Draft Report:

Maize Value Chain Study in Ghana:
Enhancing Efficiency and Competitiveness

WABS Consulting Ltd.
wabs.ltd@fpt.vn

December 2008
Exchange rate (November 2008)

One US Dollar = 1.17 Ghana Cedis (new currency)
One US Dollar = 11,700 Ghana Cedis (old currency).

Note: A revaluation of the currency was undertaken in early 2008 reducing the old currency by a factor of 10,000

Table of Contents

1. Executive Summary........................................................................................................................................5

2. Background to Maize Sector and the Maize Value Chain in Ghana.................................................................7
   2.1 Economic Background................................................................................................................................9
   2.2 Global Background to Maize Production..................................................................................................10
   2.3 Ghana’s Policy Background..................................................................................................................12
   2.4 Historical Background to Maize Development in Ghana During the Last 3 Decades....................................14

3. Maize Value and Market Chains in Ghana.......................................................................................................18
   3.1 Maize Market Chains in Ghana................................................................................................................18
      3.1.1 The Market Chain of Yellow & White Maize for Poultry Feed.........................................................18
      3.1.2 The Market Chain of White Maize for Human Consumption, (Low Value retailed at Small Scale level and Wholesale) .................................................................19
      3.1.3 The Market Chain of White Maize for Human Consumption High Value Market Chain..................................................19
   3.2 The Value Chain at the Agricultural Production Level in Ghana................................................................21
      3.2.1 Ecological Zone, Climatic Characteristics and Maize Agricultural Production Seasons.................21
      3.2.2 Soil Characteristics ..........................................................................................................................21
      3.2.3 Land Preparation Methods .............................................................................................................21
      3.2.4 Maize Yields in Ghana....................................................................................................................22
      3.2.5 Infrastructure in Maize Producing Areas ........................................................................................22
      3.2.6 Credit Provision and Utilization .......................................................................................................22
   3.3 Overview of Relevant Institutional Stakeholders in Maize Production.........................................................22
      3.3.1 Ministry of Food and Agriculture and Formal Research Services....................................................22
      3.3.2 Agricultural Research Organisations................................................................................................23
      3.3.3 Overview of Public Institutional Effectiveness ................................................................................23
      3.3.4 Inputs Dealers and Service Provision ................................................................................................24
      3.3.5 Shelling Service Providers ..............................................................................................................24
      3.3.6 Transportation Service Providers ...................................................................................................24
      3.3.7 Drying Service Providers .................................................................................................................25
      3.3.8 Storage Services and Facilities .........................................................................................................25
      3.3.9 District-Town / Village Assemblers Buying from Farmers at the Primary Level...................................25
      3.3.10 Middlemen / Intermediary Traders ................................................................................................26
      3.3.11 Private Sector (Medium & Large Scale Buyers) ............................................................................26
      3.3.12 Miller Service Providers ................................................................................................................26

4. An Efficiency Analysis of Maize Production and Processing in Brong-Ahafo and Ashanti Regions.......................27
   4.1 Efficiency Analysis at the Agricultural Production Level...........................................................................28
      4.1.1 Seed Supply and Effectiveness.........................................................................................................28
      4.1.2 Fertilizer Quality, Price of, Use of, Effectiveness and Other Related Issues ......................................30
      4.1.3 Weeding, Spraying and other Crop Maintenance Activities ............................................................31
      4.1.4 Mechanization Use and the Cost-Effectiveness................................................................................31
      4.1.5 An Assessment of Labour Supply and Issues....................................................................................31
      4.1.6 Summary of Efficiency Analysis at the Agricultural Production Level..............................................32
   4.2 Efficiency Analysis at the Primary Post Harvest Processing Level...............................................................32
      4.2.1 Harvesting, Dehusking, Bagging and Labour at all Levels of the Primary Post Harvest Processing Level....32
      4.2.2 Transportation ................................................................................................................................33
      4.2.3 Maize Shelling and Cleaning Service Providers .............................................................................33
5. An Overall Assessment of Maize Quality and Efficiency of Production of the Value Chain .................................................. 41 
5.1 Analysis and Discussion of the Efficiency of Interventions at Various Stages of the Maize Value Chain .................. 43 
5.2 Analysis of Long-List of Relevant Interventions .................................................................................................................. 43 
5.3 Discussion Regarding Interventions that can most Effectively Made ................................................................................ 46 
6. Summary of Recommendations ............................................................................................................................................. 49 
7. Annexes ..................................................................................................................................................................................... 51 
7.1 Annex 1. Definitions of Value, Supply and Market Chains .............................................................................................. 51 
7.1.1 Value Chain .................................................................................................................. 51 
7.1.2 Supply Chain ................................................................................................................ 51 
7.1.3 Market Chain ................................................................................................................ 51 
7.2 Annex 2. Supplementary Statistical Data ......................................................................................................................... 52 
7.3 Annex 3. Bibliography ............................................................................................................................................................ 54 

Table of Figures 

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1</td>
<td>Comparison Between Ghanaian Wholesale Prices and Global Prices (US $ per tonne)</td>
<td>9</td>
</tr>
<tr>
<td>Figure 2</td>
<td>Policy Constraints to Maize Trade</td>
<td>13</td>
</tr>
<tr>
<td>Figure 3</td>
<td>Selected Ghanaian Maize and Agricultural Production Policies</td>
<td>13</td>
</tr>
<tr>
<td>Figure 4</td>
<td>An Overview of Development Agency Inputs into Maize Development in Ghana</td>
<td>14</td>
</tr>
<tr>
<td>Figure 5</td>
<td>Offinso Farmers</td>
<td>16</td>
</tr>
<tr>
<td>Figure 6</td>
<td>Adobiwri Kwesi – an Example of a Progressive ‘Intermediary Farmer’</td>
<td>16</td>
</tr>
<tr>
<td>Figure 7</td>
<td>Overview of 4 Selected Value Chains of Maize</td>
<td>18</td>
</tr>
<tr>
<td>Figure 8</td>
<td>A ‘Micro’ Maize Retailer at Malaba Market in Accra</td>
<td>19</td>
</tr>
<tr>
<td>Figure 9</td>
<td>An example of a High-Value Packaged Maize Product</td>
<td>20</td>
</tr>
<tr>
<td>Figure 10</td>
<td>Some of the Numerous Maize Shelling Machines for Hire available at the Local Level</td>
<td>24</td>
</tr>
<tr>
<td>Figure 11</td>
<td>Hand-held tractor Used Mainly for Transportation</td>
<td>24</td>
</tr>
<tr>
<td>Figure 12</td>
<td>The Storage Area used by ‘Assemblers’ with an ‘Intermediary Middleman’s Truck in the background</td>
<td>25</td>
</tr>
<tr>
<td>Figure 13</td>
<td>Selection of Medium and Large Scale Buyers and Processors of Maize</td>
<td>26</td>
</tr>
<tr>
<td>Figure 14</td>
<td>A ‘Town Level’ Milling Service Provider</td>
<td>26</td>
</tr>
<tr>
<td>Figure 15</td>
<td>Diversity in the Range of Costs of Maize Production between Small, Medium and Large Scale Farmers</td>
<td>27</td>
</tr>
<tr>
<td>Figure 16</td>
<td>Calculations of the Average Investments in Production</td>
<td>28</td>
</tr>
<tr>
<td>Figure 17</td>
<td>A Possible Example of Cost Reduction in the Maize Value Chain</td>
<td>33</td>
</tr>
<tr>
<td>Figure 18</td>
<td>Weevil Infestation, found even in a more Progressive Farmer’s Crop</td>
<td>34</td>
</tr>
<tr>
<td>Figure 19</td>
<td>The Commonly Used Method of Sun Drying</td>
<td>36</td>
</tr>
<tr>
<td>Figure 20</td>
<td>An Example of Typical Maize Quality Standards</td>
<td>37</td>
</tr>
<tr>
<td>Figure 21</td>
<td>The Business Aspects of a Town-Level Maize Buyer and Processor</td>
<td>38</td>
</tr>
<tr>
<td>Figure 22</td>
<td>The Business Aspects of a Large-Scale Maize Buyer and Processor</td>
<td>39</td>
</tr>
<tr>
<td>Figure 23</td>
<td>Indicative Yields, Costs and Returns from Maize Production from Selected Countries (per hectare, US $ at 2004 values)</td>
<td>42</td>
</tr>
<tr>
<td>Figure 24</td>
<td>A Comparative Summary of Estimations of the Overall Impact that Interventions can have at Various Levels of the Value Chain (cost of interventions not factored in)</td>
<td>43</td>
</tr>
<tr>
<td>Figure 25</td>
<td>Long-list of Constraints and Intervention Implications</td>
<td>43</td>
</tr>
<tr>
<td>Figure 26</td>
<td>Development of the Rice Industry in Thailand through Inputs Dealers and Millers</td>
<td>47</td>
</tr>
<tr>
<td>Figure 27</td>
<td>Priority Actions of Farmers for the Development of the Maize Sector In Ghana</td>
<td>50</td>
</tr>
<tr>
<td>Figure 28</td>
<td>Increases in Hectares Planted, Tonnes Produced and Calculated Yields of Maize in Ghana</td>
<td>52</td>
</tr>
<tr>
<td>Figure 29</td>
<td>Numerical Details of A Comparison Between Ghanaian Wholesale Prices and Global Price</td>
<td>52</td>
</tr>
</tbody>
</table>
Table of Tables

Table 1. Regional Maize Production, Area Cropped and Yields in Ghana 2006. 8
Table 2. Estimations of Consumption of White Maize Produced in Ghana (2006) 8
Table 3. Global Maize Production & Export (million tonnes) 10
Table 4. Export Quantities and Prices (FOB) of Maize from Selected Exporting Countries 2004 10
Table 5. Indicative Incremental Farmer Development from Investment in Maize Production Inputs 11
Table 6. Increased Incomes as a Result of Increases in Inputs from a Maize Project in Uganda 11
Table 7. Breakdown of Estimated Combined Costs and Mark-ups for various Maize Value Chains in Ghana (Ghana Cedis) 20
Table 8. Rural Population Access to Infrastructure (%) 22
Table 9. Estimated Indicative, Gross Margin Output Scenarios as a result of Increases in Investment in Inputs per Hectare (late 2008 values). 29
Table 10. A Comparison of the Combined Mark-ups and Costs between Grain Traders in Africa and Asia 39

Abbreviations / Acronyms

AAGDS  Accelerated Agricultural Growth and Development Strategy
ADB  Agricultural Development Bank
AfDB  African Development Bank
ATP  Agribusiness and Trade Promotion Project
CIMMYT  Centro de Mejoramiento de Maize Y Trigo
CRS  Crop Research Institute
CSIR  Council for Scientific and Industrial Research
DAP  Development Assistance Program
DCS  Directorate of Crop Services
EBD  Export Business Development
ERP  Economic Recovery Programme
ECOWAS  Economic Community of West African States
FASDEP  Food & Agriculture Sector Development Policy
FFS  Farmer Fields School
FBOs  Farmer Based Organizations
GLDP  Grains and Legumes Development Project
GoG  Government of Ghana
GPRS  Ghana Poverty Reduction Strategy
IFAD  International Fund for Agricultural Development
IPM  Integrated Pest Management
ISSER  Institute of Statistical, Social, and Economic Research
MOFA  Ministry of Food and Agriculture
SRID  Statistical Research and Information Directorate
TIPCEE  Trade and Investment Program for a Competitive Export Economy
USAID  United States Agency for International Development
WFP  World Food Programme
1. Executive Summary

Of an estimated 5 million small scale farming households in Ghana, more than 1 million (20%) gain a main income from the production of maize. However, production is in-efficient and rudimentary. Improved seed use is low, as is fertilizer use and husbandry methods are lacking as are post harvest handling and storage methods. The current value of maize production is approximately US $ 400,000,000 a year (late 2008 values) and conservative results from fairly fundamental improvements in production (see Gross Margin calculations on the findings and expected outputs from a variety of levels of investment in maize in Ghana [Table 9.]) could result in the industry becoming worth US $ *00,000,000 a year (late 2008 values).

Numerous past projects have been implemented in maize and other staple crop production improvement. The techniques and approach have been well proven in many projects starting since 1979 (see Figure 4). What is needed is scale of replication to improve the incomes of mass population of small-scale farmers.

The main objective of this study is to find what actions can most effectively can catalyse an increase in incomes for small scale farmers involved in maize production in Ghana.

The following report summarises the main findings, conclusions and recommendations

1.1 Scope of Study and Main Findings

The most significant output of this study, has been an overall efficiency analysis (Section 4.) of the numerous stages of the maize value chain. Within this efficiency analysis, the amount of value-adding that can occur, the demand for the action estimated, the supply of services and the cost-benefit of future increased interventions of the action, have all been assessed. The use of improved seed has been found to be one of the lowest cost inputs, yet has one of the best returns to farmers, in real terms. It is calculated that approximately only 22 % of maize farmers currently use improved seed and the supply of seed is currently well below the potential demand.

Overall, further production enhancement can benefit farmers most of all. Yields have been found to be average of 1.6 tonnes per hectare and further interventions could result in an increase of income of up to 250 %. Post harvest losses ranged from 5 – 70 % depending on the practices of each individual farmer.

As regards findings of overall competitiveness of the sector, of maize production and post-harvest activities were found to be comparatively and frequently in-efficient.

1.2 Conclusions and Recommendations

As regards the main actions (some supplementary holistic actions can also have a positive effect) that can be implemented in the short-term to address the above findings, the following are recommended.

Continuation of Promoting Good Husbandry Practices

To promote this, the following should be conducted :-

- use of high yielding improved seeds
- optimal fertilizer application methods and amounts
- planting in rows, effective weeding practices and disease management etc.

Seed Supply Increase in a Market Driven and a Business-Responsive Manner

To promote this, the following should be conducted :-

- provision of information to current or potential investors of the un-met demand in seed supply. Also information as regards the current and near future competition in seed supply
Maize Value Chain Study & Intervention Analysis

- technical information on seed production and related business management
- a one-off promotion campaign to farmers encouraging the use of improved seed thus increasing the demand.

Post Harvest Losses Reduction
To promote this, the following should be conducted:
- increased use of fumigation has been observed as having significant a reduction in post-harvest losses compared to the costs.
- In a private sector lead-manner, co-ordination and the introduction of some private sector initiated quality standards
- demonstrations of some low-cost improvements in storage methods and facilities, could both result in positive benefits.

Private Sector Linkages and Involvement
This approach should be continued but with a re-newed caution and focus on partnerships with smaller companies who work in closer proximity to small-scale farmers. Since investment-in-infrastructure is of low return for maize and the sector has low level of market integration, any Public Private Partnerships are recommended to focus on areas where the private sector is willing to make the majority investment in farmers increasing their yield, which at this time, are found to be very few (see Section 5.1. for further details).

Longer term recommended interventions (5 – 10 year period) (see Section 0) include improvements in the competitiveness and efficiency of the sector, and also institutional and policy development. These recommendations are based on findings and conclusions that illustrate how cost-ranges increase significantly (see Figure 23.) when a) the amount of investment necessary to attain full efficiency is higher due to a number of reasons (e.g. lower quantities used on each occasion, country is not a producer of fertilizer, investment in transportation is less and therefore more costly, etc. i.e. Ghana, Kenya, Burkina Faso, etc.) b) due the higher cost of optimal investment, incrementally-less investment in the production of the crop is occurring, especially by the often larger numerous amounts of smaller farmers in the country. Competiveness goes spiralling down.

In summary, more investment in the sector (by farmers especially and other actors) will result in better yields, better financial returns, greater efficiency and competitiveness of the sector. No new or particularly innovative approaches are needed; just mainly a perseverance, continuation and scaling up of interventions that increase the use of inputs, good crop husbandry and effective post harvest handling. Holistic approaches (literacy training, group cohesion skills, etc.) could make a contribution but these would be additional and not be directly addressing the fundamental problem of a lack of investment by farmers in increasing their yields and a lack of investment in the Ghanaian maize industry in general (seed supply etc.). The above and following descriptions and analysis all examine how the maize chain can become more commercially efficient.

An example of how yields and incomes have increased in maize development in Uganda in recent years is included in Figure 4. In addition, an estimated Gross Margins returns Improvements are detailed in Table 6.

In addition a step-by-step process for the implementation of actions form both the point of view of the farmer and the project is further detailed in Figure 27.
2. Background to Maize Sector and the Maize Value Chain in Ghana

Maize (Zea mays) is a major staple crop in Ghana. It is also an important component of poultry and livestock feed and to a lesser extent, a substitute in the brewing industry. Maize is an important commodity in West Africa sub-regional trade, particularly between Ghana, Burkina Faso, Mali, Togo and Niger through mainly informal trading.

Maize is grown in the whole of Ghana but the leading producing areas are mainly in the middle-southern part (transitional and forest zones); with an estimated 15% grown in the northern regions of the country. On average, the volume of maize produced in Ghana has increased annually by 3.1% (1997 – 2006). Currently, the national average maize yield is estimated at 1.6 tonnes per hectare. Using improved technologies, yields of 4 - 5 tonnes per hectare have been recorded in on-farm demonstration fields. Lower yields have been attributed to traditional farming practices, the use of low-yielding varieties, poor soil fertility and limited use of fertilizers, low plant population, and inappropriate weed control. There is believed to be significant potential for improving yields through the use of hybrid maize varieties.

Obviously agricultural production is fraught with risks and unpredictability (lack of rainfall, storms damaging crops, etc.) and high inputs use do not always result in high returns. However generally speaking, improvements can most often be realized by farmers who do invest in using improved seeds, fertilizer and improved production practices etc. Section 4 of this report provides more details on the efficiency and effectiveness of each of these methods of agricultural production improvement. However, it should also be noted that farmers are often in a very poor position to negotiate competitive costs and a competitive end price for their product; for example farmers will often find only one person coming to the village to whom they can sell their crop or one person who offers transportation services. These service providers will often then offer a very uncompetitive price and the farmer has few other options to turn to.

The agricultural sector in Ghana, contributes significantly to the economy, with estimates as high as 37% of GDP in 2005 and 35.8% in 2006. The main staple crops produced in Ghana are maize, cassava, yam, and plantain. In general, these crops are produced and consumed across the country. Farming is dominated by smallholder production, estimated to contribute over 90 % of national food production with the majority of these small-holder producers being among the poorest households in Ghana. Smallholder farming faces several constraints including an effective lack of access to production inputs and efficient produce markets. New technologies such as improved seed varieties and agro-chemicals have been found to be considered as very expensive by the average small scale farmer who usually has very limited access to credit from the formal sector. Hence, adoption of technologies is low among smallholders and so are resulting annual yields and incomes. Smallholder farmers continue to use traditionally unproductive methods that result in low productivity and high post-harvest losses. As a result, the continuous use of the same plots of land season after season, without fertilizer application, the soil becomes less fertile, contributing to low yields. However, there are some farmers who are making the best use of their meagre resources and skills to raise themselves out of this situation. Such farmers have proven that they can be assisted to pull other framers out of poverty through better agro-business management so that they can become more efficient and competitive.

Maize is virtually grown in the whole country. However, the main areas accounting for more than 60 % of the 1,188,836 tonnes produced in 2006 are in the in the middle parts of Ghana or the transitional zone (Table 1). The area includes Brong Ahafo and parts of Ashanti and Eastern regions of Ghana. An estimated 15 % is grown

1 Statistics, Research and Information Directorate (SRID), MoFA (2006)
2 Statistics, Research and Information Directorate (SRID), MoFA (2006)
in the three northern regions of the country. On average, the volume of maize produced in Ghana has currently increased annually by 3.1% (1997 – 2006).3

Table 1. Regional Maize Production, Area Cropped and Yields in Ghana 2006.4

<table>
<thead>
<tr>
<th>Regions</th>
<th>Metric Tons (MT)</th>
<th>Area (Ha)</th>
<th>Yield (MT/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western</td>
<td>73,210</td>
<td>51,102</td>
<td>1.43</td>
</tr>
<tr>
<td>Central</td>
<td>166,847</td>
<td>102,648</td>
<td>1.63</td>
</tr>
<tr>
<td>Eastern</td>
<td>209,542</td>
<td>133,844</td>
<td>1.57</td>
</tr>
<tr>
<td>Greater Accra</td>
<td>2,134</td>
<td>2,879</td>
<td>0.74</td>
</tr>
<tr>
<td>Volta</td>
<td>48,286</td>
<td>35,330</td>
<td>1.37</td>
</tr>
<tr>
<td>Ashanti</td>
<td>164,226</td>
<td>138,793</td>
<td>1.18</td>
</tr>
<tr>
<td>Brong Ahafo</td>
<td>363,595</td>
<td>191,691</td>
<td>1.90</td>
</tr>
<tr>
<td>Northern</td>
<td>98,157</td>
<td>85,644</td>
<td>1.15</td>
</tr>
<tr>
<td>Upper west</td>
<td>48,128</td>
<td>36,714</td>
<td>1.31</td>
</tr>
<tr>
<td>Upper east</td>
<td>14,712</td>
<td>14,355</td>
<td>1.02</td>
</tr>
</tbody>
</table>

The number of households involved in maize production in the Brong Ahafo and Ashanti regions, are estimated to be between 600,000 – 1,000,000.5 Nationally, maize along with cassava, each are the second largest users of land (793,000 hectares and 790,000 in 2006), next to cocoa which uses 1,835,000 hectares. Which makes maize a significant crop in Ghana.6 Of 90% of the land under maize cultivation is estimated to be in field-plots of less than 1 hectare.7

Although production of maize in Ghana has in recent years, steadily increased by marginal amounts, Ghana remains to be a net importer of maize.8 Table 2. Details estimates on the consumption of Ghanaian produced maize.

Table 2. Estimations of Consumption of White Maize Produced in Ghana (2006)9

<table>
<thead>
<tr>
<th>Tonnes</th>
<th>Production / Consumption</th>
<th>% of total consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,189,000</td>
<td>Total National Production</td>
<td></td>
</tr>
<tr>
<td>675,000</td>
<td>Household consumption at a subsistence level</td>
<td>57%</td>
</tr>
<tr>
<td>150,000</td>
<td>Poultry &amp; fish feed</td>
<td>13%</td>
</tr>
<tr>
<td>170,000</td>
<td>Formally traded for human consumption (mostly wholesale)</td>
<td>14%</td>
</tr>
<tr>
<td>194,000</td>
<td>Informally traded for human consumption</td>
<td>16%</td>
</tr>
</tbody>
</table>

3 Statistics, Research and Information Directorate (SRID), MoFA (2006)
4 Statistics, Research and Information Directorate (SRID), MoFA (2006)
5 Estimations based on a combination of data (populations, labour force, household sizes and amount of land utilization compared to other crops) from Research and Information Directorate (SRID), MoFA (2006)
6 Statistical Research and Information Directorate (SRID), MOFA (2006)
8 Obtaining accurate data on imports of yellow maize into Ghana is notoriously difficult. Estimations range from 50,000 – 150,000 tonnes a year; this period of estimation ranges from 2005 to 2008 where quantities can differ greatly each year
9 Production figures from Statistics, Research and Information Directorate (SRID), MoFA (2006). Additional figures are estimates based on interviews.
2.1 Economic Background

The data provided in Figure 1. (over-page) shows that Ghanaian maize prices during 2005 – 2008 have often been more than double than those of comparable import prices\(^{10}\) & \(^{11}\).

Prices of maize in many African countries have been found to be very high due to high agricultural production costs, high transaction costs of buying the maize from many scattered small scale farmers and are kept high by often import restrictions (formal and informal) and other costs. This has negative impacts on the sector in a number of ways. Although some intra-regional trade occurs between countries in West Africa at times of shortage or seasonal fluctuations in prices (estimated to be approximately 15% of total volume\(^{12}\)), African countries that have such similarly high prices are a long way from becoming global exporters of maize.

![Figure 1. Comparison Between Ghanaian Wholesale Prices\(^{13}\) and Global Prices (US $ per tonne)\(^{14}\)](image)

For large scale buyers that have the option of importing, it is not often going to be attractive for them to invest significant amounts in increasing their supply from small-scale farmers in Ghana; current prices are not always competitive to buy at, especially if a buyer has the option of importing at a lower price. Although a large maize buyer who is importing has to import significant quantities (usually above 15,000 tonnes per shipment) and have significant finances (above approximately US $ 3.75 million per 15,000 tonnes shipment\(^ {15}\)\(^{16}\)),

\(^{10}\) These figures are comparing ‘wholesale’ prices to Cost, Insurance and Freight’ prices which when considering that The Customs and Excise Amendment Act 2008 (Act 758) June 16, 2008 resulted in the removal of import duties on yellow maize and a number of other food commodities make these prices relatively comparable. However, some minimal additional costs should be applied to the CIF maize prices such as port handling costs, levies (estimated total of 2%) etc. to make these prices more comparable. However, these additional CIF costs are likely to be very small on a per tonne basis as the costs will be spread across the whole load e.g. a minimal 15,000 tonnes at a time.

\(^{11}\) A similar conclusion is made (Food and Agriculture Organisation (2005) Briefs On Import Surges), where mean average prices in Ghana are found to be US $ 203.5 and comparable prices in the United States, were $ 86 a tonne. The cause is again mainly attributed to high production costs in Ghanaian produced rice, that were found to be 140% higher than in Thailand.


\(^{13}\) Statistics, Research and Information Directorate (SRID), MoFA (2006)

\(^{14}\) Public Ledger (2008).

\(^{15}\) Calculated at an estimated current import price of US $ 250 a tonne.

\(^{16}\) An importer is often far more assured of the quantities being easily available to a desired quality and does not involve the complications of accessing maize from thousands of small scale farmers. Virtually all of the medium and large buyers and
Maize imports are reported to have restrictions upon them where a licence is necessary to import maize from outside of Ghana. Kenya, for example has a 50% import tax on maize imported from outside COMESA\textsuperscript{17} This resulting overall high-price-impediment, is a major issue across the maize chain in Ghana as whole. The costs in every element of the chain have been found to be uncompetitively high compared to other countries even compared to most other African countries. Within the West Africa region, Burkina Faso has been found to have a low price at low-season periods, whilst Nigeria and Niger are have some of the highest prices, at present. Ghana and Cote de Ivore have relatively high prices and these high prices have an impact on trade flow of which there is very little out-flow out from Ghana and Cote de Ivore\textsuperscript{18}.

2.2 Global Background to Maize Production

World production and export of maize in recent years has overall increased as shown in Error! Reference source not found.

<table>
<thead>
<tr>
<th>Table 3. Global Maize Production &amp; Export (million tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production</td>
</tr>
<tr>
<td>Export</td>
</tr>
</tbody>
</table>

The majority of the world’s production of maize has been previously used mostly for animal feed but an increasing amount is now being used for ethanol production\textsuperscript{18}, which has contributed to global price increases in maize. Other grains (wheat, barley, rice etc.) have served human consumption markets but some of these other grains have more recently, increasingly served animal feed markets.

Table 4. below depicts some of the main maize producing and exporting countries. The last column depicts fairly consistent prices of maize for export in 2004. The wholesale price of maize in Ghana ranged from US $ 158 - $ 240 a tonne\textsuperscript{20} (an average of $ 216) although the differential between world-export prices and Ghanaian prices of maize have in recent years (2005 – 2008) increased a great deal more (see Figure 1.)

<table>
<thead>
<tr>
<th>Table 4. Export Quantities and Prices (FOB) of Maize from Selected Exporting Countries 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States of America</td>
</tr>
<tr>
<td>Argentina</td>
</tr>
<tr>
<td>Brazil</td>
</tr>
<tr>
<td>Ukraine</td>
</tr>
<tr>
<td>India</td>
</tr>
</tbody>
</table>

processors of maize source their material through a network of middlemen maize bulkers who connect between the district level and the large city (Kumasi, Accra etc.). A large buyer very rarely buys directly from the farmer due to the enormous complications of dealing with numerous small-scale farmers.

\textsuperscript{17} Nation Newspaper (1\textsuperscript{st} September 2008)


\textsuperscript{19} In 2007, the USA was predicted to use 86 million tonnes of maize for ethanol production of a total of 326 million tonnes produced (Public Ledger 2008). However, questions arise regarding the long-term sustainability of ethanol markets as many countries currently subsidize ethanol markets or the production. Furthermore the value of crude petroleum oil has recently dropped to as low US $ 33 a barrel (late December 2008) making biofuels uncompetitive.

\textsuperscript{20} Statistics, Research and Information Directorate (SRID), MoFA (2006)
Maize production in Ghana is generally observed as being inefficient and uncompetitive, mainly illustrated by low yields and high transaction costs post harvest (see Section 4.2 for more details on post-harvest transaction costs).

As a farmer realizes the benefits of investing into maize production (improved seed, fertilizer use and machinery use, etc.), she/he will have more disposable income and more money to reinvest (invest in more land, efficiency etc). As the production base becomes larger, the income again becomes incrementally larger and a farmer can lift himself up to a far more commercial level and out of poverty. A far lower proportion of the income from maize is spent on the household and the farmer has an improved knowledge base. This all starts from the farmer receiving enough advice and exposure to the benefits of using improved inputs. The following (Table 5.) is indicative of such a situation.

Table 5. Indicative Incremental Farmer Development from Investment in Maize Production Inputs

<table>
<thead>
<tr>
<th></th>
<th>Hectares</th>
<th>Yield / Hectare</th>
<th>Total Income from Maize</th>
<th>Estimated Annual Household Spending</th>
<th>Estimated amounts available for annual reinvestment into maize production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Inputs intensive / subsistence approach farmer – no or very little investment in inputs etc.</td>
<td>.5 – 1</td>
<td>1.5</td>
<td>$ 200 - 300</td>
<td>$ 300 - 400</td>
<td>None or very little</td>
</tr>
<tr>
<td>Inputs-intensive approach to farming / intermediary level (using commercial seeds, fertilizer and some mechanisation)</td>
<td>1 - 5</td>
<td>2 – 3</td>
<td>$ 400 – 1500</td>
<td>$ 600 - 1000</td>
<td>Approximately $ 500</td>
</tr>
<tr>
<td>High capital investment in maize production (using commercial seeds, optimal levels of land preparation, fertilizer application and mechanisation)</td>
<td>5 +</td>
<td>4 – 5</td>
<td>$ 5000 upwards</td>
<td>$ 3000 upwards</td>
<td>Approximately $ 2000 upwards</td>
</tr>
</tbody>
</table>

Notes on above table: The value per tonne of maize, in this illustration is calculated at $ 200 a tonne however, global prices have in recent months risen dramatically (mid 2008) and begun to fall again (late 2008).

The following Table 6. Details how via a strategy of increasing yields as a result of encouraging farmers to increase their investment in inputs, costs of production per acre have decreased and incomes to farmers have significantly increased\(^{21}\).

Table 6. Increased Incomes as a Result of Increases in Inputs from a Maize Project in Uganda

<table>
<thead>
<tr>
<th></th>
<th>Traditional (no inputs)</th>
<th>Low Inputs</th>
<th>High Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield / acre (tonnes per acre)</td>
<td>0.8</td>
<td>1.7</td>
<td>2.0</td>
</tr>
<tr>
<td>Unit cost of Prod (US$) (per tonne)</td>
<td>166,000</td>
<td>120,000</td>
<td>113,000</td>
</tr>
<tr>
<td>Gross income (US$) (per acre)</td>
<td>150,000</td>
<td>340,000</td>
<td>560,000</td>
</tr>
<tr>
<td>Net income (US$) (per acre)</td>
<td>25,500</td>
<td>136,000</td>
<td>334,000</td>
</tr>
</tbody>
</table>

Through collaboration with the private sector, APEP uses the demonstration site approach to expose farmers to improved maize production technologies. Sites promote sound agronomic practices, improved maize seed varieties, fertilizer and herbicide application and post-harvest handling techniques. By September of 2004, 291 demonstration sites were established exposing 4,227 farmers these techniques. APEP building on from the preceding IDEA project (Investment in Developing Export Agriculture) focused on:

- Increasing the private sector supply of seeds and commercially disseminating the promotion of the use of seeds (capacity building seed companies to develop effective marketing programmes e.g. demonstration plots with signboards explaining the variety and expected yields). Also company management technical assistance was given.
- Promoting best husbandry practices such as planting in rows via farmer field schools etc.
- Increasing the use the of fertilizer via cost-benefit explanations to extension workers and farmers

As a result, yields had progressively started to increase and incomes per acre had also significantly and incrementally increased.

2.3 Ghana's Policy Background

Although there were some papers that guided agriculture development in the 1960s, until recently there have not been any comprehensive policy documents that have spelt out all the key issues in the agricultural sector. During the post-independence era, Ghana witnessed significant growth mainly through large commercial farms (state farms). However, they were later badly managed by the state. Agriculture in the 1970s suffered sustained decline until the introduction of the Economic Recovery Programme (ERP) in the 1980s. From 1991, the Ministry of Agriculture developed and implemented a Medium Term Agricultural Development Programme (MTADP) which provided policy guidelines that attained an average agricultural sector growth per annum of 2.3% (1991-1995). Ghana realized that at that rate of growth, it would be impossible to achieve its target as middle income country by 2020 (now revised to 2015). Hence, the introduction of the Accelerated Agricultural Growth and Development Strategy (AAGDS) in 1996, to increase the pace of agricultural growth and forge linkages in value chain development (MoFA 2001).

Following the AAGDS, in 2002 the first Food and Agricultural Sector Development Policy (FASDEP I) was developed as the framework for the implementation of strategies to modernize the sector. The current policy (FASDEP II) which has been subsequently developed as a result of a review of FASDEP I (completed in 2007 and forwarded for Cabinet approval). FASDEP II is more comprehensive in the sense that it captures the concerns of all relevant agricultural stakeholders in a decentralized, democratic and consultative manner that has never been done before. It also embraced institutional issues even within the West African Sub-regional context by engaging both the Comprehensive African Agricultural Development Programme (CAADP) of New Partnership for African Development (NEPAD). Similarly, the new policy engulfs key objectives of the Economic Community of West African States (ECOWAS) agricultural policy, and Millennium Development Goals (MDG) that are agriculture and rural development related. It is equally explicitly connected to the Growth and Poverty Reduction Strategy (GPRS II) which is the broader national development paper. FASDEP II emphasizes on sustainable use of resources towards commercialization of agriculture with a market driven growth in mind (MoFA, 2007a). The key pillars of the FASADEP II focus on the following:

- Food security and emergency preparedness
- Improved growth in incomes

---

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

Given that crops and livestock sub-sectors are expected to lead the growth of the entire agricultural sector at an annual rate of 6% or more, maize as the most important cereal for food security and income generation has a very important contribution, if the set target is to be met. Maize is also the crop that can have a link between the livestock and crops quite visibly in terms of its contribution to poultry and ruminants feed in Ghana. Agricultural policy implication on the development of the maize industry is therefore very crucial for the sector and the Ghanaian economy as a whole. Prior to FASDEP I and II, some forms of agricultural policies, over the years, have been implemented through programmes and projects. However, a clearly analyzed, well laid-out and up to date government strategy document for the development of the maize sector has not been found. As a result the environment in which the maize sector operates in, created by government policy is often viewed as a negative one. Figure 2 and 3. exemplify the perception of the effectiveness of maize trade policy in the West Africa region.

Figure 2. Policy Constraints to Maize Trade

- Weak system of policy implementation
- Lack of policy enforcement, monitoring and evaluation mechanism
- Persistence of tariff and non tariff barriers: import duties / bans, export bans, excessive bureaucracy, extortion / bribery
- Inadequate support measures
- Poor knowledge of official policies and procedures.

Based on interviews with various persons in MOFA and the study of various background documents, the following Figure 3., provides some selected government policies in relation to the maize sector

Figure 3. Selected Ghanaian Maize and Agricultural Production Policies

- Implementation aspect of the subsidized (approximately 50%) fertilizer voucher scheme (in operation since 2007)
- Importation bans on white maize and restrictions on yellow maize imports (approximately 70,000 tonnes was reported to have been imported in 2005. Other import amounts have been minimal.).
- Supply of large scale grains storage facilities totalling over 80,000 tonnes capacity (since 1970’s)
- Supply of tractors (above 80 horsepower). 150 new tractors currently (November 2008) in store for distribution.
- Establishment of mechanization centres in strategic producing areas in the country
- Buffer stocks of maize often held to stabilize prices as a result of annual fluctuations

Overall, the effectiveness in terms of co-ordination of various polices that impact on the agricultural sector are questioned especially in regard to the competitiveness of Ghana’s various agricultural industries.

---

24 Food and Agriculture Organisation (2005) Briefs On Import Surges
### 2.4 Historical Background to Maize Development in Ghana During the Last 3 Decades.

Although yields are still low, there have been several attempts from national and international project initiatives since the 1980s through the 1990s, to date, to address the situation. The following Figure 6., details some of the chronological attempts at improving maize yields as a result of research and dissemination of the results (often via demonstration plots).

#### Figure 4. An Overview of Development Agency Inputs into Maize Development in Ghana

<table>
<thead>
<tr>
<th>Year</th>
<th>Project Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979-1994</td>
<td><strong>Ghana-Canadian International Development Agency (CIDA) Grains Development Project</strong> ran for 15 years. This project is believed to have had a more comprehensive outlook and impact on the industry than other projects. It is credited with all the major maize technologies that are presently being used in the industry. These include fertilizer application, plant population, weed control, varietal seed development and dissemination of research results to the farmers (e.g. Obatanpa). One of the most outstanding impacts of the project is the human capital development. All researchers including technical staff especially at Crop Research Institute (CRI) and most of the maize breeders were trained in Reading University and Centro de Mejoramiento de Maize y Trigo (CIMMYT). The CIDA grains development project is known to have set the stage for the interventions that the Sasaakawa Global 2000 project implemented later in 1988.</td>
</tr>
<tr>
<td>1988-1993</td>
<td><strong>Production/Extension Test Plot.</strong> The aim was to assist Ghanaian smallholder farmers to increase their maize production technology resulting in increased yields to address malnutrition and poverty reduction through income generation. The project established plots on the farmers' fields as learning platforms using Farmers Field Schools (FFS) approach where appropriate (Ansah et al., 1993). The project worked with farmers’ groups in the field and provided them with the following inputs as credit (seed maize, compound fertilizer, herbicides and money for clearing (10,000 Cedis per farmer). By 1993, a total of 1,765 farmers from all the 10 regions of Ghana participated actively in the programme. Yields doubled or tripled with an average of 1.2-3.3 tonnes per hectare between 1992-3. The programme linked farmers to credit and input distribution components and this was financed by Agricultural Development Bank (ADB). In 1993, about 60% of the 1,765 of the farmers for the first time planted a new maize variety (Obatanpa). However, the average credit recovery declined from 91% of 924 farmers in 1991, to 82% of 814 farmers in 1992 and 73% of 1,765 farmers in 1993 (Ansah et al., 1993).</td>
</tr>
<tr>
<td>1995-2000</td>
<td><strong>Roadside Demonstration Plots</strong> were established in the 1990s to 2000, a sustainable agricultural alternative technologies through a joint programme between CRI, SG 2000 and Monsanto company. A “No till with mulch” technology package was disseminated to farmers in the Forest, Transitional, and Guinea Savannah zones (Ekboir et al., 2002). This technology discouraged ploughing and encouraged the use of round-up after slashing or clearing without burning or just partial burning for the forest areas. For treatment of the maize after harvest Actellic / Super Actellic 25/50 E.C or Sumi-combi E.C were used with hand pump sprayers to treat and control the grain borers etc. The technology reduced labour requirement during land preparations and weed control by 22 % and 51% respectively. Average yields were 1.4 tonnes per hectare and 0.8 tonnes per hectare respectively for males and females. Farmers were encouraged to cultivate their plots for 2-3 years and then leave the land fallow for 5-10 years.</td>
</tr>
</tbody>
</table>
Under this programme there was 100% loan recovery until 1999 when recovery became a problem mainly because prices plummeted and partly because politicians became involved in linking farmers to the programme. Post-harvest cribs and weighing scales were all introduced to address problems in the industry. However, the concern is that these were not sustained.

The Agricultural Service Sub-sector Investment Programme (AgSSIP) became the main instrument for the implementation for accelerated growth and economic development. It covered five agricultural sub-sectors that included crops. Two main elements of AgSSIP were: a reliance on private sector-led growth, and development and decentralization (MoFA 2007c).

Notable among some key projects that focused on maize was the Food Crops Development Project which begun from 1998 and continued for five years (MoFA 1997). The objective was to build on earlier projects to enable additional 12,500 participating farm families in eight districts to raise household incomes through increased production, processing and marketing of their farm produce. It focused on other crops including maize. Farmers’ group formation, demonstration fields focused on crop intensification, credit, storage, marketing and training. Yields increased but marketing was a problem and so was the eventual recovery of loans.

Within this period similar projects by NGOs emerged setting up similar demonstration plots with similar objectives. Some such NGOs include TechnoServe and ADRA who collaborated with CRI, MoFA and SARI to establish demonstration sites in Central, Brong Ahafo, Northern and Upper West regions. It disseminated basic extension technologies with Obatanpa and Mamaba seeds to farmers, increasing yields to 2 tonnes per hectare and 4.3 tonnes per hectare respectively in 2003.

Under the AgSSIP, the Agricultural Production Support Programme (APSP) was initiated in 2005 and built upon the SG 2000 concept where inputs such as seeds, fertilizers and cash as credit, was provided. The total package was about GHc 100. The project aimed to service many farmers—in Brong Ahafo region alone it targeted 7500 farmers of which not all loans have fully been recovered. By 2006, the number of farmers rose to 12,000 with only 50% recovery. In 2007, the number of farmers participating has been reduced to 5,517 in a bid to increase monitoring and improving supervision in order to increase the recovery rate.

Clearly, the agricultural sector in general and maize in particular, has seen some efforts through project implementation aiming at yields improvement. Given the above results, some may even argue that the rate-of-return of these demonstration activities to disseminate technologies for yield improvement has been minimal; especially when one compares the efforts and investments in the maize industry with the resulting yields achieved. The consistent low or poor loan recovery through the years may have other historical and other explanations but one cannot disregard the fact that low yields are perhaps the most important issue.

Figure 5. provides an example illustration of a group of many of the numerous small-scale farmers in Ghana who have not yet invested in using ‘commercial inputs’ and not increased yields or developed as a result.
Figure 5. Offinso Farmers

Offinso farmers are a group of approximately 10 farmers living in the same village. Most of the farmers are growing 2 acres of maize with some having 1 acre and one farmer 10 acres. A demonstration plot was recently set-up in their village demonstrating the benefits of improved maize production practices. Half of the farmers adopted these improved practices and increased their yields from 4 bags (520 kg per acre) to 8 bags per acre. The other half did not adopt these improved practices. Some had experienced up to a 12% loss in their maize output when cobs of maize were left in the rain.

Obviously the policy and programmes, institutional arrangements and context that have prevailed during implementation of each of these activities shaped what were rational and feasible at that time with given resources, experience and understanding. Hopefully, some lessons have been learnt to further improve the situation especially regarding low recovery of loans and a lack of sustainability of the programmes after the projects that established them have ended. Perhaps such support and services are not meant for all categories of farmers - especially those are poorly resourced. Instead they are for those farmers who will always remain organized, integrated into markets and capable of articulating their needs and seek new solutions to emerging problems beyond the project support system.

2.5 Background to TIPCEE and Maize Promotion Activities in Recent Years

The Government of Ghana’s (GoG) main policy thrust in agricultural development is to modernize the sector. Modernization is defined as improving access of small farmers to modern productive technologies, irrigation, credit and extension advice, while at the same time opening up rural communities to improved transport and marketing of agricultural produce (MoFA 2007a). In line with these set goals, the Ministry of Food and Agriculture (MoFA) has developed the Food and Agriculture Sector Development Policy (FASDEP) aimed at harnessing resources and harmonizing donor support to achieve agricultural modernization. A fundamental part of this policy is to develop a market for smallholders’ produce as a key driving force for rural economic development. Many have come to the common conclusion that to enhance agricultural innovations that will accelerate modernization, commercialization and provision of using value chain approaches are the most effective approaches. The Trade and Investment Program for Competitive Export Economy (TIPCEE) has chosen a ‘Lead Farmer’ approach, where the demonstration of improved practices are conducted on a plot of land through the owner of this land. This ‘Lead Farmer’ is aimed to be not only a demonstrator of the technical aspects and outputs but also an example of the positive life changes and advances that are made in the development of this person’s livelihood and outlook in life.

Figure 9. exemplifies such a ‘Lead Farmer’ (or intermediary farmer) who has invested in using ‘commercial inputs’ and has increased yields. As a result he has greatly improved his family’s socio-economic position, approach to life and is overcoming his / her prior situation of poverty.

Figure 6. Adobiwiri Kwesi – an Example of a Progressive ‘Intermediary Farmer’

Adobiwiri Kwesi in 1989 begun growing maize on 4 acres of land with mainly slash and burn methods of production. In 2001 he started to use herbicides and improved seed. His production had expanded to 45 acres. As a result of TIPCEE project interventions, since 2007 he started to plant in rows and use...
fertilizers in a best practice manner (applying fertilizer at strategic times - sowing, emergence and flowering). As a result of improved yields he has decided to consolidate his production has reduced the acres planted to currently 25 acres. Yields are now 14 maxi-bags per acre (1300 Kg per acre / 3250 kg per hectare) where as previously yields were 1040 Kg per acre. Mr Kwesi says the experience he has gained over the years has improved his income and standard of living.

Mr Kwesi can now afford to have 2 wives and 8 dependents including 7 children. He has sufficient housing (although still basic), a small general provisions store, is starting an agricultural inputs store and has a tractor & shelling machine that he rents out. He now owns 45 acres of land and has registered the property.

He believes maize farming which contributes over 60% of his annual income has helped him pay for his children education and health insurance for all his dependants including a nephew at 15 Cedis per person per year. However, it was observed that his post-harvest knowledge and facilities would benefit from investment and improvement. He hopes to get maize seeds that are even higher yielding than Obatanpa and Mamaba so that he can maximize the use of his land and diversify into other crops. He would now like to access a credit facility from a bank to purchase a 5-10 tonne capacity truck that would used in his farm as a rent-out service to others.

He estimated his current post-harvest losses to be at about 20%. However, given what we observed in terms of infestations by insects and rodents and the way he had heaped/stored the grains in a room with little ventilation, the consultants believed the losses could even be as much as 35%.

Mr Kwesi says the experience he has progressively gained over the years, has little by little, each year contributed to his increased yields and income. He has learned each year what has worked the previous year and what has not, and then tried again the next year what he has felt was positive to add onto his future plans and practices. It has all been a slowly progressing labour of work.

His major regret is that he has never received either formal or informal education and therefore lacks literacy and numeracy skills to build up adequate records that will enable him qualify for a credit loan facility and also keep proper business records. Although he did show to the consultants some rudimentary records that indicated that last year alone his total sale from maize was 10,526 Cedis against a total cost of 4,236.60 Cedis. He had saved 3,000 Cedis in the bank.

Many of the progressive farmers in Ghana, who grow maize, have started to hire or share-crop further land to increase their overall scale of production.
3. Maize Value and Market Chains in Ghana

A number of value and market chains exist in maize, in Ghana. The following describes some of these.

3.1 Maize Market Chains in Ghana

The cost and mark-up structures of yellow and white maize are very different, as are the end uses. White maize is mostly for human consumption, however, some is used as poultry feed. Yellow maize is virtually all used for poultry consumption. The followingFigure 10 provides an overview of four value chains of maize, each with either a different end market or a different maize variety. For reasons of bulking and cost-efficiency, virtually all these market chains work through low-cost bulking agents working at the micro-level and intermediary level (see Sections 3 & 4 for further details of the nature of these operators in the marketing chain).

### Figure 7. Overview of 4 Selected Value Chains of Maize

<table>
<thead>
<tr>
<th>Yellow Maize for Poultry Feed</th>
<th>White Maize for Poultry Feed</th>
<th>White Maize - Human Consumption Low Value retailed at small scale level (&amp; wholesale)</th>
<th>White Maize - Human Consumption High Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imports From low-cost producing countries</td>
<td>Farmer production (mostly small scale)</td>
<td>Farmer production (mostly small scale)</td>
<td>Farmer production (mostly small scale)</td>
</tr>
<tr>
<td>Micro-bulkers / middlemen</td>
<td>Micro level (district) bulking</td>
<td>Micro level (district) bulking</td>
<td>Micro level (district) bulking</td>
</tr>
<tr>
<td>Medium / Large scale processor / packager</td>
<td>Middlemen working between district and city</td>
<td>Middlemen working between district and city</td>
<td>Middlemen working between district and city</td>
</tr>
<tr>
<td>Retail / wholesale to poultry farmers</td>
<td>Medium / Large scale processor / packager</td>
<td>Millers</td>
<td>Micro-scale retailers in cities or towns</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Consumers</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Retailers (Small – large)</td>
</tr>
</tbody>
</table>

3.1.1 The Market Chain of Yellow & White Maize for Poultry Feed

There are many similarities between the yellow and white maize market chains post-purchase by the medium or large processing companies. Bulking of quantities for white maize occurs by micro level bulkers (see Section 3.3.9 for more details) who initially buy maize from farmers and transport it to the district towns (up to a maximum of approximately 5 tonnes per agent. For further bulking to occur ‘middlemen’ or ‘intermediary-bulkers’ will buy, transport and store the maize. These activities are usually undertaken by Town/district level Commission Agents..

Most of value-adding in this chain occurs by medium or large sized companies. Processing involves transportation, cleaning, packaging, marketing and retailing activities. The end product is often whole grains sold for the buyer to mill and mix additives themselves or sometimes pre-milled and with additives (soya, fishmeal etc.) added.
However, the main differences between the value chains of white and yellow maize is that until recently, virtually all yellow maize has been imported.

3.1.2 The Market Chain of White Maize for Human Consumption, (Low Value retailed at Small Scale level and Wholesale)

Including maize consumed at the subsistence level, human consumption along the low-value chain is probably the largest segment of maize consumption. Initially micro level bulkers buy maize from mostly small-scale farmers. Maize that is consumed in cities (Kumasi, Accra etc.) or town, outside the maize production triangle is bulked further by ‘middlemen’ or ‘intermediary-bulkers’ who often own or have access to trucks and have capital sufficient to trade in larger quantities.

Maize is most often sold at the retail level unmilled (still in grain form) and many households still mill the maize for domestic use with ‘pastel and mortar’ (heavy wooden pole and wooden bowl for grinding the maize) or take it to a machine-milling service (also known as corn-mill or hammer-mill) (see Section 5. for more details).

Figure 8. A ‘Micro’ Maize Retailer at Malaba Market in Accra.
Note : this retailer is one of many situated close to the stores of ‘middlemen’ in the same market area.

Maize sold at the ‘micro’ retail level in an unpackaged form was found to be selling at between 0.7 and 0.9 Ghana Cedis per kg. A large proportion of the maize for human consumption is milled in large-scale mills and sold in bulk to institutions (army, schools, World Food Programme etc.)

However, maize that does not progress to the larger cities or towns outside the maize producing area, will move off the chain at earlier stages (e.g. maize to be consumed in Sunyami will often be bought straight from the farmer or bought from the micro-level bulkers, by-passing the inter-city middlemen).

3.1.3 The Market Chain of White Maize for Human Consumption High Value Market Chain

A market has emerged in Ghana in recent years for pre-mixed and attractively packaged foods that contain maize (fufu, kenke, banku, porridge etc.). Such products at a retail price, can range from US $ 1 to 2 per Kg. This segment of the market is small compared to other segments. This market chain differs from the low-value maize products chain, at a point from the ‘middlemen’ onwards, where food processing companies become involved and more value-adding occurs.

25 TIPCEE in conjunction with Aqua Farms has begun to promote the production of yellow maize in Ghana.
Figure 9. An example of a High-Value Packaged Maize Product

The following Table 7. Provides a breakdown of estimated costs and mark-ups of maize in three value chains.²⁶

<table>
<thead>
<tr>
<th>Stage of Process</th>
<th>Estimated Price at end of stage (per 100 Kg)</th>
<th>Costs &amp; Mark-up as % of final price (based on average price)</th>
<th>Stage of Process</th>
<th>Estimated Price at end of stage (per 100 Kg)</th>
<th>% of final price (based on average price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm gate price</td>
<td>31</td>
<td>38%</td>
<td>Farm gate price</td>
<td>29</td>
<td>4%</td>
</tr>
<tr>
<td>Small scale Farmer sourcing, transportation, cleaning, packaging, management costs, risk factors and mark-up</td>
<td>20</td>
<td>3 + 19%</td>
<td>District bulker costs &amp; mark-up</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inter region trader costs &amp; mark-up</td>
<td>15</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Miller costs &amp; mark-up (when also trading)</td>
<td>17 + 21%</td>
<td>Processing miller, additional ingredients, baking etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Retailer costs &amp; mark-up</td>
<td>17 + 25%</td>
<td>High value retailer costs &amp; mark-up</td>
</tr>
<tr>
<td>Retail Price</td>
<td>52 Cedis</td>
<td>80 average (70 – 90) range found</td>
<td>Retail Price</td>
<td>225 average (150 – 300) range found</td>
<td></td>
</tr>
</tbody>
</table>

²⁶ Similar data is also found in World Bank Agriculture Development Report (2008) page 119.

²⁷ A range of prices and costs were found at various levels by the consultants during primary research in the field. Some further calculations resulted in such data as percentages, etc.
Note: whilst the small-scale retailer may be making a greater profit per kg, her or his quantity traded amount per month is far less than a trader who deals in bulk quantities.

The overall end-prices of the commodity are all high compared to many export-producing countries, starting at the farm gate price\textsuperscript{28}. Costs and mark-ups by small-scale businesses are estimated to be comparatively smaller (see Figure 21. for illustrations of selected businesses and service providers).

### 3.2 The Value Chain at the Agricultural Production Level in Ghana

The following sections describe the maize value chain at the agricultural production level.

#### 3.2.1 Ecological Zone, Climatic Characteristics and Maize Agricultural Production Seasons

Although ecological zones and their ensuing climatic conditions influence productivity especially under rain-fed agricultural systems, they rarely affect maize yields as a singular factor. The transitional zone is one of the five ecological zones in Ghana, located between forest and the Guinea savannah where majority of maize is produced. The Transition Zone stretches across the centre of the country from east to west where soils are deep and friable and well drained, and there is less dense forest cover\textsuperscript{29}. Trees are shorter with thick bark and interspersed with grasses. Important weeds are *Panicum maximum* (Guinea grass) and *Imperata cylindrica* (Spear grass). The average annual rainfall and temperature are 1,300 mm and 27\textdegree centigrade respectively. The Transitional zone has two main seasons (minor and major) and both are suitable for maize production. Due to the generally favourable climate and less dense vegetation, the Transition Zone is extensively seen by some as having potential for commercial farming, especially for grain production. Maize cultivation in the major season usually occurs from March to June where a short dry-spell in occurs in July and is used for harvesting and sun-drying. This is followed by a minor season from August to November.

No reports were received that any maize is irrigated in Ghana during its agricultural production cycle. It is generally realized that irrigation is not cost effective for maize production, especially in this geographical area.

#### 3.2.2 Soil Characteristics

The soils of the Ashanti and Brong Ahafo Regions are highly weathered with predominantly light textured surface horizons in which sandy loams and loams are the common textural classes. The lower soil horizons have relatively heavier textures varying from coarse sandy clay loams / sandy loams to clays. Both of these soil types drain well. Heavier textured soils are normally abundant in the valley bottoms, which are ideal for rice cultivation. The levels of organic carbon, nitrogen and available phosphorus levels are generally very low\textsuperscript{30}.

#### 3.2.3 Land Preparation Methods

Cultivation is most often of a ‘minimal-tillage’ method where a previous crop’s weeds are sprayed with a herbicide and the only soil cultivation that occurs, is sufficient to plant new seeds (i.e. shallow digging). However, in the northern part of the transitional zone that is almost turning grassland, tractor services are being used for land preparation including ploughing and harrowing (e.g. Nkoranza and Wenchi Districts).

\textsuperscript{28} Many export-competitive farm gate prices of maize (not including the majority of African prices) are two-thirds or lower, than the price of Ghanaian maize farm gate prices.

\textsuperscript{29} Ekboir (2002).

\textsuperscript{30} Food and Agriculture Organization (2005) Fertilizer Use by Crop in Ghana
3.2.4 Maize Yields in Ghana

Yields are currently very low at an average of 1.6 tonnes per hectare\(^{31}\) where 4 or 5 tonnes per hectare should be achievable provided sufficient investment in inputs and improved practices are conducted by the farmer (see example of small scale farmer yields in comparative countries Error! Reference source not found.& Figure 23.)

3.2.5 Infrastructure in Maize Producing Areas

Major trunk roads connecting the regional and district capital towns and cities are generally in good condition. However, feeder roads are generally in a far less positive condition. Table 8 below provides a comparative analysis of rural infrastructure development in Ghana and other comparative countries.

<table>
<thead>
<tr>
<th></th>
<th>Road (All Season) 2004</th>
<th>Electricity (2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>47 %</td>
<td>28 %</td>
</tr>
<tr>
<td>Vietnam</td>
<td>84 %</td>
<td>72.3 %</td>
</tr>
<tr>
<td>Ghana</td>
<td>61 %</td>
<td>21 %</td>
</tr>
</tbody>
</table>

3.2.6 Credit Provision and Utilization

Formal bank interest rates to agriculture are reported to currently be between 24.25 – 26.00 % per annum\(^{33}\). Of the total annual disbursement of loans, agricultural production receives far less than 10%\(^{34}\). In addition, interviews with groups of farmers revealed that very few small scale farmers are able to meet bank’s criteria to access credit and as a result very little utilization of formal credit occurs by small scale farmers for maize production. The provision of collateral and being part of a registered cooperative with an acceptable accounting system, is often beyond the reach of most small scale farmers.

However, a number of informal loaning activities occur for often short and very specific activities; for example by maize shelling service providers to farmers, who are paid once the crop is sold. Inventory Credit Programmes that include an element of credit have been attempted and are planned again in the future\(^{35}\). Very occasionally, inputs have been provided on credit to small-scale maize farmers.

3.3 Overview of Relevant Institutional Stakeholders in Maize Production

The following is a description of the main institutions currently involved in maize production promotion in Ghana.

Public Institutions in the Maize Value Chain

3.3.1 Ministry of Food and Agriculture and Formal Research Services

The goal of MoFA is to create an environment for sustainable growth and development of the agricultural sector. The ministry therefore exists to promote sustainable agriculture and agribusiness through efficient policies and co-ordination, monitoring and evaluation of the sector (MoFA, 2007c). As in all crops including maize, MoFA is

---

\(^{31}\) Statistics, Research and Information Directorate (SRID), MoFA (2006)


\(^{33}\) Statistics, Research and Information Directorate (SRID), MoFA (2006)

\(^{34}\) Statistics, Research and Information Directorate (SRID), MoFA (2006)

\(^{35}\) For example Agribusiness Trade Project (future planned project activities) and Natural Resources Institute (1995 – 1997)
responsible for the overall co-ordination of projects and programs in the maize industry through the Directorate of Crop Services (DCS). The DCS’s annual planned activities broadly include the following (MoFA 2008):

- Improvements in maize production and productivity levels
- Capacity building for stakeholders [producers/ Farmer based organizations (FBOs) etc.]
- Promotion of maize value chain development as a concept in the industry
- Sustainable land and environmental management

The DCS works with the other sectors of the ministry including the Agricultural Extension Services Directorate (AESD) which facilitates among other things technology dissemination, FBOs formation and development with other stakeholders. At the District level, the District Director of MoFA works with a team of staff including the Management of Information System (MIS) officer and a number of Agricultural Extension Agents (AEAs) distributed in the District’s MoFA operational areas. Extension at the local level from time to time receive support from donor-funded projects.

An Agricultural Engineering Department with a head office in Accra provides occasional technical inputs such as plastic imported maize storage cocoons (20 tonnes, 50 and above) and tractors (above 80 horse power).

Whilst Agricultural Extension Services exist at the district level it proved difficult to get detailed statistical data on the subject but it was generally reported that farmers very rarely receive agricultural extension advice as expected due logistical challenges. Hence, some sort of support is usually received from external development organizations and projects such as TIPCEE.

3.3.2 Agricultural Research Organisations

The various directorates under MoFA work in collaboration with the CSIR under which the CRI in Kumasi and Savannah Agricultural Research Institute (SARI) in the North. They develop technologies for farmers to improve the maize industry. For instance, in maize seed multiplication and development, breeder seeds are produced by the CRI or SARI. Foundation seeds are then multiplied by the Grains and Legumes Development Board (GLDB) while, inspection and monitoring of certified seeds is carried out by the Seed Inspection Unit (SIU) under Plant Protection and Regulatory Service Directorate (PPRSD) of MoFA.

3.3.3 Overview of Public Institutional Effectiveness

Institutions related to the development of the maize industry in Ghana are frequently considered to be ineffective as explained as follows:-

“Although the general extension system is still popular, it has serious deficiencies. These include the lack of adequate and well-trained extension workers; the lack of participation by small farmers in extension decision-making; poor extension/research linkages; the lack of adequate infrastructure and other support facilities; and above all, poor management”

Associations or viable working groups, specifically working in the maize sector, were found to be very few except the emerging indications from project assisted groups that have common unifying force or interest such as the demonstration site and common marketing needs etc. As a result for example, the industry does not have a unified set of aims or even quality standards that farmers should aim for, or a more standardized price range.

---

3.3.4 Inputs Dealers and Service Provision

Numerous district-level inputs retail service providers can be found. These are mostly supplied by a number of large national importers of agricultural inputs. Competition is relatively strong (more than 8 such outlets in the relatively small suburbs of Sunyani) and the range of stock is sometimes limited (few stocked chemicals suitable for the fumigation of a small quantity of maize and not many found to be stocking maize seed – although it was not the maize planting period at the time of consultants visit). Examples of such a companies are Wienco, Dizengoff & Agricare. Agricare Limited for example is engaged in the manufacture, import and export trade in agricultural equipment, animal feeds, supplements and veterinary products. Agricare Limited is a member of the Association of Ghana Industries. Agricare operates mainly from Kumasi as one of the major wholesale buyers/millers in the maize supply chain (see annex for stakeholders in supply chain).

3.3.5 Shelling Service Providers

Throughout the region, shelling services by machine can be found at the community level where each community is likely to have a handful of service providers. A service provider is usually an individual owning one machine on wheels, that is taken from farm to farm and charged out on a per bag shelled, basis. These business services are often in the form a young man who has a minimal level of education, few other employment opportunities and is in his first stages of business.

Figure 10. Some of the Numerous Maize Shelling Machines for Hire available at the Local Level.

3.3.6 Transportation Service Providers

Transportation Service Providers can be widely found in various forms namely small trucks, tractors (above 100 horsepower) including hand-held (as shown in Figure 15.) and even cars where bags of maize are loaded onto seats.

Figure 11. Hand-held tractor Used Mainly for Transportation
3.3.7 Drying Service Providers

Drying service providers are not often found but can be found as part of a company’s secondary activities; where its primary activity is higher-value food processing. For example, a drying service can be found at Yedent foods in Sunyani.

3.3.8 Storage Services and Facilities

Since the 1970’s government has installed fairly evenly across 27 locations of the country, large scale storage facilities. The total storage volume is reported to be 80,105 tonnes averaging out at 2966 tonnes per location. These are either in the form of silos or warehouses.

Large and medium sized processing companies, and smaller middlemen are all found to have their own storage facilities which are most often in the form of warehouses with grain stored on the floor. Some of these facilities, particularly the smaller ones, are rudimentary, which may just in fact be the room of a house.

Assemblers at the village and town level have been found to often store the bags of maize on raised wooden frames (2 – 4 inches off the ground) and cover with tarpaulins, in the open ground.

Farmers again may just be using the room of a house or be using a purpose built crib which is a building made from low cost materials of unsawn wood and corrugated metal roofing sheets.

3.3.9 District-Town / Village Assemblers Buying from Farmers at the Primary Level

At the district level, at least one bulking point can found (Sunyani has 2) per town. Approximately 30 – 60 micro-buyers operate in Sunyani and approximately 60-150 micro-buyers in Nkoranza Town. During the high season amounts handled through these bulking points per month, have been found to be 1,300 tonnes and 5,200 tonnes for Nkoranza and Techiman respectively. The assemblers most often buy at the farm gate and sell to larger middlemen-traders who come from outside the district, to the local bulking area to buy.

As an example assemblers in Nkoranza have formed an association with a membership of approximately 150 members.

The land that this ‘market’ is operated on is reported to be owned by the local chief who allows its use at no or very little cost.

Figure 12. The Storage Area used by ‘Assemblers’ with an ‘Intermediary Middleman’s Truck in the background.
3.3.10 Middlemen / Intermediary Traders

These persons buy from the village / town assemblers and transport to the larger towns, cities or larger buyers. These buyers often have a 15 – 20 tonne truck with which they transport the maize. These traders are better capital-resourced either with formal bank loans or their own personal capital.

3.3.11 Private Sector (Medium & Large Scale Buyers)

A number of large and medium sized companies buy and process maize. Some of these companies have significant investments in processing machinery and infrastructure (storage, milling, packaging, etc.). Figure 13. below provides an overview of a selection of some of these companies.

Figure 13. Selection of Medium and Large Scale Buyers and Processors of Maize

<table>
<thead>
<tr>
<th>Company</th>
<th>Current Annual traded quantity of maize</th>
<th>Method of Procurement</th>
<th>Market Targeted</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Hussien</td>
<td>1200 – 2000 tonnes</td>
<td>Through middlemen</td>
<td>White maize for human consumption</td>
</tr>
<tr>
<td>Yahwe Salom</td>
<td>12,000 tonnes</td>
<td>Through middlemen</td>
<td>White maize for human consumption</td>
</tr>
<tr>
<td>Premium foods</td>
<td>20 – 50,000 tonnes</td>
<td>Through middlemen</td>
<td>Institutional buyers (army, schools, WFP)</td>
</tr>
<tr>
<td>Ghana Agro Food Co.</td>
<td>10 – 15,000 tonnes</td>
<td>Through middlemen</td>
<td>Poultry Feed</td>
</tr>
<tr>
<td>Aqua Farms</td>
<td>Approx. 30,000 tonnes</td>
<td>Importation mainly but has started to buy directly from farmers in Sunyani via TIPCEE Project</td>
<td>Poultry Feed</td>
</tr>
</tbody>
</table>

3.3.12 Miller Service Providers

At the town and city level, numerous milling-only service providers can be found (make a charge to mill the grain only and do not buy and sell the maize). Households or small scale retailers are the main customers of this service. Service providers often have basic machinery and a basic business premises, with low overhead costs (mainly overheads of labour, electricity and maintenance). Charges were reported to be 1 Cedis per 130 Kg of maize grain milled (approximately 2.5% of the farm gate value of the maize.)

Figure 14. A ‘Town Level’ Milling Service Provider

Companies that sell maize in large quantities in a milled form (often to institutions such as schools, army etc.) often have their own larger milling machinery.
4. An Efficiency Analysis of Maize Production and Processing in Brong-Ahafo and Ashanti Regions

The overall costs of production in Ghana are high, hence the comparatively high price of Ghanaian maize at various levels of the market chain. This results in a wide range of negative aspects for the sector, such as it being cheaper to import maize and the lack of sufficient competitiveness to consider maize as a significant export commodity. Investment in the sector is also limited as a result of the overall un-competitiveness of the sector.

In order to address this over-riding issue, the number of areas of in-efficiency will have to be highlighted, carefully understood and appropriate cost-reducing strategies defined. Some areas of in-efficiency will be having a significant impact and some a lesser impact. Some areas of in-efficiency can be addressed more easily, at less a cost and some not so easily.

In-efficiencies have been observed as occurring at both the agricultural production level, post harvest and the trading & secondary processing levels. Agricultural production in-efficiencies are mainly caused by the lack of investment in inputs (improved seed & fertilizer). Post Harvest in-efficiencies are caused by a variety of aspects such as poor storage, the lack of use fumigation inputs and poor handling in general. At a trading and secondary processing level, the combination of mark-ups and costs are far higher in Ghana (and Africa overall), than with comparative crops in many Asian countries. Quantities traded are far less per trader and costs per tonne handled are not believed to be any higher.

It should however, be noted that different sized farmers experience different costs as a result of mainly their economy of scale and their access to non-hired in labour, as is explained in Figure 19. below.

Figure 15. Diversity in the Range of Costs of Maize Production between Small, Medium and Large Scale Farmers

| Many activities in maize production in Ghana occur by hand and for small-scale farmers who use their own (or family labour), costs are not directly incurred and neither does labour have to be hired in. Production plots are often so small that it is inefficient to transport machinery to operate on the small plots, let alone the time it takes to disassemble machines, re-set-up and operate on small plots that have frequent turn-around. |
| For the few larger scale farmers producing maize in Ghana, machinery use can sometimes be worth investing in due the greater amount of self-use of the machinery. |
| However, for many medium scale farmers they are stuck between neither being economically viable to invest in machinery or cost-effectively hire in labour. Some of the costs medium scale farmers are reporting that they find they have to pay for sub-contracting out or hiring in machinery, are very high. These medium scale farmers say they have tried negotiating and shopping around but they often have few other options but accept the high prices. The service providers know the medium-sized farmers have few other options but to only pay the high price offered to them. |
| Costs, overall are high for maize production in Ghana but are found to be especially high for many medium sized maize producers. |
| When the costs for medium scale farmers are factored into data, high-end costs will be very high and averages will be pushed up. |
4.1 Efficiency Analysis at the Agricultural Production Level

Based on data collected as part of this research, of 7 areas of analyzed input (as shown in Figure 20.), it has been found that 3 areas are of the lowest areas of the cost of inputs and 3 areas are generally the highest. The cost of Seed, Maintenance and Other Costs (Land Rent, bagging and tools) are found to be the lowest; at each less than 7% of the total cost. The cost of land preparation (labour and herbicide), Cost of Fertilizer (material only) and the cost of Harvesting & Shelling (Labour and machinery hire) were each found to the highest costs (ranging from 20.5 – 30.5 % of the total cost per acre. Based on the experience of the consultant who analyzed this data, an overview concludes that this data is generally indicative of many typical small-scale farmer maize production situations in Africa.

Figure 16. Calculations of the Average Investments in Production

<table>
<thead>
<tr>
<th></th>
<th>Land Preparation &amp; Planting (Labour &amp; herbicide costs)</th>
<th>Seed (Investment per Acre)</th>
<th>Sowing labour and watering</th>
<th>Maintenance (Weeding labour, herbicide and fertilizer application)</th>
<th>Fertilizer (Cost of)</th>
<th>Harvesting &amp; Shelling</th>
<th>Other Costs (Land Rent, bagging and tools)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Average investments per acre (materials and labour)</td>
<td>29.20</td>
<td>6.70</td>
<td>10.55</td>
<td>6.70</td>
<td>24.63</td>
<td>36.64</td>
<td>5.55</td>
</tr>
<tr>
<td>% of total average investments</td>
<td>24.3%</td>
<td>5.6%</td>
<td>8.8%</td>
<td>5.6%</td>
<td>20.5%</td>
<td>30.5%</td>
<td>4.6%</td>
</tr>
<tr>
<td>Increases in yield compared to if the input had not been used (if attributed solely to this input)</td>
<td>1.3 tonnes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increases in income as a result of input investment (approximate value of 0.3 Cedis per Kg)</td>
<td>390 Cedis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated potential return on investment (attributed solely to this input)</td>
<td>383 Cedis per acre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ratio of Returns to Investment (attributed solely to this input)</td>
<td>1 : 57</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overall, improvements are occurring for farmers who have invested in inputs and as a result are successful in their agricultural production. These farmers are found to be receiving gross margins of up to 358 Cedis per acre compared to those who do not invest in improved inputs. Farmers who are still successful in their agricultural production received an estimated average of up to 114 Cedis per acre. Those who were using improved seed only were attaining average yields of up-to 2.3 tonnes per hectare (1.3 tonnes increase on average per hectare) per whereas some of those who were also using fertilizer were attaining yields of up-to 3.4 tonnes a hectare (1.1 tonnes increase on average per hectare).

The average returns calculated from using improved seed are higher (383 cedis per acre) compared to the returns from investing in fertilizer (305 Cedis). The returns on the amount of investment are far higher (1:57) for seed than for fertilizer (1:15). According to this data, a resource constrained farmer benefit more by investing in improved seed than in fertilizer even when the fertilizer is subsidized by 50% of cost to the farmer.

---

37 A number of farmers were not successful in gaining significant improvement in gross margin figures due to the risks of farming that commonly include disease, drought, storms etc.

38 The approximately 20% of farmers who were not successful in their agricultural production (i.e. experienced a gross-margin loss in production) have not been included in these calculations.)
Of the total amount of farmers interviewed regarding this Gross Margin data, positive incomes ranged from 115% to 445% of the total costs of production. Some farmers made a gross gains of as much as 358 Cedis per acre. The total investment per acre ranged from 63 to 289 Cedis per acre. However, approximately 20% of the farmers received losses in their production.

Table 9. below provides an indicative illustration of how increases in investment result in an expected higher returns per hectare. Costs and return data is based on average cost is based upon costs and returns data found in the field during research.

Table 9. Estimated Indicative, Gross Margin Output Scenarios as a result of Increases in Investment in Inputs per Hectare (late 2008 values).

<table>
<thead>
<tr>
<th>Units/Hectare</th>
<th>Low Inputs</th>
<th>Medium Input</th>
<th>High Input (Hybrid Seed)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main Production</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maize</td>
<td>Tonne</td>
<td>300.0</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Inputs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seeds (OPV)</td>
<td>Kg</td>
<td>1.5</td>
<td>5</td>
</tr>
<tr>
<td>Seeds (Hybrid)</td>
<td>Kg</td>
<td>2.5</td>
<td></td>
</tr>
<tr>
<td>Fertilizer (NPK)</td>
<td>Kg</td>
<td>1.3</td>
<td>50</td>
</tr>
<tr>
<td>Hericid &amp; Pesticide</td>
<td>Lump Sum</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Other non labour costs</td>
<td>Lump Sum</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td><strong>Sub Total before labour</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>128</td>
<td>264</td>
<td>468</td>
</tr>
<tr>
<td><strong>Labour</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Days</td>
<td>2</td>
<td>120</td>
<td>240</td>
</tr>
<tr>
<td><strong>Total Costs including labour</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>348</td>
<td>484</td>
<td>688</td>
</tr>
<tr>
<td><strong>Profit Margin before labour</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>343</td>
<td>657</td>
<td>753</td>
</tr>
<tr>
<td><strong>Profit Margin after labour costs</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>103</td>
<td>417</td>
<td>513</td>
</tr>
</tbody>
</table>

Notes on Above Gross Margin Calculations:

1. These calculations are illustrated to show how increases in investment result in an expected higher returns per hectare.
2. Average cost and return data is based upon costs and returns found in the field during research.
3. Land is assumed as owned and an explicit cost of its use is not included.
4. Other non labour costs include land usage taxes, depreciation on tools, water for irrigation etc.

The provision of chemical inputs is widespread and availability at local inputs dealers is not found to be an issue. The overall cost-effectiveness of most inputs is realised to be efficient although affordability is often found to be a major constraint.

---

39 Report from Technoserve staff conducting an informal evaluation of maize projects and the effectiveness of project interventions.
The current government fertilizer subsidy (2008) will of course have an impact on these figures, however, it is not known for how long this subsidy will continue. According to these calculations, in theory the use of credit at an average 25% per annum interest rate would still be viable, however, in reality for farmers to borrow money at commercial rates for small plots of land (i.e. 1 – 2 acres), such a small loan with all the time and other related costs and risks in agricultural production, it often becomes unviable.

4.1.1 Seed Supply and Effectiveness

Although many farmers are reported to be still saving their own seed from previous crops, farmers are reported as having a limited access to commercial higher yielding varieties. Based on a sample of farmers in the project area, farmers using improved seed only, farmers were sometimes getting yields of up-to 2.3 tonnes per hectare of the study sample group only 63% had invested in improved seed.

However, currently seed supply is estimated as insufficient (shortfall of approximately 8,000 tonnes). Of 1,982,500 acres of maize planted in 2006 seed supply was sufficient for 444 acres (22% of total land planted). In addition the price of 13.5 Ghana Cedis per 9 Kg (1.5 Ghana Cedis per Kg) for Open Pollinated Seed suggests that supply is lower than the demand and numerous verbal reports were received substantiating this. A number of inputs dealers interviewed, responded saying that have not been offered maize seed to sell and therefore did not have seed to sell. The continuing low yields of maize also maybe a contributing symptom of a poor supply and/or use of seed.

However, research has recognized that hybrid maize has a more uniform production, is higher yielding and more stable in performance than open-pollinated (OP) maize. Consequently, the CRI developed and released quality protein (QPM) hybrid maize Mamaba in 1997. Apart from its uniformity, Mamaba is 25-30% higher yielding than the other OP varieties of comparable maturity cycle. In more perfect conditions Mamaba is reported to yield 5-7 tonnes per hectare and is early maturing and drought-resistant. Of higher yielding varieties sometimes available, Obaatanpa (open pollinated), released in 1992 with a potential yield (stated by the selling company) to be of 4.6 tons per hectare. Hybrid seed has been frequently found to be higher yielding in many parts of the world, as a result of trials conducted. However the cost of hybrid seed has found to be 50% higher although resulting in often higher gross margins.

A number of specialist commercial seed producers are reported to be emerging. These seed producing companies are Wienco (joint partnership with a South Africa seed producer), Dizengoff (joint venture with Pioneer Seeds of South Africa) Aglow, Sefa and Jane, Agrimat and Obek, while the major seeds growers are Ababio, E.B Yirenkyi, Kennedy and Emtrade (2008 seeds award winner) and also commercial activity from a Government Seed Production Unit (Alpha Seeds Co., etc.). As an example local seed production by Alpha Seeds is reported to be currently occurring by 400 out-growers (average 10 acres each). A network produces foundation and breeder seed for the GLDB under a MOFA Unit.

4.1.2 Fertilizer Quality, Price of, Use of, Effectiveness and Other Related Issues

Fertilizer has been found to be widely available, even more so since the 50% government subsidy has been initiated. It was reported that the price subsidy has resulted in an increased demand and use of fertilizer. Prior
to this subsidy, the dramatic oil price rise of (May – August 2008) contributed to an increase in the price of fertilizer. The price of fertilizer before any subsidy during this high-price period was approximately as much as US $ 1 per Kg, which many farmers at the time, found to be unaffordable. However, on a global price level, the price of fertilizer in Ghana prior to the recent subsidy, was considered not to be high compared to other importing countries and especially competitive, when the current subsidy is taken into account. The average amount of fertilizer use in Ghana in 2004 was estimated at about 5 kg per hectare (whereas an optimal amount is considered to be 55 Kgs for maize) which is half the level of sub-Saharan Africa and at a quarter of the level of Africa as a whole.\textsuperscript{44}

Based on a sample of farmers in the project area, using improved seed and fertilizer, farmers were sometimes attaining yields of up-to 3.4 tonnes per hectare. Based on data collected and subsequent analysis, farmers who invested more than 49 Cedis per acre in fertilizer, overall returns per acre ranged between 207 to 288 Cedis per acre. Of the farmers in this sample group, all had invested in using fertilizer had also invested in improved seeds. Whereas farmers who had invested in 18 Cedis or less in fertilizer received less than 76 Cedis per acre, for their crop. Of the sample group only 12% had invested in more than 49 Cedis per acre in fertilizer.

Gross margin calculations of this maize production and other on-farm trials have show that an investment in fertilizer of a balanced nitrogen, phosphate and potash content (of up to 650 Kg per hectare), received the highest yields and gross margin returns.\textsuperscript{45}

4.1.3 Weeding, Spraying and other Crop Maintenance Activities

Based on data collected and subsequent analysis, farmers who invested in the maintenance of the crop (labour in weeding, herbicide and spraying labour) have been observed to also be gaining higher yields. As an example, of the sample group, of all the farmers who invested in more than 40 Cedis per acre, overall returns per acre ranged between 207 and 315 Cedis per acre. All of these farmers had also invested in improved seeds and applied fertilizer. Whereas farmers who had invested in 18 Cedis or less in crop maintenance, received less than 116 Cedis per acre. Of the sample group only 12% had invested in more than 40 Cedis per acre in crop maintenance activities.

4.1.4 Mechanization Use and the Cost-Effectiveness

Mechanization can be sometimes found at various levels of the production and processing cycle (land preparation, shelling of the maize etc.), however, due to the generally low cost of labour and the high cost of mechanisation, mechanization is not often economically viable. For example it was reported that the cost per acre to just plough was 25 Cedis (approximately 25% of the total cost of production).

4.1.5 An Assessment of Labour Supply and Issues

To small-scale farmers who use their own or family labour do not find that labour costs are an issue, whereas those who are hiring-in labour (medium scale farmers, etc.) are finding it an issue.

The general cost of hired-in labour was reported as comparatively low\textsuperscript{46} at a reported average cost of 2 Cedis per day (US $ 1.81). However, reports were received that when the cost of labour was high or a shortage in

\textsuperscript{44} Food and Agriculture Organization (2005) Fertilizer Use by Crop in Ghana.
supply is experienced, more herbicide was used, than weeding using labour. Some medium and larger scale farmers reported that they hired labour at many stages of the production cycle; for example sub-contracting out a whole stage (e.g. fertilizer application or weeding). With 13% of the sample group of farmers making a loss in production, in-efficiencies in sub-contracting labour utilization could well be occurring.

4.1.6 Summary of Efficiency Analysis at the Agricultural Production Level

In summary the main inefficiencies in agricultural production have been found (in order of relevance) to be:

- **Low levels of improved seed supply and use** – resulting in high prices of the limited amount of seed supplied, low yields by farmers and an overall increased cost of the final product.
- **Low fertilizer use** – resulting in low yields.
- **Low investments in crop maintenance and weeding** - resulting in low yields
- **Mechanization costs high and low use of**
- **A lack of realization by farmers of the economic benefits from investing in improved inputs**

Investments in seed and weeding have been found to be most cost-effective and have the lowest requirement of cost to the farmer.

4.2 Efficiency Analysis at the Primary Post Harvest Processing Level

Gross Margin costs to farmers at the ‘Harvesting and Shelling’ stage (Harvesting Labour, Transportation, Dehusking, Shelling and Cleaning, Cost of Sacks, Bagging Labour and Storing & Fumigation Treatment) on average were calculated at 30.5% of the total cost of production, which is considered to be comparatively high. Costs have been found to be high at the various stages throughout this stage of operation. Being the reason why many small-scale farmers have not promptly conducted post-harvest activities. In many cases, farmers have waited to conduct post harvest activities until a buyer is present, by which time the losses would have doubled or tripled.

4.2.1 Harvesting, Dehusking, Bagging and Labour at all Levels of the Primary Post Harvest Processing Level

Many farmers reported that they hired labour to conduct operations at these stages of the production cycle, of which the range of costs per acre, for these activities, ranged from 12.7 Cedis to 87.9 Cedis. An average cost per acre was found to be 40.76 Cedis, which may suggest that some farmers are paying a high cost when such sub-contracting out. The majority of small-holder farmers who do not sub-contract out, are not faced with such high costs.

---

46 With Ghana being generally a country with high costs, casual labour at a cost of US $ 1.81 a day is considered (compared to other low-income countries – India, Vietnam, China, etc.) to be a competitive price.
4.2.2 Transportation

Transportation by the farmers generally occurs by the carting of the maize cobs from the field to the homestead or place of storage, and sometimes from the place of storage to the place of sale. Total costs of transportation for farmers during these stages were reported to be between 6 Cedis and as much as 26 Cedis per tonne, which is on the higher end, are a considerably high cost for distances that are estimated to be often under 10Km. Apart from proximity and the general lack of good farm roads, that influence such cost, the high cost could well be attributed to the small amounts that are handled by farmers, making the activity less viable due to the economy of scale. Larger sized, traders reported that they paid 6 - 12 Cedis per tonne for transportation, however, this is for distances of approximately 100 Km.

4.2.3 Maize Shelling and Cleaning Service Providers

The cost of machine shelling and cleaning at 1.2 – 2 Cedis per bag (or 18.5 – 30 Cedis per acre based on a 2 tonne per hectare yield) contributes to the comparatively high cost of production or the high pre-farm-gate prices. Farmers however, expressed their preference to pay for machine shelling, compared to shelling by hand, despite the costs of machine shelling.

However, shelling service providers reported that they only earned an income 30% of the time on average throughout the year. With machines that can shell up to 3 tonnes in a day, the potential income can only be 27 Cedis every 3 days. Costs to such a business operator will include fuel, maintenance and depreciation on the machine, and / or interest on loan with which he bought the shelling machine.

Figure 17. A Possible Example of Cost Reduction in the Maize Value Chain.

The retail cost of a shelling machine in Ghana is reported to be $ 1600 upwards. A similar machine in Vietnam for example costs $ 350 FOB (however, should be considered to be at least double at a retail price once imported in Ghana). This illustrates how the costs of operation are far higher in Ghana than in many other countries outside of Africa.

A lower Cost Shelling Machine from Vietnam

Other than perhaps operational costs, the overall mark-up of micro-level operator’s shelling services are not considered to be an area where a great deal of cost reduction can easily occur.

4.2.4 Storage & Infestation Fumigation

The costs of storage are for the majority, in the initial capital costs and the returns are gained often as the crop is utilized over the year or exported. Where a price fluctuation occurs due to seasonality, returns can be gained at selling the product at a far higher price than it was purchased at. The losses that can occur if a product is not

47 Many farmers store maize on the cob and decide to shell and sell the maize at various times during the coming year as prices rise. In other words farmers use the maize as a ‘bank’ of stock that gains value, if kept until the high-price season.
properly stored, can be far greater than the cost of an effective storage system. However, the initial capital cost of storage can be prohibitive for both small-scale farmers and even medium sized or larger businesses. Overhead costs in storage are mostly in the form of depreciation costs.

The large scale government provided storage facilities spread across the country (totalling over 80,000 tonnes capacity) are currently used (renting) by large scale maize dealers and very rarely by smaller scale dealers. Government is reported to have attempted to divest these facilities (Ghana Food Distribution silos and warehouses) in recent years, but without success.

Of farmers interviewed in primary research as part of this study, only 8% said they invested money in either storage or fumigation as an overhead cost. Fumigation costs are however, very low and were to cost from 0.20 – 1.0 Cedis per tonne depending on the overall quantity to be treated (larger quantities are cheaper to treat on a per tonne basis).

Small scale farmers were found to be storing maize on the floor of the room of the house or be using a ‘crib’-type storage facility (a building made from unsawn timber but with often a corrugated metal sheeting roof).

Post harvest losses were reported to be occurring with approximately 5 – 70% of the crop. The causes were reported or observed to include, leaving the cobs of maize in the field and in the rain, storing the maize on an un-raised or wet floor, rotting due to storage at a high moisture content, rodent or weevil infestation. The consultants frequently observed that farmers practiced poor post harvest practices and even those who were considered better farmers were not different in this regard and still practiced poor post harvest activities (as shown in Figure 23.).

Some low cost improvements in storage methods and facilities (such as raising cribs off the ground and providing very simple rodent prevention devices*, or infestation fumigation) could result in very positive benefits.

For example, the increased use of fumigation has been observed as having significant a reduction in post-harvest losses compared to the costs. A cost of fumigation costs approximately between 0.2 and 1 Cedis per tonne (depending on quantity to be treated) and the amount that can be lost per tonne at 80 cedis (calculated at a 20% loss), results in the fumigation being a highly economically beneficial practice.

4.2.5 Drying Services
As an example of such services occasionally available, Yident foods in Sunyami produces a high value packaged maize-food product and as part of the process uses a drying machine. However, the company allows the use of machine to external uses for a service-charge when it is not being used as part of the food product manufacturing by the owner company. This drying machine is available for use at approximately 5 Cedis per 130 kg to reduce the moisture by 4 %, which calculates at $ 0.4 per Kg. This equates at 120 – 140 % of the total current value of a bag of maize which add up to more than an un-high-value-added\textsuperscript{48} retail value. The cost per Kg for use of the drying machine within the company is likely to be considerably less (although still quite high) but is justified by often the higher mark-ups in the market chain.

Micro-scale bulking agents reported that the cost to them for machine drying was approximately 2.5 Cedis per 130 Kg. This service was rarely ever used due to the high cost.

It is concluded that a low value product such as maize for a low-value market, drying by machine is not economically viable when a farmer or a small trader has the option of drying in the sun (as is shown in Figure 24, where traders are frequently using the practice of drying in the sun).

\textsuperscript{48} An ‘un-high-value-added’ product is one that is not sold in a high quality packaging, with a specific processing process applied and without a high profit margin.
The service provider reported that a demand is present for the use of the machine during rainy periods but the demand is low at other times. Due to the cost of fuel, drying of grains by machine compared to farmer drying in the sun, is seen as not economically viable unless a high-value end-use of the grain is going to occur (niche market products, etc.).

4.2.6 An Overview Assessment of Maize Farmer Groups

Whilst this study was not employed to conduct an intensive study of the efficiency of farmer groups, some observations were made and the effectiveness of groups can have a significant bearing on the overall cost-efficiency at this level.

Of a number of groups visited, the mobilization of farmers to attend meetings was not found to be a challenge. However, most farmers reported that they bought their inputs, planted their crops and marketed their products individually, although communication between the farmers seemed to be good.

The authors of this report, firmly believe that groups can only effectively form, under their own energy and self-realized justification for it. Groups that are encouraged to form by other parties often result in a transient interest or formation. Overall, the impression gained was that groups had potential but the justification for groups to form, needed to be strengthened (i.e. contracts were not found where farmer groups were selling in bulk [i.e. above 60 tonnes at a time] and farmers were found to be selling on an individual basis).

4.2.7 A Summary of An Efficiency Analysis at the Primary Post Harvest Processing Level

In-efficiencies are occurring at a number of stages. The overall quality and quantity of maize sold by farmers is a contributing factor to farmer’s resulting low economic position. Farmers are not often able to negotiate an improved price. The costs of services to farmers are also high.

The vast majority of farmers sell on an individual basis. Sometimes selling (even less than a tonne at a time), can be particularly costly on a per tonne basis in terms of handling, (compared to handling numerous tonnes all at one time). It was observed that the quality of maize was also often very low. Farmers who were interviewed regarding the quality of their maize, were aware of the problems but often conducted few actions to address the problems.

During the field visits, the consultants found no mention of unified quality standards aimed for or implemented by a number of private sector buyers or government departments.
For reasons of a need for cash, physical losses (rotting, insect infestation, availability of sufficient quality storage facilities, - farmers in sub-Saharan Africa and other low income countries have been found to sell their grain soon after harvest.

Both the lack of quantity and quality will contribute significantly to the efficiency of farmer’s overall cost of production. Figure 20. details a recommended quality that should be aimed for and also provides a comparison of the quality of maize found during fields visits in the maize triangle (transitional zone) of Ghana.

### Figure 20. An Example of Typical Maize Quality Standards.

<table>
<thead>
<tr>
<th>Quality Aspects</th>
<th>Recommended Quality to be Aimed For</th>
<th>Quality Found During Visits in central Ghana</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moisture Content</td>
<td>less than 13%</td>
<td>12 – 18%</td>
</tr>
<tr>
<td>Foreign matter</td>
<td>less than 0.5 % (must be clean)</td>
<td>Frequently includes foreign matter</td>
</tr>
<tr>
<td>Broken grains</td>
<td>less than 2%</td>
<td>Frequently broken grains</td>
</tr>
<tr>
<td>Shrivelled, diseased or discoloured grains</td>
<td>less than 4%</td>
<td>Frequently more than 5%</td>
</tr>
<tr>
<td>Insect Damage</td>
<td>less than 1%</td>
<td>Frequently insect damage</td>
</tr>
<tr>
<td>Live weevils</td>
<td>none at all – must have been fumigated</td>
<td>Frequently found</td>
</tr>
</tbody>
</table>

In summary the main inefficiencies in stages of primary post harvesting processing stages have been found (in order of relevance) to be :-

- **High cost of providing services to farmers**
- **Farmers and small scale service providers being at poor position to negotiate low costs – quantities are small and qualities are poor**
- **Lack of the realization of the benefits that can be gained from investing in quality and a lack of attention to detail by farmers in terms of attaining quality**
- **Farmers invest in improved farmer-level storage methods**
- **A lack of a realization that farmers can often benefit by working in groups**

### 4.3 Efficiency Analysis at the Trading and Secondary Processing Levels

The nature of maize trade in Ghana and in Africa as a whole, is generally considered to be more costly and with higher per tonne mark-ups compared to other low-income countries who also buy from mostly small-scale farmers. However, Asian traders tend to trade larger quantities, per trader, than in Africa. The following sections analyses the economic aspects of the various players in the post farm-gate market chain of maize.

#### 4.3.1 Assembler at Farmer Level / Primary Level Bulkers

The following Figure 21. illustrates the business aspects of the numerous assemblers who often by at the farm gate from farmers.

---

The numerous town-level assemblers and secondary processors are generally of a very small size. Each one is likely to have 10 – 50 bags of stock at any one time and this calculates to $ 400 – 2000 of capital. The operators of these facilities are often young men who do not have other employment opportunities. They are introduced to the business initially as hired labour lifting the 130 Kg sacks onto trucks. Some start to buy and trade their own small stock. Observations show that even those that have been in the business for many years have not increased their personal income or overall stock very much during the period. Calculations reveal that with a turnover of stock every 2 weeks an overall income is approximately $ 90 or $ 180 a month of which this often shared between 2 – 3 persons. Their income is often supplemented by the providing of truck loading labour to other similar businesses but this can only often amount to an additional $ 30 - 50 a month per person.

Due to the informality of their business situation (stock stored outside and only covered with tarpaulins), losses often occur in heavy rain, but losses are not occurring because of any other obvious reasons (infestation, handling etc.) These business operators do not own a business premises and have few other fixed assets that can be used as collateral for gaining further capital via a bank loan. Much of their service is provided to farmers on credit to the farmers, where the farmer pays the assembler at the time the maize is actually sold.

Although they operate in the open, some of them have access to market stores for storage. The storage cost is 0.30 Cedis per bag per month. Treatment may be done at the wholesale buyers’ expense.

**Constraints as Reported by Members of a Group**
- Lack of financial support to buy the maize in appreciable quantities and store before the arrival of wholesale buyers
- Lack means of transport e.g. motor bikes to make contacts with farmers.
- It was estimated that each group will require a working capital of about 8,000 Cedis as short term revolving fund.
- Inadequate storage facilities- entire current storage capacity is about 1,664 MT for the two major associations which are both sharing space in the market- creating overcrowding especially during market days.
- The average post-harvest loss at this level is estimated at 5%. This is considered to be a major constraint but they do not know how to address the problem since they have no training and infrastructural support.

Need technical training to reduce losses and record-keeping and management skills to be efficient and also attract bank loans.
4.3.2 Middlemen / Intermediary Traders

Middlemen / intermediary traders buy from the assemblers and transport to the larger towns, cities or larger buyers. These buyers have a 15 – 20 tonne truck. In a year, 2,000 – 10,000 tonnes are reported to be handled. Although profits could be as much as US $ 50,000 or more in a year, losses could be a lot more than this as result of price fluctuations or losses during storage. Costs to such a business operator can include fuel, truck maintenance and depreciation, labour (loading and unloading), storage, product cleaning and interest on loans of working capital.

4.3.3 Private Sector (Medium & Large Scale Buyers)

The following (Figure 22.) illustrates the business aspects of the numerous (estimated to be about 30 – 50 in number) large scale maize traders and processors that exist in Ghana.

Figure 22. The Business Aspects of a Large-Scale Maize Buyer and Processor

A large scale business in Ghana with a crop-cycle* turnover of 50,000 tonnes of maize is estimated to have turnover of between US $ 20 – 40 million. If the cost of the initial materials (maize at farm gate or landed-import price cost) are estimated at approximately 15 million the actual costs incurred in value adding and doing business (management costs, financing costs etc.) could be as much as $ 14 million. Although profits seem to be potentially high at an estimated $ 1 million a year, fluctuations in the price of the maize have been known to be commonly more than double in year where losses could be as much as $ 15 million in a year. Therefore the risk-cost factor can be far higher than the gains-potential in this type of business

*A crop cycle in this context is defined to be the buying of a crop, processing it and selling it, rather there being a number of crop harvests in a year.

4.3.4 A Summary of Efficiency Analysis at the Trading and Secondary Processing Levels

The following (Table 10.) details a comparison between the mark-ups and costs between grain traders in Africa and Asia

Table 10. A Comparison of the Combined Mark-ups and Costs between Grain Traders in Africa and Asia

<table>
<thead>
<tr>
<th></th>
<th>Estimated combined costs &amp; mark-up as % of final price</th>
<th>Estimated % of total profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer level of agricultural production</td>
<td>Negative 100% - + 400% of cost of production</td>
<td>40%</td>
</tr>
<tr>
<td>District bulker costs &amp; mark-up</td>
<td>4%</td>
<td>1 - 3 %</td>
</tr>
<tr>
<td>Inter region trader costs &amp; mark-up</td>
<td>19%</td>
<td>negative 100% - + 50%</td>
</tr>
<tr>
<td>Miller costs &amp; mark-up (when also trading the maize)</td>
<td>21%</td>
<td>10 - 30%</td>
</tr>
<tr>
<td>Retailer costs &amp; mark-up</td>
<td>25%</td>
<td>10 - 30%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Estimated combined costs &amp; mark-up as % of final price</th>
<th>Estimated % of total profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maize in Ghana</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rice in Cambodia51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated % of total profit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Estimated combined costs &amp; mark-up as % of final price</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

50 Based on calculations by the consultants
51 World Bank (2002) Rice Value Chain Study Cambodia

40
Whilst it has been recognized that rice trading in South East Asia is not always particularly profitable, the above illustration shows that the industry in Asia is generally a lot more competitive and the costs and mark-ups are a lot less as percentage. This results in a commodity with a retail price only 50 – 60% more than the farm gate price, despite the processes for rice are comparatively more costly than for maize (rice requires a more complex milling process) (whereas retail prices in Ghana are more than 60% above the farm-gate price [see Table 7. For details]). However, traders in South East Asia generally trade larger quantities than the quantities handled by persons in a similar position in the maize market chain, in Africa. This greater economy of scale allows for a minimum rate of income for the trader but at more competitive trading on a per tonne basis.

Furthermore, the current farm gate price of maize in Ghana in November 2008 has been reported to be 380 – 450 Cedis per bag (US $ 0.29 – 0.34 per Kg) when for example the farm gate price in South East Asia (Vietnam and Thailand respectively) at the same time was US $ 0.19 - 0.25 per Kg. This could also well be illustrating that the increased costs and mark-ups in Ghana are for the majority, due to high post-farm-gate costs and margins. See Section 6.

In summary the main inefficiencies in stages of trading and secondary processing stages have been found (in order of relevance) to be:

- Poor quality for sale at the farm-gate and sometimes trader levels
- Low quantities handled and in-efficient quantities of scale
- High risks and therefore high mark-up margins

\[^{52}\text{Public Ledger (November 3rd 2008)}\]
5. An Overall Assessment of Maize Quality and Efficiency of Production of the Value Chain

Inefficiencies have been observed in the value chain at various levels. A clear symptom of inefficiency (with probably a number of causes), is the price increases seen during the months of May – July each year (See Figure 1.) Between 2005 and 2007 the seasonal price differentiation ranged from approximately US $ 100 – 150, per tonne. With the overall seasonal price increase being approximately 30% more than the low season price. The causes of this price increase are probably broadly an insufficient supply during this period and possibly the year overall.

At the production level, Figure 28. (over page) illustrates (based on indicative calculations) how high levels of investment in inputs, larger quantities handled (larger quantities of fertilizer, seed, the final product, etc.) and mechanization, all lead to lower costs and a higher final yield. Farming activities in such a situation result in higher returns per hectare and higher profits per hectare.
<table>
<thead>
<tr>
<th>Country</th>
<th>Average Yield (tonnes per hectare)</th>
<th>Overall / Total Cost / Investment per hectare (estimated value of paid-out labour included)</th>
<th>Cost of Seed per hectare</th>
<th>Wholesale value on local market (2004 prices)</th>
<th>Current Return on Investment / Net Profit estimates (per hectare) at post farm gate prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>5.3</td>
<td>90 – 130</td>
<td>9 – 15</td>
<td>126</td>
<td>500 – 550</td>
</tr>
<tr>
<td>Argentina</td>
<td>4.8</td>
<td>80 – 140</td>
<td>9 – 15</td>
<td>112</td>
<td>360 – 410</td>
</tr>
<tr>
<td>Brazil</td>
<td>4.8</td>
<td>80 – 140</td>
<td>9 – 15</td>
<td>119</td>
<td>355 – 405</td>
</tr>
<tr>
<td>Ukraine</td>
<td>4.6</td>
<td>80 – 140</td>
<td>12 – 18</td>
<td>137</td>
<td>412 – 462</td>
</tr>
<tr>
<td>Thailand</td>
<td>3.8</td>
<td>60 – 200</td>
<td>12 – 18</td>
<td>147</td>
<td>342 – 392</td>
</tr>
<tr>
<td>India</td>
<td>3.6</td>
<td>60 – 200</td>
<td>12 – 18</td>
<td>146</td>
<td>295 – 320</td>
</tr>
<tr>
<td>South Africa</td>
<td>2.7</td>
<td>50 – 210</td>
<td>12 – 18</td>
<td>123</td>
<td>175 – 225</td>
</tr>
<tr>
<td>Kenya</td>
<td>1.5</td>
<td>40 – 220</td>
<td>20 – 30</td>
<td>225</td>
<td>175 – 225</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>1.6</td>
<td>40 – 220</td>
<td>20 – 30</td>
<td>142</td>
<td>65 – 115</td>
</tr>
<tr>
<td>Ghana</td>
<td>1.5</td>
<td>40 – 220</td>
<td>20 – 30</td>
<td>203</td>
<td>145 – 195</td>
</tr>
</tbody>
</table>

**Notes on data sources and nature of information:**

- Sources are numerous some of which were conflicting, therefore an approximate average has been provided. Cost of seed is given on an optimal rate of application.
- Without 'agricultural-risks' factored in

**Notes on the efficiency and competitiveness of each country:**

- High levels of investment, large areas of production and more effective economies of scale have made the sector more profitable and competitive. For example optimal levels of mechanisation is used.
- High levels of investment, large areas of production and more effective economies of scale have made the sector more profitable and competitive. Mechanisation is often used although labour costs are often lower than high-income countries.
- High levels of investment, large areas of production and more effective economies of scale have made the sector more profitable and competitive. Mechanisation is often used although labour costs are often lower than high-income countries.
- Has smaller production areas. Is a net importer of fertilizer. Is a net exporter of maize seed. Is a net exporter of maize. Small scale mechanisation is often used although labour costs are often lower than high-income countries.
- Has smaller production areas. Is a net importer of fertilizer. Is a net exporter of maize seed. Is a net exporter of maize. Small scale mechanisation is often used although labour costs are often lower than high-income countries.
- Has a mixture of small and large production areas. Is a net importer of fertilizer. Is a net exporter of maize seed. South Africa is one of the few significant African exports of maize and works hard to keep its prices competitive so that it can compete with other exporters of maize. Small scale mechanisation is often used although labour costs are often lower than high-income countries.
- Has mostly small production areas. Is a net importer of fertilizer. Is a net importer of maize seed. Mechanisation is rarely used due to the comparatively higher investment-cost of mechanisation. Kenya is a net importer of maize.
- Has mostly small production areas. Is a net importer of fertilizer. Is a net importer of maize seed. Mechanisation is rarely used due to the comparatively higher investment-cost of mechanisation. Due to its lower prices is a net exporter of maize.
- Has mostly small production areas. Is a net importer of fertilizer. Is a net importer of maize seed. Mechanisation is rarely used due to the comparatively higher investment-cost of mechanisation. Ghana is a net importer of maize.

**Notes on the efficiency and competitiveness of each country:**

- High levels of investment, large areas of production and more effective economies of scale have made the sector more profitable and competitive. For example optimal levels of mechanisation is used.
- High levels of investment, large areas of production and more effective economies of scale have made the sector more profitable and competitive. Mechanisation is often used although labour costs are often lower than high-income countries.
- Has smaller production areas. Is a net importer of fertilizer. Is a net exporter of maize seed. Is a net exporter of maize. Small scale mechanisation is often used although labour costs are often lower than high-income countries.
- Has a mixture of small and large production areas. Is a net importer of fertilizer. Is a net exporter of maize seed. South Africa is one of the few significant African exports of maize and works hard to keep its prices competitive so that it can compete with other exporters of maize. Small scale mechanisation is often used although labour costs are often lower than high-income countries.
- Has mostly small production areas. Is a net importer of fertilizer. Is a net importer of maize seed. Mechanisation is rarely used due to the comparatively higher investment-cost of mechanisation. Kenya is a net importer of maize.
- Has mostly small production areas. Is a net importer of fertilizer. Is a net importer of maize seed. Mechanisation is rarely used due to the comparatively higher investment-cost of mechanisation. Due to its lower prices is a net exporter of maize.
- Has mostly small production areas. Is a net importer of fertilizer. Is a net importer of maize seed. Mechanisation is rarely used due to the comparatively higher investment-cost of mechanisation. Ghana is a net importer of maize.
Based on the above indicative calculations, it can be concluded that where investment in attaining maximum yields occurs, resulting yields are higher, costs per hectare are lower, and the situation results in one where farmers receive a better return on their investment / profit per hectare. However, the cost-range becomes wider as a) the amount of investment necessary to attain full efficiency is higher due to a number of reasons (e.g. lower quantities used on each occasion, country is not a producer of fertilizer etc. i.e. Ghana, Kenya, Burkina Faso, etc.) b) due the high cost of optimal investment, less investment in the production of the crop is occurring, especially by the often larger numerous amounts of smaller farmers in the country. As a result, the profit of maize production becomes incrementally less profitable on a per hectare basis for countries where farmers have not invested in maize production and their quantities of production have remained uncompetitively low. Investment in the efficiency of production has a great deal of catching up to do, if ever the industry can become export-competitive again. Interventions that could possibly ease high post harvest costs are the greater use of storage facilities and an increased use of finance. However, the longer-term addressing of the causes is more likely to be related to the overall efficiency of the sector e.g. increased quantities and qualities (particularly at the farmer production level, efficiencies and mark-ups at trader levels, efficiencies and mark-ups at service-provision levels – results will start to be seen with a reduction of prices particularly at peak-price periods. Often the most effective way to improve competitiveness is firstly an increase in competition between the amount of services or the amount of a product provided which results secondarily in competition between the quality of products or services on the market.

5.1 Analysis and Discussion of the Efficiency of Interventions at Various Stages of the Maize Value Chain

Of a sample of farmers interviewed during this study, costs of production (including labour valued at a hired-in rate) were compared to the income from the sale of the final product and the resulting returns on investment (or profit margin) for the 73% of the farmers that found maize production profitable, incomes ranged from 115% to 445% of the costs of production. Those who were using improved seed only were getting yields of up-to 2.3 tonnes per hectare whereas some those who were also using fertilizer were getting yields of up-to 3.4 tonnes a hectare. Figure 24. (below) provides an overview of the overall impact of various levels of intervention.

Figure 24. A Comparative Summary of Estimations of the Overall Impact that Interventions can have at Various Levels of the Value Chain (cost of interventions not factored in).

<table>
<thead>
<tr>
<th>Stage of Value Chain</th>
<th>Potential for Efficiency Improvement at this stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved Seed and fertilizer use</td>
<td>150 - 250% increase in production</td>
</tr>
<tr>
<td>Harvest &amp; Post Harvest losses reduction</td>
<td>5 – 70% decrease in losses</td>
</tr>
<tr>
<td>Trading and Secondary Processing Level</td>
<td>0 – 50% decreases in mark-ups and costs – possibly</td>
</tr>
</tbody>
</table>

Note: The cost of interventions are not factored into the above, however, the cost of appropriate interventions at each level are estimated to not greatly differ at each level.

5.2 Analysis of Long-List of Relevant Interventions

The development of a basic product like maize does not likely require any new or complex approaches but is likely to require a mixture of fundamental activities that need to be conducted well, in an appropriately proportioned manner. In summary the main inefficiencies in the sector have been found as explained (Figure 25.)

Figure 25. Long-list of Constraints and Intervention Implications

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Possible Actions</th>
</tr>
</thead>
</table>
| Low levels of improved seed supply and use | • Conduct a more in-depth study of the demand and current supply of improved seed. Dissemination of the survey targeted at potential investors.  
• Specialist technical advice to seed producers e.g. in business aspects, business partnerships, advise to the companies on how to effectively respond to a market opportunity. |
| Low levels of fertilizer                 | • Dissemination of information to farmers on the                                 |

<table>
<thead>
<tr>
<th>Constraints / Recommended Nature of Providing Intervention</th>
<th>Potential Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business-stimulation aims could easily turn into business-subsidy actions and produce negative long-term results rather than positive ones.</td>
<td>High</td>
</tr>
<tr>
<td>Fertilizer subsidies are costly to the national</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>use</strong></td>
<td><strong>economic benefits of using fertilizer even when unsubsidized</strong></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Low investments in crop maintenance and weeding</strong></td>
<td>• Dissemination of information to farmers on the economic benefits of practicing effective weeding practices</td>
</tr>
<tr>
<td><strong>Mechanization costs high and low use of</strong></td>
<td>• Unlikely to be any actions where short-term results are seen.</td>
</tr>
<tr>
<td><strong>A lack of a full realization by farmers of the economic benefits from investing in improved inputs</strong></td>
<td>• Dissemination of information to farmers on the economic benefits of using improved inputs.</td>
</tr>
<tr>
<td><strong>High cost of providing services to numerous small scale farmers</strong></td>
<td>• Unlikely to be any actions where short-term results are seen.</td>
</tr>
<tr>
<td><strong>Farmers and small scale service providers being at a poor position to negotiate low costs</strong></td>
<td>Note: Few likely actions where short-term results can be seen.</td>
</tr>
<tr>
<td><strong>Lack of the realization of the benefits that can be gained from investing in quality and a lack of attention to detail by farmers in terms of attaining quality</strong></td>
<td>• Dissemination of information to farmers on the economic benefits of focusing on quality.</td>
</tr>
<tr>
<td><strong>Farmers invest in improved farmer-level storage methods</strong></td>
<td>• Demonstration and dissemination of information to farmers on the economic benefits of using improved storage (including fumigation) methods.</td>
</tr>
<tr>
<td><strong>A lack of a realization that farmers can sometimes benefit by working in groups</strong></td>
<td>• Dissemination of information to farmers on the economic benefits that can sometimes be realised of selling in bulk as a group and the learning that</td>
</tr>
</tbody>
</table>
can sometimes occur in a group. – 300 Cedis per acre, however, due to risk in production (drought, disease) this investment maybe lost approximately 20% of the time.

<table>
<thead>
<tr>
<th>Low quantities handled and inefficient quantities of scale</th>
<th>Dissemination of information to farmers on the economic benefits that can sometimes be realised of selling in bulk as a group and the learning that can sometimes occur in a group. Farmers should try to improve quantity of their product – group work maybe a means for attaining quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>High risks and therefore high mark-up margins at large scale trader / processor level.</td>
<td>Note: Very few likely actions are present where short-term results can be seen. The long-term might improve once efficiency and economies of scale improve. If medium and small-scale traders increased in their capacity and competitiveness with large scale traders; large scale traders may possibly become more competitive. Government policy making needs greater care to not have sometimes distortionary policies.</td>
</tr>
<tr>
<td>Overall the sector is inefficient and the price of the end product is uncompetitively high</td>
<td>Numerous contributory interventions that will improve efficiency from the agricultural production levels to the end-product levels. For example use of improved seed, better production practices (weeding etc.), increasing economies of scale, decreasing losses and making the sector more competitive.</td>
</tr>
</tbody>
</table>

Improving efficiency and economies of scale will involve numerous activities that all partly contribute to efficiency (e.g. improving yields, quality, quantities sold by farmers, efficiency and price of services to farmers, trading and the overall prices gained).

Improving efficiency and economies of scale will involve numerous activities that all partly contribute to efficiency (e.g. improving yields, quality, quantities sold by farmers, efficiency and price of services to farmers, trading and the overall prices gained).

High

High

High

With an average land size of less than one hectare and seed costing $23 – 30 per hectare, credit is not found to be a necessity especially at interest of an average of 25% and where the risk of lending to agriculture is often found to be high. The use of subsidized credit is not recommended for reasons of sustainability of the service and the sustainability of institutions offering the service.

Currently minimal levels of tillage are occurring in Ghana and other areas of investment into mechanization are also unlikely to result in increased incomes, given especially the small plots of land in which production is occurring. Mechanisation activities, more than those currently occurring (shelling, cleaning etc.), are not likely to have direct cost saving or an increase in financial returns; costs are only likely to increase if mechanisation is introduced for activities like harvesting or land preparation. Furthermore the capital cost or the operational cost (fuel etc.) is unlikely to realise a return (compared to the use of hand-labour) in these small-scale activities.

On the few occasions, Public Private Partnerships have been proven to occur successful in agricultural development, are where a highly integrated market is concerned and a clear return on the investment can be attained, especially by the private sector. Infrastructure that is commonly and directly required for maize production and domestic marketing, are roads, market places and to a degree storage. Investment by large-scale private sector is currently limited to and is only occurring at a minimal levels (e.g. private sector investing in farmer training, or inputs on credit, etc.) let alone anything at a more substantial level (e.g. roads, railways, etc.).

and leadership of the group can often be more costly and problematic than the benefits of being in a group. Group work is not necessary a solution in its self and not end to all problems.


55 A Public-Private Partnership (PPP) is defined as participation by the private sector (the for-profit or not-for-profit sectors) in the provision of infrastructure services in cases where, if left to the free market alone, such private participation would not occur because of the low returns on investment or the levels of risk involved, financial or non-financial.
maize sector does not have a highly integrated market chain and produce can be sold to a wide range of buyers at any time during the various stages. Unless, highly donor subsidised, it is unlikely the private sector is interested in joint investment partnerships in the maize chain in Ghana. When the private sector is interested, it is less in ‘public-good’ investments and more in ‘private-good’ assets where the returns on them can be better controlled (e.g. a road can be used by all, but a transportable piece of machinery can be hired out in more of controlled manner). If any joint investments are to occur in areas where a strong public benefit can be realized across the numerous small-scale farmer, efforts should be targeted towards areas where there is currently a lack of investment (not increasing competition for small traders who have already invested e.g. portable maize shelling machinery, etc.)

The approximately 10% of farms that are over 20 acres in size, for the majority have higher levels of investment in them on a per acre basis. As illustrated in this report, this production is resulting in a higher return per acre. The most effective link that there is between these small, medium and large scale farmers is the demonstration effect of the following:

- Large buyers buy only through middlemen and large buyers rarely communicate with small-scale farmers let alone invest directly into their production.
- For buyers who have the option of importing yellow maize, it is clearly not worth these companies investing in the improvement of small farmer production.

Therefore it is recommended that the project only works with companies that have a more direct relationship working with farmers and have proven their prior investment into small scale farmer production. In this regard, the working with micro and intermediary sized middlemen will be more appropriate although more difficult. Large companies are more easily seen due to their ‘larger-company–interface’ (size, logos, advertising etc.) and smaller companies will have to be sought out in terms of individual persons or the places in which they operate from (markets places etc.) In theory, more farmers can be impacted-upon through one large company at a time, whereas

56 JSA Consultants Ltd (2008) Rapid Reconnaissance Data Collection for Maize Market Chain Analysis For TIPCEE Project
57 During the field visit it was also noted that farmers consistently mentioned the need for Government to fix prices of maize. This appeared to be a cross-cutting concern in all the communities visited. However, the consultants believe that this concern is as result of the seasonal symptoms of price volatilities; which are a result of weak or an under-developed market integration in the value chain. To the farmers, the solution is very simplistic “GoG should just fix the problem as done in cocoa industry”. The root-causes are the inefficiencies of the industry, particularly at the production and post-harvest levels. The causes have been present over the long term, but have only been more pronounced in their exposure when there is a price rise or decline. These inefficiencies can substantially be addressed by reducing production cost and increase yields. Price fixing by GoG is not the solution.
fewer farmers can be communicated with when working with smaller companies. This in reality is not necessarily true as is illustrated in Figure 26. below.

**Figure 26. Development of the Rice Industry in Thailand through Inputs Dealers and Millers.**

During the 1980’s Thailand implemented strategies to develop its rice industry. Its industry now has developed to be the world’s largest exporter of rice, exporting approximately 45 % of its production with an annual value of approximately US $ 1,700 – 1,900 million. In the early 1980’s Government developed a broad strategy of development including the promotion via the private sector to provide sufficient inputs, information to inputs dealers who passed this information onto farmers and also information to millers and traders who also then worked more closely with farmers. Over approximately a 10 year period, rice yields have grown dramatically and the overall national output also increased. National poverty also dramatically decreased as a result of this.

When working with a number of companies, the less effective ones can be given less attention and the more effective more attention. Working with one company does not allow for a competitive approach between partner companies. Therefore, at least an initial dialogue with a number of potential companies is recommended.

First dialogue and the understanding of finite areas of opportunity for improving the efficiency of maize production or business activity should be developed. Secondly, opportunities where links of working more closely with farmers and where technical assistance can be given, should be developed. Joint intervention plans for working with each individual micro or intermediate entity should be developed and submitted to senior project management for approval.

In work that aims to promote the business aspects of a sector, a line is often confronted; a line that can be easily crossed from what is intended to be stimulating investment in an effective manner into a situation where an intervention is subsidizing investment. In this context, one will have to be cautious of this thin line whether an intervention is demonstrating effective practice or setting-up operational systems for private sector companies.

Any activities that aim to stimulate the supply of a business service or product, need to do so in a manner that incites further business investment and business activity. When a business realises the potential for a business activity or is given technical assistance to better conduct an activity, he or she will hopefully investment more into the business activity and supply more of the service or product. Where the business is subsidised to conduct an activity the business will often find the subsidy more attractive than the profit margin for conducting the actual business service.

Therefore it is recommended that any activities (for example are promoting an increased supply of improved seed), are of a ‘minimalist’ nature and involve initially activities of helping existing service businesses to better realise the market potential, and possibly technical assistance in specialist areas of seed production where such technical assistance is demanded for. The primary aim of stimulating investment by the business its-self should always be at the forefront. Since it has been reported that a number of companies are currently increasing their provision of seed (Wienco, Dizengoff, Pioneer Seeds and Alpha Seeds) a great deal more in this regard may not need to be conducted. However, if purely local production of seed is to occur, it may take some year to develop as the various levels of foundation and breeder seed all have to be grown.

Focusing more attention on the more progressive lead farmers as to improve upon efficiencies at the production and post-harvest levels, could well be considered for greater emphasis by TIPCEE. For example lead farmers who are investing the provision of services and the demonstration of best-practices to other farmers (see Figure 6.)
Improvements in agricultural and trade policy could well benefit the sector, especially in terms of making the sector more competitive\textsuperscript{58}.

In summary it is recommended that the project continues production enhancement (increasing farmer yields, farmer investment in inputs, etc.), moves where resources allow in the next year, towards quality improvement and a reduction of losses at post harvest and start some initial activities increasing the supply of improved seed.

\textsuperscript{58} Food and Agriculture Organisation (2005) Briefs On Import Surges
6. Summary of Recommendations

The main actions (some supplementary holistic actions can also have a positive effect e.g. institutional development etc.) that can be implemented in the short-term to address the above findings, the following are recommended.

that will most likely have the most impact, are recommended to be few in number, need to be constantly worked upon and are fundamental in nature. A project’s duration is better adjusted to suit a realistic amount of time of an intervention rather than an appropriate intervention being adjusted to suit a project-life cycle.

Overall, a consolidation of current activities is recommended. A focus on the development of quality of these activities is firstly recommended. In detail actions should include :-

**During the next 12 – 24 months**

The currently used ‘holistic’ approach of is encouraged for continuation, where ‘lead’ farmers are a essential medium of the approach.

**Agricultural Production Enhancement** – given that this intervention can generally result in the most effective increases in income for small scale farmers (see Section 4. for more detail), this intervention is encouraged to be continued and strengthened. In particular actions that will increase a market driven and sustainable supply of seed are recommended. The provision of information to current or potential investors of the un-met demand, the current of near future competition in seed supply or technical information on seed production should result in business investment-stimulating outcomes (e.g. a one-off promotion campaign to farmers encouraging the use of improved seed. Actions that directly subsidize a business’ operations, are not recommended.

**Post Harvest Losses Reduction** – losses have been observed as occurring between approximately 5 – 70% of the crop. A focus on improving specific areas of loss is recommended. For example, the increased use of fumigation has been observed as having significant a reduction in post-harvest losses compared to the costs. Also, some co-ordination and the introducing of some private sector initiated quality standards as well as some low cost improvements in storage methods and facilities, could both result in positive benefits. An integration of TIPCEE’s currently planned activities into further quality improvement activities, are recommended.

**Private Sector Linkages and Involvement** – this principle of this approach is one of the strengths of many more recent projects. This approach should be continued but with a re-newed caution and focus on partnerships with smaller companies who work in closer proximity to small-scale farmers.

To Summarise of this a set by set intervention process is detailed in Figure 27. on the following page.

**During the Short-Term and Longer Term**

In addition to the above activities, the following should be included in a longer-term project.

**Continue with the above Technical Approaches to Improve Yields (where found to be effective) and Scale Up** – These tangible actions are probably the most valuable of all since they are actually producing results and serve as an example of effective good practice.

**Competitiveness and Efficiency of the Sector** – Efficiency improvement is probably the most effective long-term goal where impacts are likely only to be felt in the long term. Currently in Ghana, the overall cost of production and the price of maize in Ghana are comparatively high. Intervention impacts are most likely to be seen after periods beyond the average project life of a USAID project (i.e. impacts are most likely to be seen after 5 – 15 years). An import substitution strategy is likely to be a long-term and complex goal but could be part of an overall strategy to
improve efficiency and competitiveness of the sector. In the long–term (beyond 5 years or more), Ghana could possibly become an intra West Africa exporter as a first step but any further goals would have to be very long-term.

**Institutional and Policy Development** – An overall National Maize Sector Development Strategy is recommended. In this document, realistic targets should be set for development particularly at the small-scale farmer level (yields improvements) and related policy and institutional development should be planned to occur. If the results are comprehensive and of significance, this strategy could also stand as an example for small-scale farmer development of other crops.

A summary of recommended step-by-step actions is provided in Figure 27. Below.

### Figure 27. Priority Actions of Farmers for the Development of the Maize Sector In Ghana.

<table>
<thead>
<tr>
<th>Step #</th>
<th>Action that will Benefit Farmers (by order of most benefit farmers and time-priority)</th>
<th>Recommended Support by Project</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Invest in using improving seed</td>
<td>Encourage investment by the private sector in supplying seed to meet the demand</td>
<td>Is the lowest cost improvement and can have the highest return.</td>
</tr>
<tr>
<td>2.</td>
<td>Adopt practices of planting in rows, weeding and applying fertilizer effectively</td>
<td>Train farmers to adopt good crop husbandry practices</td>
<td>To a non-labour-constrained family, has no or very little cost to implement</td>
</tr>
<tr>
<td>3.</td>
<td>Improve post-harvest handling practices (e.g. store in a dry area and fumigate stored product).</td>
<td>Train farmers to adopt good post harvest practices</td>
<td>To a non-labour-constrained family, has no or very little cost to implement</td>
</tr>
<tr>
<td>4.</td>
<td>Join a group and try to get group sell together in large quantity and negotiate a reasonable price.</td>
<td>Encourage small private sector to link with groups and explaining to the group how they supply quantity and quality in reliable manner. Encourage private sector to be reliable and reward such supply.</td>
<td>Can add to income increases</td>
</tr>
<tr>
<td>5.</td>
<td>(over the long-term) Invest in the improved income you have gained from previous crops (larger land area, more fertilizer etc.) and contribute to further improvements in the efficiency of the sector</td>
<td>Encourage further investment and as a result improvements in the efficiency of the sector</td>
<td>Can again add to income increases</td>
</tr>
</tbody>
</table>
7. Annexes

7.1 Annex 1. Definitions of Value, Supply and Market Chains

A range of definitions are as follows:

Value Chain

The value chain methodology is a tradition developed from two strains of literature: the business literature on strategy and organization of Porter and the literature of global commodity chains promoted by Gereffi and developed in numerous studies in the late 1990s. The “value chain” is defined by Kapinsky as “the full range of activities which are required to bring a product or service from conception, through the intermediary phases of production, delivery to final consumers, and final disposal after use.” Briefly, such analysis focuses on the interaction of actors along each step of the production system (from raw producer to consumer) as well as the linkages within each set of actors. Such an approach thus considers international trade relations as being part of a series of networks of producers, exporters, importers, and retailers, whereby knowledge and relationships are developed to gain access to markets and suppliers. As UNCTAD notes, such a perspective means that the success of developing countries in value-adding their production lies in the ability of these countries to access these networks.

The chain of activities gives the products more added value than the sum of added values of all activities. It is important not to mix the concept of the value chain with the costs occurring throughout the activities. A diamond cutter can be used as an example of the difference. The cutting activity may have a low cost, but the activity adds to much of the value of the end product, since a rough diamond is significantly less valuable than a cut diamond.

The objective of value chain analysis is to assign cost to various actions along the chain to better understand the cost of policy/regulatory and market function activities, as well as both technical and human resource related productivity actions.

Supply Chain

Supply chain management is often thought of as the efficient movement of material though a channel to the point of consumption. It encompasses the planning and management of activities spanning sourcing, conversion and logistics, and importantly includes coordination with channel partners – suppliers, intermediaries, service providers, customers.

Market Chain

The term market chain analysis merges the traditional value chain analysis with a supply chain approach by integrating supply and demand and understanding the cost structure involved along the channels. The market chain review seeks to understand each stage of production in relation to the market and to improve supply to the market with the desired product or service at the right price, in the right place, at the right time, in the right form, and at the

UNCTAD/DITC/COM/TM/1. Geneva, United Nations Conference on Trade and Development
right standard in an efficient, competitive manner that sustains both the producer and all those along the chain to final consumer.

Value and market chain analysis of maize sector looking deeply at numerous aspects of the chain with an analytical focus on efficiency at various stages. Seed sourcing, planting agronomy & crop maintenance, harvesting, market demand and market management will all be looked at. Issues such as farmer-price-risk, and low yields will be each thoroughly researched at the farmer level, an analysis of data collected will be conducted as will more subjective analysis based on farmer, trader and service-provider perceptions. Overall returns analysis will be conducted on maize production and marketing in various scenarios as will it with other comparative agri-income options in the geographical situation. Project intervention strategies will be devised and detailed, based on economically viable opportunities in the value chain.

7.2 Annex 2. Supplementary Statistical Data

Figure 28. Increases in Hectares Planted, Tonnes Produced and Calculated Yields of Maize in Ghana

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hectares Planted</td>
<td>996</td>
<td>1,015</td>
<td>1,015</td>
<td>1,013</td>
<td>938</td>
<td>1,400</td>
<td>1,269</td>
<td>1,158</td>
<td>1,171</td>
<td>1,169</td>
</tr>
<tr>
<td>Tonnes Produced</td>
<td>652</td>
<td>697</td>
<td>697</td>
<td>695</td>
<td>713</td>
<td>940</td>
<td>792</td>
<td>733</td>
<td>740</td>
<td>793</td>
</tr>
<tr>
<td>Average tonnes per Hectare</td>
<td>1.53</td>
<td>1.46</td>
<td>1.46</td>
<td>1.46</td>
<td>1.32</td>
<td>1.49</td>
<td>1.63</td>
<td>1.58</td>
<td>1.58</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Note: According to the above, starting with an average yield of 1.49 tonnes per hectare (1997 & 1998) yields have hardly increased over the 10 year period (average yield 1.53 tonnes per hectare 2001 – 2006 inclusive.)

Figure 29. Numerical Details of A Comparison Between Ghanaian Wholesale Prices\(^ {62}\) and Global Price\(^ {63}\)

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>JAN</td>
<td>FEB.</td>
<td>MAR</td>
<td>APR</td>
</tr>
<tr>
<td>Ghana 'Wholesale' price</td>
<td>227</td>
<td>249</td>
<td>279</td>
<td>333</td>
</tr>
<tr>
<td>US No. 3 CIF Europe</td>
<td>97.2</td>
<td>95.26</td>
<td>98.66</td>
<td>97.47</td>
</tr>
<tr>
<td></td>
<td>JAN</td>
<td>FEB.</td>
<td>MAR</td>
<td>APR</td>
</tr>
<tr>
<td>Ghana 'Wholesale' price</td>
<td>255</td>
<td>243</td>
<td>222</td>
<td>233</td>
</tr>
<tr>
<td>US No. 3 CIF Europe</td>
<td>108.9</td>
<td>101.7</td>
<td>108.2</td>
<td>114.1</td>
</tr>
<tr>
<td></td>
<td>JAN</td>
<td>FEB.</td>
<td>MAR</td>
<td>APR</td>
</tr>
<tr>
<td>Ghana 'Wholesale' price</td>
<td>207</td>
<td>223</td>
<td>236</td>
<td>254</td>
</tr>
<tr>
<td>US No. 3 CIF Europe</td>
<td>180.4</td>
<td>168.1</td>
<td>153</td>
<td>163.5</td>
</tr>
</tbody>
</table>

\(^{62}\) Statistics, Research and Information Directorate (SRID), MoFA (2006)
\(^{63}\) Public Ledger (2008)
<table>
<thead>
<tr>
<th>Year</th>
<th>Ghana 'Wholesale' price</th>
<th>2008</th>
<th>313</th>
<th>351</th>
<th>398</th>
<th>512</th>
<th>545</th>
<th>648</th>
<th>576</th>
<th>358</th>
</tr>
</thead>
<tbody>
<tr>
<td>US No. 3 CIF Europe</td>
<td>2008</td>
<td>231.1</td>
<td>233.8</td>
<td>249</td>
<td>246.1</td>
<td>311.3</td>
<td>239.2</td>
<td>222.3</td>
<td>231.1</td>
<td>200</td>
</tr>
</tbody>
</table>
7.3 Annex 3. Bibliography

Food and Agriculture Organization (2005) Fertilizer Use by Crop in Ghana
Hicks (2000). TechnoServe Inventory Credit Programme.
MoFA (2007a). Food and Agricultural Sector Development Policy II
MoFA (2007b). Beneficiary assessment of Agricultural Services Sub-sector Investment Programme
Nation Newspaper (1st September 2008)
Public Ledger (November 3rd 2008)
RATES Centre (2003) Maize Market Assessment and Baseline Study for Uganda
Centre for Regional Agricultural Trade Expansion Support
UNCTAD/DITC/COM/TM/1. Geneva, United Nations Conference on Trade and Development
World Bank (2002) Rice Value Chain Study Cambodia