigation. • New commercial crops, technologies, and improved seed varieties introduced to smallholders. • Farm equipment and refrigerated vehicles provided. • Nucleus farm provides inputs and technical assistance to out-growers. • Nucleus farms often integrated to market, with branding, to preserve and add value to the supply chain. • Proximity to national, regional, and European markets. • Nucleus estate provides water to smallholders. • Irrigation providers offer technical support. • Private company manages the maintenance of the canal.	• Initial funding required for smallholder irrigation developments. • Limited local markets. • European quality requirements and supermarket specifications. • Poor farmer knowledge at start of programs. • Time-consuming training of farmers in high-quality products. • Higher overhead costs (extension staff). • Land tenure is a controversial issue for large-scale commercial farming investments. • Smallholders provided with inputs subsidized by nucleus farm initially, but eventually have to pay themselves. • Power shortages and high tariffs. • High costs of processing. • Inequitable distribution of benefits and risks.

Source: Authors' compilation, 2013.

Chapter 6 - Market opportunities

Ghana's agricultural sector offers significant market opportunities for irrigation in both the smallholder and commercial sectors. Key areas of opportunity are outlined below.

Natural resources

Ghana's plentiful water resources, large tracts of available land, good soils, and suitable climatic conditions for the production of many crops present significant opportunities to intensify its irrigation sector. The country's resources make it ideal for the commercial farming of key staple crops such as maize, soya, and rice, which would also help create more jobs.

Crop markets

Based on the analysis in Section 2, rice, wheat, sugar, and palm oil will be able to expand production fairly easily, with the domestic market absorbing the additional output. Cocoa, fruit, and vegetables have good access to world markets and will be able to increase production even if domestic markets become saturated. If the production of maize, cotton, and coffee increased, the regional ECOWAS market should be able to accommodate these crops.

Fiscal incentives

Imported irrigation equipment is exempt from customs duties and value-added tax, making it an attractive market opportunity. However, as previously noted, there is a high level of bureaucracy involved and it is important to ensure that the equipment is correctly classified at the time of import.

Investment in irrigation

Institutions such as the World Bank, USAID, and the African Development Bank are helping to develop irrigation in Ghana, providing significant current and scheduled future support through infrastructure development projects. The Ghanaian government is also working to expand the sector, aiming to increase irrigated land from 31 000 to 100 000 hectares by 2020 in support of its objective to intensify agriculture.

Source: FAO/Roberto Faidutti.

The informal irrigation subsector involves private individuals and small groups of farmers irrigating their own holdings with no or minimal public support. This subsector is estimated to cover about 186 000 hectares – comprising the largest part of agricultural water management in Ghana. Although its significance is recognized in Ghana's irrigation policy, these systems still receive inadequate public support. Informal irrigation includes inland valley water management; river, stream, and lake water-lifting and groundwater pumping systems; and small reservoir and dugout-based irrigation. The subsector presents an opportunity to invest in the development of these emerging systems and unlock the potential of smallholder farming.

A string of new commercial projects are raising the levels of investment in irrigated agriculture. This trend is expected to continue as Ghana makes slow but steady progress in institutional reform, which will ultimately help the country tap its vast irrigation potential.

Farming communities

NGOs provide valuable advice and technical assistance to farmers. It is estimated that small-scale farmers could double their yields in the dry season by following such advice.

Annex 1 - Sector overview – major players

Ghana has a range of organizations working to expand the irrigation sector, including various donors, agricultural companies, NGOs, public sector organizations, and MFIs.

The donors actively engaging in irrigation include the World Bank, the Japan International Cooperation Agency, USAID, the Millennium Challenge Corporation, the French Development Agency, and the International Fund for Agricultural Development, and FAO. Intermediary NGOs are also playing an increasingly active role in the sector, including helping farmers access agricultural technologies. In Ghana, NGOs such as TechnoServe, the SEND Foundation, the Adventist Development Relief Agency, IDE, and ACDI/VOCA are fostering smallholder linkages.

The public extension system lacks the capacity to respond to technical assistance needs and intermediation with private operators along the value chains is weak. These challenges have contributed to high production and transaction costs for farmers and high levels of aid dependency and mistrust, undermining the scope for contractual relationships between the various value-chain actors.

Table 5 sets out the major players in the country's irrigation sector.

Table 5: Major players in the sector

Stakeholder type	Major players
Donors	• World Bank • USAID • Millennium Challenge Corporation • International Fund for Agricultural Development • Japan International Cooperation Agency • AgDevCo • SNV Netherlands Development Organization • French Development Agency • Korea International Cooperation Agency • African Development Bank • German Development Bank (KFW)
Commercial farms	• Wienco • Vegpro Ghana Ltd • Olam • Freshfields Farms • Agri Ghana Ltd and Terragric Gh Ltd • GADCO • Kwanim Farms Ltd
Research institutions and networks	• International Water Management Institute • Farmers Organization Network in Ghana
Irrigation dealers and traders	• Dizengoff Ghana Ltd • Agrimat
Microfinance institutions /financial consulting firms	• Acumen • Carana Corporation • TechnoServe • Sinapi Aba Trust
NGOs	• Solidaridad • ACDI/VOCA • IDE Ghana
Irrigation suppliers	• Grundfos • Valmont/Valley

Source: Authors' compilation, 2013.

The table below presents a list of the existing irrigation development projects in Ghana.

Table 6: Major donor-funded projects in agriculture, including the irrigation subsector

Institutions	Commitment (USD million)	Type of financing
World Bank (International Development Association)	100	Loan
Millennium Challenge Corporation	200	Grant
International Fund for Agricultural Development	78.5	Loan
USAID	45	Grant
AfDB	131.2	Loan/ grant
European Union, Organization of the Petroleum Exporting Countries Fund, and the Global Environment Facility	4.3	Loan/ grant

Source: Authors' compilation, 2013.

Table 7 presents selected agriculture production companies and their irrigation business models.

Table 7: Classification of selected companies in Ghana by business model

Business model	Business entity	Value chain	Initiator/sponsor
Contract farming – out-grower program	Afrique Link Ltd	Tomato	n.a.
	Blue Skies	Fruits	Private
	Ghana Nuts	Soy	n.a.
	Golden Exotics	Pineapple & banana	Private
	Masara N'arziki	Maize	Private
	Millennium Foods	Maize	Private
	Scan Farms	Fruits & vegetables	n.a.
	Olam Ghana	Cotton	Ghanaian government and private
Contract farming – nucleus farmer program	Afife Rice Irrigation Project	Rice	Ghanaian government
	Benso Oil Palm Plantation	Palm oil	Development partners and Ghanaian government
	GADCO Ghana Limited	Rice	Private and AgDevCo
	Ghana Oil Palm Development Company Ltd	Palm oil	Private and Ghanaian government
	Ghana Rubber Estate Ltd	Rubber	Development partners (European Union, French Development Agency, KfW)
	Guinness Ghana Sorghum Project	Sorghum	TechnoServe, private, KfW
	Integrated Tamale Fruit Company	Mango	Private (Dutch Govt. support)
	Twifo Oil Palm Plantations Ltd	Palm oil	Private, Ghanaian government, French Development Agency
	Vegpro Ghana Limited	Vegetables	Private and Ghanaian government
Management contract (nucleus estate with smallholder program)	Benso Oil Palm Plantation	Palm oil	Ghanaian government and private
	Ghana Oil Palm Development Company Ltd	Palm oil	Ghanaian government and private
	Twifo Oil Palm Plantations Ltd	Palm oil	Ghanaian government and private, European Union, Challenge Development Corporation
Farmer-ownership	Kuapa Kokoo Ltd	Cocoa	Private, development partners (Department for International Development)
	Single Mothers Association	Rice	Ghanaian government and private

Farmer-ownership/ joint venture	Afrique Link Limited	Tomato	Ghanaian government and private, GIZ
	Kuapa Kokoo Ltd	Cocoa	Private
Hybrid: spot buying plus contract farming	Ghana National Onion Traders and Transporters Association	Onion	Ghanaian government, GIZ, USAID
	Ghana National Tomato Traders and Transporters Association	Tomato	Ghanaian government, GIZ, USAID

Source: Paglietti, Sabrie, Review of smallholder linkages for inclusive agribusiness development 2013.

Annex 2 - Crop market size assessment

This Annex assesses the expansion potential of some of the most important crops in Ghana. The projections displayed in the table below are based on long-term trends in output, while allowing for the sharp (but unsustainable) rates of increased production that many crops have experienced in the past few years.

Table 8: Initial crop production forecasts for Ghana to 2025 (000 metric tons)

	1995	2000	2005	2010	2012	2015	2020	2025	% Growth rate, 2012-2025
Paddy rice	201.7	248.7	287.0	491.6	481.1	465.2	505.2	545.2	1.4%
Maize	1 034.3	1 012.7	1 171.0	1 871.7	1 949.9	2 130.6	2 293.5	2 456.4	1.6%
Millet	200.8	169.4	185.0	219.0	179.7	200.9	208.1	215.4	1.0%
Sorghum	360.1	279.8	305.0	324.4	280.0	280.0	262.5	245.0	-1.2%
Sugar	14.6	18.6	18.6	19.3	19.7	19.7	20.0	20.3	0.3%
Cotton	26.3	30.0	19.2	23.2	24.0	26.5	28.1	29.7	1.3%
Bananas	8.0	10.0	26.3	70.0	75.0	81.0	85.7	90.5	1.3%
Citrus	230.3	335.3	543.3	626.0	630.3	660.8	711.7	762.6	1.5%
Coffee	3.8	2.0	1.2	1.2	1.5	1.5	1.4	1.4	-0.1%
Vegetables	0.0	3.5	8.6	10.0	11.0	13.1	13.9	14.8	1.7%
Fruit	1 950.1	2 391.4	3 505.2	4 483.1	4 603.3	4 784.9	5 126.2	5 467.5	1.4%
Pineapples	20.0	60.0	70.0	50.0	55.0	55.1	59.7	64.2	1.4%
Cocoa beans	403.9	436.6	740.0	632.0	700.0	713.1	737.0	761.0	0.7%
Palm oil	102.0	108.0	117.0	120.0	122.0	138.8	152.0	165.3	2.0%

Source: Estimates based on historical FAO data.

Notes: Sugar is presented rather than sugar cane to allow comparison with consumption.

These production forecasts are used to predict the country's crop area, based on trend increases in yields, to 2025. In some cases, increases in yield will deliver almost all of the output expansion, which means that the area used for paddy rice, citrus,

cocoa beans, and pineapples can decrease. In other cases, such as maize, yield increases merely slow the required rate of area expansion.

Increased irrigation should generate faster yield increases. To allow for this effect, it is assumed that the irrigated area for the rice and vegetable crops remains at its current percentage penetration. If the crop area expands so does the absolute irrigated area. It is forecast that 3 percent of the total cultivated area for maize, sugar cane, bananas, cotton, and palm oil will be put under irrigation by 2020. These estimates are theoretical and do not consider potential hydrological constraints.

Table 9: Initial crop area forecasts for Ghana to 2025 (000 hectares)

	1995	2000	2005	2010	2012	2015	2020	2025	% Growth rate, 2012-2025
Paddy rice	99.9	115.2	120.0	181.2	189.5	184.2	185.5	186.6	0.0%
Maize	688.6	694.7	750.0	991.7	1 042.1	1 251.2	1 289.2	1 324.0	1.1%
Millet	204.0	208.0	185.0	176.6	172.5	198.2	196.0	194.0	0.2%
Sorghum	334.5	288.7	305.0	252.6	230.8	245.0	219.3	195.8	-1.9%
Sugar	4.0	5.5	5.5	5.7	6.0	6.6	6.7	6.8	0.5%
Cotton	28.3	50.0	25.0	25.9	27.0	28.6	28.9	29.2	0.4%
Bananas	3.5	3.5	6.6	7.3	7.5	15.6	15.7	15.8	2.2%
Citrus	33.8	48.7	40.4	22.8	41.3	41.2	41.2	41.1	0.0%
Vegetables	80.8	155.8	107.8	75.4	76.9	108.5	110.1	111.5	1.3%
Fruit	269.6	321.8	364.7	392.6	402.4	476.1	482.5	488.3	0.7%
Pineapples	3.5	10.0	10.5	9.5	9.8	8.8	9.1	9.3	0.2%
Cocoa beans	1 000.0	1 500.0	1 850.0	1 600.2	1 600.3	1 751.8	1 737.9	1 725.2	0.1%
Palm oil	23.0	24.8	26.7	28.8	36.5	39.7	40.4	40.7	0.5%

Source: Estimates based on historical FAO data.

The current irrigated area presented in the table is almost double the estimate of 31 000 hectares of the country's current, fully controlled irrigable area presented elsewhere in this report. This is because the current irrigated land is cropped twice a year, with double-cropping of almost all 20 000 hectares of irrigated rice-land with vegetables, and two vegetables double-cropped on about 10 000 hectares. This means that two crops (and therefore 2 hectares of land for the purposes of the table) are produced on 1 hectare of irrigated land each year, one after the other.

If double-cropping of rice and vegetables is accounted for and those areas are removed, the total extra irrigated land drops to about 51 000 hectares. About 80 percent of this land is accounted for based on the assumption that 3 percent of maize area will be irrigated in future.

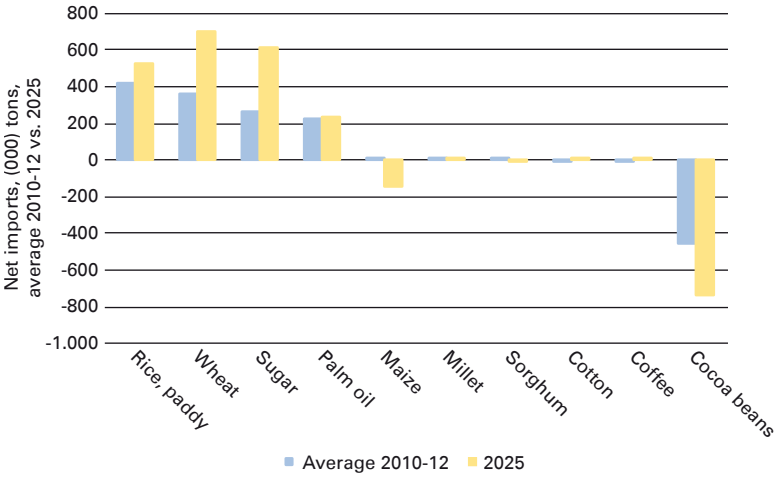
Domestic market expansion

An open domestic market with import parity conditions would typically offer the most attractive farm gate prices to a Ghanaian producer. Estimated domestic consumption to 2025 can be used to forecast the future exportable surpluses and import requirements for each crop. Vegetables, fruit, and citrus generally do not have accurate and reliable aggregate data available because these crops are often sold in local, informal cash markets where transactions are not recorded.

The forecasts for consumption are then combined with the forecasts for production, which gives an exportable surplus/net import requirement for all the recorded crops to 2025. The figure below identifies the current net import requirement for the most important crops in Ghana.[20]

20 The crops included are not recommendations for irrigation; they are merely crops that can be irrigated in some situations. The analysis in this chapter considers only where market access could present a barrier to a crop's expansion.

Figure 11: Current Ghanaian net imports versus forecast import requirement in 2025



Source: Estimates based on historic FAOSTAT data.

Regional market expansion

Once the domestic market is exhausted, Ghanaian producers can take advantage of the wider ECOWAS trade bloc. This analysis does not account for the prospective, parallel expansion of the same crops in other member countries. If other ECOWAS countries were to significantly expand these crops, prices would drop due to downward pressure and the prospects for Ghanaian regional demand would be undermined.

Table 10 compares the forecasts for annual Ghanaian supply increases against forecasts of annual ECOWAS demand increases to 2025. The data is presented in terms of percentage annual compound rates of growth and absolute increases in metric tons between 2013 and 2025.

Growth in maize production will need to be absorbed by regional markets. Domestic prices could be exposed to a swing from import parity to export parity conditions if production expands too fast, but strong growth prospects in ECOWAS should accommodate Ghana's ambitions. Sugar also benefits from a strong regional market opportunity if the domestic market cannot

accommodate its growth. The crops most vulnerable to regional market constraints are cocoa beans and palm oil.

Table 10: Growth rates – Ghanaian production versus ECOWAS consumption, 2013–2025

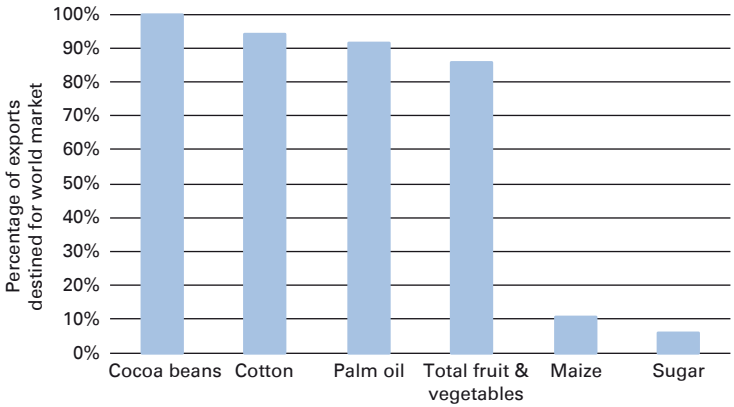
	ECOWAS consumption		Ghana production		Difference	
	% Growth rate	Increase in 000 metric tons	% Growth rate	Increase in 000 metric tons	% Growth rate	Increase in 000 metric tons
Wheat	3.0	2 296	-	-	3.0	2 296
Paddy rice	3.3	6 392	1.4	64.1	1.9	6 328
Maize	2.4	5 870	1.6	506.5	0.9	5 363
Millet	1.5	2 654	1.0	35.7	0.5	2 619
Sorghum	1.7	2 926	-1.2	-35.0	2.9	2 961
Sugar	2.8	1 134	0.3	0.6	2.6	1 134
Cotton	1.4	62	1.3	5.7	0.0	56
Coffee	2.4	150	-0.1	-0.0	2.5	150
Palm oil	1.4	344	2.0	43.3	-0.6	300
Cocoa	2.4	14	0.7	61.0	1.8	-47

Source: Calculations based on FAOSTAT data.

World market expansion

Cocoa, cotton, palm oil, fruit, and vegetables are the biggest exports outside the region.

Figure 12: Percentage of major Ghanaian exports destined for the world market



Source: Calculations based on FAOSTAT data.

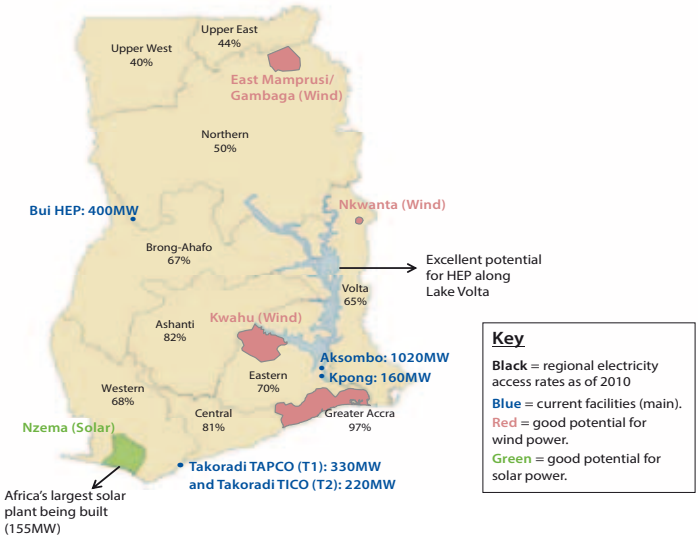
Annex 3 - Power infrastructure

Ghana is the fastest-growing economy in Sub-Saharan Africa and power plays a critical role in this rapid development. The country has one of the highest electrification rates in Africa, relatively good generating capacity, and costs of connectivity are low in comparison with its neighbors.

Ghana has strong political will to increase electrification, targeting 100 percent by 2020. About 72 percent of the country is electrified already, and the country is also working to diversify its energy mix. Bringing access to electricity to rural areas is a priority.

The map below presents Ghana's power infrastructure. At present, the Northern, Upper East and Upper West regions, where electrification rates average between 40 percent and 50 percent, are less favored locations for irrigation development due to power availability.

Figure 13: Ghana's power infrastructure



Source: FAO.

Annex 4 - Water management

Figure 15: Suitability – inland valley rice

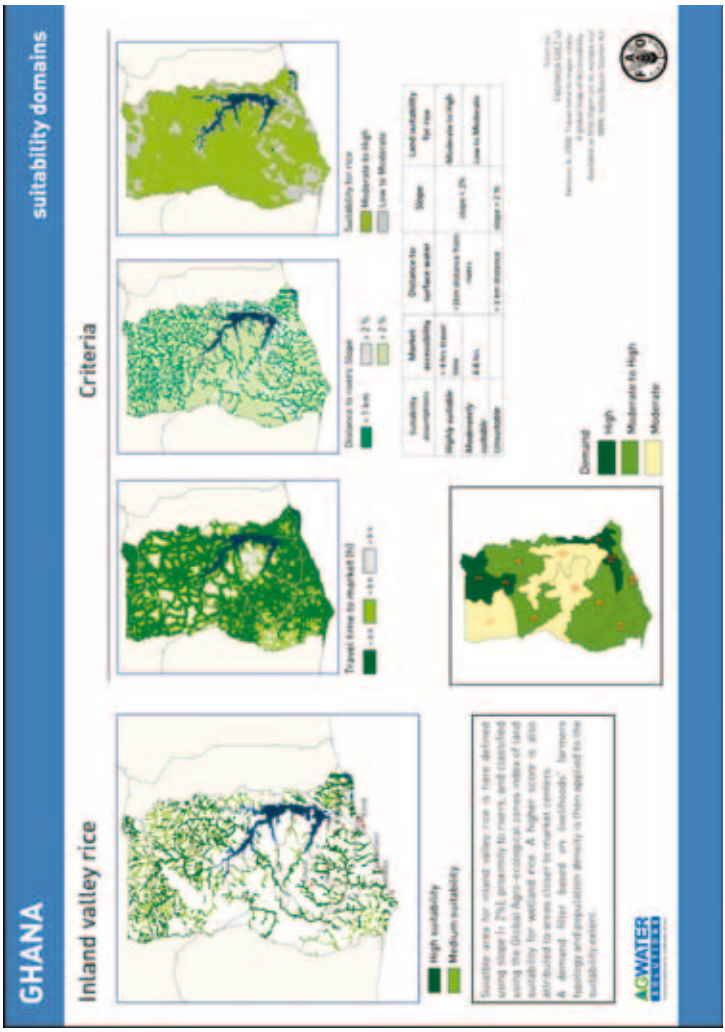


Figure 16: Suitability – pumps

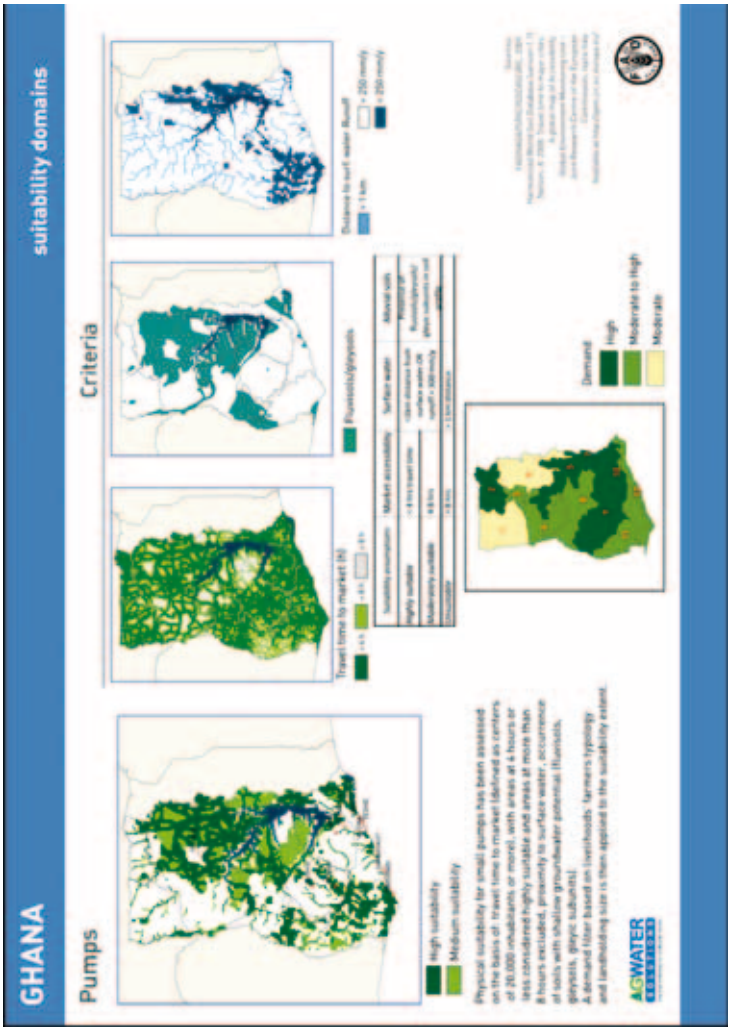
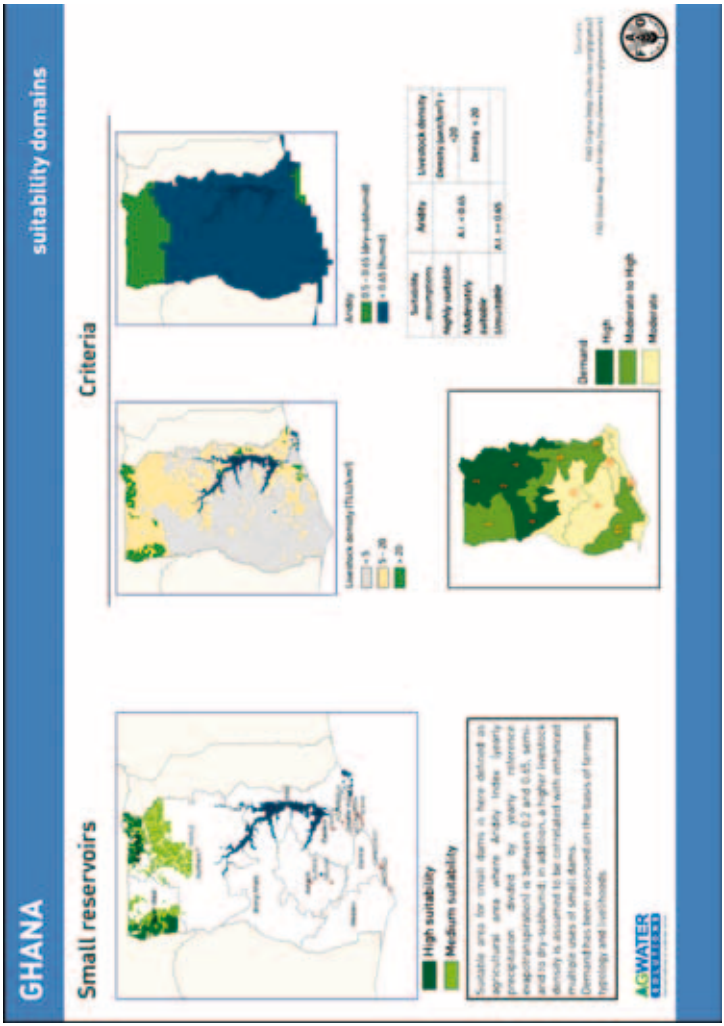


Figure 17: Suitability – small reservoirs



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