

Food and Agriculture Organization of the United Nations



Ethiopia Irrigation market brief





Ethiopia

Irrigation market brief

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FOREWORD

In Africa, agribusiness, more than any other sector, has the potential to reduce poverty and drive economic growth. Agriculture accounts for nearly half of the continent's gross domestic product 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, 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, 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 rainfed 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 third in a series of market briefs produced jointly by the IFC and the Food and Agriculture Organization of the United Nations (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 Ethiopia, recent performance, and opportunities for future growth. In order to provide a wider regional perspective, subsequent irrigation market reports will be prepared for Kenya and Senegal. Reports for Ghana and Zambia have already been prepared.

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

IFC is the largest global development institution focused exclusively on the private sector. Working with private enterprises in more than 100 countries, IFC uses its 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 – making sure people have regular access to enough high quality food to lead active, healthy lives – is at the heart of FAO's efforts. 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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ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
ATA	Agricultural Transformation Agency
BIR	Ethiopian currency unit
COMESA	Regional Common Market for Eastern and Southern Africa
DBE	Development Bank of Ethiopia
FAO	Food and Agriculture Organization of the United Nations
GDP	Gross domestic product
GIZ	Gesellschaft für Internationale Zusammenarbeit (formerly GTZ) (German Society for International Cooperation)
GoE	Government of Ethiopia
IDE	International Development Enterprises
IFAD	International Fund for Agricultural Development
IFC	International Finance Corporation
IWMI	International Water Management Institute
JICA	Japan International Cooperation Agency
MFI	Microfinance institution
MoA	Ministry of Agriculture
MoWE	Ministry of Water and Energy
NCA	Norwegian Church Aid
NGO	Non-governmental organization
PPP	Public-private partnership
SWOT	Strengths, weaknesses, opportunities, and threats
USAID	United States Agency for International Development
USD	United States dollar
WB	World Bank
WRF	Warehouse receipt financing

Chapter 1 – Overview

Agriculture and the economy

The Federal Democratic Republic of Ethiopia is a landlocked country. With a population of about 92 million, Ethiopia is the second most populous country in Sub-Saharan Africa. Despite being one of the poorest countries, with a per capita income of USD 454 (substantially lower than the regional average), Ethiopia's recent economic and development performance is staggering; economic growth averaged 10.6 percent per year from 2007 to 2012. However, Ethiopia still relies heavily on food aid, receiving 25 percent of global food aid for Sub-Saharan Africa. Significant contributors to food aid dependency are deficiencies of purchasing power and high food price inflation (FAO, 2014).

The performance of the Ethiopian economy as a whole is highly correlated with the agricultural sector. Agriculture contributes approximately 44 percent to the national gross domestic product (GDP), and it accounts for 70 percent of export earnings. The largest share of export value comes from cash crops such as coffee and sesame. Ethiopia has Africa's largest livestock population serving diverse functions; they are a source of food, income, draft power, and manure for fuel and crop production.¹ Livestock contributes 47 percent to agricultural GDP and 85 percent of farm cash income. The recent performance of the agricultural sector is highlighted in the figure below.

¹ IGAD (2013), The Contribution of Livestock to the Ethiopian Economy, Policy Brief No: ICPALD 5/ CLE/8/2013.



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

Source: FAOSTAT, 2012.

The agricultural sector provides for the livelihoods of 76 percent of the country's workforce. About 80 percent of employed people living in rural areas work in this sector.

Land, crop production, and water

The country's population density is moderate, with 85 people per km², compared with 15 in neighboring Somalia, 18.8 in Sudan, and 73 in Kenya. Ethiopia also has significant water resources – nearly 1 330 m³ of water per inhabitant, compared with 2 251 in Somalia, 589 in Somalia, and 479 in Kenya.²

Cereals (maize, sorghum, wheat, and barley) dominate by volume and value, followed by vegetable, cotton, and roots and tubers. The next group includes sugarcane, pulses, other annual crops, and citrus.

Agriculture in Ethiopia is small-scale, dominated by limited access to technology and institutional support services. There are about three million smallholder farmers, with an average farm size from 0.5 hectares to 2 hectares, currently producing 95 percent of the country's food crops. Commercial farmers

² FAO, AQUASTAT data. Renewable internal freshwater resources per capita are calculated using the World Bank's population estimates.

produce only 5 percent. Maize is typically a smallholder staple as is teff, while commercial farmers dominate sugarcane, vegetables, fruit trees, and coffee. Vegetables and cereals are produced by both farm systems.

Both irrigated and rainfed agriculture are important in the Ethiopian economy. Nevertheless, virtually all food crops (97 percent) in Ethiopia come from rainfed agriculture, with the irrigation subsector accounting for only about 3 percent of the food crops. Industrial crops such as sugarcane, cotton, and fruit are mostly irrigated. The estimated harvested area for the major irrigated crops is shown in Figure 2.



Figure 2: Area estimates for the main irrigated crops in Ethiopia - 2012

Source: Authors' estimates based on historical FAO data and fieldwork.

Rainfed farming has always been the main livelihood for most Ethiopian people. It is supported by traditional water harvesting practices, particularly in central-north, eastern, and southeastern areas of the country. The proportion of traditionally irrigated land (almost half of the total irrigated area) and the number of farmers involved indicate the significant economic and social role of traditional irrigation for rural society. Urban and peri-urban irrigation are not significant in terms of area coverage and production, but the traditional irrigation practiced around Addis Ababa plays an important role in supplying vegetables to the Addis Ababa market. The use of irrigation technology, although currently not widespread, can reduce risk and improve production.

Traditional farming systems in Ethiopia are adapted to the country's major agroecological zones. The midlands and highlands primarily support integrated crop and livestock production, while pastoral systems dominate in the lowlands. The country's 32 major agro-ecological zones can further be grouped into three primary zones, according to rainfall and evapotranspiration: *high rainfall zone, moisture deficit zone, and pastoralist zone*³ (Figure 3). According to a recent study,⁴ development aid was largely directed to the second and third zones, owing to the vulnerability of the populations and the large-scale irrigation potential in lowland areas – mostly pastoralist zones. But currently the Government's development priorities also include high rainfall zones.



Figure 3: Three major zones with distinct water availability

Source: International Water Management Institute (IWMI).

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

³ High rainfall zone: Rainfall generally exceeds 800 mm/year, with great variability. Irrigation would be supplementary to produce a second crop and increase productivity. Typical development is mixed crop and livestock systems, though crops dominate. This zone covers 24 percent of land, 43 percent of population, and 51 percent of permanent crop output. Moisture deficit zone: Rainfall tends to be lower than 600 mm/year, but it's highly variable. Production is typically mixed crop and livestock, with crops dominating. These areas are often vulnerable and degraded, with low productivity, and overpopulated. Irrigation could secure food production, improve livelihoods, and increase food resilience. This zone covers 32 percent of land, 47 percent of population, and 39 percent of permanent crop output. Pastoralist zone: With the exception of the westernmost part of the country, rainfall is lower than 600 mm/year. Pastoralist, livestock-based, and nonsedentary systems prevail. These areas are constrained by vulnerability and low livestock productivity. Irrigation would create other livelihood options and increase food resilience. This zone covers 44 percent of permanent crop output.

⁴ Awulachew et al. (2010)



Figure 4: Harvested area by crop group in Ethiopia, 2002-2012

Source: FAOSTAT.

Scope to develop irrigation

Ethiopia offers ample scope for growth in agricultural production through irrigation development as the country is endowed with a substantial amount of water resources.⁵ Although the surface water resource potential is impressive and underdeveloped, over-exploitation of and competition over water resources exist in areas where irrigation is practiced intensively (Awash River and depleted lakes such as Lake Haromaya). At the same time, the surface water resources of some of the major rivers such as Abbay and Tekeze (both tributaries of the Nile River) are flowing in deep gorges along rugged areas that are unsuitable for irrigation. The country, however, remains well placed to develop irrigation-based agricultural production.

In Figure 5, the inner (yellow) circles represent the estimated current irrigated area of crops in Ethiopia. The outer circles are proportionate to the relative total area sown with these crops: maize, sorghum, and wheat are the dominant crops.

About 37 percent of all vegetable production is irrigated with flood irrigation (156 000 hectares), and 100 percent of sugar and cotton production is irrigated (22 000 and 80 000 hectares, respectively).

⁵ Surface water: Ethiopia has 12 river basins that provide an estimated average annual runoff of 125 billion m³, with the Abbay basins (in central and northwest Ethiopia) accounting for 45 percent of this amount. Initial estimates of groundwater potential vary from 2.6 to 13.5 billion m³, although some experts suggest this could be much higher (Awulachew et al., 2010).



Figure 5: Estimates of the relative size of irrigated area by crop in Ethiopia, 2013

Source: FAO Aquastat.

Major market players

Various public and private players engage in Ethiopia's irrigation development (Annex 2). The public sector includes different Government institutions, non-governmental organizations (NGOs), and international donors who are directly or indirectly involved in the implementation of the various irrigation projects in the country.

The Ministry of Water and Energy (MoWE) is responsible for developing largescale irrigation schemes mainly for public farms, although it is currently also developing large schemes for communities. The Ministry of Agriculture (MoA) is responsible for developing community-managed small-scale irrigation schemes (up to 250 hectares), from scheme formulation to development and extension services (including marketing).

The donors actively engaged in the irrigation subsector are:

- World Bank
- Japan International Cooperation Agency (JICA)
- International Fund for Agricultural Development (IFAD)
- Danish and Norwegian cooperation
- German Development Agency
- African Development Bank (AfDB)
- FAO

Intermediary NGOs⁶ are supporting communities in irrigation development (new construction and rehabilitation), excluding the provision of extension services. Some of the local NGOs active in small-scale irrigation development include: International Water Management Institute (IWMI); International Development Enterprises; Relief Society of Tigray in the Tigray region; Organization for Rehabilitation and Development in the Amhara region; and Oromo Self Help Organization in the Oromia region.

There are several private sector commercial companies that develop and manage their own irrigation schemes (Annex 2). These companies mainly produce cotton, flowers, and vegetables and are usually located along the Awash River and Rift Valley lakes. In addition, there are some cooperatives that manage irrigation schemes, such as the Lee-Asita Irrigation Users Cooperative, which covers some irrigation in Afar.

A great number of manufacturers and a wide variety of irrigation equipment can be found in Ethiopia, despite the small share of potential irrigable area currently irrigated. This may be related to the importation process, where the equipment is imported for a specific pre-approved project in order for it to be duty-free, which gives large farmers a greater say in the procurement process.

Investment opportunities

Ethiopia's growing population of over 92 million provides investment opportunities in irrigated agriculture targeting an international market. This potential, both for commercial and smallholder production, is supported by its substantial availability of water and land, diverse agro-ecological zones, and ongoing improvements in road infrastructure and air transport (including its relative proximity to the Middle East and Europe).

Ethiopia has a longstanding and positive attitude towards foreign private investment with sound macro-economic policies and a stable foreign exchange environment. The existence of private players and public institutions in the sector, albeit their limited capacity, has created an enabling environment for investment in irrigated agriculture, especially when these can directly benefit smallholders. Investment opportunities exist in the production and processing of agricultural crops such as coffee, tea, sugar, flowers, fruits and vegetables, wheat, maize, beans, peas, lentils, soya beans, and chickpeas.⁷

Government incentives are in place, such as duty-free importation of production equipment, grace periods, and an income tax holiday. The country's recently

⁶ World Vision, Action AID, Dan Church Aid, World Lutheran Federation, SOS Sahel Ethiopia, Norwegian Church Aid (NCA), and Irish Aid

⁷ Ethiopia Fiscal Guide 2013/2014 - https://www.kpmg.com/Africa/en/KPMG-in

approved fiscal and non-fiscal legislation promotes private investments, privileging agricultural investment and the creation of an enabling investment environment in Ethiopia. All agriculture machinery and equipment, including pumps and spare parts, necessary to produce export products are tax exempt and imported through suppliers' credit. Additional tax incentives may be available for export products.⁸

⁸ Ibid.

Chapter 2 – Market analysis

Untapped potential

FAO estimates that Ethiopia's potential irrigable land amounts to 2.7 million hectares. This enormous potential, however, remains largely undeveloped. Only 11 percent of this area was equipped for irrigation in 2001, which was among the lowest percentages in Africa. Since then the IWMI reports the area to have grown to 610 000 hectares in 2010 (Figure 7).

Ethiopia remains largely dependent on rainfed agriculture. The country receives significant rainfall, although distribution and intensity vary, generally decreasing from southwest to northeast. Droughts occur every four or five years. If well managed, Ethiopia's surface water and groundwater systems are sufficient to meet most domestic and irrigation purposes. But the lack of installed water infrastructure provides a serious constraint to irrigation development.



Figure 6: Map of Ethiopia and its neighboring countries

Source: FAO Aquastat.

The following figure shows Ethiopia's current and potential irrigable land in hectares.



Figure 7: Estimated irrigation area in Ethiopia ('000 ha)

Source: FAO Aquastat; IWMI; Government of Ethiopia (GoE).

Development aid was largely directed to the moisture deficit and pastoralist zones, owing to the vulnerability of the populations and the large-scale irrigation potential in lowland areas – mostly pastoralist zones. But currently the Government's development priorities also include high rainfall zones.⁹ The Ethiopian Government has ambitious plans to increase irrigated land in the near future. Irrespective of timely target achievement, the business environment is supportive to investments in irrigated agriculture, especially when these can benefit smallholders directly.

Because the investments in irrigation are site specific – and natural conditions such as soil and water availability vary greatly in the country – it is not possible to estimate with sufficient accuracy the range of investment capital based on the projected expansion in irrigation area. Currently, Ethiopia annually imports irrigation equipment worth USD 70 million (section below). If the Government's political targets on irrigation were to be achieved on time (by 2020), the annual market size for the *irrigation equipment component* could reach ten times the size of current imports.

Trade

Ethiopia's imports of irrigation equipment have trended upwards since 2006, with peaks and troughs that correspond to the requirements of the different

⁹ Awulachew et al. (2010).

infrastructure projects being built in the country. In 2012, the value of imports was USD 70 million. According to the UN Comtrade database, in 2012, the most important categories were: PVC pipes – net imports of USD 16 million in 2012 (23 percent of total); gate valves – net imports valued at USD 15 million in 2012 (21 percent); motorized pumps – net imports accounted for USD 10 million in 2012 (15 percent); and HDPE pipes – net imports of USD 10 million in 2012 (15 percent). These categories are also the ones that show a stronger import growth over the last few years.

Opportunities and challenges

Ethiopia enjoys a fast expanding irrigation subsector as previously presented. This is due to the enormous untapped irrigation potential, the need to provide food, industrial raw materials, and labor to a large and growing population, and the improving business climate in the country.

Domestic and foreign investors are provided with incentives to establish an export-oriented horticultural company. Incentives include (among others) the duty-free importation of production equipment and an income tax holiday.

Ethiopia's recent economic and development performance is staggering; economic growth averaged 10.6 percent per year from 2007 to 2012. Ethiopia still relies heavily on food aid, receiving 25 percent of global food aid for Sub-Saharan Africa. There is an enormous need to invest in irrigated agriculture to ensure food security for a population of over 92 million. Government donorsupported projects are also playing an increasingly important role in the commercialization of agriculture.

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

- Unclear land access procedures
- Lack of access to inputs and financing
- Inadequate farming skills
- Resistance to the adoption of new technologies/crops by traditional cereal farmers, combined with Ethiopian farmers' extreme risk aversion
- Poor agricultural extension and irrigation water management-related service delivery, particularly for small-scale farmers
- Frequent drought leading to rapid depletion of some water resources
- Lack of access to technical and market information (leading to high transaction costs)
- Insufficient physical infrastructure, particularly power supply to rural areas

Less than 12 percent of Ethiopia's cultivated land is irrigated. Business volumes are growing, particularly for drip irrigation equipment for open field vegetable production. Not only are the irrigated areas expanding rapidly but farmers are also demanding improved quality irrigation systems. Irrigation is centered almost exclusively on sugarcane, cotton, maize, and commercial exportable fruit and vegetable production. This poor irrigation penetration is largely due to the lack of technical capacity, unclear land access processes, and limited business skills. The weak institutional capacity of irrigation authorities and the country's legal framework are also hindering the irrigation sector's growth. Delays in the construction of major irrigation infrastructure continue. High competition over limited water resources under current water management practices in the Awash Basin and Rift Valley lakes, where investing in irrigation is promising, also limits the scope for private investment. There is growing concern about water use because of the conflict between the environment and agriculture. particularly in lowland rural areas, where total base-flows are diverted for irrigation without releasing water for ecological conservation.

Although public-private partnership (PPP) has been practiced for irrigation water management and marketing, the lack of policy and legal frameworks and absence of institutional and regulatory mechanisms for PPP are also challenges. On a positive note, the country has recently endorsed a Proclamation for Irrigation Water Users Association, which will empower water users to play a key decision-making role in the irrigation water management.

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





Source: Authors' compilation, 2014.

The figure below sets out key data on the different levels of agricultural production. By far the most commonly used irrigation technique in Ethiopia is surface irrigation. Figures from 2001 indicate that surface irrigation constitutes around 98 percent. Sprinkler irrigation accounted for approximately 2 percent. Localized irrigation was negligible.



Figure 9: Farmer typologies, irrigated crops, and constraints

Source: Authors' compilation, 2014.

Expanding the crop market

Expanding the irrigated crop market in Ethiopia 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 into these markets, with green representing the most easily absorbed crops.

Figure 10: Market absorption of crops - opportunities and threats

	Domestic Market	COMESA	World
Opportunity	all but maize	wheat, maize, rice	cotton, barley, sugar
Threat	cotton	cotton, barley	
[wheat, so	orghum, rice, sugar]	[barley] [maize]	[cotton]

Source: Authors' compilation, 2014.

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 Ethiopian production on national, regional, and world markets. The figure below identifies Ethiopia's current net import and forecast import requirements in 2025 for a range of important crops.



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

Source: Authors' estimates based on historic FAOSTAT data.

The results of a sensitivity analysis, taking into account different levels of achievement of the irrigation target set by the Government of Ethiopia (see main report), show that Ethiopia is likely to remain a net importer of rice and sugar in the foreseeable future, while increased production of rice, sugar, and wheat could easily be absorbed in the domestic market. Additionally, the regional market could accommodate any excess maize, should Ethiopia's production rise to surplus levels. Demand growth for barley and cotton is not as strong in the regional market, but these commodities benefit from a strong track record of accessing the world market in advantageous conditions.

Fruits and vegetables face a different challenge. These crops are perishable and need an efficient supply chain to reach their end markets. This is especially true for the share directed to distant markets. Another essential requirement is that farmers have the adequate level of assistance to make the right planting and harvesting decisions so as to benefit from the best marketing opportunities. Moreover, there is need for investment in new agroprocessing capacity and

value chain linkages that address product perishability and the fulfillment of the quality standards demanded by foreign markets. If these logistical and marketing issues are rightly addressed, Ethiopia has all the conditions to continue to tap into the European, American, and other emerging and quality demanding markets, while supplying the growing domestic market.

The potential crop market size is unlikely to form a substantial barrier to the estimate of 140 000 hectares of additional irrigated land from 2015 to 2025 in Ethiopia.¹⁰

¹⁰ See full report for complete analysis.

Chapter 3 – Supply chain and services

Supply chain

Despite its vast potential, Ethiopia still has a relatively undeveloped market for irrigation equipment. As shown in the figure below, distributors are concentrated in Addis Ababa. These distributors supply irrigation equipment in other areas of the country, but they tend to operate from their headquarters in the capital. One of the suppliers contacted (Bruh Tesfa) is headquartered in Mekelle – the capital of the Tigray region. The company also has a branch office in Addis Ababa, and is supported by agents in different regions.



Figure 12: Location of major irrigation equipment suppliers

Source: Author's compilation, 2014.

Suppliers have plans for expanding outreach networks outside of Addis Ababa. Developing a wider distribution network will boost demand.

For small private farms, the supply chain and service market are obstacles to growth. The supply chain faces the following challenges:

- Distributors are still based mostly in the capital city and their radius of action is limited.
- Suppliers keep minimal stocks of irrigation equipment with the consequence of further delays in technical assistance.
- Official support services for small-scale irrigation, such as input supply, credit, and marketing systems, are virtually absent.

The process of importing irrigation equipment into Ethiopia takes, on average, one to two months from the moment the order is placed. There are two major ways of importing:

- Under the client's approved investment project: This is the preferred way because equipment comes in duty-free for the duration of the duty exemption granted to the project. This is generally granted for five years and is renewable.
- (ii) Directly by the distributor: The company pays 30 to 35 percent import duties on average (and 15 percent value-added tax that is reimbursed), making the equipment more expensive. This is avoided as much as possible; however, distributors would cater for smaller projects that are not duty exempt, as well as keeping minimal stocks.

As the vast majority of equipment is imported under the client's investment project, clients tend to be more involved in the choice of the manufacturer. This may account for the fact that distributors work with a great variety of manufacturers, with no exclusivity agreements.

Manufacturers and distributors

In Ethiopia, there is a wide variety of irrigation equipment from many different manufacturers. This may be related to the importation process where in most cases the equipment is duty-free, imported for a specific pre-approved project, giving large-scale farmers a greater say in the procurement process.

Some of the irrigation equipment most commonly referenced includes irrigation pumps, micro-irrigation, centre pivots, pipes and fittings, and different product lines. The table below identifies major suppliers by type of equipment and origin.

Suppliers	Main irrigation equipment supplied	Origin
Astunet	PVC Pipes	Ethioplastic (Ethiopia); n.a. (Holland)
	Pumps	Lombardini (Italy); Robin (Japan); others
	Centre pivots	Chamartin (Spain); Irrifrance (France); Reinke (USA); Valley (USA)
	Sprinklers	Chamartin (Spain)
	Drip equipment	Chamartin (Spain)
Bruh Tesfa	Micro-irrigation	Azud (Spain)
	PE Pipes	Agru (Austria)
	Drippers, drip lines, sprinklers, mini- sprinklers, valves, filters, connectors, fittings, controllers	Irri al tal (Israel)
	Water meters and valves	Arad (Israel)
	Drip, HDPE pipes, fittings	Bruh Tesfa (Ethiopia)
Hikas Engineering & Trading P.L.C.	Drip equipment	Plastro (Israel), EcoFlo (India)
	Sprinklers	Plastro (Israel), EcoFlo (India)
	Centre pivots	n.a. (USA)
	Flexi-flume	Bartlet (Australia)
	Family drip kits	Plastro (Israel), EcoFlo (India)
	Gravity mini-sprinklers	EcoFlo (India)

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

Source: Fieldwork, 2014.

Astunet is a distributor of irrigation equipment for controlled environment and open field systems. Most of Astunet's clients are private commercial companies, although the company also supplies individual farmers and NGOs with family irrigation kits (500 m²).

Commercial farmers mostly use centre pivots and sprinklers. Small farmers use traditional methods such as micro-irrigation of harvested rainwater, pumping (human powered), and river diversion. As their incomes rise, small-scale farmers move away from human powered pumps and increasingly adopt low-cost motor

pumps. They might even adopt localized sprinklers. Experience from the Rift Valley region shows that some 30 percent of farmers have moved from hand pumps to diesel pumps. The majority of farmers (70 percent) have not changed because of the small size of their land and the advantage of the hand pumps' low operating and maintenance costs.

Bruh Tesfa is an Ethiopian company engaged in the design and installation of comprehensive irrigation and water supply systems. The company manufactures various types of PE and HDPE pipes, fittings, conduits, and geo-membrane liners for reservoirs and irrigation canals. It also supplies drip, centre pivot, travelling gun and sprinkler irrigation systems, automatic, semi-automatic, and manual irrigation control systems, complete sets of greenhouse irrigation systems, and equipment for pipe-supported furrow irrigation.

Hikas Engineering & Trading P.L.C. targets private commercial farms and also the Government tenders. Hikas focuses on modern irrigation systems such as pressurized drip and sprinkler equipment, pipes (PE, HDPE) and fittings, centre pivots, travelling guns, and flexi-flume tubes for furrow irrigation systems. Hikas also sells small-scale gravity "family" drip kits and gravity sprinklers (mini-sprinklers). There are also 15 other smaller companies selling irrigation equipment in Ethiopia, almost all of which are based in Addis Ababa.

Average unit costs

The costs for irrigation systems are always strongly site specific: they vary with the nature of the crops, source of water, and topographical, pedological, and geological conditions, among others. For this reason irrigation equipment suppliers tend to resist quoting generic unit prices and this was the case found during fieldwork in Ethiopia. The table below summarizes the average retail prices practiced by a small sample of irrigation equipment suppliers. They are only indicative. One other distributor was supplying family irrigation kits to individual farmers and NGOs at a cost of USD 65 to 80 for each 500 m² kit (without the barrel or installation).

Main irrigation equipment supplied	Per hectare cost (USD)
Manual drip systems	USD 5 000
Automated drip systems	USD 9 000 - 10 000
Movable sprinklers, centre pivot, travelling gun	USD 3 500 - 4 000

Table 2: Irrigation equipment retail pricing, 2013

Source: Fieldwork, 2014.

The types of irrigation systems most commonly found in Ethiopia include river diversion, small earth dams ("runoff reservoir"), pump irrigation systems with water from rivers, ponds, or lakes ("river-lift"), and pump irrigation systems with groundwater ("groundwater lift"). In the framework of the World Bank's Agricultural Growth Project, a study commissioned by the Ethiopian MoA¹¹ compared the *hardware component*¹² *of the unit construction costs* actually registered in a sample of irrigation schemes in the Oromia, Amhara, and Tigray regions (Figures 13 and 14). After carrying out a financial analysis of surface water and groundwater irrigation, one of the study's conclusions was that groundwater development for irrigation systems with surface boosting should not be encouraged. Instead, direct pumping is advisable in order to minimize investment costs in Ethiopia.



Figure 13: Surface water irrigation - Average unit investment cost, 2012 (USD/ha)

Source: MoA (2012), adapted.

¹¹ Ethiopian Ministry of Agriculture (2012) Trend Assessment and Technical Estimation of Investment Cost of Irrigation in Ethiopia. Addis Ababa, Ethiopia: unpublished.

¹² Hardware investment costs are all costs related to physical construction/excavation, structures, facilities, equipment and materials, such as water well construction, earthworks, dam, canal, access road, sluice, water-gate, irrigation equipment, etc. Software investment costs are those related to engineering management, technical assistance, agricultural support, and institution building. The costs of the software component were not included here.





Source: MoA (2012), adapted.

Assistance and maintenance services

Most of the large companies provide a broad scope of services to farmers, from project design, to equipment supply, installation, maintenance and aftersale assistance, to farmer training and irrigation management (Table 3). Some companies claim to reach all of the Ethiopian territory, but most of these companies tend to operate from their headquarters in Addis Ababa and have to travel to the farming sites whenever assistance is needed. One company is based in the Tigray region and operates both from Addis Ababa and the Tigray region. One of the suppliers has a team of engineers and agronomists trained in Israel that designs and installs the irrigation systems. This team also trains its clients in irrigation management.

Company	Services provided	Coverage
Astunet	 Consultancy and supervision: project survey, design, site planning, and field follow-up service Equipment supply Installation of irrigation systems 	The whole country, from Addis Ababa; East Africa for the supply of plastic pots
	 Agronomic support through own engineering team and local and foreign collaborators On-site training for the clients' employees 	
Bruh Tesfa	 Manufacturing and supply of irrigation equipment Consultancy and supervision: feasibility studies, design, surveying, map preparation for large-scale irrigation 	The whole country, from Addis Ababa and the Tigray region
	Installation of irrigation and control systems	
	 Maintenance and after-sale services in modern irrigation, including welding services on PE pipes and fittings 	
Hikas Engineering	 Study and design of irrigation projects Equipment supply Installation of irrigation equipment Maintenance and after-sale support 	The whole country, from Addis Ababa

Source: Fieldwork, 2014.

Some companies acknowledge that local maintenance providers can only perform basic repairs, and if a major problem occurs, the equipment must be fixed in Addis.

Smallholder farmers are generally dissatisfied with the maintenance by irrigation equipment companies. This is mainly due to the limited stocks of spare parts held by the companies. Farming companies have resorted to keeping a minimum stock of replacement parts because of taxation.

Financial services

Commercial banks, microfinance institutions (MFIs), and cooperative societies provide financing to the agricultural sector. However, only a small share of the total loan portfolio of commercial banks is designated to agriculture – 9.6 percent between 2005 and 2009. Moreover, this lending is biased towards investment in export facilities rather than production and distribution, which has limited the development of agribusiness.

According to the World Bank, Ethiopia has one of the lowest financial inclusion ratios of Sub-Saharan Africa, with only 14 percent of adults having access to

credit. Moreover, the rural areas are largely underserved as bank branches are aggregated in urban areas. Many farmers access credit through informal financial providers.¹³

Investors wishing to obtain financing for agricultural projects can do so with the Development Bank of Ethiopia (DBE), a Government-owned bank established 160 years ago. The DBE loans have favorable conditions (including grace periods for loan repayments at relatively low interest rates: equity ratio of up to 70:30). The recent focus of the DBE is to provide medium- and long-term loans for investment projects engaged in agriculture agroprocessing (20 percent of business), manufacturing (70 percent), or the mining sector (10 percent), and having an export focus. In line with the Growth and Transformation Plan, fruit and vegetable exports are identified as one of DBE's priority subsectors. Acting as an asset development bank, no collateral or external guarantees outside the project are required: the bank takes the project itself as collateral. Due diligence is strict, with every project appraised by teams of experts that perform a risk assessment according to international project appraisal standards.

Access to credit is one of the biggest barriers to the smallholder irrigation sector's expansion in Ethiopia. For small-scale farmers living under the poverty line (USD 2/day), it is hard to afford even the cheapest irrigation pumps. A number of NGOs and MFIs work with small-scale farmers to help them secure financing for irrigation pumps and equipment, but even these have limited capacity.

To increase access to agricultural finance, particularly for smallholders, the Government of Ethiopia helped to establish Oromia Cooperative Bank of Ethiopia, a bank that specializes in financing agricultural enterprises and has implemented a law governing warehouse receipt financing (WRF). Currently, four commercial banks allow farmers to use warehouse receipts as collateral to access loans. So far, the banks have only disbursed Ethiopian BIR 10 million in WRF loans.

Advisory services

Farmers in Ethiopia receive advisory services from the MoA, NGOs, and private firms. Ethiopia's agricultural extension system is one of the largest in the world, with over 60 000 development agents working throughout the country's nine regions. Different Government and International Development Agency programs address capacity building at regional level. The Agricultural Transformation

¹³ Agribusiness Indicators: Ethiopia, published in April 2012, World Bank. For more information, please contact: Grahame Dixie, Agribusiness Unit Team Leader Agriculture & Rural Department (ARD), E-mail: Gdixie@worldbank.org.

Agency (ATA) has established a phone-line extension support training system aimed at farmers producing high-value irrigated crops.

However, official extension services are still biased towards rainfed agriculture and generally provide no training on appropriate water management, agronomic, and crop protection practices, or other techniques that are essential to the more intensive farming of higher-value crops. Extension staff is often not conversant with irrigated agriculture.

NGOs play an important role in providing extension services to farmers. A number of them, specialized in irrigation, promote new technologies and higher revenue crops, thus mobilizing smallholder farmers to adopt irrigation. This is a continuing challenge as in many cases farmers resist changing from traditional rainfed activities. Their services include advice and technical assistance on adequate planting dates, use of good quality seed, correct use of fertilizers, installation and operation of pumps and simple irrigation equipment, and horticultural techniques and marketing.

Chapter 4 – Barriers and constraints

Irrigation in Ethiopia is hindered by various systemic and market barriers. Systemic barriers include technical capacity, limited value chain support and crop marketing, land tenure, and water access. Market barriers include access to finance, land and credit, lack of farmer knowledge, and supply chains.

Technical Capacity

Ethiopia faces a shortage of irrigation engineers and related professionals in this field. Regular delays in the construction of major irrigation infrastructure are attributed to escalating costs resulting from insufficient financial capacity to face those costs, poor project planning, and deficient project implementation.

The Government has also been prioritizing the building of irrigation projects, with insufficient attention given for the completion of the environmental assessment and feasibility studies at the social and economic levels. Lastly, the institutional relationship between the Water Bureau of the MoWE and the Agricultural Bureau of the MoA at *woreda* (district) level is weak and in need of improvement. The latter body needs to staff its district bureaus with more irrigation engineers and system designers if it is to fulfil its mandate next to small-scale farmers.

Post-harvest and marketing issues

In addition to the challenges discussed above, there is a range of postharvesting and marketing issues preventing farmers from maximizing the productivity of irrigated land.

Crop marketing is seen by a wide range of actors as their major concern, particularly for those small-scale farmers who have recently started to grow higher-value horticultural crops. The choice of crop tends to be based on the local agronomic possibilities, and as a result, in a given region farmers tend to plant the same small group of crops and then harvest them in a concentrated period.

Post-harvest losses are estimated at 30 percent of overall production. One of the crucial factors is the *perishability* of the product, compounded by virtually no storage capacity. This leaves the farmers in the hands of aggressive brokers from Addis offering them prices up to 20 times lower than wholesale market prices in the capital.

Access to inputs and after-sale services

The limited availability of inputs and the high costs involved in procuring them are among the most important constraints to commercial agriculture in Ethiopia.

Distributors cannot increase supply in remote areas while there is insufficient demand.

Larger commercial farming companies generally have good input access. Statesupported services for small-scale irrigation – such as input supply, credit, and marketing – are virtually non-existent. Small farmers purchase seeds from local dealers (often not certified or genuine), use fertilizer leftovers from the rainfed season, and have no provision of agrochemicals at all.

The majority of farmers consider the general handling of maintenance by irrigation equipment companies, and in particular the low stock levels, unsatisfactory. The reason being is the full payment of duties and taxes, which does not happen when imports are made under the approved investment projected. As a consequence, farming companies have resorted to keeping a minimum stock of replacement parts for themselves.

The supply chains of farm machinery and irrigation equipment are still largely undeveloped in remote areas. This is slowly improving as distributors extend their network to newly irrigated areas.

Land tenure and availability

Access to land is also an important economic resource for the majority of Ethiopians who, one way or the other, depend on agricultural production for their income and rural livelihoods. Available empirical evidence on land rights and land administration in Ethiopia shows that the land tenure systems have been an important determinant of investment in land improvement measures and the sustainable use of land. In Ethiopia, land has been owned by the state since 1975. The process for acquiring a land lease is coordinated by the Ethiopian Agricultural Investment Land Administration Agency. Leases are reported to vary in length, from 25 years for arable crops to 45 years for perennial crops. Under current guidelines, the allocation of irrigated land is administered on a case-by-case basis by the central Government. Displacement from farmland is widespread, with the vast majority of locals receiving no compensation. Some of the companies complained of delays in being granted land leases.

Farmers resist new technologies

Farmer knowledge is also a major obstacle to the expansion of irrigation. Many farmers in Ethiopia lack the knowledge and skills to expand irrigation. They often do not have sufficient knowledge of cultivation techniques and 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.

Small-scale farmers and communities are resistant to new ideas and to the adoption of new technologies. Their business strategy is often one of low investment-low income, showing markedly risk-averse behavior. This is compounded by the fact that farmers often feel unfairly treated by brokers and are distrustful of any third party.

NGOs are trying to change this mind-set by demonstrating new technology, in cooperation with the staff of official extension services at *woreda* (district) level. The level of technology adoption varies by region, but it is always greater after farmers see the results of trials carried out at the designated farmer training centers. Some NGOs help farmers find out-takers for their products and mediate in the supply contracts signed between producers and buyers.

Access to finance

Access to credit is one of the biggest barriers to the irrigation sector's expansion in Ethiopia. For small-scale farmers, finance is not readily available, and some struggle to afford even the cheapest irrigation equipment. A number of NGOs and MFIs work with small-scale farmers to help them secure financing for irrigation pumps and equipment, but their financial capacity is also limited.

Access to electricity in rural areas

Although the cost of electrical power was never mentioned as a barrier to business development, access to electricity in rural areas is not widespread. In the few places where there is electricity, the frequent power interruptions make most farmers opt instead for diesel pumps or generators. An extended and more reliable energy grid is paramount to the success of irrigation, especially for groundwater projects.

Chapter 5 – Irrigation business models

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

Governments of Ethiopia, at different times, made efforts to use existing water resources to improve agricultural production and productivity. First, large-scale irrigation schemes with mechanized agricultural activities were developed through state farms. Several important benefits accrue from large-scale irrigation that are relevant to the Ethiopian irrigation sector, including: (i) per hectare investment is less costly than the isolated small-scale schemes, particularly when compared with deep groundwater or small dams; and (ii) large-scale schemes can break the relationship between agricultural growth and rainfall. Critics of large-scale irrigation argue that such schemes benefit commercial farms instead of smallholders. Mathara and Wonji are two domestic examples of large-scale schemes that have successfully benefited smallholders as presented in the next paragraphs.

In the 1980s, emphasis was given to the importance of small-scale irrigation systems, which resulted in the establishment of the Irrigation Development Department under the MoA. The overall impact and sustainability of these efforts, however, were minimal.

Ethiopia's Growth and Transformation Plan 2010/11-2014/15 acknowledges the increasing importance of linking smallholder farmers to high-value markets through contract farming (outgrower schemes). Despite this potential, the experience of contract farming in Ethiopia has been limited due to inappropriate policy and binding formal legislation that support contract farming arrangements. This is further compounded by the lack of an in-depth study to guide policy-making.¹⁴

Agricultural projects with irrigation

Four business models of irrigated farming in Ethiopia are presented in Annex 4 – they vary in land size, crops, organizational structure, labor and capital involved, and target markets. Irrigation efficiency varies greatly between these projects, from the large-scale sugar production estate of Wonji Shoa, able to stock its own equipment and receive technical assistance whenever required, to the small-scale farmers' scheme of Belbelit that struggles to maintain the

¹⁴ USAID (2012): Contract Farming and Policy Options in Ethiopia. Accessed the 13/10/2014 at http:// www.ethiopia-ciafs.org/docs/contract_farming.pdf

primary canals in sufficient condition to carry water to the plots. In between these extremes lie two medium-sized private companies – Johannes Agro-Industry and Ethio Veg-Fru farms. A common constraint is the inadequate maintenance received for their irrigation systems: Agro-industry contracted out its technical assistance to a company based in Kenya, while Ethio Veg-Fru resorts to keeping a stock of spare parts to face unexpected breakdowns.

The Methara (4 100 hectares) and Wonji Shoa schemes (10 150 hectares) are publically managed irrigation schemes for sugarcane. While the irrigated land is commercially owned, the benefits to smallholders are twofold: (i) through outgrower schemes; and (ii) through the creation of alternative livelihoods in the form of permanent and temporary employment.

In the Mathara scheme, 11 000 jobs were created, 3 700 of which are permanent. Employees have access to free housing, water, and electricity as well as schools, clinics, and other facilities. In the case of the Wonji scheme, 4 000 to 7 500 jobs are provided annually, depending on the time of year. Moreover, there are seven cooperatives that operate in conjunction with the Wonji factory to cultivate and sell sugarcane to the enterprise as outgrowers. The Wonji enterprise also provides technical advice to these outgrowers as well as farm equipment and finance. Land is mechanically prepared by the main estate. The sugarcane is burnt, manually cut, loaded with grab loaders onto 12-ton tractor-pulled trailers and hauled to the sugar mill. The company is in the process of implementing an expansion project that includes the building of a new factory.

While these are two examples of schemes that benefit both commercial and smallholder farmers, there are emerging examples of large-scale schemes in Ethiopia intended for the exclusive benefit of smallholders. Two such examples are the Fentale and Koega Schemes. The Fentale Scheme, for instance, is a gravity-based irrigation scheme aimed at reducing persistent food insecurity and enhancing pastoralists' livelihood options in the Oromia region.

While neither scheme has been in existence long enough to fully assess the benefits to smallholders, the success of the Methara and Wonji Schemes and the smallholder-driven intervention of the Fentale and Koega Schemes are positive initial indications that large-scale irrigation can be used to the benefit of smallholders in Ethiopia.

	Benefits	Challenges
Farmers	 Large-scale schemes can break the relationship between agricultural growth and rainfall Investment per hectare less costly than the isolated small-scale schemes Increased yields and income of farmers Guaranteed reliable markets and fixed pricing structures Ability to do medium- and long-term planning Benefit from the introduction of technologies and improved varieties Access to credit, inputs, technical advice, and extension services Ability to increase productivity and output with reduced input costs Irrigation technical support Private company managing the maintenance of the canal Assistance in complying with vital sanitary and phytosanitary standards Benefit from increased credit worthiness 	 Initial funding required for smallholder irrigation developments Limited local markets Knowledge gaps and lack of improved irrigation technologies Quality requirements and specifications Subject to inequitable distribution of benefits and risks Weak bargaining power owing to dependence on the companies' firms
Companies	 Improve supply quantity and quality Promote efficiency in farming and management, compared with plantations Maximize productive capacity and reduce overhead costs Transfer or shift sharing of production risks to farmers Benefit from alternative supply mechanism (e.g., plantations constrained by land shortage) Manage their reputational risk Benefit from group negotiation and improved communication Improve quality of services and expand scope of services 	 Incur high transaction costs in dealing with individual farmers Incur higher overhead costs (extension staff on the ground) in high quality products Productive capacity not maximized due to the lack of farmers' technical skills Land tenure a controversial issue for large-scale commercial farming investments Power shortages and high tariffs Smallholders provided with inputs subsidized by nucleus farm initially, but eventually having to pay themselves High costs of processing

Table 4: Benefits and challenges of nucleus and outgrower business models

Chapter 6 – Market opportunities

Ethiopia'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

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

Crop markets

Based on the analysis in Section 2, production of wheat and sugar will be able to expand most easily as the domestic market can absorb all additional output. Fruits and vegetables are experienced in accessing world markets and this should enable expansion in those sectors, even if domestic markets become saturated. Regional Common Market for Eastern and Southern Africa (COMESA) market expansion can accommodate further production of maize, sorghum, sugar, and other crops.

The prevalence of malnutrition, especially in cereal-producing areas, has led to UNICEF launching a revised National Nutrition Plan for Ethiopia in June 2013, with a focus on the production and consumption of vegetables. Retailers in Addis Ababa are interested in sourcing quality products from local farmers. Products like honey, ginger, and *moringa* (horseradish) are in demand by Addis Ababa supermarkets. During the 55 days of fasting between March and May, Orthodox Christians in Ethiopia do not eat meat. This coincides with a peak in the consumption of vegetables, with a direct implication on price increases.

Fiscal incentives

The Government has approved fiscal and non-fiscal legislation that privileges agricultural investment projects. All equipment related to agriculture is tax-free for the duration of the project. Pumps and spare parts are considered to be agricultural equipment. The equipment can only then be sold to another project that has been granted the same benefits. Further tax incentives may be available on condition that products are exported. The Government, through its

Ethiopian Investment Agency, is trying to encourage the production of crops for exports, so that foreign currency is brought into the country.

Investment in irrigation

Institutions such as the World Bank, IFAD, and AfDB are helping to develop public irrigation in Ethiopia, providing significant support through infrastructure development projects. The Ethiopian 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.

Although there are several reasons to be cautious about achieving these objectives, the picture is that of a fast expanding irrigation subsector in Ethiopia. This is due to the enormous untapped irrigation potential, the need to provide food and labor to a large and growing population, and the improving business climate in the country. The main growth in irrigated areas in the short and medium term – as stated in all the country's strategy papers – will come from small-scale irrigation.

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 – Country statistics

Selec indica	ted ators		2007	2009	2012
	GDP	(current billion USD) *	19	28	42
	G	DP per capita (USD) *	236	332	454
/IC	Agricultural valu	e added (% of GDP) *	46	50	49
NON	Agricultural value added	(average 2007-2011)			6.4
CO	(% growth) *	(2011)			4.9
-010-E	То	tal population (million)	80.4	84.8	91.7
soc	Rural	population (% of total)	84	83	83
	Agricultural labor force (% of total labor force)	79	78	76
	Human Develop	oment Index (2012) **	0.396	6 (ranking 17	'3)
	Per cap	ita cultivated land (ha)	0.18	NA	0.18
	Area equipped	for irrigation (ha, 2011)		290 000	
	Value of total agriculture	e (current million USD)	9 441	11 546	8 056 (2011)
DE	Value of cereals production	n (current million USD)	3 820	4 780	3 073 (2011)
TRA		Yield cereals (hg/ha)	14 390	16 825	20 046
N AND	Cereal import depende	ency ratio (%, average 2007-2009)	10.	1 - Net imp	
UCTIC		Production quantity	Maize; roo	ots and tube fresh	rs; whole cow milk
PROD	-	Production value	W indigenous	/hole fresh o s cattle mea	cow milk; t; cereals
JRAL	Tan 2 commedities (2011)	Import quantity	Wheat; r	aw centrifuç	gal sugar; palm oil
CULTI	Top 3 commodities (2011) -	Import value	Wheat; pali	m oil; raw ce	entrifugal sugar
AGRI	-	Export quantity	Sesame	seeds; gree c	en coffee; Iry beans
	-	Export value	Green co	offee; sesam fresh ve	ne seeds; egetables
	Top 3 partners (2011)	Import value	Malaysia Unite	; Russian Fe ed States of	deration; America
		Export value	Gerr	nany; Soma	lia; China

Select indica	tors		2007	2009	2012
	Top 3 commodities availa	able for consumption (2009)	Maize; wh	eat; other c	ereals
	Dietary Energy Su	ipply (kcal/capita/day)	1959	2053	(2105)
NOI	General / I	Food CPI (2000=100)	184.8 / 214.3	184.8 / 214.3	184.8 / 214.3
TRIT.	People undernourished	33.2		33.2	
INN .	(million)	32.1		32.1	
Ŋ	Proportion of	40.9%		40.9%	
ΥA	undernourished (%)	37.1%		37.1%	
CURIT	Prevalence of underv	weight children (% of children under 5)	34.6 (2005)	NA	29.2 (2011)
D SE	Prevalence of stunting (%	6 of children under 5)	50.7 (2005)	NA	44.2 (2011)
FOO	Prevalence of wasting (%	6 of children under 5)	12.3 (2005)	NA	10.1 (2011)
-	Global Hung	ger Index (%, 2013) ^	25.7	7 (Alarming)	
	Access to improved	water sources (% of population)*	42	45	42

Source: FAOSTAT; *Source: WB; **Source: UNDP; ^ Source: IFPRI. Note: Food CPI 2009, 2011: 2008=100 in FAO FAPDA Ethiopia Country Fact Sheet on Food and Agriculture Policy Trends (October 2014).

Annex 2 – Major players in the irrigation market

There are various public and private players in irrigation development. The public sectors include different Government institutions, non-governmental organizations, and international donors that are directly or indirectly involved in the implementation of the various irrigation projects in the country. Table 5 presents a list of major players in the irrigation development and Table 6 a list of current and future investment.

Names of Organizations	Role/activity	Address /Location	Contact Person
Agricultural Transformation Agency (ATA)	Government agency	Off Meskal Flower Road across Commercial Graduates Association Phone +251-930098873	Seyoum Getachew, Director, email - Seyoum.Getachew@ ata.gov.et
Ministry of Water & Energy (MoWE)	Government agency	Phone +251-911887678	Solomon Chere
Ministry of Agriculture (MoA) - Agricultural Extension Directorate	Government agency	Phone +251-116460676	
Central Statistics Office	Government agency	AA, Piasa, Phone +251-	Agri. Sec. head and Librarian
Development Bank of Ethiopia	Financial institution	Phone + 251-0115544500	Dereje Awguchew (Manager. Corporate credit process) email- derejemekuria2@gmail. com
IFAD	Participatory Small-Scale Irrigation Development Programme is a USD 140 million project, including BIR 340 million to promote small-scale irrigation schemes: 12 020 hectares of newly irrigated land in four large regions - Oromia, Amhara, South, Tigray.	at office of MoA Phone +251-911959843	Jemal Aluje Gendo jemalgando@gmail.com phone: 0911213750
International Water Management Institute (IWMI)	International donor agency	in ILRI-Ethiopia Campus Bole Sub City, Kebele 12/13	Dr. Simon Langan, head of Office for the Nile Basin and East Africa s.langan@cgiar.org

Names of Organizations	Role/activity	Address /Location	Contact Person
Ethiopian Agricultural Investment Agency & Land Administration	Responsible for land lease; facilitates land access to rainfed areas. Under the regional governments, irrigation land will not be leased.		Bernalem Bekde bernalemmogessie@gmail. com
Ethiopian Investment Agency	Promoting the country's investment opportunities and conditions to foreign and domestic investors; issuing investment permits, work permits, trade registration certificates and business licenses; assisting investors in the acquisition of land, utilities, etc., and providing other pre- and post-approval services to investors.	Bole Africa Avenue Phone +251- 912085485	Mr. Yisfaligne Woldeamanuel (Custom Duty officer) email: w_yisfaligne@yahoo. com phone: 0913339867
GIZ	International donor agency (focal office)	At offlice of MoA Phone +251-910685682	Hailu Hunde (Irrigation head), Tesfaye Chekol (Watershed head)
JICA	Provides capacity building of official regulatory bodies to supervise irrigation schemes.	Mind bldg, 6th floor, Ethio- China road, Bole - Phone- 0115504755	Furmiaki Saso, Project formulation advisor, agriculture sector Saso.furmiaki@jica.go.jp
World Bank		Africa Ave - Phone - 0115176000 (3elila Wudneh, Comm. Officer
USAID	USAID's portfolio in Ethiopia is one of the largest and most complex in Africa.	US embassy, Entoto Street, PO Box 1014, Addis Ababa Phone +251 11 130 6002	Phone 0111306002
International Development Enterprise (iDE)	iDE provides extension services, market information for high-value crops and tries to link farmers directly to markets, circumventing brokers as much as possible.	Phone +251-114672906/7/8 Tel: +251-115-570-678	Mr. Fasika Afework f_afework@ide.org. et fahtam@gmail.com

Names of Organizations	Role/activity	Address /Location	Contact Person
Oromia Microfinance Institution	Oromia Credit and Saving Share Company (OCSSCO) has a mission to alleviate poverty in Oromia by availing financial services to the poor and assisting them to make the best use of indigenous resources and knowledge.	P.O.Box 19853, Addis Ababa Phone: 0115-534870/72/73 Email: ocssco@ethionet.et	υ/a
	AGRIBUSINESS COMPANIES (Gov	vernment and private)	
Upper Awash Agro Industry Enterprise	Governmental organization producing fresh and processed fruit and vegetable products for the local and export market.	Along the upper bank of the Awash River. Addis Ababa, Ethiopia Phone: +251 114 42 30 00/849 00 26	а/ц
Wonji Sugar Estate, government owned farm	Wonji was established by the Dutch company HVA in 1954; 12,000 hectares irrigated, all furrow and flexi-flume; 6,000 hectares own estate and 6,000 hectares outgrowers	O Box 446, Nazreth, Wonji, Oromia region, Ethiopia Tel: 022-2200028 Fax: 022-2200977	Mr Furo Beketa Berisso, General Manager email: wssfgm@ethionet.et phone: 0911492601
Metehara Sugar Estate & Factory	Government-owned farms	MPO Box 5664, Addis Abab, Ethiopia Tel: 251 1513180 Fax: 251 2113419 msfgm@ethionet.et	в/ц
Ethio-VegFru	Established in 2005 as an export-oriented, vegetable producing joint venture, with 50 percent Dutch capital and 50 percent Ethiopian capital. Its farm in the Koka region has a total area of 150 hectares, of which 100 hectares are equipped for drip irrigation, and 40 hectares are dedicated to eco-tourism.	Addis Ababa, Ethiopia Ex FAO Koka email: etvf@ethionet.et.	Esayas Phone 0911508682- Alarouchdi, Khaled.

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Names of Organizations	Role/activity	Address /Location	Contact Person
Johannes Agro-industry	A 49-hectare farm, near Koka, producing hybrid seed maize under a 32-hectare centre pivot for the company Pioneer South Africa. The average registered maize yield is 4-5 tons/hectare, but this year 6 tons/hectare were expected.	Кока	n/a
Ethio Agri-Ceft	Private company, purchases current fertilizers such as diammonium phosphate and urea from the Government	Holeta flower farm Mekanisa, Office Phone - +251- 911898076	Kebede Amede (Agriculture Dept. manager), Asefa Kejella
Finchaa Sugar Estate		Po Box: 5734, Addis Ababa, Ethiopia Tel: 011-5512557 Fax: 011-5512911	
Yaya Koka Agro-Industrial Enterprise	Privately owned farm	Koka, Phone 0922580346	Million (Farm manager) Naod (Field supervisor)
Ethio-VegFru	Joint venture, with 50% Dutch capital and 50% Ethiopian capital	Koka, Phone 0911508682	Mr. Esayas Mengistu Farm Manager email: etuf@ethionet.et phone: 0911508682
Yaya Koka Agro-Industrial Enterprise	Privately owned farm	Koka, Phone 0922580346	Million
	IRRIGATION SUPPL	JERS	
Hikas Engineering & Trading PLC	The company focuses on modern irrigation systems: it supplies pressurized drip and sprinkler equipment, pipes (PE, HDPE) and fittings, centre pivots, travelling guns, and flexi- flume tubes for furrow irrigation systems.	Phone +251-116479732 -921786364 Along the road to CMC	Tsega-alem Kahsay, General Manager tsekhs@gmail.com

Names of Organizations	Role/activity	Address /Location	Contact Person
Bruh Tesfa Irrigation and Water Technology PLC	Ethiopian company engaged in the design and installation of comprehensive irrigation and water supply systems. The company manufactures various types of PE and HDPE pipes, fittings, conduits, and geo-membrane liners for reservoirs and irrigation canals. It also supplies drip, centre pivot, traveling gun and sprinkler irrigation systems; automatic, semi-automatic, and manual irrigation control systems.	Headquarter located in Mekelle, capital of Tigray region, near Bole Printing Phone +251-0116639615 +251-0917811678	Hagos Gebru (AA branch manager) Teklay Hafte (Sales & distrbn head)
Astunet Business Enterprises PLC.	Distributor of irrigation equipment for controlled environment and open field systems. ABE provides a wide range of services, from general consultation to complete management and production of turnkey projects. Most Astunet's clients are private commercial companies, although the company also supplies individual farmers and NGOs.	Phone +251 11 6627967, +251 91 1203372 Bole, House No. 1205, The road between: Brass Hospital and NOC Gas station behind TK building	Ms. Aster Tesfamichael (Managing Director) astunet@gmail.com
Davis & Shirtliff Trading Ethiopia PLC	Established supplier and distributor of high quality water-related equipment in Ethiopia, sourced from a number of industry leading companies from around the world.	91 3060711, Bole On St. Urael - Atlas Hotel Road, KASONS Building	Kirkos, Phone +251- 11 5159341
ACME Engineering	Irrigation equipment suppliers	Bole near MOENCO Phone +251-0116639615 +251-0917811678	

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	Projects	Commitment (USD million)	Main objective	Project end date	Type of financing
WB (IDA)	Irrigation and Drainage Project	100m	To increase sustainable agricultural output and productivity	Oct-17	loan
WB (IBRD/ IDA)	Sustainable Land Management Project-II	50m	To reduce land degradation and improve land productivity in selected watersheds	Apr-19	loan
WB	Agricultural Growth Project (additional financing)	50m	To increase agricultural productivity and market access for key crop and livestock products	Sept-15	grant
AfdB/WB/ DFID/UNICEF	Support to the One Water- Sanitation and Hygiene National Program (OWNP)	288m	Improved and sustainable water supply facilities in rural and pastoral areas institutions and urban areas	Dec-18	loan-grant
AfDB	Drought Resilience and Sustainable Livelihoods Programme in the Horn of Africa	30m	To enhance drought resilience and improve sustainable livelihoods of the pastoral communities	Jun-17	loan-grant
AfDB	Support to Agricultural Research for Development on Strategic Crops in Africa (SARD-SC)	39m	To enhance food and nutrition security and contribute to poverty reduction in Bank's low income Regional Member Countries (RMCs)	Jun-16	grant
GAFSP-public sector	Agricultural Growth Program (AGP)	50m	To increase agricultural productivity and market access for key crop and livestock products	Sept-15	grant
GAFSP/IFC	africaJUICE	бm	To realize passion fruit potential of its existing farm and its outgrowers and on diversifying its product base	n.a.	loan-grant
United States	Feed the Future and Global Climate Change initiatives	194m	Strengthening private sector involvement in the agriculture economy and policy research	2014	grant

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

	Projects	Commitment (USD million)	Main objective	Project end date	Type of financing
apan	Ethiopian Water Technology Centre Project Phase III	n.a.	To increase the number of skilled technicians who work in water supply maintenance electromechanical pumps and water management	2014	grant
	Project for Rural Water Supply Sanitation and Livelihood Improvement	n.a.	Dissemination of Rope Pumps for Drinking Water (WAS-RoPSS)	2015	grant
JNDP/ AECID/Gates oundation/ CIDA	Enhancing National Capacity for Agricultural Growth and Transformation	18.8m	TA to the Ministry of Agriculture. Including to bridge the sub-national capacity gap for integrated water resource development in developing regional states	2015	grant
FAD	Participatory Small-scale Irrigation Development Programme	40m	To improve the food security nutrition and incomes of poor rural households by developing irrigation schemes for small-scale farmers	2015	loan-grant
FAD/GEF	Community-based Integrated Natural Resources Management Project	17.4m	To enhance the access of poor rural people to natural resources such as land and water and to introduce improved technologies for agricultural production	2017	loan-grant
FAD	Rural Financial Intermediation Programme – Phase II	100M	To provide poor rural people with sustainable access to a range of financial services	2019	loan-grant
France (AFD/ FFEM)	Initiative du Bassin du Nil	4.3m	Sustainable water resources management at regional level	n.a.	grant
Vetherlands	Innovative Business Model (IBM) on High Value Crops	n.a.	Promotion and implementation of an innovative business model to commercialize Ethiopian farmers	2018	grant

Source: Authors compilation.

Annex 3 – Water management figures



Figure 15: Preliminary map of groundwater potential

Source: IWMI, based on data from the Ethiopian Institute of Geological Surveys (EIGS) and the British Geological Survey.



Figure 16: Existing irrigation development

Source: IWMI.

Figure 17: BANKS



The map indicates the location, density and ownership of bank branch offices throughout the country. In rural areas, the location is displayed at the centre of each woreda in which one or more banks have an office. The size of the symbol indicates how many branch offices are found in that location. Addis Ababa has 131 bank branch offices and is symbolized, accordingly, with a large symbol. All other locations in the country have 10 or fewer bank branch offices.

The prevalence of government versus privately owned bank branch offices is indicated by symbol colour: the darkest orange indicates that all banks in the woreda are private: the darkest purple indicates that all are government owned. The lighter the shade, the more even the mix between government and privately owned banks. For example 35 per cent of bank branch offices in Addis Ababa are government owned, so a light orange fill is used to indicate a preponderance of privately owned banks within the city.

While both private and government banks have wide branch office distributions, the ten to cluster along all-weather roads. Moreover, compared to government banks, private banks rarely have branch offices in rural locations off main roads.

Data source: Information supplied by government and private commercial banks 2005

Figure 18: Roads



Data sources: World Food Programme-Ethiopia; Ministry of Agriculture and Rural Development-Woody Biomass Project; Ethiopian Mapping Authority; and Ethiopian Development Research Institute.

Annex 4 – Agricultural projects with irrigation

Purposely, our field mission visited four very different farm projects – in land size, crops produced, organizational structure, labor and capital involved, and target markets.

Wonji Shoa Sugar estate

Located in the southeastern Central Rift Valley, 110 km from Addis Ababa, Wonji was established by the Dutch company HVA in 1954. The adjacent Shoa Sugar Factory was included in the company in 1962. Wonji and Shoa sugar factories together have the capacity to crush 3 000 tonnes of sugarcane per day.

The company has an *outgrower scheme* that was started in 1971 with 1 019 hectares and then expanded in 2008 to 2 000 hectares. There is an association of outgrowers comprising 34 associates that represent 8 000 farmers with areas from 0.25 hectares to 10 hectares. The main estate provides support in the form of building capacity, farm equipment, and finance. Land is mechanically prepared by the main estate. The sugarcane is burnt, manually cut, loaded with grab loaders onto 12-ton tractor-pulled trailers and hauled to the sugar mill.

The company is in the process of implementing an expansion project that includes the building of a new factory of 6 250 tcd. At the time of the visit, the company was planting a new 12 000 hectares of irrigated sugarcane to feed the new factory. Of this total, 6 000 hectares will be directly farmed by the estate and the remaining 6 000 hectares by the outgrowers.

The estate managed sugarcane area will include 1 800 hectares of centre pivot irrigation – of which eight pivots of 75 hectares each were being installed – with the remaining area served by dragline sprinklers. The area managed by outgrowers will be furrow irrigated with the use of flexi-flume equipment. Irrigation suppliers are 3SI (France), for Irrifrance centre pivots and dragline sprinklers; and Ethiopia Steel Corporation for hydrant valves, rain bird sprinklers, hoses and draglines. The company did not want to provide data for capital or operation costs of irrigation.



Figure 19: Wonji Shoa Sugar estate, Koka

Source: Diogo Machado Mendes, FAO (2014).

Belbelit Smallholders Irrigation Scheme

Situated between the Jama River and the village of Lemi, 150 km north of Addis Ababa in the Amhara region, Belbelit is an irrigation scheme started by the NGO EOTC-DICAC in 1998 on land owned by 220 farmers/households (corresponding to approximately 1 000 people). This first project, which ran from 1998 to 2006, focused on the development of infrastructure under a rural development programme. A second project started in 2006, targeting value chain development activities. This ended in 2011. Since then EOTC-DICAC has been waiting for funds pledged by the Interchurch Organization for Development Cooperation (ICCO) for further value chain development.

The irrigation scheme is now servicing 160 hectares of land. Water is sourced from an artesian aquifer and is always available in vast quantities throughout the year. Distribution from the headwork is done by a network of canals. Some farmers manage to irrigate using only gravity, while others pump water from the primary cement canals. Farmers buy the pumps and equipment from the MoA's local office, usually with cash¹⁵ without the need for credit. The main problem seems to be how to transport the pumps, since there is no regular transport to and from town.

^{15 1} diesel pump of 5hp purchased locally costs the equivalent of USD 280 on average.

Farmers are organized into a Water Association Cooperative, started in 2005 by the EOTC-DICAC in collaboration with the Government's agricultural local office. The cooperative is legally certified and can take credit from banks. It collects a water fee from farmers that it uses to pay for the management of the irrigation scheme. The cooperative is looking for funds to maintain the headwork infrastructure and irrigation canals. This is seen as an emergency because floods are destroying the reservoir and the canals. As a mitigating measure, farmers are using a gabion structure of wire mesh filled with stones to support the infrastructure; any flash flood – common in the village – can wash everything away.

In the rainy season, farmers plant sorghum, teff, and mangetout beans for food. In the dry season, irrigated crops include plant pepper, tomato, onion, mangetout beans, Swiss chard (locally called lettuce), beetroot, irrigated teff, some cotton for own consumption, avocado, papaya, and sugarcane for chewing and for sale in the local market. Traders come to the village to collect the produce on donkeys. The cooperative would like to acquire a van to help with the transport of inputs to the village and of produce to the markets.

Access to inputs is a concern: the Government is involved in the procurement process but is said to be too slow, and private suppliers are not working in this region yet. Farmers are looking for chemicals for mango and papaya and certified seed for vegetables, which they haven't been able to find. They use common seed bought in local markets. The cooperative is also looking to replace fruit trees with new varieties. Farmers wish to receive training on modern agricultural techniques. In the past, the MoA and the EOTC set up demonstration areas to show the difference between the two plots – one with all the good crop husbandry techniques, the other using traditional methods.

Johannes Agro-Industry

Johannes Agro-industry is a 49-hectare farm, near Koka, producing hybrid seed maize under a 32-hectare centre pivot for the company Pioneer South Africa. The average registered maize yield is 4-5 tons per hectare, but this year 6 tons per hectare were expected. Maize is rotated with vegetables such as green beans, dry beans, tomato, and onions for sale at the local Koka market. The farm also has a mango and citrus orchard (5 hectares) that is drip irrigated. The trees were only three-years-old at the time of the visit, and production had not reached commercial level. The company is thinking of selling future production in the Koka region, and possibly also in Addis Ababa.



Figure 20: Belbelit Smallholders Irrigation Scheme

Source: Diogo Machado Mendes, FAO (2014).

The irrigation of maize is supplementary only, as the crop is planted during the rainy season, whereas vegetables are irrigated full-time as they are grown during the dry season. The irrigation equipment is supplied by Aqua-Valley Services, a company based in Naivasha, Kenya. Maintenance for the centre pivot is carried out by a technician based in Kenya. Johannes Agro-Industry pays for the flights and accommodation of this person, whenever maintenance is due.

Johannes reported problems with the procurement of seed for vegetable expansion. It is currently buying seed from Aga Genetics, Israel, for a price considered excessive. No water charges were being paid yet, although the company was aware of Government plans for that in the near future. The cost of electric power was not considered excessive but there were severe problems with power cuts that caused irrigation to stop for the duration of the blackout. Figure 21: Johannes Agro-Industry, Koka



Source: Diogo Machado Mendes, FAO (2014).

Ethio Veg-Fru, Koka

Ethio Veg-Fru Plc. was established in 2005 as an export-oriented, vegetable producing joint venture, with 50 percent Dutch capital and 50 percent Ethiopian capital. The company is certified under the international quality standards Global Gap, BRC, TESCO, and ETI. Its farm in the Koka region has a total area of 150 hectares, of which 100 hectares are equipped for drip irrigation, and 40 hectares are dedicated to eco-tourism.

From December to the end of May – the off-season in Europe – the company grows green beans and French beans of different sizes for export to Europe. The company is exporting around 1 000 tons per year to Europe, mainly to Holland, via air and then road freight. The flight goes to Brussels from where the clients take the merchandise. Tomato, onion, and pepper are produced all year for local and Middle Eastern markets. They are flown out of Addis Ababa to Dubai. Vegetables reach higher prices on the European market but the quality requirements are very high. Conversely, the market in Dubai pays less but is also less demanding on quality. From June to October, the company produces hybrid maize seed, in cooperation with the Government Research Centre, for the Government Agricultural Bureau.

All the crops produced at Ethio Veg-Fru's Koka farm are drip irrigated. The equipment is supplied by OMNI, an Israeli company based in Addis. The cost

of investment for drip irrigation is USD 7 000 per hectare. This is based on the latest investment the company did in another farm. It includes the pump house, fertirrigation, drip lines, and the system installation on 100 hectares. Water is pumped from the Awash River nearby but is low quality, carrying too much silt. So the company uses cheap drip lines that it replaces every year.

Maintenance and spare parts are a problem. Due to import processes (discussed in previous chapters), equipment suppliers in Ethiopia do not keep enough equipment stocks, and producers must keep their own stock of spare parts. The company finds it hard to purchase the drip lines it needs on the market. Water fees were not being paid yet, but the company is prepared to pay them when these are introduced. Ethio Veg-Fru finds that the supply of fertilizers and agrochemicals has improved every year. These products are widely available at different suppliers and have good quality. The Government's Horticultural Agency helps the company with technical advice.

Ethio Veg-Fru mentioned that one of its constraints was acquiring the lease for more land. The company identified with the MoA a 600-hectare plot that is 14 km from Koka, with electricity, water, and feeder roads. This land needs drainage infrastructure valued by the company at USD 4 million for the 600 hectares. The Government is willing to lease this land but Ethio Veg-Fru complains of delays in the process. Credit is not a problem for this company because it is only using its own capital.

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