INTERNATIONAL FOOD POLICY
RESEARCH INSTITUTE
sustainable solutions for ending hunger and poverty
Supported by the CGIAR

Maize Value Chain Potential in Ethiopia

CONSTRAINTS AND OPPORTUNITIES FOR ENHANCING THE SYSTEM

WORKING PAPER | July

WITH SIGNIFICANT CONTRIBUTIONS FROM SHAHIDUR RASHID, KINDIE GETNET, AND SOLOMON LEMMA

TABLE OF CONTENTS

EXECUTIVE SUMMARY

MAIZE IN ETHIOPIAN AGRICULTURE

This report reaffirms that maize continues to be a significant contributor to the economic and social development of Ethiopia. As the crop with the largest smallholder coverage at 8 million holders (compared to 5.8 million for teff and 4.2 million for wheat), maize is critical to smallholder livelihoods in Ethiopia. In addition, maize is the staple crop with the greatest production at 4.2 million tons in 2007/08, compared to teff at 3.0 million tons and sorghum at 2.7 million tons[1].

Moreover, maize plays a central role in Ethiopia's food security. It is the lowest cost source of cereal calories, providing 1½ times and two times the calories per dollar compared to wheat and teff respectively. An effective maize sector could propel Ethiopia's food production to quickly reduce the national food deficit and keep pace with a growing population.

THE POTENTIAL OF A VIBRANT MAIZE SECTOR

While maize already plays a critical role in smallholder livelihood and food security this role can be expanded. Maize is the staple cereal crop with the highest current and potential yield from available inputs, at 2.2 tons per hectare in 2008/09 with a potential for 4.7 tons per hectare according to on-farm field trials, when cultivated with fertilizer, hybrid seed, and farm management practices[2].

It is estimated that, by bridging this yield gap and tapping into latent demand sinks, smallholders could increase their income from approximately USD 60 per hectare today to USD 350 to USD 450[3].

If yield potentials are realized, maize can also contribute towards improving food security and reducing land degradation through producing an incremental 1 million tons on 30 percent less land, and increasing the aggregate revenue generated from maize. For example, the poultry industry could generate USD 360 to 580 million in value in 2020 and source maize for feed from 50,000 to 100,000 smallholders.

CHALLENGES IN THE VALUE CHAIN

However, a series of constraints span the maize value chain in production, aggregation and trading, and demand sinks, or the end markets. High-level findings are presented below:

- **Production.** Productivity remains below potential due to low input usage and limited crop rotation; there is significant post-harvest loss of 15 to 30 percent of production, primarily on-farm; national maize commercialization rates are low at approximately 20 to 30 percent; most marketable surplus is sold within three to four months of harvest when prices are lowest due to farmers' cash needs and risks associated with pest infestation and other storage losses, and; smallholders are vulnerable as producers and consumers to food safety concerns from aflatoxins.**Aggregation and trading.** There is a lack of a fully functioning maize market, reflecting a weak industry structure. Four inter-linked issues have been observed as primary contributors to this situation: (i) price volatility, with intra-annual price swings up to 40 to 50 percent; (ii) lack of a year-round market, with most trading activity three to four months after harvest; and (iii) lack of depth, or sufficient supply, especially for quality maize.
- **Demand sinks.** On-farm consumption is the largest source of demand today, with few large, downstream buyers and limited processing activity. The most attractive demand sinks for maize are in food and livestock feed, with potential demand of 800,000 tons of cereal demand for food and upwards of 450,000 tons of maize demand for feed.

RECOMMENDATIONS

Core interventions and enabling activities can holistically strengthen the Ethiopian maize value chain – growing both supply and demand by increasing productivity from potentially lower acreage, and realizing key latent sources of demand, supported by a stable, liquid and year-round market. These recommendations are complementary to and intended to accelerate the impact of the current strategies of the Government of Ethiopia (GOE) and development partners:

[1] Central Statistical Agency (2007/08)
[2] FAO; World Bank Country Memorandum for Ethiopia; Central Statistical Agency(2008/09)
[3] The expected income growth to USD350 is based on the assumption that smallholder farmers become high input users and increase their yield to four tons/ha

- **Create clear role for co-operatives in the maize value chain and provide the necessary tools for them to be effective.** Simplifying the management and decision-making functions of co-operatives will reduce the capability and governance burden required to run them effectively. For instance, co-operatives could sell standardized input packages and buy maize at published and transparent prices.

- **Catalyze the growth of latent demand sinks, starting with feed for poultry.** Creating incremental demand sinks for maize will catalyze greater productivity and efficiency in the value chain, e.g., GOE should facilitate the growth of the poultry sector, where there is significant latent demand.

- **Foster emergence of strong, licensed traders to stabilize market.** Greater participation by the private sector in grain trading is of critical importance to create a year-round, liquid market that will benefit smallholders, by providing a consistent outlet for their produce, and downstream actors, by providing a consistent supply of quality grain. Supported by appropriate regulatory structures, expansion of various initiatives planned or already under development by the Ethiopia Commodity Exchange (ECX) could facilitate the orderly growth of such partners.

- **Define a clear and transparent role for government in maize markets, gradually shifting away from *ad hoc* stabilization efforts.** A clear mandate should outline when GOE intervenes in the maize market to prevent extreme price fluctuations, shortages, or excesses. Developing a transparent mandate of when and how market failures are addressed will provide all stakeholders with transparency and certainty of government intervention and reducing the perception of *ad hoc* interventions that reduce confidence of partner organizations.

There is also a set of critically important enabling actions that will further strengthen the maize market:

- **Improve storage management practices and equipment on- and off-farm.** Reducing on-farm and off-farm post-harvest losses will directly increase smallholder income and improve food security.

- **Continue efforts to increase market information.** Existing best practice mechanisms (e.g., ECX, regional marketing information systems) should be identified and used as channels to disseminate price and other market data to improve linkages in the maize market (e.g., crop forecasts for demand and supply).

- **Improve farm management practices of other crops.** Maximizing the productivity of maize should go hand-in-hand with improving productivity of other crops, for instance the sustainability of maize production is linked to effective crop rotation with pulses.

Realizing the potential of the maize value chain cannot be done in isolation; it will only occur if other components of the agriculture system are functioning effectively: extension, improved seed, integrated soil fertility management, pest management and irrigation. This report outlines a process by which Ethiopia may adopt a series of closely related activities to realize the potential in the maize value chain, while increasing incomes of its smallholder farmers and delivering on national food security objectives. Recommendations for improvements in other areas of the agriculture system are addressed in separate diagnostic reports.

THE WAY FORWARD

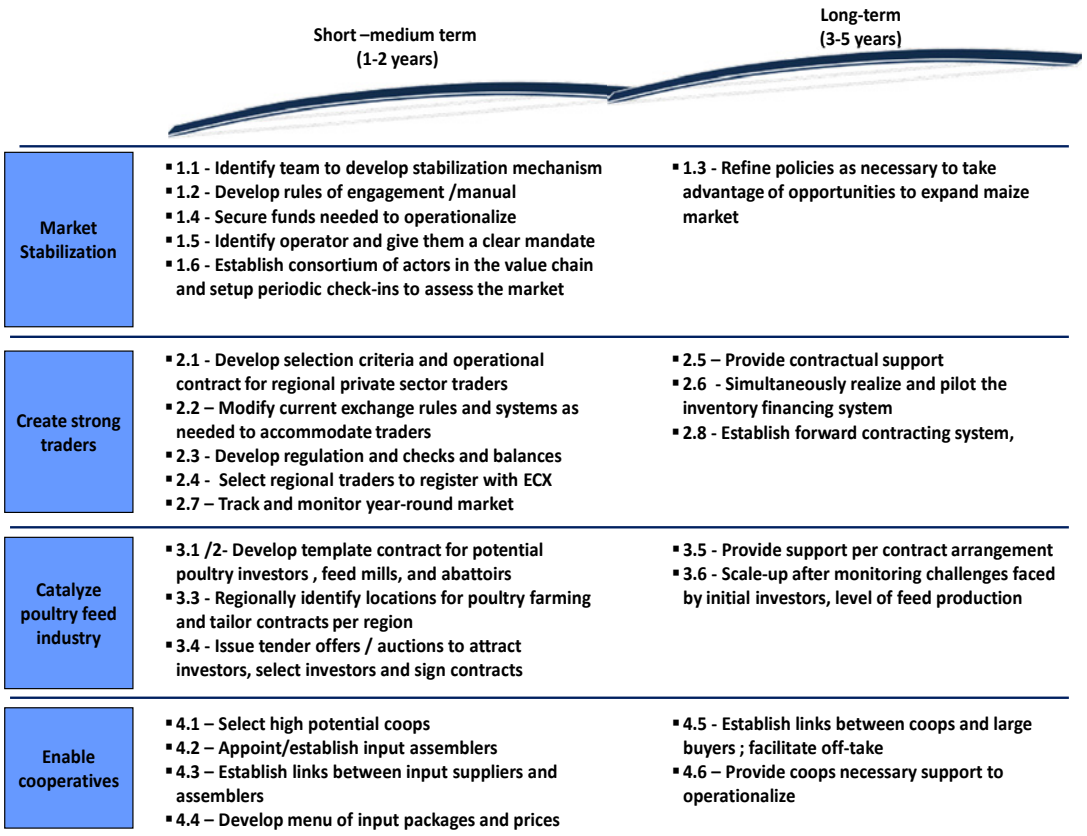
With a clear, credible plan of action, and an effective performance management process, Ethiopia will be in a strong position to deliver on this future vision of the maize value chain. Ethiopia can convert this latent potential into critical improvements in food security and livelihood for the country. The recommendations of this report offer a first view on how Ethiopia can chart a practical path of initiatives to achieve these goals.

Implementing the recommendations outlined in this report will undoubtedly require significant human and financial resources. It will also require a level of sequencing and coordination that has in the past been challenging to implement at a national level, not only in Ethiopia but in most countries in similar situations. To achieve these objectives, GOE will need to work closely with all its partners (donors and development community, NGOs, co-operatives and unions, national and international research organizations, private sector and the various organizations working directly with farmers at the local level).

This report provides a preliminary view on the sequencing of activities to strengthen the maize value chain. However, the recommendations and sequencing of activities outlined in this report must also be seen within the context of the overall recommendation provided in the holistic and integrated report, which seeks to find common themes from the various diagnostics requested by the Prime Minister. The integrated report also provides a clear vision on a possible implementation strategy, which would be a critical aspect of realizing the recommendations outlined in this report.

Detailed actions, owners, and prioritization of the recommendations are presented in the main report. A preliminary view of the sequencing of high-priority activities that could strengthen the maize value chain is as follows (Figure 1):

Figure 1: The recommendations are grouped into four themes



ACKNOWLEDGMENTS

Since the maize sector diagnostic was initiated in November 2009 at the request of H.E. Prime Minister Meles Zenawi, over one hundred collaborators have generously participated in the process, from smallholder farmers and rural Development Agents to research institutes and the Ministry of Agriculture and Rural Development.

The Ministry of Agriculture and Rural Development provided guidance and leadership throughout. We are particularly grateful to H.E. Minister Ato Tefera, State Minister Dr. Abera Deressa, State Minister Bashir Abullahi, State Minister Mitiku Kassa, State Minister Yaekob Yalla and their colleagues in the federal Ministry, regional Bureaus of Agriculture and Rural Development, and the *woreda* and *kebele*-level offices. Dr. Solomon Assefa, Director General of the Ethiopian Institute for Agricultural Research, and his colleagues at EIAR also provided invaluable input.

A panel of Ethiopian experts including Dr. Seme Debela, Dr. Solomon Bekure, Dr. Teferi Amakeltech, Yeshi Babunuki, Dr. Berhande Gebrikidan, Dr. Tesfai Kumsa and Dr. Gete Zeleke have provided ongoing guidance. We would also like to provide special thanks to Marco Quinones, Dr. Eleni Gabre-Madhin, Derek Byerlee, and Tsedeke Abate.

Beyond the local, regional, and federal governments, a broad number of Ethiopian institutes, research organizations, NGOs, private sector partners, and others engaged with teams of researchers in developing the content and recommendations from this work. These include: Addis Ababa University, Agricultural Research Institutes in Amhara, SNNP, Tigray, and Oromia, Bahir Dar University, Ethiopian Commodities Exchange, Ethiopian Institute for Agricultural Research, Ethiopian Seed Enterprise, Haramaya University, ICARDA, ICRISAT, Jimma University,

Many donors and global experts were also engaged directly in the process. The CGIAR representations in Addis Ababa provided generous use of facilities for consultant teams and expert leadership in the diagnostic areas, with particular thanks to the International Food Policy Research Institute, the International Water Management Institute, and the International Livestock Research Institute. We would also like to recognize the many institutions and donor agencies who contributed: the Alliance for a Green Revolution in Africa, ACDI-VOCA, African Development Bank, CARE, Catholic Relief Services, Center for International Agriculture in the Tropics, Center for International Forestry Research, CIMMYT, the Royal Dutch Embassy, the World Food Program (WFP) of the United Nation, the Food and Agriculture Organization (FAO) of the United Nations, GTZ, International Development Enterprises, IPMS, Iowa State University, Michigan State University, Natural Resources Institute, Oxfam, Oxford University, PanVac, Sasakawa Africa Assoication, SNV, Islamic Relief, JICA, Save the Children, Technoserve, Tamrat, University of Texas A&M, Tufts University, UN OCHA, University of Minnesota, USAID, Wageningen University, Washington University, World Bank, and the World Food Program.

A full list of all contributors to this work is included in Appendix 2.

ACRONYMS

ADLI	Agricultural Development-Led Industrialization
AMC	Agricultural Marketing Corporation
BMGF	Bill & Melinda Gates Foundation
BoARD	Bureau of Agriculture and Rural Development
CIA	Central Intelligence Agency
CSA	Central Statistical Agency
CV	Coefficient of Variation
DA	Development Agent
ECX	Ethiopian Commodity Exchange
EIAR	Ethiopian Institute of Agricultural Research
EGTE	Ethiopian Grain Trading Enterprise
ESE	Ethiopian Seed Enterprise
ETB	Ethiopian Birr
FAO	Food and Agriculture Organization of the United Nations
FCI	Food Corporation of India
GDP	Gross Domestic Product
GOE	Government of Ethiopia
MoARD	Ministry of Agriculture and Rural Development
MoFED	Ministry of Finance and Economic Development
NGO	Non-governmental organization
PADETES	Participatory Demonstration and Training Extension System
PASDEP	Plan for Accelerated and Sustained Development to End Poverty
PSNP	Productive Safety Net Program
SD	Standard Deviation
SDPRP	Sustainable Development and Poverty Reduction Plan
USAID	United States of America Agency for International Development
VAT	Value-Added Tax
WFP	World Food Program
WRS	Warehouse Receipt System

BACKGROUND

Agriculture is the core driver for Ethiopia's growth and long-term food security. The stakes are high: 15 to 17 percent of GOE's expenditures are committed to the sector[4], agriculture directly supports 85 percent of the population's livelihoods[5], 43 percent of gross domestic product (GDP)[6], and over 80 percent of export value[7].

Ethiopia's agricultural sector has witnessed consistent growth since 2003: maize production has expanded at 6 percent *per annum*, and the aggregate export value across all commodities has grown at 9 percent *per annum*[8], underpinning an 8 percent annual growth rate in GDP[9]. Public investment has expanded access to productive inputs, such as hybrid maize seed and fertilizer[10]. Concerted government spending in extension has also established over 8,500 Farmer Training Centers (FTCs) and trained 63,000 Development Agents (DAs) from 2002 to 2008[11]. However, the sector continues to

[4] World Bank PER (2008)
[5] CIA (2009 est)
[6] Data from MoFED quoted in the Policy and Investment Framework (dates TBC)
[7] MoARD (as announced in March 2010); US Department of State (2010)
[8] FAOStat (1998 to 2008)
[9] World Bank (dates TBC)
[10] Refer to the seeds and soil fertility diagnostic reports for more details
[11] Refer to the extension diagnostic report for more details

face a set of constraints that restrict further and accelerated growth. Markets are underdeveloped, federal- and regional-level public and private sector partners lack capacities to implement, some gender imbalances continue to be unaddressed, safety nets account for a large proportion of agricultural spending, irrigation potential remains underdeveloped, shortages of improved inputs hinder growth, and key areas of the enabling environment require improvement. Most importantly 5 to 7 million Ethiopians remain chronically food insecure[12].

At the request of GOE, in 2009, the Bill & Melinda Gates Foundation (BMGF) agreed to undertake diagnostic reviews of Ethiopia's seed system, irrigation, extension, agricultural finance; soil fertility/fertilizer and markets value chains for maize, livestock, and pulses. Jointly, these sub-sector diagnostics inform a separate holistic report with systems-level recommendations across agriculture. This systems-level work captures common themes from the more soloed diagnostics and identifies priority areas to drive food security and growth. The integrated, summary report also provides an implementation strategy for a program to accelerate agricultural development in Ethiopia.

The development of these reports has been led by senior fellows with the International Food Policy Research Institute (IFPRI), the Ethiopian Institute for Agricultural Research (EIAR), the International Livestock Research Institute (ILRI), the International Water Management Institute (IWMI), and the Association of Ethiopian Microfinance Institutions (AEMFI). Throughout their work, these sector experts worked closely with technical experts at the Ministry of Agriculture and Rural Development (MoARD) as well as other local stakeholders and local and international content experts.

The findings of the sub-sector diagnostics and the system-wide report are a complement to national GOE strategies, namely PASDEP II, along with corollary projects financed by GOE and its development partners. The purpose of the work is to support GOE to help accelerate the achievement of PASDEP II's goals for sustainable growth, food security, and a pathway to middle-income status by 2025.

METHODOLOGY OF DIAGNOSTIC WORK

In close consultation with the Ministry of Agriculture and Rural Development (MoARD), a team of local and global experts, led by International Food Policy Research Institute (IFPRI), undertook the maize value-chain diagnostic in Ethiopia from November 2009 to April 2010. Over 100 stakeholders, including many small-scale farmers, were consulted as part of the process at the *kebele*, *woreda*, regional, and federal level. An independent Ethiopian expert panel, an international content group, development partners, local institutions, NGOs, and other actors also provided input into this work. These discussions culminated in a wide ranging stakeholder convening held in the beginning of March 2010, where the team's preliminary finding and recommendations were presented. This final report reflects the input of all local partners and stakeholders currently operating in the maize value chain in Ethiopia.

This sectoral analysis, similar to the diagnostic work in other sub-sectors of Ethiopia's agricultural system facilitated by the BMGF at the request of the Prime Minister, consisted of a rigorous multistep process, described below:

- **Extensive review of the relevant literature.** The maize value chain in Ethiopia has been the subject of substantial investigation. The team conducted an exhaustive review of over 40 reports, which provided a baseline understanding and starting point for the team's work. A listing of the various reports consulted is contained in Appendix 1.1. Further, a rich analysis of international cases provided a context to understand the enabling factors in other economies for successful interventions.

- **In-depth key informant interviews.** Over 100 stakeholders, including MoARD, BoARD, *woreda*- and *kebele*-level government staff, development partners, research institutes, traders, cooperatives, unions, farmers, investors, and others participated in interviews. Appendix 1.2 contains the complete list. The interviews brought context to and surfaced constraints identified in the literature review; they also provided a soundboard to validate findings and recommendations.

- **Collection of primary qualitative and quantitative data –** primary data were collected through participatory rapid assessment methods to fill key gaps in the available data set. This

[12] Expert interviews (2010)

involved interviewing farmers' groups, community leaders, and local traders on various aspects of their operations. The fact-driven analysis allowed teams of consultants to make sectoral projections and modeling around constraints and opportunities in the maize value-chain. These analyses, in conjunction with informant interviews and literature reviews, provided the basis for a broad set of systemic recommendations designed to strengthen the current Ethiopian maize value-chain.

- **Multi-stakeholder convenings.** Convenings were held toward the end of the study to present, test and further refine the team's initial findings and recommendations. Convenings were attended by regional and federal government officials, private sector representatives, as well as national and international research organizations.

- **Synthesis and validation with expert panels.** As a final review of the recommendations and findings. Three separate expert panels were consulted during the review process: an independent Ethiopian content expert panel; an international content expert group; and a high-level advisory group for cross-sectoral and broad development issues. Input was provided by these panels in an iterative process, consisting of meetings and direct comments into documents, held over a multi-month period. During this period, the team also continued to receive feedback from MoARD leadership.

The methods sought to combine academic rigor with a participatory, forward-looking, and actionable process with the stakeholders in Ethiopia who, at the end of the day, are the protagonists who will be affected by and take leadership in the implementation of the findings and recommendations of this work. It also sought to interact directly with the farmers, particularly women, who are not only the primary beneficiaries of the work, but the final link in the chain in implementing recommended interventions. The incorporation of a farmer perspective ensures that recommendations are demand driven, catering to the needs of the clients of this work.

CURRENT STATUS AND FUTURE POTENTIAL FOR MAIZE

Importance of maize in Ethiopia

Agriculture continues to be the dominant sector in Ethiopia's economy, with cereals playing a central role. Grain production and marketing are particularly important: studies show that cereals account for 65 percent of the agricultural value added[13], equivalent to about 30 percent of the national GDP[14]. Maize is Ethiopia's largest cereal commodity in terms of total production, acreage, and the number of farm holdings. The following subsections elaborate on the importance of maize in terms of its coverage and contribution to food security.

1.1.1 Importance of maize in production value

Maize is the largest and most productive crop in Ethiopia (Table 1). In 2007/08, maize production was 4.2 million tons, 40 percent higher than teff, 56 percent higher than sorghum, and 75 percent higher than wheat production. With an average yield of 1.74 tons per hectare (equal to 3.2 million tons grown over 1.8 million hectares) from 1995 to 2008, maize has been the leading cereal crop in Ethiopia since the mid-1990s in terms of both crop yield and production. Wheat and sorghum yields have averaged 1.39 and 1.36 tons per hectare, respectively.

[13] Diao et al. (2007)

[14] Grain production and marketing is 65 percent of agricultural value added, and agriculture is 47 percent of GDP, grain production and marketing as share of GDP is equal to 0.65 x 47 = 30.6 percent

Table 1: Cereal production and area by crop type, 1994-95 to 2007–08 (production in '000 of tons and area in '000 of hectares

Year	Teff		Maize		Sorghum		Wheat		Barley	
	Prod	Area	Prod	Area	Prod	Area	Prod	Area	Prod	Area
Mean 1995-2000	1,706	2,094	2,730	1,624	1,488	1,164	1,134	939	940	947
2000/01	1,750	2,094	3,306	1,651	1,549	1,170	1,605	939	1,107	945
2001/02	1,645	2,107	3,050	1,647	1,572	1,117	1,461	991	979	957
2002/03	1,950	2,033	3,154	1,718	1,774	1,181	1,646	1,041	1,132	988
2003/04	1,687	2,110	2,744	1,766	1,784	1,237	1,618	1,110	1,087	1,019
2004/05	2,048	2,098	2,906	1,810	1,718	1,297	2,213	1,139	1,376	1,077
2005/06	2,247	2,117	3,912	1,804	2,200	1,328	2,307	1,213	1,398	1,109
2006/07	2,463	2,143	4,124	1,883	2,340	1,393	2,500	1,288	1,470	1,157
2007/08	3,025	2,263	4,162	1,978	2,685	1,452	2,382	1,382	1,467	1,172
Mean	1,949	2,194	3,154	1,805	1,774	1,301	1,646	1,181	1,132	1,050

Source: Authors' compilation based on CSA Agricultural Sample Survey Reports for various years.

In addition to the highest total production *per annum* and the highest per-hectare yield, maize is also the single most important crop in terms of number of farmers engaged in cultivation. The vast majority of Ethiopian farmers are small-scale producers – estimates show about 94 percent of Ethiopian farmers rely on less than 5 hectares of land, of which 55 percent cultivate less than 2 hectares[15]. Eight million smallholders were involved in maize production during 2008/09 production season, compared to 5.8 million for teff and 4.5 million for sorghum, the second and third most cultivated crops in Ethiopia[16].

Importance of maize in households' food security

Maize is instrumental for the food security of Ethiopian households, and is the lowest cost caloric source among all major cereals, which is significant given that cereals dominate household diets in Ethiopia, as highlighted by Table 2. The unit cost of calories per US dollar for maize is one-and-a-half and two times lower than wheat and teff respectively. Maize is also a low-cost source of protein in comparison to other cereals: maize provides 0.2 kg of protein per USD, compared to 0.1 kg of protein per USD from teff and 0.2 kg of protein from wheat and sorghum[17]. Figures in Table 2 suggest that an average Ethiopian consumes a total of 1,858 kilocalories daily of which four major cereals (maize, teff, wheat, and sorghum) account for more than 60 percent, with maize and wheat representing 20 percent each.

[15] Rashid and Negassa (2010)
[16] Central Statistics Agency (Date TBD)
[17] EGTE (dates TBC); Caloriecount

Table 2: Importance of staple foods in diet of Ethiopia (2003)		
Commodities	**Daily caloric intake**	**Percentage of daily caloric intake**
Maize	383	20.6
Wheat	364	19.6
Teff	254	13.7
Sorghum	191	10.3
Other	666	35.8
Total	**1,858**	**100.0**

Source: As reported in Rashid (2010), the estimates for Teff are from the CSA and the rest from FAOSTAT

Table 3 disaggregates the link between income and cereal consumption. Except for teff, caloric intake from cereals declines with the increase in income – that is, moving from quintile 1 to 5. Rural households also appear to derive more calories from cereals than urban households. Finally, the contribution of processed cereals is still very low in Ethiopian diets, representing only 3 percent at national level, 13 percent among urban households, and only 2 percent among rural households. Across different income groups, the share of processed cereals ranges from 1.4 percent among the poor and 5.5 percent among the rich. This implies that processing is still at rudimentary level.

Given current upward trends in income growth combined with the variance in consumption habits by income level, there will be changes in the aggregate cereal consumption patterns of Ethiopians. These trends suggest that there will be more demand for processed maize in the future, as well as for livestock and feed, as animal protein consumption is also a function of income. They also show that maize will continue be a critical dimension of household food security.

Table 3: Calorie intake from cereals by income group and location (percent)

	Teff	Wheat	Barley	Sorghum	Maize	Other Cereals	Processed Cereals	Total Cereals
National	**8.9**	**8.9**	**4.4**	**8.2**	**8.6**	**1.6**	**3.2**	**43.8**
Income groups								
Quintile 1 (lowest income)	8.9	9.6	6.9	9.5	10.5	1.5	1.4	48.3
Quintile 2	9.2	9.6	5.5	7.9	10	2	2.1	46.3
Quintile 3	8.3	8.9	5.3	7.9	10.2	1.9	2.4	44.9
Quintile 4	8.7	9.2	2.4	10	7.7	1.4	3.6	43.0
Quintile 5 (highest income)	9.4	7.5	3.1	6.1	5.9	1.4	5.5	38.9
Urban / Rural								
Urban	16.7	4.9	1.1	1.8	1.9	0.9	12.6	39.9
Rural	7.5	9.6	5	9.3	9.9	1.7	1.5	44.5

Source: IFPRI calculations based Household Income, Consumption, and Expenditure Survey of CSA

Policy environment

The policy environment has had multiple effects on the maize value chain, particularly price policies.

In Ethiopia, strong control over food markets began when the socialist government came to power in 1974. During this time, the government was in control of almost all aspects of grain markets, leaving very little or no incentives for the farmers to increase productivity and traders to engage in trade.

The tight regulation over grain trade started loosening in the early 1990s after the change in power. The new government understood the importance of the cereal sub-sector and placed heavy emphasis on cereal production and marketing in each of its successive agricultural development strategies. Recent government policies and strategies, including the Agricultural Development Led Industrialization (ADLI), the Sustainable Development and Poverty Reduction Plan (SDPRP), and the Plan for Accelerated and Sustainable Development to End Poverty (PASDEP), all highlight the importance of cereals in overall economic development. As part of these strategies, GOE has undertaken substantial market reforms to stimulate the development of the cereals sector, including accelerated investments in road and communication networks and adaptation of major programs to increase cereal production through large scale demonstrations of the benefits of modern seeds and greater fertilizer use[18].

To date, the above policies have led to boost in production, encouraging development of private sector, and reducing transactions costs. Total production of four major cereals has jumped from 8.2 million tons in 2000/01 to roughly 12.3 million tons in 2007/08 (Table 1); hundreds of thousands of small traders make their living by dealing in cereals; and the cost of trading a ton of cereal has declined from ETB 156 in 1996[19] to ETB 54.0 in 2008[20]. In real terms, this represents a decline of 302 percent[21].

[18] The recent assessment of the infrastructural development and public spending in Ethiopia is documented in Mogues et al. (2008)
[19] Gabre-Madhin (2001)
[20] Rashid and Hill (2009)
[21] Rashid and Negassa (2010)

Challenges of Grain Market Liberalization

With favorable weather and increasing adoption of the new technology, Ethiopia enjoyed two consecutive years of bumper crops in 2000/01 and 2001/02. But the blessings of the technology and good weather did not translate into improvements in farm households' well-being. The farm gate price of maize declined by an unprecedented 80 percent in early 2002, making maize farming highly unprofitable – so much so that some farmers allegedly did not find it worthwhile harvesting their maize crops. The ratio of input prices to producers' prices increased from 1.7 in 2000 to about 9.0 in 2002 and the fertilizer application declined by 22 percent in the next cropping year. Although price stabilization was no longer in its mandate, EGTE was directed to buy maize in order to boost farmers' confidence. The EGTE procured 18,000 tons of maize, of which 11,000 metric tons were exported. The situation took a turn for the worse in mid-2002, however. The rains did not come on time for the main cropping (*meher*) season, farmers reduced modern input applications, and it became evident that cereal production would be significantly lower than the previous year. Production forecasts for maize were revised downward by as much as 52 percent, making both government and its development partners nervous about a looming food security crisis, with the potentials of about 15 million people facing starvation. The crisis was eventually averted with generous donor support that included more than 1 million tons of food aid.

SOURCE: Adapted from Rashid and Negassa (2010)

However, the road to liberalized cereal markets has not been easy. Although the government withdrew from markets through a series of proclamations and regulations during 1999 to 2002, the country encountered problems in 2002, when cereal markets collapsed following two consecutive years of bumper harvests. Absence of the Ethiopian Grain Trade Enterprise (EGTE) in its price stabilizing role not only adversely affected small cereal growers but also contributed to production declines in the following years due to reduced use of modern inputs (see boxed text above).

The EGTE faced the opposite challenge in 2005 to 2008. Despite consecutive years of reported good harvests, prices of major cereals started rising sharply since late 2005, as did overall macro-inflation. Local grain procurement by the World Food Program (WFP) and EGTE fell to almost zero, and strategic grain reserves declined sharply to only 17 percent of the targeted level of 407,000 tons, posing significant risks of increased vulnerability to poor food insecure households. Furthermore, although many poor households in rural Ethiopia had access to the large-scale Productive Safety Net Program (PSNP), launched in January of 2005, urban households lacked access to similar programs. Therefore, the sharp increase in prices of all major cereals in the main urban centers became a major policy concern, which led to re-instituting of the urban food rationing program in April 2007. Actual distribution of wheat under this program began in Addis Ababa in June 2007 and 11 other urban centers were added by August 2008. Between June 2007 and June 2008, the program distributed about 249,000 tons of wheat at a subsidized rate of ETB 1,800 (or about USD 180) per metric ton, which was 89 to 306 percent lower than the wholesale price in the Addis Ababa market[22]. Other measures included imposition of 10 percent surtax to partly offset the costs of urban rationing and suspension of the value-added tax (VAT) on food items.

These examples underscore three important takeaways indicative of Ethiopia's cereals market. First, markets are still unable to absorb periodic shocks, as represented by the 2002 collapse. Second, although the shock was eventually managed through EGTE intervention, damage was already done as many farmers sold their crops (and possibly livestock later) before EGTE's intervention in 2001/02 and many farmers reduced input use in the following year. If a clearly defined price floor was in place, farmers would not have suffered these losses. Finally, instead of being transparent, the policy interventions in both 2001/02 and 2008 have been *ad hoc*, which has potentially shaken market actors' confidence and diminished the effectiveness of policy interventions.

Market attributes of maize

Market fundamentals determine both tradability and fluctuations of prices in maize. When a commodity plays a critical role in households' diets, such as maize in Ethiopia, variations in tradability and price can have serious implications for food security. The next two sub-sections examine the tradability and price volatility of maize.

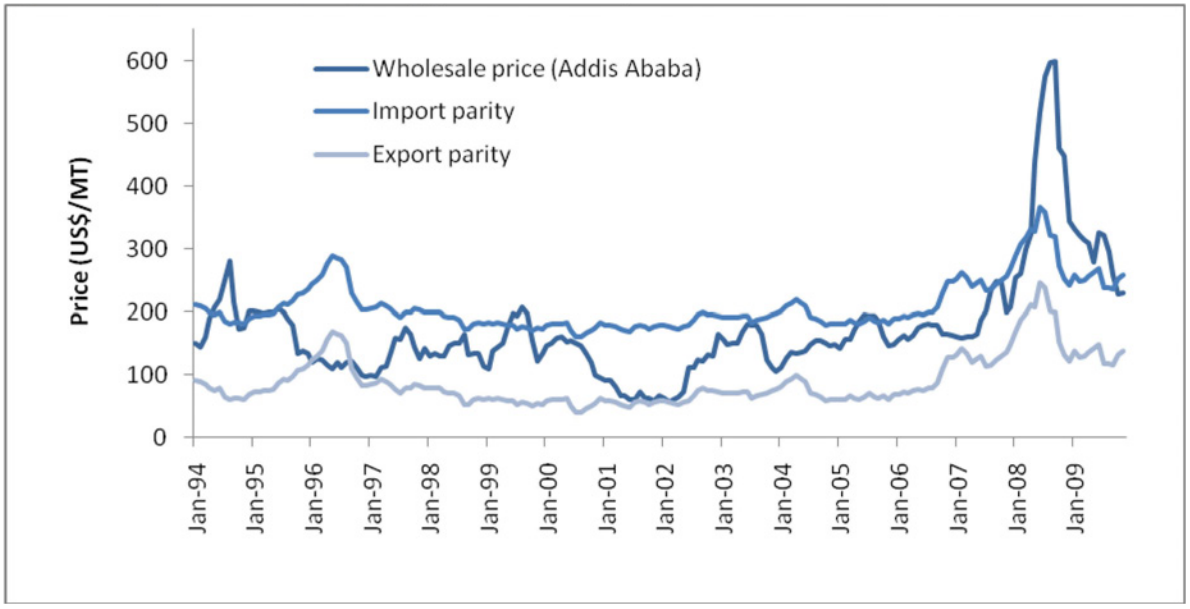
[22] Because of the high price differentials, urban food rationing served as an income transfer program. According to data from an urban household survey administered by the WFP in June and July 2008, about 93 percent of recipient households immediately sold their ration on the open market, either to buy other cereals or to meet other consumption expenditure

Non-tradability of maize

In Ethiopia, most cereals are non-tradable – meaning they are neither exportable nor importable. As a result, with the exception of food aid import, all major cereals are domestically grown and consumed. In Ethiopia, cereals are non-tradable due to high costs of transporting cereals both from the main port in Djibouti to primary consumption areas and from the main production areas to the port. Thus, the cost of transport is so high that it is not profitable to import or export cereals.

One way to further examine the tradability of a commodity is through export and import parity prices, which represent prices at which a commodity will be exportable or importable. Figure 2 presents monthly parity prices and wholesale price of maize in Addis for January 2004 to November 2009, which shows that, with few exceptions, domestic prices have historically been within export and import parity prices. This implies that maize is not profitable to import or export. The exceptions are observed only in 2001/02, when the market collapsed, and in 2008 when the government had to ration foreign exchange due to a balance of payments problem.

Figure 2: Import and export parity price of maize (Jan 1994 - Nov 2009)



Source: Rashid (2010)

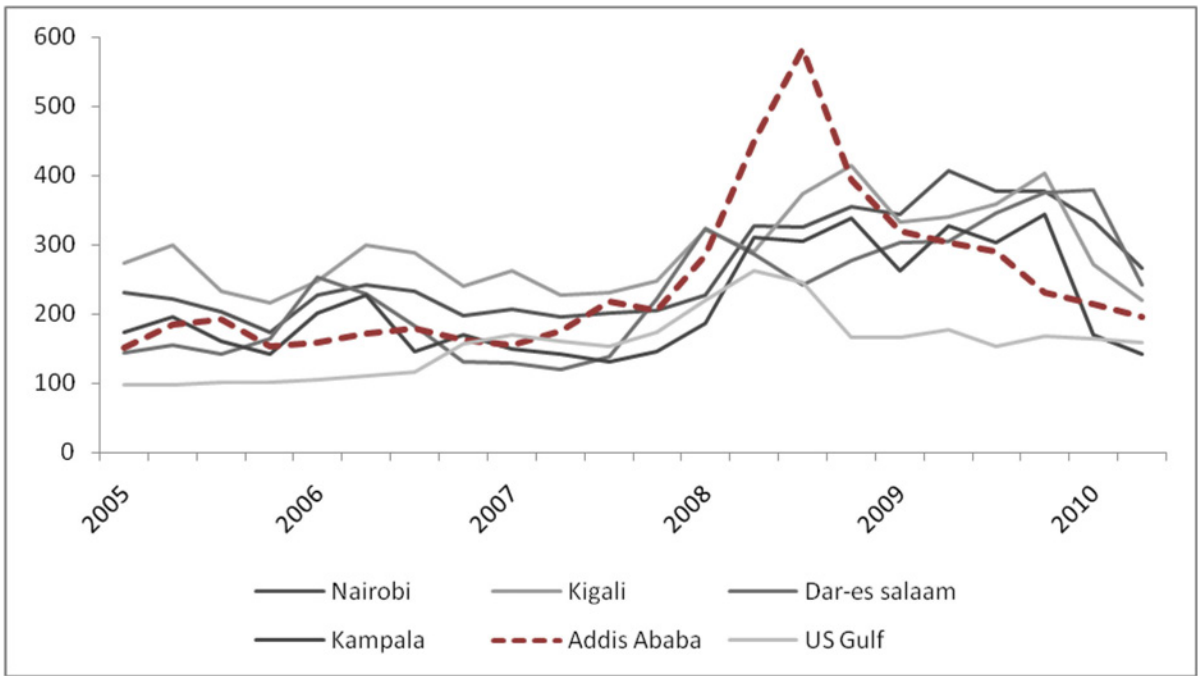
Figure 2 is constructed based on the US gulf prices for maize. Rashid and Assefa (2007) undertook a similar analysis using regional market prices and found that maize is not tradable regionally either. However, their study noted that the price difference between Nairobi and Sashamene (an Ethiopian market location on the main road to Kenya) averaged as much as USD 100 per ton, but that trade could still not occur due to prohibitively high transportation costs. Moreover, while macro policy reforms in the 1990s brought exchange rates to near equilibrium, leading to significant reduction in the distortions to agricultural incentives, the Ethiopian Birr became overvalued again in 2007 to 2008. The overvaluation of exchange rates along with rationing of foreign exchange led to the increase in the domestic prices to way above import parity in 2008. Once these issues were addressed domestic prices fell within the export and import parity again in 2009.

Price volatility

While price volatility is endemic to all markets, there has been excessive volatility in the Ethiopian maize market as demonstrated by the high standard deviation and Coefficient of Variation (CV) in maize prices in Addis relative to other geographies in Figure 3. Variation of commodity prices between locations and over time is a natural market phenomenon. In fact, price variation is necessary for the existence of a market, as it creates the incentives that attract market actors to engage in trade when prices increase. Thus, it is not the variation in prices (across space and over time) *per se* that should be of concern to the policymakers, but rather excessive variability or, in some cases, little or no variability of staple food prices. Excessive variability of prices, to a large extent, is a reflection of a lack of market integration across space. On the other hand, little or no variability in prices has often been

the outcome of policy interventions, such as pan-territorial pricing, which is what Ethiopia practiced in the 1970s and 1980s.

Figure 3: Ethiopian maize prices (USD/ton) and variability, 2005 - 10



	Nairobi	Kigali	Dar-es Salaam	Kampala	Addis Ababa	US Gulf
Mean*	**235.8**	**262.5**	**206.5**	**182.2**	**198.8**	**135.8**
SD*	76.0	75.9	82.8	75.6	109.2	44.5
CV*	**0.32**	**0.29**	**0.40**	**0.42**	**0.55**	**0.33**

* Mean, Standard Deviation (SD) and Coefficient of Variation (CV) are calculated based on monthly data from January 2000 to June 2010

Source: Authors Compilation based on RATS, EGTE, and FAO database

Following market liberalization policies, cereal price variability has increased in Ethiopia, as would be expected. However, the higher variability of maize prices in Addis compared to neighboring countries demonstrates that there are structural bottlenecks in the Ethiopian maize market. For instance, as demonstrated in Figure 3, the Ethiopian maize market appears to be more volatile than world markets (represented by US gulf prices) and neighboring countries, with an estimated Coefficient of Variation (CV) of 0.55 relative to 0.33 and 0.42, on the world market and the next most volatile neighboring country, Uganda, respectively. Of the other three neighbors, Kenya appear to have lower volatility than Tanzania and Uganda, perhaps because Kenya is well integrated to the world market and continues to maintain a large food price stabilization program. In terms of price levels, maize prices in Ethiopia averaged about USD 299, which is much lower than all of its neighbors, except Uganda.

Future potential

Improving and strengthening the maize value chain in Ethiopia has the potential to generate significant benefits for small-scale producers. The benefits can be derived largely through productivity increases and improvements in marketing. Given that a very large number of smallholders are involved in maize production, increased productivity (e.g. achieving the potential productivity level demonstrated in on-farm trails) will directly benefit poor farmers only if marketing is simultaneously improved. This can trigger multiplier effects, including increased off-farm income and increased income from diversification to other crops. Furthermore, increased productivity can lead to better soil health management, as more can be produced from smaller land, providing farmers with opportunities to rotate crops and diversify their crop portfolios.

There are various estimates of Ethiopia's potential for maize productivity. On-farm trials suggest a yield potential of 4.7 tons per hectare compared to the 2008/09 national yield estimate of 2.2 tons per hectare[23]. This implies that yield can be more than doubled. Yield growth potential for maize is much higher compared to other cereals, such as wheat, sorghum, and barley. Achieving the yield potential of maize would be possible through interventions such as improved technology adoption among smallholder farmers (e.g., chemical fertilizers, improved seeds, integrated pest management) as well as measures to reduce soil degradation (e.g., crop rotation), irrigation practices, and improved technical efficiency. Recommended interventions in other components of the agricultural system – soil health, irrigation, improved seed, finance, extension – are addressed in separate diagnostic reports.

Improvements in smallholder income from maize interventions can also be drawn from improvements in handling, storage and marketing:

- **Storage and handling.** Recent estimates on post-harvest losses for cereals range from 20 to 40 percent of gross production[24]. Taking the lower bound estimate of 20 percent, and given maize production is 4.2 million tons, cutting post-harvest loss in half will result in an additional marketable surplus of 420,000 tons. This translates into increased food security, with a larger food supply, and improvements in smallholder income if surplus grain is marketed.
- **Marketing.** Benefits to smallholders can be increased by (i) improving the marketing and (ii) increasing their shares in the retailing:
    - *Improving marketing.* Currently, share of the farmers in the retail market is only about 4 percent[25]. Given the very long marketing chain, the smallholders do not currently capture much value. This can be changed through improved aggregation, market linkages, quality control and better handling of post harvest practices.
    - *Increasing shares in retailing.* Raising farmers' share of end prices is possible by improving the negotiation capability of farmers, such as through co-operatives and other institutional mechanisms and aggregation models. Exploiting opportunities from sources of demand such as ready markets (corn flour, corn starch, local food aid procurement) and large scale expansion of maize industry for latent demand sinks (poultry feed, ethanol, and safety net programs)[26] are estimated to generate incremental revenue of more than USD 550 million.

At an aggregate level, the analyses in the diagnostic report suggest that there is a potential to increase smallholder income from approximately USD 60 per hectare today to USD 350 to USD 450 per hectare. This analysis is based on underlying assumptions about yield, waste reduction through post-harvest management, and availability of year-round market. For instance, the expected income growth to USD 350 is based on the assumption that smallholder farmers become high input users and increase their yield to four tons/ha. Under such an assumption, a farmer is likely to incur a cash cost of about USD 240 and generate an output value of USD 590, securing a cash margin of USD 350. If the potentials are realized, maize can also contribute toward improving food security and reducing land degradation (producing an incremental 1 million tons on 30 percent less land), as well as increase production value. For example, poultry industry can generate USD 360 to 580 million in value in 2020 and source maize for feed from 50,000 to 100,000 smallholders.

MAIZE VALUE CHAIN DIAGNOSTIC FINDINGS

Value chain overview

The maize value chain in Ethiopia involves multiple actors, including: input suppliers, producers, traders (local assemblers and wholesalers), retailers and processors, and consumers. Major actors, their activities, and the scale of operation of each actor are presented in Table 4. Note that there are many actors between the producers and the consumers, all performing various activities at different scales of operation, a model that can indicate inefficiencies in the value chain. For instance, a recent

[23] FAO (dates TBC); World Bank Country Memorandum for Ethiopia (dates TBC); Central Statistical Agency (2008/09)
[24] FAO (dates TBC)
[25] IFPRI (2009)
[26] Capturing optional demand markets through expansion of large-scale maize industry is estimated to induce demand for maize more than double the current production size

study found that a typical trader in Ethiopia operates within a radius of only 64 kilometers, suggesting that grains change many hands before reaching consumers, as grain often travels much further than 64 kilometers to consumers[27]. The large number of players along the value chain, and the fact that traders operate within a small radius, has important implications for marketing efficiency. It implies that spatial arbitrage takes place depending on personal relationships (or social capital), limiting long distance trade and increasing the price that consumers pay.

Table 4: Major actors, key activities, and average scale in Ethiopia's maize value chain

Major actors	Key activities	Average scale
Farmer (smallholder farmers)	Production	Produce at a small scale. Sell only around 20% of produce, most immediately at harvest. Limited input use.
Local trader/ assembler/co-operative (Individuals in towns close to producing farms)	Assemble from farmers and sells to larger buyers typically transport grain on donkeys to nearest town	Transaction size about 1 ton and typically trade 4 market days a month
Wholesaler/unions (primary private individuals. Other actors include EGTE and commercial farmers)	Own or rent storage but usually do not store for more than one month. Use a broker to find buyers in Addis Ababa (main market) or other deficit areas	Typically have limited scale. Transaction of one truckload (about 5 tons). Typically trade 4 market days a month
Wholesaler (primary traders in major markets (for example, mercato in Addis Ababa). Other actors include EGTE and commercial farmers	Use brokers to source grain from surplus areas. Own or rent storage and store grain for 1 - 2 months. Sell to retailers and processors	Transaction size around 10 tons. Sources from multiple traders/wholesalers
Retailer / processor (retail shops or processors in major markets (for example, Addis Ababa)	Directly (or through brokers), source grain from wholesalers. Clean grains and sell to end consumers. Little or no grain storage. Limited large-scale value addition	Transaction size of about two tons (retailers)

Source: Regional Agricultural Trade Supports (RATS) project study on maize value chain (2003), participatory rapid assessment, and expert interviews

Explaining the complexities of Ethiopian marketing chain, with full treatment of each of the actors, is beyond the scope of this paper. Therefore, the focus of the analysis has been on three broad stages: production, aggregation and trade, and consumption (demand sinks). The underlying objective is to understand the opportunities and constraints observed in each of the three stages in order to systematically identify appropriate intervention strategies for each stage of the value chain. The following three sections will examine production, aggregation and trade, and consumption (demand sinks) separately.

Findings on the production system

Cereal producers in Ethiopia are primarily smallholder farmers. They face a range of constraints across the value chain from production to aggregation and trading to commercialization that limit their productivity and incomes. For instance, smallholders often make limited use of commercial inputs, have low bargaining power, and sell only about 20 percent of their produce on average. Producers sell the majority of their produce immediately after harvest when the price is lowest, because of urgent cash needs (including loan repayment) and fear of risk due to storage loss[28]. The results of the value chain analysis on production are presented in the following two subsections, namely an overview of the domestic production systems and major challenges in the production system.

[27] Rashid and Minot (2010)

[28] Most of the marketed volume of maize (60 percent) is marketed during January, February, and March (immediate periods following the harvesting and threshing time of November and December). The remaining 25 percent is sold during April, May, and June, 14 percent during July, September, and October, and 2 percent during October, November, and December

Overview of domestic production

Production – involving input acquisition, planting, growing, and harvesting – is the key activity in the maize value chain. Maize production activity is performed by three types of actors: subsistence farmers, market-oriented smallholders, and commercial farmers.

Subsistence farmers are by far the major actors as maize producers both in terms of numbers and in terms of total product volume. These actors are characterized by small land ownership (usually less than 2 hectares) and low utilization of yield enhancing technologies such as hybrid seeds and chemical fertilizers. At an aggregate level, less than 5 percent of the farmers use high yielding seed and 5 percent of the farmers apply chemical fertilizers[29]. Women are involved in maize production at different stages, including 60 percent of the maize processing in Ethiopia, and family labor is the major source of farm labor. Most farmers use traditional methods of shelling, such as hand shelling and beating sacks for shelling. They also use traditional facilities for maize storage, such as *dibignit* and *gotera* mud structures, which are likely to increase post-harvest losses.

There are several estimates on marketed surplus of maize, a measure of commercialization, ranging from 15 to 30 percent of total production[30]. This is mostly sold by the second group of actors in maize production – market-oriented smallholder farmers – which account for roughly 40 percent of total holdings. These producers own relatively more land (2 to 5 hectares), hire temporary labor, use manually operated machines for some operations (for example, for maize shelling) and make more use of improved technologies such as seeds and chemical fertilizers. Market-oriented smallholder farmers sell a considerable proportion of their maize produce (around 40 to 60 percent).

The value chain network functioning around smallholder farmers comprises linkage among input suppliers (private), farmers, co-operatives, extension service providers, credit service providers, and traders. Where co-operatives are well developed and organized, they tend to provide input supply and product marketing services to smallholders.

The third type of maize producers is commercial farmers, including some that also produce hybrid maize seeds. While such commercial farmers are few in number, they operate at a relatively large scale (more than 50 hectares of land per farm), and are mechanized in their plowing, harvesting, and shelling activities. They also have better storage facilities, use improved seeds, chemical fertilizers, and hire laborers. This group of farmers operates mainly in Amhara and Oromiya regions and many of them specialize in seed production. They sell their products to wholesalers in surplus areas and to EGTE, and in the case of seed producers, to co-operatives and Bureaus of Agriculture and Rural development (BoARDs).

Production stage challenges and opportunities

Maize farmers in Ethiopia face a series of challenges that limit their overall production and income. The key challenges can be broadly categorized into three groups: (i) lower yields due to limited use of modern inputs; (ii) majority of sales immediately after harvest; and (iii) high post-harvest losses (both on- and off-farm).

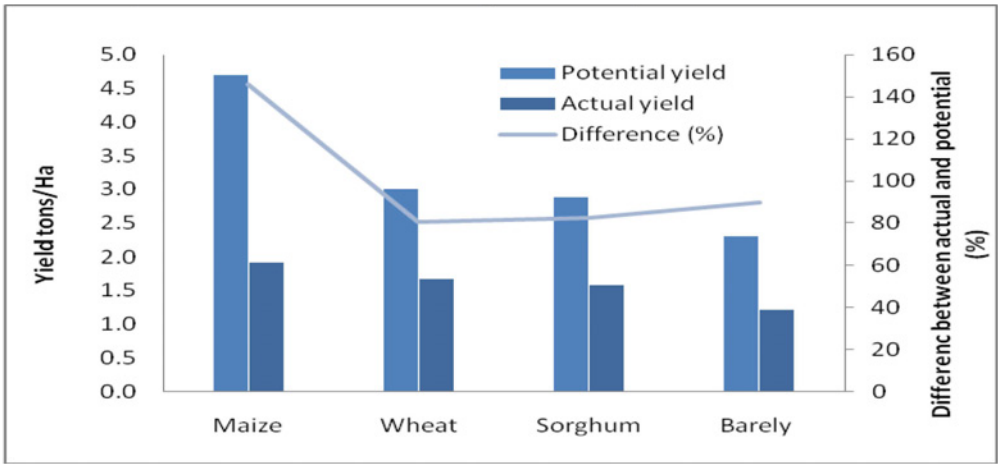
Lower yields due to limited use of modern inputs

To address the first challenge, GOE has placed heavy emphasis on increasing cereal productivity in all of its policy strategies, especially in PADETES. As a result, compared to other cereals, maize yield has grown faster in recent years. For instance, during 2003 to 2007, average maize yield was 1.9 tons per hectare compared to 1.7 tons/ha for wheat, 1.6 tons/ha for sorghum, and 1.2 tons/ha for barley[31].

However, among all major cereals, maize still has the highest potential for additional yield gains (Figure 4). During 2003 to 2007, maize yield has averaged 1.9 tons compared to a conservative estimate of yield in farm-level trials of 4.7 tons, giving a difference between potential and actual as 146 percent of current average yield. For all other major crops, the gap between potential and actual yields, as percentage of actual yield, is within 80 to 90 percent.

[29] Byerlee et al. (2007)
[30] IFPRI (2009)
[31] FAOStat (2003-2007)

Figure 4: Actual and potential yields of major cereals, 2003 - 08



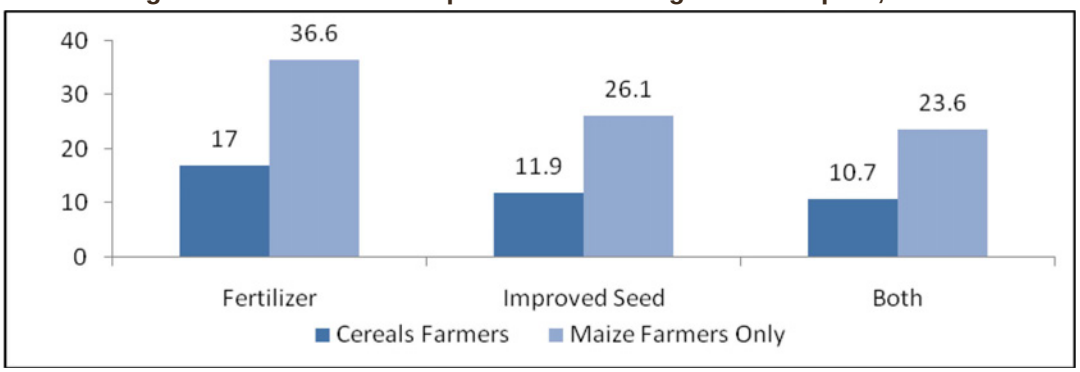
Source: Authors' calculation from CSA data and World Bank Memorandum (2006), potential yields based on on-farm trials

Available statistics suggest that potential maize yields have not been realized due to limited use of modern inputs, such as hybrid seeds and chemical fertilizer. Estimates from a recent household survey, jointly conducted by IFPRI and EDRI in 2008, provide the most up to date evidence on the status of modern input use in the country[32], as presented in Figure 5. This indicates that only about 17 percent of all cereal growers in the country used fertilizer and 12 percent used improved seeds. The numbers vary widely across regions, ranging from about 36 percent in Amahara to only 2 percent in Tigray.

Estimates of chemical fertilizer use for maize cultivation are significantly higher than the national average for the cereal growers. Roughly 37 percent of the maize farmers used fertilizer, more than twice the national average of 17 percent for all cereal farmers. Similarly, an estimated 26 percent of the maize growers used improved seed, which is again more than twice the national average for all cereals farmers.

Note that to achieve the yield potential, a farmer has to use both modern seeds and chemical fertilizer along with good farm management. Again, estimates in Figure 4 indicate that, only about 11 percent of all cereal growers used both improved seeds and fertilizers, which is less than half the proportion of maize farmers.

Figure 5: Percent of Ethiopian farmers using modern inputs, 2008



Note: The averages are sample weighted average, not simple average of the regions

Source: Authors' calculations IFPRI-EDRI household survey, 2008

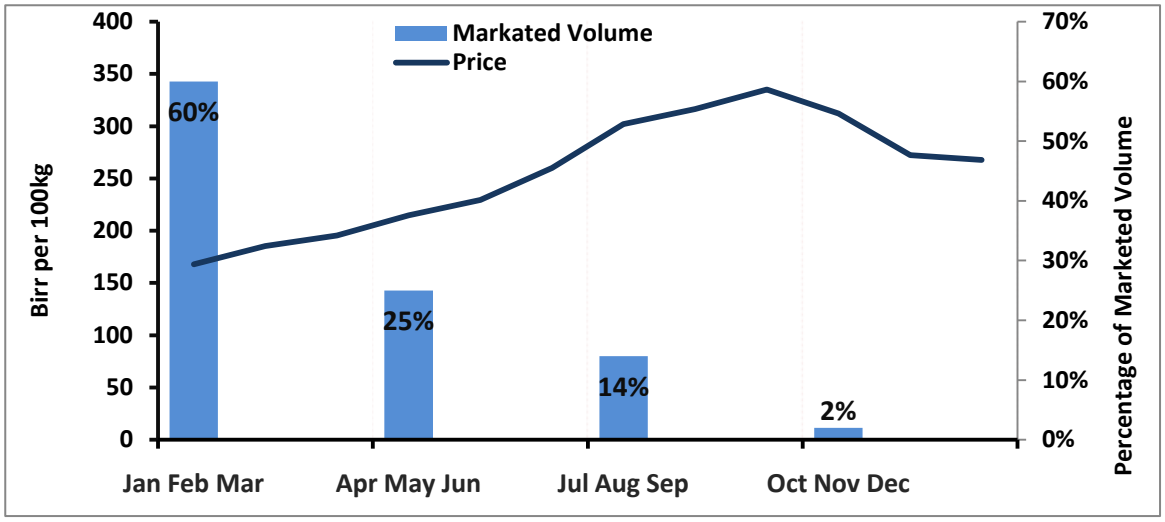
[32] The IFPRI-EDRI survey included about 2,000 households and was representative of all cereals growing regions

Majority of sales immediately after harvest

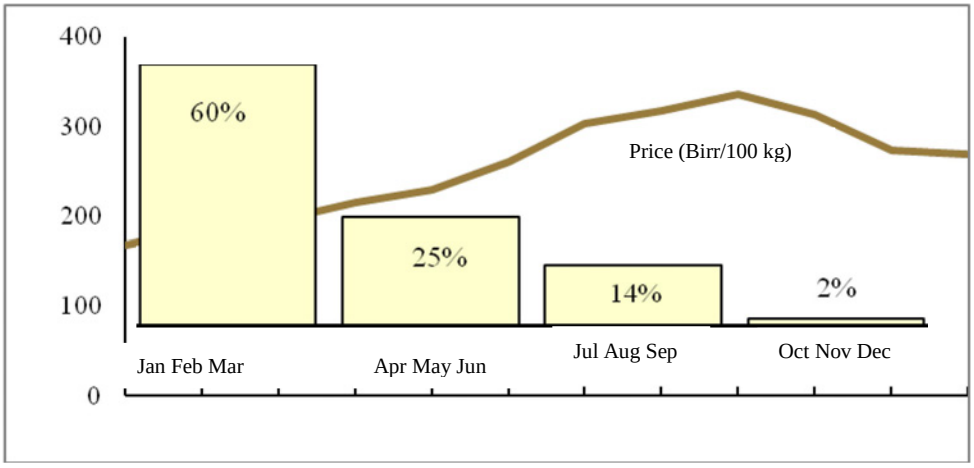
The second challenge that Ethiopian maize farmers typically face is distress sales immediately after harvest – Figure 6 illustrates the challenge. This demonstrates that 60 percent of the total marketed volume is sold during the first three months after the harvest and another 25 percent in the next three months. By the time prices peak, farmers are left with only 16 percent of the market volume. The maize that is marketed during the lean period is supplied by a few large traders, implying that the benefit from higher prices does not accrue to smallholders.

The uneven distribution of maize marketing inter-annually is not unique to Ethiopia. Farmers in most developing countries exhibit similar marketing patterns, selling during the period immediately following harvest, due to liquidity constraints, lack of adequate storage, and uncertainty in price variability. However, in Ethiopia, this appears to be particularly severe. The methods and timing of harvest, as well as traditional storage facilities (*mud pits*, *gotera*) pose higher risks of pest infestations, disease and quality deterioration than many other developing countries. Moreover, farmers also have to repay loans, pay for children's school fees, and meet other financial obligations during the first three months after the harvest. As a result, farmers often find it profitable to sell immediately after harvest despite low prices.

Figure 6: Price movement and timing of maize sales



Source: Price Source: EGTE, marketed volume data are based on Abebe and Hundie (2002) and participatory rapid assessment in January 2010.



Source: Price Source: EGTE, marketed volume data are based on Abebe and Hundie (2002) and participatory rapid assessment in January 2010.

High post-harvest losses

The final major challenge that maize farmers face is the high post-harvest losses, with estimates varying from 20 to 40 percent of the gross production[33]. The rapid assessment conducted for this study suggests a slightly lower level of 15 to 30 percent; with losses concentrated at the farm level. Losses were found to be driven primarily by the timing of harvesting, shelling methods, and the type of storage devises. On-farm storage structures, such as *dibignit* and *gotera,* can also make maize susceptible to different types of damages, including weevil and rodent attacks, which cause substantial loss of stored grain. Moreover, harvesting and crop management practices are sub-optimal in the sense that there are losses resulting from improper handling, threshing, and transporting.

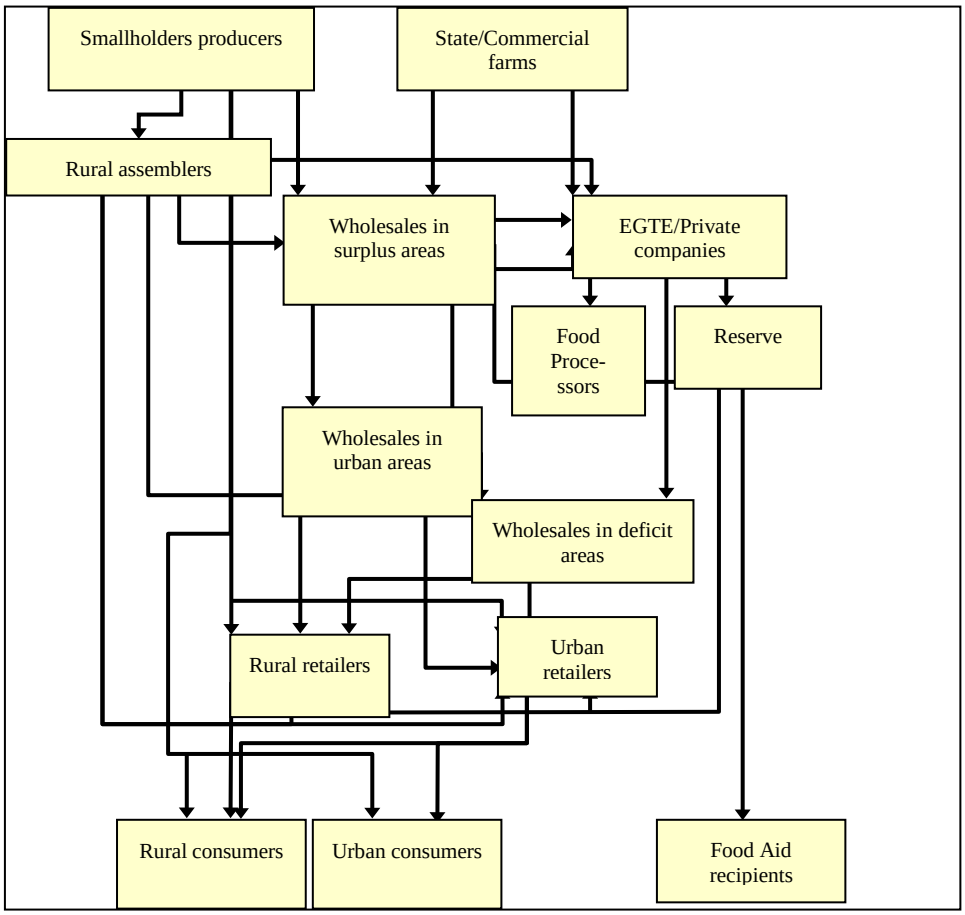
The benefit of crop rotation is worth noting. Current crop rotation practices in Ethiopia, which leave about one-third of the maize cultivated area without rotation, lead to soil nutrient loss and to pest infestation. Loss of nutrients such as nitrogen, potassium, and phosphorous is estimated to be about 122, 82, and 13 kg/ha[34] due to lack of appropriate rotation practices. If smallholders are able to employ crop rotation with the proper amount of input usage, this could result in a possible yield increment by nearly 150 percent as outlined above. Methods to improve soil health are further explored in the separate soil health diagnostic report.

Aggregation and trading

Increasing maize productivity will benefit smallholders only if the marketing activity (aggregation and trading) is well developed. By serving as a channel to transfer products to intermediate and final consumers, a well developed marketing system creates the economic incentive for producers to invest in production and productivity enhancing activities. Although most maize produced in Ethiopia is used for on-farm consumption, the maize that is marketed faces a market characterized by poor coordination, low scale and volume of operation, high cost and high risk. Such bottlenecks in maize marketing reflect inadequate market fundamentals, leading to weak industry structure with adverse consequences for all actors in the value chain from smallholders, to traders and consumers. The long and complex maize marketing chain in the country (Figure 7) exemplifies the inadequate maize market fundamentals.

[33] FAO (2009)
[34] Expert interviews (2010); field visit to Bako (2010)

Figure 7: A typical maize marketing chain in Ethiopia



Source: RATES 2003; Expert Interviews; Field Visits

The maize marketing chain is not only long and complex; the scale of operation at various stages is also very small (Table 5). A typical local trader / assembler transacts about one ton of maize (worth about USD 300) four times a month during the peak periods, which goes up to three to five tons in the case of traders in the surplus areas, and to 10 tons a week for the wholesalers in Addis Ababa. Most local traders do not have their own trading premise or storage facilities. In terms of storage capacity and financial ability to store, only traders in the large terminal markets can store maize for one to three months.

Table 5: Typical trading volumes along the value chain

Agent	Trading volume
Local trader/assembler	▪ Transaction size approximate to 1 ton ▪ Typically trade 4 market days in a month
Trader (surplus area)	▪ Transaction size approximate to 3 to 5 tons (one ISUZU truck) ▪ Typically trade 4 market days a month ▪ Turnaround time of 3 to 5 weeks
Trader (Addis Ababa/deficit area)	▪ Transaction size approximate to 10 tons a week ▪ Own or rent storage and usually store grain for 1 to 3 months
Retailer	▪ Transaction size approximate to 2 tons (retailers)

Source: RATES Maize Value Chain Study [2003]; expert interviews; field visits

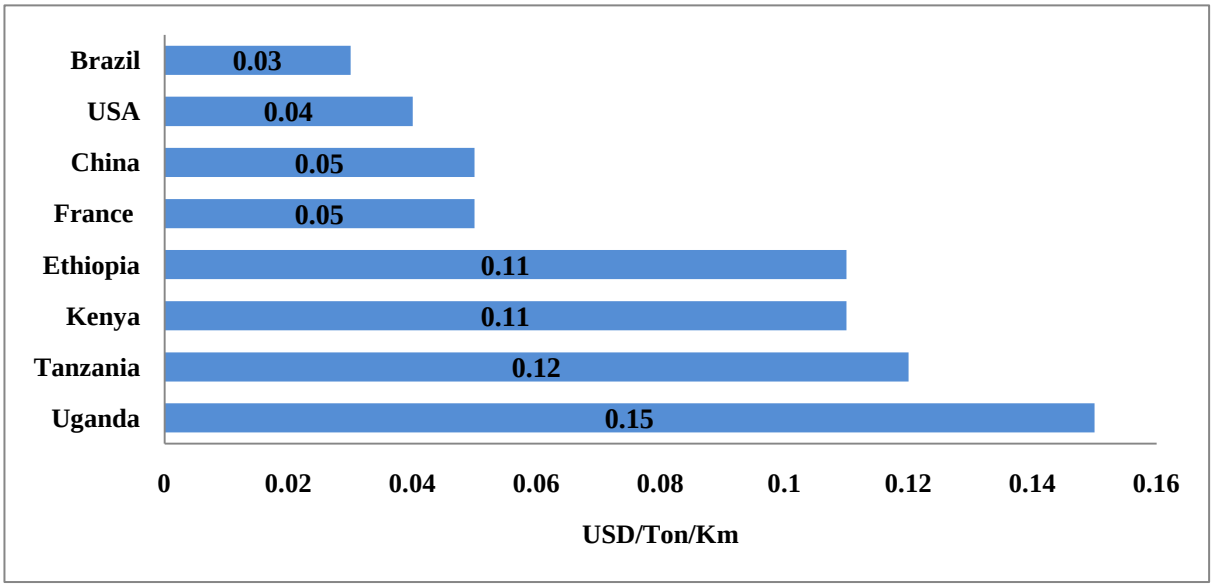
Market fundamentals

Building infrastructure, addressing information asymmetry, and supporting institution building are widely recognized as the government's responsibility. Simultaneously, these are also commonly cited as the sources of market failures. Following is a discussion on the status of each of these market fundamentals.

Infrastructure building

While Ethiopia has made remarkable progress in reducing transaction costs and improving overall infrastructure during the past decade, the country's maize market is still characterized by inefficient movement from surplus to deficit areas. Ethiopia is a geographically diverse country and maize from surplus areas needs to move long distances to eventually reach the consumers in the deficit areas. In the current market structure, maize primarily moves through the Addis Ababa market, which is considered as a source of market information and center of price discovery. Transporting most maize through Addis often adds to transactions costs and thus the final prices that a consumer in the deficit area pays. Furthermore, while there has been reduction in average transportation costs per kilometer in recent years, there is room for further improvements (Figure 8). In particular, although Ethiopia's average transport costs of USD 0.11/t/km fares well compared to its neighbors, it is still more than two times higher than in China and three times higher than in Brazil:

Figure 8: Long-distance transportation cost in selected countries (USD/ton/km)



Source: World Bank (2009)

Institution building

Despite the Government of Ethiopia's efforts in institution building, the functionalities of the key institutions such as credit, insurance, and risk management are still limited. The following four examples demonstrate the need for continuing development of key institutions. Table 6 presents a summary of these examples.

Table 6: Summary characteristics of enabling institutions in Ethiopia

Institutions/ organizations	Expected role	Current reach/coverage
EGTE	Historically, EGTE was responsible for price stabilization; but its mandate has changed over the years. By a 2002 proclamation, price stabilization role was eliminated, but was re-instated following 2008 food crisis	Very limited role in terms of its market share and reach to the smallholders. It's primarily purchases at the local market level; responsible for imports; gathers price information; and have intervened in markets occasionally
Credit (Banking)	Providing financial access to various actors in the value chain.	Bank branch to population has improved from 1:250,699 in 1998 to 1:156,128; but still limited access
Insurance	Risk management in case of shocks, accidents, and other losses	Insurance branch to population ratio has improved from 1:780,658 in 1998 to 1: 539,350; but it is very low access
ECX	Price discovery, risk management, alleviation of liquidity constraints through Warehouse Receipt System	100% coverage for coffee and oilseeds and pulses by law; limited coverage for cereals
Co-operatives	Risk pooling, technology diffusion, product aggregation, price negotiations, and better marketing	Limited coverage; limited management skills; and weak overall human capacity

Source: Authors' characterization

- **EGTE.** EGTE was initially mandated to stabilize domestic prices of main staple cereals, thereby reducing the risk of volatile prices for consumers and suppliers. However, it has been given conflicting mandates over the years. One proclamation indicates that EGTE is required to stabilize prices, perform on a commercial basis, and earn foreign exchange. The conflict occurs where the mandate of price stabilization, which is a social function requiring subsidies, competes with the mandate to earn foreign exchange which requires making profits, which is not a social function. Furthermore, EGTE intervenes as and when necessary, making such interventions *ad hoc* while sending inconsistent signals to the actors in the value chain. Moreover, EGTE purchases on an *ad hoc* basis, without set rules such as price floors to protect farmers from further price decline, and usually intervenes immediately after harvest while it sells the stocks around the year. EGTE's market sales would be more strategic in terms of achieving price stabilization if instead they were concentrated in lean seasons when maize supply to makers is limited. In recent years, EGTE has also been mandated to export coffee and pulses, which may limit its role in cereal markets due to capacity constraints.

- **Credit and insurance.** Ethiopia has made significant progress over the last ten years with regard to the provision of credit and insurance. Specifically, the ratio of bank branches per capita has increased from one branch to 250,000 people in 1998 to one branch to 156,000 people in 2008. This is almost a 60 percent improvement, but still extremely low density of bank branches relative to total population. In 2008, the country had 562 bank branches of which almost 35 percent were in the urban areas, implying that access to banking in rural areas was very limited. Similar characterization can be done for insurance sector. Insurance is also limited in rural areas, especially as, there is no agricultural or crop insurance[35].

- **ECX.** The Ethiopian Commodity Exchange (ECX), a national commodity exchange, has received wide range of media coverage for its design, use of modern technology, management and other institutional attributes. However, its role in cereal trade has so far been limited. In fact, since a government proclamation mandated that coffee be traded through the exchange, ECX has primarily been focused in that area at the expense of trading in cereals. A recent proclamation, which requires all oilseeds and pulses exports to go through ECX, may further delay the development of trading in cereals as ECX has been wise to carefully and deliberately roll out new initiatives to guard against overextending its capabilities.

[35] Refer to the agricultural finance diagnostic report for more details

Lack of professional management within co-operatives

■ **Management issues**

Only one salaried management employee (accountant), with limited professional and educational experience.

Less savvy than traders and other intermediaries (for example, limited knowledge of demand and price information).

Need for training in the areas of purchasing, bookkeeping, business development, market information gathering and storage management

■ **Weak relationships with the unions**

Co-op union is responsible for a large number of co-operatives and unable to support them (for example, not providing loans).

Limited trust between co-operatives and unions (for example, co-operatives unsure if dividends will be paid in cash or shares).

Some co-operatives prefer not to go market through unions, thereby limiting access to large demand centers.

■ **Limited/no access to finance**

Limited financing available from unions due to capacity constraints; co-operatives have limited direct access to commercial banks due to lack of sufficient collateral.

Financing limits day-to-day operations of co-operatives (for example, unable to buy volume from farmers, forced to turnover quickly).

Source: Authors' observations from field interviews conducted in Bako in 2009

- **Co-operatives.** Since early 2000, GOE has provided strong support to the development of agricultural co-operatives with an objective to improve smallholders' links to the markets. The policy environment for co-operative development has improved tremendously, and there is an ongoing manpower capacity building effort. In 2009, the number of multipurpose agricultural co-operatives operating in different parts of the country was approximately 6,725. These co-operatives are mainly engaged in providing commercial inputs to farmers and in marketing agricultural products of farmers. Nevertheless, according to a recent study, the size of co-operative membership is small, the commercialization impact of co-operatives is limited, and incentives for co-operative participation are poor[36]. The same study reports that only 40 percent of farm households in 2006 had access to a co-operative in their peasant association; and that in peasant associations where a co-operative exists, only 17 percent of the households had membership in the co-operative. Among other things, as summarized in the box above, the internal environment of co-operatives (poor management and low participation of members) contributes to the slow development and impact of the sector.

Consequences of inadequate market fundamentals

Inadequate market fundamentals result in a weak industry structure, manifested by: (i) fragmented demand and supply, (ii) absence of year-round markets, and (iii) a lack of depth in the market. A discussion of these three factors follows.

Fragmented demand and supply.

First, the fragmentation of trade is evident in the small transactions sizes (1 to 5 tons) and the small volume that is traded through co-operatives. One primary cause of fragmentation is that traders are not strategically linked to each other. Fragmented trading, and hence small business volume, precludes traders from reducing the unit cost of operation through necessary scale and from investing in storage required to take advantage of temporal arbitrage. Fragmented trade applies on both the supply and demand side:

[36] Bernard et al. (2008)

Market actors' opinions

"Government has the right to protect the consumer but the interventions make it risky for me to buy and hold large quantity of grain" *~Trader in Bako*

"It is very difficult to get financing, much harder [for maize] than for some other crops" *~ Trader in Shashemene, Awasa*

"Almost every decision [relating to co-operative purchase] needs board approval, so buyers do not wait and find another trader" *~ Union manager in Awasa*

Source: Authors' research

- **Fragmented supply.** Given the small size of supply from individual farmers, operating a warehouse of 5,000 tons capacity will require aggregation of grain from about 15,000 smallholders. Aggregation through co-operative marketing provides a scale advantage both to the producers and traders. However, the amount of grain aggregated and traded through co-operatives is limited, largely due to underdeveloped co-operative structures swamped by management and financial constraints. The co-operatives are unable to carry out a year-round, liquid trading function, primarily due to management and governance related challenges such as weak management capacity, lack of role clarity between board and managers and insufficient access to working capital.
- **Fragmented demand.** Small number of large buyers against many small retailers leads to fragmented demand.

Second, fragmented demand and supply results in a lack of large scale aggregation and storage, which in turn leads to an absence of year-round market. Underdeveloped aggregation and storage practices are results of various factors, including limited scale and storage capacity of private trade, little volume traded through co-operatives, and lack of quality control. Risk and fear of *ad hoc* government intervention of different forms and lack of adequate working capital limits the storage and aggregation capacity of the private sector. The box above presents the reflection of some key value chain actors with regard to the various risks they face. Problems related to poor management at co-operatives and lack of finance, together with mistrust of members in co-operatives as a result of bad legacy, affect the performance of co-operatives in terms of aggregating grains.

Finally, the lack of depth in the maize market, particularly of quality maize, creates supply shortages, especially for large buyers. Large buyers face challenges in procuring consistent supply of quality maize. As such, processors prefer procuring maize from commercial farms over smallholders, typically seeking to secure their own maize production before investing in processing activities. Currently, there is not a formal quality control infrastructure, such as instruments to check for consistency in size, color, and level of moisture content. Instead, traders and co-operatives lack the appropriate storage structures like ventilation and handling facilities; chemical treatment practices are inefficient because of lack of appropriate facilities, and; quality control is usually made visually and based on mutual trust with producers. The lack of quality control is of particular concern regarding the presence of aflatoxins, a carcinogen, in maize (see box on the following page). Developing appropriate standards around acceptable levels of aflatoxins, as well as encouraging pre- and post-harvest treatments, such as through better storage facilities, is an essential component of future interventions in the maize market.

Minimizing risk of aflatoxin, improving food safety

The lack of quality control standards for maize in Ethiopia is of particular health and economic concern with regard to aflatoxin, a carcinogen and mutagen that occurs in variety of crops including cereals, oilseeds, spices, and tree nuts. Chronic exposure to aflatoxin has serious health effects for humans and other animals, resulting most noticeably in liver tumors, liver cancer, and death. Aflatoxin is often referred to as a "silent killer" as it can take long periods of continual exposure for negative health effects to occur, though immediate death, while rare, may occur.

Aflatoxin is prevalent throughout East and West Africa. One study shows that 90 percent of Africans tested show evidence of aflatoxin exposure, and in parts of West Africa exposure is as high as 99 percent. Similar to East Africa and most of West Africa, Ethiopia has a serious problem with aflatoxin, though the exact levels of exposure are uncertain due to a lack of data or testing.

While aflatoxin is prevalent throughout the continent, few countries in Africa routinely test for aflatoxin in maize that is not exported of bought by a major buyer (e.g. food processor, WFP). For instance, within Ethiopia, a national standard has yet to be set for “acceptable levels” of aflatoxin. However, some large buyers, like WFP, have already set such standards for food purchases and donations. It is likely that ECX will have similar standards in the future.

Aflatoxins not only pose a serious health risk, but also a significant economic risk to farmers should their crop be rejected from buyers. For instance, in Kenya two WFP purchases were recently confiscated and destroyed because of unacceptable levels of aflatoxin. This is of particular concern to smallholders as aflatoxin occurs primarily where there is high moisture content and high temperatures, which is often driven by inadequate storage structures.

Any recommendation that seeks to increase the productivity of maize must consider the health and economic risks that aflatoxins pose. Smallholders who depend on maize for livelihood improvements yet do not take preventative measures for aflatoxin risk either (i) severe health repercussions from consuming high levels of the toxin, or (ii) significant economic risks from having supply rejected from the commodity exchange, exporters, processors, or other buyers.

So what is the solution for aflatoxin? Although there are some promising avenues for pre- and post-harvest treatment of infected maize, treatments will be expensive. In developed countries, it is estimated that pre- and post-harvest interventions to combat aflatoxins add approximately 20 percent to the cost of the product to consumers. To date, no pre- or post-harvest treatment has been implemented at any scale in Ethiopia (nor elsewhere in Africa). Moreover, the cost of aflatoxin treatment must be considered alongside the other investments asked of smallholders to improve productivity such as improved seeds, fertilizer, and irrigation. In sum, combating aflatoxin will require a combination of quality standards and testing, proper pre- and post-harvest interventions, and extension interventions to increase awareness around the health and economic repercussions of not preventing the toxin in maize.

Source: Authors analysis

Quality control services are limited because there is not a market for differentiated qualities of maize, except basic differentiations such as white versus yellow maize and insect infested versus clean maize. Moreover, there is limited market incentive to award product quality, and the private sector lacks capacity and scale to invest in quality control facilities. Such constraints lead to loss of farm income because farmers are unable to satisfy demand for higher quality grain that can command higher price, including trading maize on the Ethiopian Commodity Exchange (ECX), supplying to food-aid organizations that have quality standards, and entering into contracts with agro-processors. Similarly, traders and co-operatives are not able to fully exploit benefits from temporal arbitrage.

The lack of year-round market, price instability, and lack of depth have adverse consequences for all actors in the value chain as described below:

- **Smallholders** receive a low price at sale for their grain and have a constant fear of losses due to infestation and price crashes, particularly during a bumper harvest. In addition, smallholders have a very thin market outlet in the pre-harvest season.
- **Aggregators** (co-operatives and traders) also receive low price at sale and have limited maize trading activity during the pre-harvest season.
- **Processors and downstream actors** (both current and potential actors) are challenged by an inconsistent supply of quality grain and significant price volatility, particularly if they are sourcing from smallholders. Further investment in downstream activity is also being discouraged by perceived difficulty to get supply.

- **Consumers** are faced with a situation in which their cheapest calorie source is seasonal with significantly higher prices in the pre-harvest season.

Sources of demand

The degree to which maize can enhance smallholder livelihood and contribute to overall economic growth depends on the extent to which latent demand can be accessed at the end of the value chain. End market opportunities are major drivers of value chain dynamics. Developing strong downstream demand for maize is critical to strengthening the value chain as it provides farmers with reliable incentives to boost productivity. Export markets, processing industries (poultry and animal feed and bio-fuel production), domestic household consumption and procurement for food aid could provide ample end-market opportunities for maize. It is estimated that such "demand sinks" could absorb as much as double the current production of maize. Nevertheless, this is in contrast with the current situation where by on-farm consumption is the largest demand sink, especially as there are few large downstream buyers and insignificant processing activity. This presents challenges for any increase in maize production over current levels.

Below is an examination of possible demand sinks for maize within Ethiopia. Of the options below, capturing latent food and feed demand appear to be the most attractive demand sinks in the long term based on economics and Ethiopia-specific constraints.

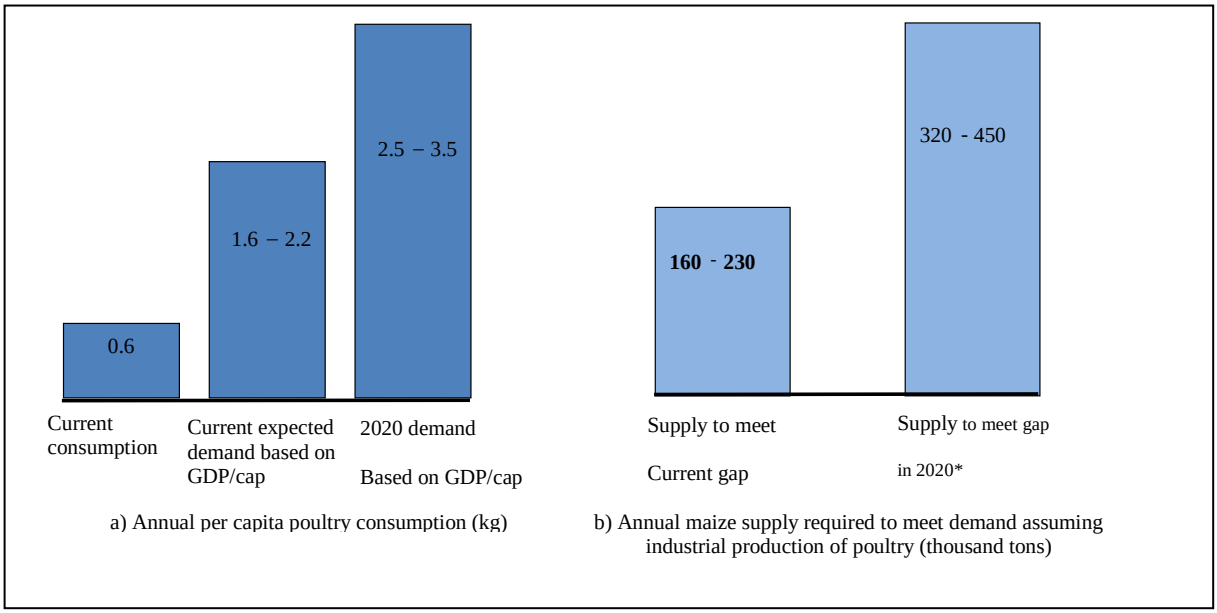
Food demand

A preliminary analysis of potential demand indicates that there is a large food demand from unmet local consumption for food aid (cereal demand of approximately 500,000 tons for relief and additional 300,000 tons for safety net programs) with ready buyers. Maize is the most suitable crop for unmet consumption, as wheat is 30 percent more expensive per ton, and teff is over 100 percent more expensive[37]. Moreover, The World Food Program (WFP) was already procuring 40 percent of food aid import locally before a procurement ban[38], suggesting that they are a ready buyer.

[37] EGTE

[38] The local procurement ban has been lifted for the P4P program (WFP), which is allowed to purchase 40,000 tons locally

Figure 9: Expected poultry demand in Ethiopia and derived maize demand of the poultry industry



* Estimated based on historical population and GDP per capita growth and correlation between GDP per capita and poultry consumption

Source: FAO; Global Insights; interview with poultry farmers

Feed demand

There is also latent feed demand from shifting to grain-fed poultry and other livestock and capturing latent livestock demand. Analyzing the poultry industry as an example of broader feed opportunities, it can be concluded that poultry production in Ethiopia today is substantially below expected levels given GDP per capita. Moreover, the poultry industry is relatively unproductive due to limited use of quality feed. Closing these gaps could create a poultry industry worth USD 360 to 580 million by 2020, requiring annual supply of 320,000 to 450,000 tons of maize. Figure 9 illustrates current poultry demand, in contrast with the expected demand given current levels of GDP, as well as the expected demand in 2020 based on an increase of GDP. In addition, the maize supply required to meet this demand is shown.

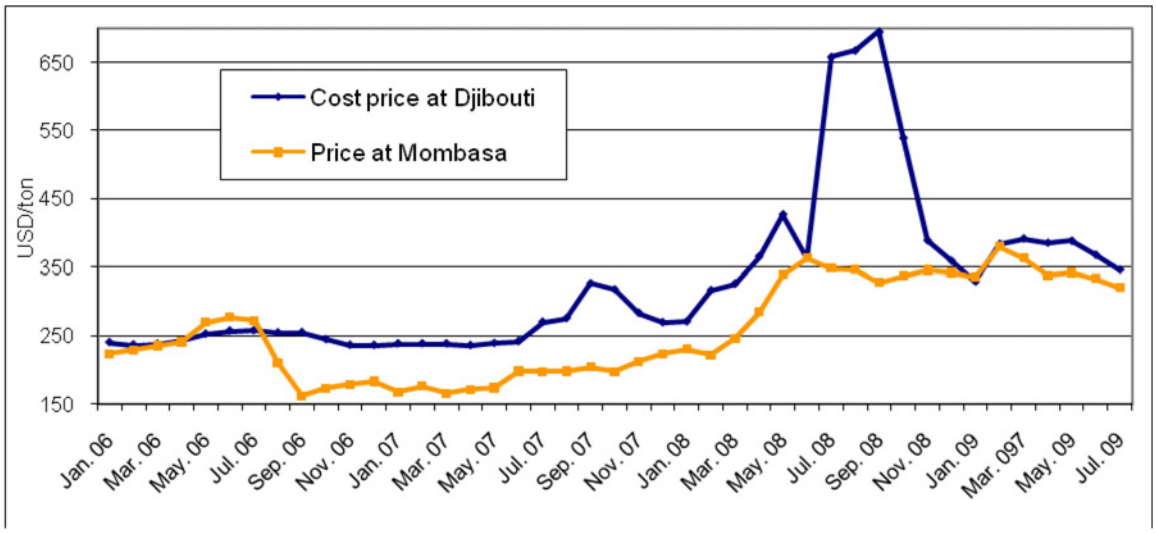
Conversely, exports and bio-fuels are less attractive demand sinks.

Exports

As examined in section 2.3.1, maize is not an attractive crop for export. The domestic price for maize is often above the export parity, implying that traders will make less money when selling maize internationally. This is compounded by high transport cost, making export less attractive.

Although Ethiopia has geographical proximity to the Middle East and East African regional markets, as a land-locked country, domestic land transport is expensive and makes exporters uncompetitive. For instance, direct linkage to Kenya through road transport is not well developed and cost of transport via Djibouti is not likely to be competitive – transporting a ton of grain from Addis Ababa to Djibouti costs USD 80 per ton. Figure 10 illustrates that the border price (excluding shipping cost) at Djibouti is more than the price at Mombasa (Kenya), making it unattractive for Ethiopia to export to the Kenyan market.

Figure 10: Export price of maize at Djibouti and price at Mombasa



Source: EGTE; FAOSTAT; RATIN; WFP; year for each case

Bio-fuels

Bio-fuels have high potential from a production perspective, but current economics suggest that price per gallon would be higher than historical imported price of fuel. The economics are further hindered by transportation costs of fuel exports – local demand for gasoline is limited, so reaching scale in bio-fuels production would require the ability to export, which is likely unviable at current prices given transportation costs.

In sum, the end-market opportunities identified (local unmet consumption, local processing for import substitution, and exports to neighboring countries) are estimated to demand around 315,000 tons, or USD 42 million, of maize (Source). Provided that the market is competitive and some of the market hurdles are removed, the demand side is quite encouraging to absorb and allow more supply.

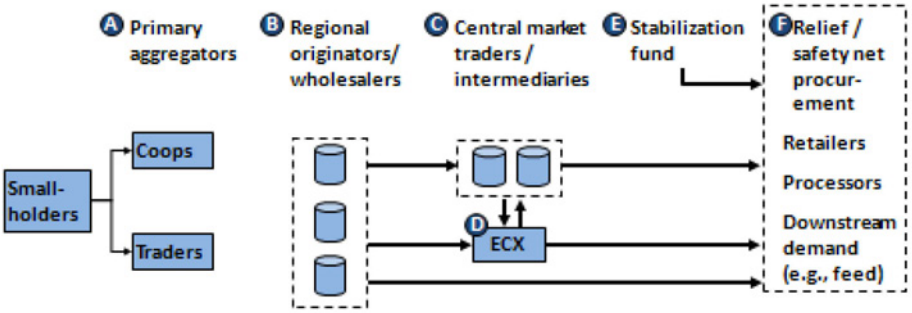
RECOMMENDATIONS

In the context of developing the maize sub-sector of Ethiopia toward improving the income of small-holders and supporting the overall economic development process of the country, it is important to envision a comprehensive intervention approach that embraces the entire value chain. Improving the productivity of only one aspect of the maize value chain has the potential to yield disastrous results, such as during the bumper crops of 2002, where production was improved, but unmatched by improvements in aggregation and marketing, resulting in crops that were left to rot in the field.

The future Ethiopian maize value chain should demonstrate increased productivity from potentially lower acreage and a gradual realization of key latent demand sinks with both ends of the value chain enabled by a stable, coordinated, liquid and year-round market. More production is needed for food security, however, it can have an adverse income effect without additional demand, and acreage increase is not sustainable without rotation (mono-culture). It is therefore critical to grow productivity, commercial demand and increase rotation over time. From the supply side, greater productivity from input use, reduced losses and effective crop rotation to sustain productivity, while on the demand side, realization of latent demand sinks such as domestic sourcing of food for relief and safety net programs, development of a feed/poultry industry, and increased processing from a more developed food processing sector could be envisaged. Creating such an effective chain will be a gradual process and requires holistic improvements in supply, demand and market mechanisms in parallel.

The set of core interventions identified and other enabling actions that can be taken to holistically strengthen the maize value chain are discussed in the next section. An end state vision of what the maize value chain could resemble is shown in Figure 11:

Figure 11: Vision for Ethiopia's of future maize market



Source: Authors analysis

The vision for the activities of these actors, as well as how this differs from today, is as follows:

- **Small local co-ops and traders** would aggregate grain from farmers at the village level, ensuring adequate and efficient shipment of surplus to the nearest market. This is different from the current situation in that there would be more significant volume going through co-ops, and primary actors would have stronger market linkages to large traders.
- **Regional originators** would source grain from production zones and be able to hold stock until sufficient demand arises. Relative to the current situation, trading would be larger-scale and maize supplies could be stored year-round.
- **Central market traders/intermediaries** would provide liquidity to the central market in Addis, enabling cross-regional flows and available supply year-round for buyers. This would require a greater degree of depth to supply large amounts of grain year-round than is currently available.
- **ECX** would create a year-round liquid market for maize (and other cereals), providing smallholders a consistent outlet for their produce and downstream actors a consistent supply of quality grain. Unlike today, financing and storage support would be available to enable a year-round market.
- **A stabilization fund** would buy and sell strategically to prevent market failures. Different from today, the stabilization fund would address market failures in a systematic and predictable way that is transparent to all actors in the value chain.
- **Relief procurement.** Local procurement volume, timing and price would be determined according to local stabilization needs, and any shortage would be imported. Unlike today, there would be no ad hoc decision making on the ability to procure locally, and decisions would be made in relation to stabilizing the maize market.

Core recommendations

Strengthen stabilizing role government currently plays in maize market with clear and transparent system with capable partners

GOE currently operates in a stabilizing role in maize and other cereals markets to ensure that: **(i)** there are no extreme price fluctuations and supply shortages or excesses and **(ii)** actors in the value chain have a clear and transparent understanding of when and how market failures will be addressed, alleviating their perceived risk. However, today's system lacks the clarity and mandate needed to do this role effectively. Working with the current stabilizing partner, EGTE, the government role should be clarified to ensure appropriate market intervention. It is necessary to ensure that there is no ad hoc distortion, and that there are clear, transparent ways to address market failures to alleviate perceived risks and market distortions.

Specifically, the actions to implement this recommendation are to:

- **Develop transparent and predictable parameters that direct when and how interventions are conducted** in the maize market. Interventions should be linked to local food aid procurement (e.g., sell to them in times of surplus), the domestic market (e.g., sell when price nears import parity, buy during bumper harvests or when price is near the cost of production) and the global market (e.g., release or import in times of shortage). Potential rules of intervention to address market failures could include buying prices based on cost of production and selling prices based on import costs. In such a model, storage of excess maize could be through EGTE warehouses or in strategic grain reserve storage.

- **Set up a decision-making panel to approve such interventions** on the ministerial level. Such a panel should be supported by a technical, advisory group, and will enable EGTE's core functions.

- **Conduct a targeted project to develop this revised and systematic mechanism** and its appropriate governance structure. If EGTE will be the executing body, the dual mandate (profitability and stability) of EGTE has to be revised, and organizational capabilities should be strengthened to improve execution on this clarified mandate. Alternatively, incentives can be designed for licensed private sector actors to execute this mechanism on behalf of the government.

Table 7 below provides concrete actions and potential owners and stakeholders for each step to develop a market stabilization mechanism:

Table 7: Implementation actions to create a market stabilization mechanism

Actions	Potential owners
Identify working team and multi-stakeholder advisory panel that will develop a clear stabilization mechanism	MoARD/BoARD
Develop algorithm with rules of engagement and operational manual to execute this, e.g. identifying buy and sell triggers and enabling data like crop forecasts	MoARD/BoARD, multi-stakeholder advisory panel, local and international technical experts
Refine policies as necessary to take advantage of opportunities to expand maize market	MoARD/BoARD
Secure funds needed to operationalize	MoARD/BoARD, donors
Identify operator for the rules of engagement established and give them a clear mandate to execute	MoARD/BoARD, multi-stakeholder advisory panel
Establish consortium of main public, private and social sector actors in the value chain and setup periodic check-ins to collectively and transparently assess the market	MoARD/BoARD, multi-stakeholder advisory panel

Source: Authors' analysis

Establishing this clear and transparent mechanism should simultaneously reduce the maize price instability and the perceived risk amongst all actors in the value chain. In particular, smallholder farmers should have greater security leading to increased production and increased food security. Over time, there could also be the emergence of strong private sector trading (see recommendation 3) that will create a more stable, liquid, year-round market leading to minimal role for the public sector in the grain market.

One key lesson from international case studies (see boxed text "International case studies") is that such market stabilization strategies need to be very carefully designed and over time, the public sector should progressively withdraw and create the environment for effective private sector operation to play the role while the public sector acts as a regulator and provide intervention as a last resort.

International case studies of stability mechanisms

Several international cases highlight potential approaches and key lessons to addressing market failures with market stabilizers. China's experience may be particularly relevant to Ethiopia.

India. The Food Corporation of India (FCI) purchase, stores, and distributes wheat and rice to the poor after procuring from farmers to support price. The approach has a marginal impact on stability of the market due to the small share of total volume traded. Consumers gained most, with mixed benefits for producers and high cost to FCI.

Egypt. The government began with state-controlled procurement, marketing, and processing systems and have reduced government intervention with more private traders over time, and now provide subsidized wheat to consumers. The approach provides for a steady supply of wheat, but with misaligned incentives for farmers and at a high costs to government. The partial privatization has improved price stability and market integration.

China. The state system provides fixed procurement contracts for farmers into government warehouses and provides rationing to consumers. Early in the development stages of this, the public sector played a key role in both mitigating market failures and building confidence in the market, but this required scale and skillful execution to be effective. However, there are pitfalls to avoid: distorting incentives over time, e.g. low prices that discourage producers or subsidies that are impossible to sustain; original intentions to privatize but fear of market liberalization that leads to continued and originally unplanned state interventions, and; negative fiscal impact if stabilization measures become de facto subsidies.

Foster emergence of strong licensed traders to create a more liquid, year-round market, by creating an appropriate regulatory framework and incentive mechanisms

Strong traders will be required to create a year-round liquid market for maize (and other cereals) that will benefit smallholders (consistent outlet for their produce) and downstream actors (consistent supply of quality grain). These traders will initially require support (financing and/or storage) and a structured market outlet, which can initially be provided through by engaging them in local procurement of maize by the government and donors agencies.

The Ethiopian Commodity Exchange (ECX) can be used as a platform to enable this recommendation. Large regional traders can be identified (based on an ECX membership criteria), registered on ECX and given support required (financing and/or storage) to create a year-round liquid market. Over time, these traders can also be the agents through which forward contracting is introduced on ECX. Simultaneously, the inventory financing system can be launched, as planned by ECX, to build the capacity of smaller aggregators to trade year-round.

The specific types of interventions needed to stimulate this include:

- **Providing financing support.** This ensures that these traders have the working capital to both create a liquid market (have access to buy and sell large quantities of grain as and when the market demands) and to have a year-round market (have the ability to buy and sell year-round).
- **Providing storage support**. This can initially be through leasing space in government owned warehouses (e.g., EGTE warehouses) or working with donor organizations to provide the quality and quantity of storage that will be required.
- **Providing assistance in establishing a structured market outlet**. This can initially be provided by the local procurement of maize for relief and safety net programs. Later this can be expanded to other demand sinks (e.g., feed for commercial livestock production, food processing).

Smallholder farmers will have a secure market outlet through these traders, and there can be a gradual transition to forward contracting with these traders, enabling small-holders to attain better prices for their produce. Similarly, downstream actors (e.g., future food processors / feed mill operators) will have more security of supply from these regional traders. Once trading is being conducted at scale, these private market makers will stimulate a year-round market with more depth than the current structure.

However, it must be noted that this transition to strong private traders is likely to be a gradual process and not all types of procurement can feasibly be carried out by the private sector through the exchange. Similarly, it does not appear feasible for ECX to perform all procurement operations of the

Ethiopian Grain Trade Enterprise in the short run. Furthermore, regulations should be in place to prevent rent-seeking behavior among traders. Nonetheless, gradual capacity building of the traders will create confidence in a market that should evolve into a thriving private year-round market accommodating actors of all sizes and functions, stabilizing prices, and yielding the greatest returns to smallholder farmers through improved, transparent market access.

Given the strong presence of brokerage institution in the Ethiopian grain market, though dominantly informal, handling a considerable volume of business with strong social capital and market influence, working with such actors in the market would be useful. One of the possibilities could be to gradually bring such actors into the formal market system through negotiations and providing appropriate incentives and support. Otherwise, their continuous and strong presence in the market will make it difficult for the licensed and formal actors to be effective and competitive runners of the intended coordinated and year-round cereal market.

Table 8 below contains more details on the specific implementation steps and the potential owners and stakeholders required for each step.

Table 8: Implementation actions to create strong, licensed traders

Actions	Potential owners
Develop selection criteria and operational contract for regional private sector traders, e.g. support that will be provided on financing and/or storage, trade volume that they need to be conducting	MoARD, ECX, ECEA, BoARD
Modify current exchange rules and systems as needed to accommodate traders	ECX, ECEA
Develop regulation and checks and balances	ECEA, MoARD
Select regional traders with presence in key maize belts initially and register with ECX	MoARD, ECX, ECEA, BoARD
Provide contractual support guaranteed, e.g. financing and storage, to accelerate operations	ECX, ECEA, MoARD, BoARD
Simultaneously realize and pilot the inventory financing system as planned by ECX and MoARD	ECX, ECEA, MoARD
Track and monitor year-round market, e.g. price trends, sale volume year around	MoARD, ECX, ECEA
Over time, establish forward contracting system, piloted with regional and central market drivers	ECX, ECEA

Catalyze the growth of latent demand sinks, starting with poultry feed

Creating incremental demand sinks for maize will be required to catalyze greater productivity and efficiency in the value chain. There is significant latent feed demand for poultry and growing this sector will increase production value of maize. Actions, such as developing and issuing tender offers to potential poultry investors, should be taken to catalyze the growth of this industry. Security of supply could be provided through contracted maize supply for potential feed mills and poultry farmers (by market maker or large trader/union). Additional incentives such as long-term land leases or tax breaks can be used to promote inclusive models like this.

Furthermore, a smallholder out-grower model has had success in other countries and can be encouraged in high potential areas of Ethiopia. Brazil's poultry industry is based on small out-growers with each smallholder looking after a poultry shed that can produce 10,000 or more broilers every two months. These smallholders have strong contracts with chicken producers that provide other upstream (e.g., feed mills, technical support/extension) and downstream (e.g., abattoirs, packaging) services. Examples of such a smallholder friendly model of increasing commercial production of poultry also exists in sub-Saharan Africa and details of a model being used in Mozambique are provided in the box on the following page.

Case study – Smallholder out-grower model in Mozambique

An aggregator signs a contract with smallholder out-growers and provides the inputs needed. For example, the aggregator has contracts to supply day-old chicks and feed to smallholders and provides extension services.

Smallholders grow the chicks in houses that have low investment cost. For example, sheds being used in parts of Mozambique are made of local mud and local recycled materials (10 to 20 percent the cost of a normal mud shed).

Even with the low capital investment from the smallholders, they achieve high productivity in poultry production, comparable to large-scale commercial operations. For example, there has been evidence of mortality rates of only 2 to 3 percent.

The aggregator buys back the poultry and sells live animals or conducts other downstream activities before sale (e.g., has an abattoir for processing and/or packaging facility).

In addition to creating demand and increasing the production value of maize (main feed used in poultry production), this provides significant increase in income to the smallholder poultry out-grower. For example, the profit to family over 72 weeks is five times the capital cost of the shed and smallholder families have made USD 1,000+ profit per year. In addition, this has lower cash flow risk (potential for cash to be received every 42 days) and weather risk.

Source: Authors analysis

Table 9 provides more details on the specific implementation steps and the potential owners and stakeholders required for each step.

Table 9: Implementation actions to catalyze poultry feed industry

Actions	Potential owners
Develop template contract for potential poultry investors with terms of support for smallholder poultry production	MoARD, BoARD
Simultaneously develop contracts for feed mills and abattoirs	MoARD
Regionally identify locations for poultry farming and tailor contracts per region	BoARD
Issue tender offers / auctions to attract investors, select investors and sign contracts	MoARD, BoARD, investors, suppliers
Provide support per contract arrangement (e.g. financing guarantees, technical assistance, supply contract for maize from new, licensed regional traders, extension support to develop the maize varieties needed)	MoARD, BoARD
Scale-up after monitoring challenges faced by initial investors, level of feed production	MoARD, BoARD

Source: Authors' analysis

Create clear role for co-operatives in maize value chain and give necessary support to make them effective

Today support for farmers is fragmented – co-ops provide inputs but limited marketing, traders are the main grain buyers, credit co-ops provide farming and extension training on agronomic practices.

An alternative vision includes revitalized aggregators with simplified and standardized transactions with farmers: standard input packages and credit facilities, simple off-take arrangements based on transparent pricing linked to the market and close links to extension.

The functions performed by the co-operative system need to be streamlined in order to simplify the management and decision making required. Making the role of the co-operatives simple and transactional will reduce the capability and governance burden required to run them effectively. It is important for co-operatives to supply producers with standardized input packages at widely publicized prices and to buy maize (and other cereals) at competitive and transparent prices to be passed along to a larger buyer (for example, regional trader), with clear incentives for product quality. Several steps need to occur in order for this to happen:

- Input assemblers, working closely with Ethiopian Seed Enterprise (ESE) and the Ethiopian Institute for Agriculture Research (EIAR) and their regional office, will be needed to package inputs and distribute to co-operatives.

- High potential co-operatives in main maize areas should be selected and linked to large buyers who can take advantage of the primary aggregation offered by co-operatives.
- Selected co-operatives should adopt a new management structure (improved managerial skill, simplified approach, limited decision making required) and be supported in early stages for finance to purchase maize at publicized prices, sell maize packages.
- Extension can be linked to the co-operative system by seconding Development Agents (DAs) to co-operatives to assist in farmer implementation of input packages (for example, optimal agro-economic practices) and off-take (for example, building knowledge of quality requirements needed by buyers).

Table 10 below provides more details on the specific implementation steps and the potential owners and stakeholders required for each step:

Table 10: Implementation actions to support co-operatives

Actions	Potential owners
Select high potential co-operatives in the main maize areas, e.g., 50 - 60 *woredas* with high yield and commercialization, to initially support	MoARD, BoARD, co-operative promotion agency
Appoint / establish input assemblers who will assemble input packages for farmers in high yield potential maize belts	MoARD, BoARD, co-operative promotion agency
Establish links between input suppliers and assemblers	MoARD
Develop menu of input packages, e.g. tailored to agro-ecological conditions and affordability different segments of farmers; approve prices for different input packages	EIAR, regional research institutions, MoARD, BoARD
Establish links between high potential co-operatives and large buyers and facilitate off-take arrangements between co-ops and buyers	Co-operative promotion agency, MoARD, BoARD
Prove co-ops the necessary support need to operationalize; workshop to explain packages and off-take arrangements; place DAs in co-ops to test alternative models for extension delivery	MoARD, extension director-ates, co-operative promotion agency

Enabling actions

Apart from the four core interventions outlined above, there are a set of enabling actions that will further strengthen the maize market. These include:

Improving on-farm storage management practices and equipment to reduce post-harvest losses

Reducing on-farm post-harvest losses will directly increase smallholder income and improve food security. This recommendation focuses on stimulating the testing, development and scale-up of on-farm storage structures that can prevent post-harvest losses, as detailed in Table 13. Both storage structure and practices need to be addressed:

- Tenders or contracts should be offered with set criteria for storage system development (for example, maximum loss levels, maximum cost of structure, minimum capacity) and contracts offered to the best provider for scale-up opportunities.
- Storage management practices (for example, optimal harvesting time, drying techniques, storage hygiene) need to be improved and should be disseminated through the extension system. This is particularly important in order to combat the presence of aflatoxin – smallholders should be educated on the health and economic repercussions of the toxin, as well as on the best storage and harvesting practices to prevent it. Improvement of storage management practices should be one step in a wider intervention to develop, commercialize, deploy, and scale up interventions that prevent the consumption of toxins, including: teaching farmers about pre-harvest and harvest agronomic practices; disseminating technology for appropriate post-harvest drying, storing, and processing activities; developing alternative uses for contaminated foodstuffs; and ensuring proper bio control (e.g. identifying the affected strains). Interventions should be pursued in collaboration with the multiple international research and donor organiza-

tions that are already working to develop farm-level interventions to prevent its consumption (e.g. FAO, World Bank, USAID).

Finally, smallholders must also have greater access to credit in order to purchase storage structures. Methods to provide credit to smallholders are addressed in full in the Finance diagnostic report.

Table 11 represents the various stages in the production and post-harvest management of maize, with a description of the current status, and opportunities for improvement. While this is not an exhaustive and rigorous characterization (in the sense that this is not based on systematically conducted nationally representative surveys), the table demonstrates very clearly that the interventions needed to change the current situation from planting to marketing are not complicated; and much of the technology is readily available and are in use in many different countries, including some of the developing countries in Africa.

Table 11: Opportunities in production and post-harvest management of maize

Value chain activity	Current situation	Improvement opportunities
Planting	▪ Oxen-plowing (3 - 5 times) ▪ Some use of fertilizer[39] but very limited use of hybrid seed ▪ Sowing by broadcasting ▪ Mono-cropping and limited rotation	▪ Supply of hybrid seed treatment before planting[40] ▪ Row planting of seedling (requires labor and is time-intensive); regular crop rotation
Growing	▪ Hand weeding (at least after 20 and 40 days of planting) ▪ Oxen plowing	▪ Supply of optimum chemicals (herbicide and insecticide)
Harvesting	▪ Manual removal of cob in field *or* cutting of entire plant and removal at home ▪ Manual shelling by hand or hitting of cob in a sack	▪ Supply and adoption of low-cost shelling devises ▪ Provide extension advice on trade-offs between field and home removal of the cob
Post-harvest management	▪ Traditional storage (underground pits, *gotera*) ▪ Treatment (often non-standard chemicals) to protect grain	▪ Low-cost individual or community storage structures that prevent losses from pest attacks and spoilage due to high moisture contents
Marketing/ consumption	▪ More than 60% of produce is consumed ▪ Around 20% of the maize produced is sold ▪ Around 60% of sales occur immediately after harvest	▪ Increase commercialization through increased yield and reduced losses ▪ Improve storage and alleviate liquidity constraints through WRS; so that farmers do not have to sell immediately after harvest

Source: Authors' characterization based participatory rapid assessment in 2009

Table 12 below provides more details on the specific implementation steps and the potential owners and stakeholders required for each step.

[39] Refer to soil fertility diagnostic report for an overview of fertilizer usage practices (and other soil fertility techniques)
[40] Refer to seeds diagnostic report for recommendations on how to improve the availability of hybrid maize seed

Table 12: Implementation actions to improve on-farm storage management practices and structures	
Actions	**Potential owners**
Develop template criteria for on-farm storage structure, including capacity, acceptable loss range, maximum cost structure	MoARD, EIAR, regional research institutes, BoARD
Tailor criteria to the different needs / drivers of losses in these main maize producing areas	EIAR, regional research institutes, BoARD
Issue a tender for private sector actors and existing research institutions to develop pilot storage structures	MoARD
Conduct rapid field assessment of these structures in the main maize producing areas and ask technical experts to improve as needed	MoARD, BoARD, regional research institutes
Issue contract for best provider to produce storage structures in bulk and provide extension support to ensure uptake from farmers	MoARD, BoARD
Simultaneously develop extension module and train DAs on delivering best practice storage management, including optimal harvesting time, drying, storage, hygiene, separation of grain	MoARD, federal and regional extension, BoARD

Scaling-up efforts to increase market information and transparency

Much has been done to improve market information systems in Ethiopia, particularly through efforts of regional governments and the Ethiopian Commodity Exchange. Existing best practice mechanisms (for example, ECX, regional marketing information systems) should be identified and used as channels to disseminate not only price data, but also other market intelligence data needed to improve linkages in the maize value chain.

Below are more details on the specific implementation steps and the potential owners and stakeholders required for each step:

Table 13: Implementation actions to increase market information	
Actions	**Potential owners**
Collect and triangulate market information data (price, demand and supply signals by region) available from different sources, e.g. crop forecasts from donors, EGTE, CSA, and regions	MoARD, BoARD, CSA, EGTE
Develop simple, standard display of regional price, supply, and demand forecasts so farmers / aggregators can make informed buy and sell decisions	MoARD, BoARD
Identify current best practice information delivery channels, e.g. ECX, regional marketing information systems, and disseminate market information data	MoARD, BoARD
Simultaneously, use government network, e.g. post data in *kebele* offices and FTCs, to disseminate information periodically	MoARD, BoARD
Hold expos for buyers and sellers in deficit and surplus maize regions to create better market linkages, similar to initiatives with foreign buyers and local exporters in high value crops	MoARD, BoARD

Improving farm management practices to enhance maize productivity

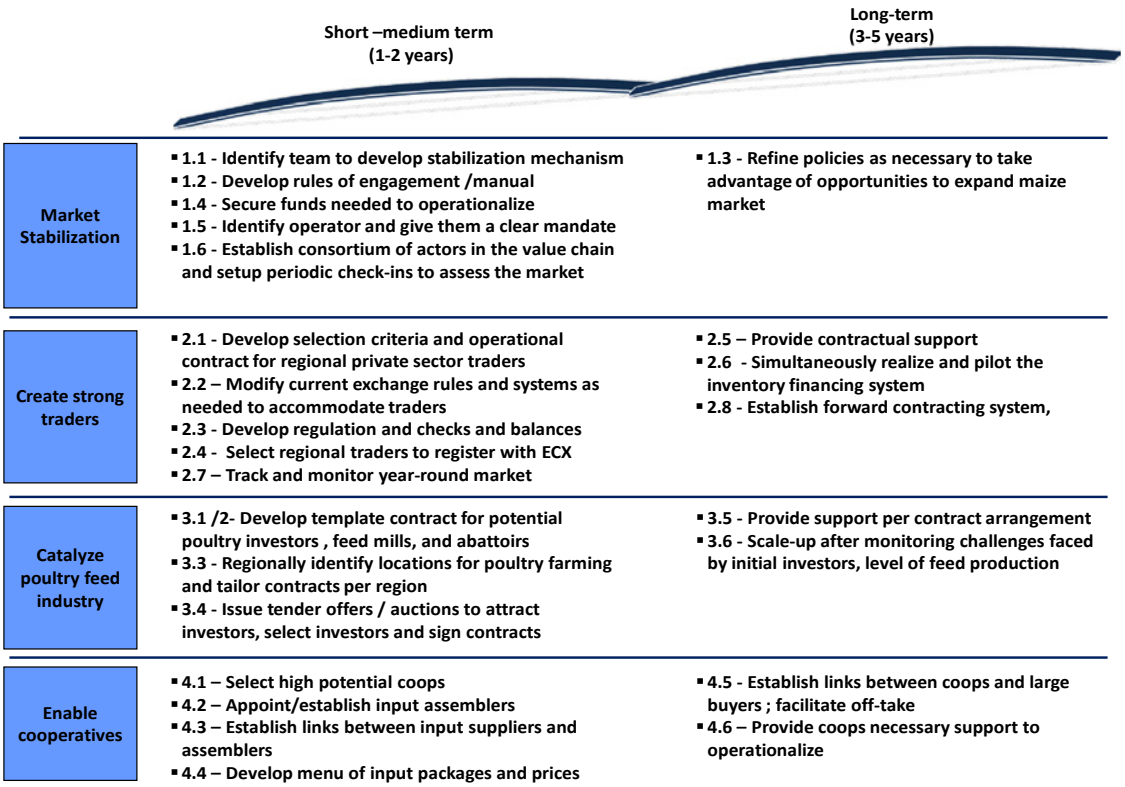
Maximizing the productivity of maize should go hand-in-hand with improving the productivity of other crops. There are adverse consequences to replanting maize on the same land year-on-year and the sustainability of maize production should be linked to effective crop rotation. Improving farm management practices should include the development of modules on crop rotation in co-operation with the extension system for maize production, as detailed in Table 13.

Implementation modality

Fully implementing the recommended strategies needs considerable financial and time resources and prioritizing and sequencing. Accordingly, it is recommended that a programmatic approach be adopted to implement the proposed strategies step-by-step. The implementation of the strategies could be envisaged within five years' time. Within this framework, the first two years would be used to

strengthen the value chain to serve the immediate market and the last three to five years used for developing the industry structure to serve new markets and support boost in productivity. Interventions and sub-actions have to be rigorously prioritized to go after the high potential opportunities, with details and sequencing as listed in Figure 12.

Figure 12: Implementation modality



For implementation to be successful, a range of actors including GOE, the Ministry of Agriculture and Rural Development, the donor and NGO community, and the private sector will need to work together to implement the various components and programs. Ultimately, the transformational change required will need to come from within Ethiopia – from the actors in the value chain and existing institutions to the highest policymakers.

CONCLUSION

OVERVIEW

The findings in this report demonstrate the importance of maize as a significant contributor to the economic and social development of Ethiopia. Maize is grown by more small-scale farmers than any other single crop in Ethiopia, and remains a central building block for the country's long term food security. GOE along with its development partners have made great strides toward enhancing the productivity of maize with expanded access to hybrid varieties and improved extension. Realizing the full potential of the crop as a component of Ethiopia's long-term food security and growth relies on clear direction and execution capacity from GOE and a wide number of stakeholders.

FIVE-YEAR SECTORAL VISION

The next five years will be a critical window to accelerate the achievement of the long-term vision for the maize value chain. At the close of this period, the report envisions an effective and functioning mechanism in place for market stabilization, a strong network of traders, a vibrant demand pull in poultry feed and food aid, and strong and efficient co-operatives to drive growth and food security in the sector. The potential is sizable: projections show the ability to boost smallholder income from

USD 60 per hectare to USD 350 to 450 in a five-year window in some high potential areas with the demand pull in place with food aid and poultry to drive these livelihood improvements.

With a strong and functioning value chain beginning with production, then aggregation and trading, and finally with unlocked demand sinks, GOE and its development partners, along with the private sector are in a remarkable position to place Ethiopia on the first five-year trajectory to fully develop the sector by 2025.

THE WAY FORWARD

Accelerating the five-year vision contained in this report will undoubtedly require the effective use of significant human and financial resources. It will require a level of sequencing and coordination that has in the past been challenging to implement at a national level, not only in Ethiopia, but in success cases globally, from Latin America to East Asia. To achieve these objectives, GOE will need to work closely with all its partners, ranging from the development community to the private sector. The recommendations contained in this report offer a preliminary view on the sequencing of various activities to strengthen the maize value chain.

The findings contained in this report are also complementary to a range of other findings across the diagnostic studies supported by the BMGF from April 2009 to March 2010. The five-year sectoral vision for maize relies on a set of factors contained in accompanying diagnostic reports, including a robust system of agricultural extension, a vibrant and efficient seed sector for hybrids, and access by small-scale producers to irrigation. Additionally, a set of enabling factors will deepen the impact of these recommendations, including financial services, rural infrastructure, and information and communication technologies. At every stage of the value-chain gender must be prioritized, as women are often primarily responsible for planting, harvest, value addition, and marketing.

Since each of these sectors is mutually dependent, the recommendations and sequencing of activities for the maize value chain must be seen within the context of the overall recommendations provided in the holistic and integrated report requested by the Prime Minister. With maize as a key crop to drive Ethiopia's growth and food security, these steps will be critical to accelerating the long-term vision of achieving middle-income status by 2025.

APPENDIX 1: REFERENCES AND OTHER RESOURCES

Abebe, G. H., Hundie, B. (2006). Farmers' Post-Harvest Grain Management Choices under Liquidity Constraints and Impending Risks: Implications for achieving food security objectives in Ethiopia. International Association of Agricultural Economists Conference

Alemu, D. (2008). Grain Markets in Ethiopia: a literature review. United Nation Wold Food Program 2008.

Alemu, D., Gabre-Madhin, E. Z., Dejene, S. (2006). From farmer to market and market to farmer. IFPRI

Bernard, T., Alemayehu, S. and Gabre-Madhin, E. (2008). Impact of co-operatives on smallholders' commercialization behavior: Evidence from Ethiopia. Agricultural Economics, 39(2): 147-161.

Bernard, T., Gabre-Madhin, E. Z., Taffesse, A.S. (2006). Is there really strength in numbers? Impact of co-operatives on smallholder commercialization in Ethiopia. African Association of Agricultural Economists

Bernard, T., Spielman, D. J. (2009). Reaching the rural poor through rural producer organizations? A study of agriculture marketing co-operatives in Ethiopia.

Dercon, S., Hill, R.V. (2009). Growth from Agriculture in Ethiopia: Identifying Key Constraints. DFID

Diao, X., Fekadu, B., Haggblade, S., Taffesse, A. S., Wamisho, K., and Yu, B. (2007). Agricultural Growth Linkages in Ethiopia – Estimates Using a Semi-Input-Output Model and an Economy-Wide Multi-Market, IFPRI Discussion Paper No. 695.

Gabre-Madhin, E. Z. (2001). Market Institutions, Transaction costs and social capital in Ethiopian grain markets. IFPRI. Ref: 2001055539

Gabre-Madhin, E. Z. (2003). Getting Markets Right in Ethiopia. IFPRI

Gabre-Madhin, E. Z. (2007). The Ethiopian Commodity Exchange (ECEX): Making the market work for all.

Gebremedhin, B, Fernandez-Rivera, S., Hassena, M., Mwangi, W., Ahmed, S. (2007). Maize and Livestock: Their inter-linked roles in meeting human needs in Ethiopia.

Gebremedhin, B, Hoekstra, D. (2008). Market orientation of smallholders in selected grains in Ethiopia: implications for enhancing commercial transformation of subsistence agriculture. IPMS

Gray, G. (2008). Bellmon Analysis For Title II Monetization and Distribution Commodities for Ethiopia. USAID

IFPRI (2008). Cereal Availability Report on Ethiopia, 2008. Report Submitted to the Joint Research Center of the European Union

Lirenso, A. 1994. Liberalizing Ethiopian Grain Markets. In H. Marcus and Grover Hudson, eds., Papers of the 12th International Conference of Ethiopian Studies. East Lansing: Michigan State University, pp. 2-24.

Nesha, K., Haile, M., Beyene, H. (2007). Profitability of major crops among small holders: The Case of Welmera Woreda. EARO Holleta Research Center

Pender, J., Alemu, D. (2007). Determinants of smallholder commercialization of food crops: Theory and evidence from Ethiopia. IFPRI

Rashid, S. (2010). Staple Food Prices in Ethiopia. Paper Prepared for the COMESA policy seminar on "Variation in staple food prices: Causes, consequence, and policy options," Maputo, Mozambique, 25-26 January 2010, under the African Agricultural Marketing Project (AAMP).

Rashid, S. Hill, R.V. (2009). On the hypothesis of structural changes in Ethiopian grain markets

Rashid, S. Minot, N. (2010). Are staple food markets in Africa efficient? Spatial Price Analyses and Beyond. AAMAP

The Mitchell Group Inc. (2005). Evaluation of Agricultural Co-operatives in Ethiopia (ACE) Program Activities. USAID

The RATES Center (2003). Maize Market Assessment and Baseline Study for Ethiopia

USAID (2008). Bellmon Report for Ethiopia. Addis Ababa: United States Agency for International Development.

Webb and von Braun (1995). Famine and Food Security in Ethiopia. John Wiley & Sons Inc.

World Bank (2009). A study of regional maize markets and marketing costs. Ref: 49831

World Bank (various years). World Bank Country Memorandum for Ethiopia, Washignton DC: the World Bank

Byerlee, Derek & Spielman, David J. & Alemu, Dawit & Gautam, Madhur, 2007. *"Policies to promote cereal intensification in Ethiopia: A review of evidence and experience,"* IFPRI discussion papers 707, Washington DC: International Food Policy Research Institute

Famine Early Warning System Network / USGS (2007) – Review of trade and markets relevant to food security in the Greater Horn of Africa

Mogues, T., Ayele, G., and Paulos, Z. 2008. *The bang for the Birr: public expenditures and rural welfare in Ethiopia.* IFPRI Research Report 160. International Food Policy Research Institute.Washington, D.C., USA.

WFP (2008) – National market profile of Ethiopia: a food security perspective

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

2033 K Street, NW, Washington, DC 20006-1002 USA
T +1 202 862 5600 • Skype: ifprihomeoffice • F +1 202 467 4439
ifpri@cgiar.org • **www.ifpri.org**

Project Contributors: IFPRI, Ethiopian Institute of Agricultural Research (EIAR), Ambo College (Ethiopia), International Livestock Research Institute (ILRI), International Water Management Institute (IWMI), Association of Ethiopian Microfinance Institutions (AEMFI), Ministry of Agriculture and Rural Development (MoARD).

The authors gratefully acknowledge the McKinsey & Company team for their analytical support and assistance.

This Working Paper has been prepared as an output for the Assessment of Key Areas of Ethiopian Agricultural Sector Project, funded by the Bill & Melinda Gates Foundation, and has not been peer reviewed. Any opinions stated herein are those of the author(s) and do not necessarily reflect the policies or opinions of IFPRI.