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# VALUE CHAIN ANALYSIS (VCA) IN MALI: MILLET, SORGHUM, AND RICE

CEREAL VALUE CHAIN (CVC) PROJECT

**May 2014**

This publication was produced for review by the United States Agency for International Development. It was mainly written by Dr. Ahmad Jazayeri, CVC Project's Value Chain Competitiveness Director, in collaboration with CVC technical staff members.

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## **DISCLAIMER**

The author's views expressed in this publication do not necessarily reflect the views of the United States Agency for International Development or the United States Government.

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# LIST OF ACRONYMS

APO/OPA	Agricultural Producer Organization
ASSEMA	Association of Malian Seed Producers
BDS	Business Development Services
BEE	Business Enabling Environment
BNDA	National Agricultural Development Bank
CMDT	Malian Company for Textile/Cotton Development
CNS	National Seed Council
CRRA	Centre Régional de La Recherche Agricole
CVC	Cereal Value Chain Project
DNA	Direction National de l'Agriculture
DRA	Direction Régional de l'Agriculture
DUP	Deep Urea Placement
EAC/CPS-SDR	Enquête Agricole de Conjoncture/Cellule de Planification et Statistique – MOA
ECOWAS	Economic Community of West African States
FAO	Food and Agriculture Organization of the United Nations
FCFA	<i>Franc CFA</i>
FENTARA	<i>Fédération Nationale des Transformateurs des Produits Agroalimentaires</i>
FMD	Fertilizer Micro Dose
FEWS NET	Famine Early Warning Systems Network
FtF	Feed the Future
GAP	Good Agricultural Practices
GIZ	Gesellschaft für Internationale Zusammenarbeit
GMM	Grand Moulin du Sahel
GOM	Government of Mali
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IER	Institute d'Economie Rural (Institute of Rural Economics)
IFDC	International Fertilizer Development Center
IICEM	Integrated Initiatives for Economic Growth in Mali
INTSORMIL	The International Sorghum and Millet Collaborative Research Support Program
IRS	Intensive Rice System
M&E	Monitoring and Evaluation
MALIMARK	Mali Agricultural Marketing Trust
MDF	Moulin du Sahel
MOA	Ministry of Agriculture
NGO	Non-Governmental Organization
ON	Office du Niger
OPAM	Office des Produits Agricoles du Mali
ORM	Office du Riz Mopti
ORS	Office du Riz Ségou
P4P	Purchase for Progress
SOCAFON	Société Coopératives des Artisans et Forgerons de l'Office du Niger Société Faso Djigi (Fertilizer Importer)
SFD	
SMIL	Sorghum and Millet Innovation Lab
SMFM	Sell More For More (ACDI/VOCA Training Modules for Cooperatives)
SRI	System du Riz Intensifié
UCODAL	Unité de Transformation et de Conditionnement des Denrées Alimentaires
WFP	World Food Program

# EXECUTIVE SUMMARY

This report is an assessment of the sorghum, millet, and rice value chains in Mali under the Cereal Value Chain (CVC) Project. The report summarizes the current status of these value chains and asks some key questions that could be addressed over time under the CVC project.

## SORGHUM AND MILLET VALUE CHAIN

### END MARKET OPPORTUNITIES

Consumption of sorghum and millet are traditional staples in Mali but increasingly less important in urban areas with about 20% of the production reaching urban markets. Population growth and urbanization do not automatically translate into higher demand for sorghum and millet. Higher incomes of the urban population and the change in taste preferences of the younger generation (the majority of the Malian population) have brought about a significant substitution away from these cereals towards rice, wheat, maize, and potatoes. The market itself is narrow and it is based principally on demand for the untransformed grains. Annual variation of production is mostly driven by the climatic factors and not by demand factors as compared with rice and maize whose rapid expansion in the past 10 years are clearly demand driven. The sorghum and millet markets have little depth due to the limited extent of value addition activities mainly by small scale women operated processing factories and the absence of any large scale industrial processing of these cereals.

The principal market opportunities are in the areas of increasing the transactions between wholesalers and institutional buyers (mainly WFP), between wholesalers and foreign (mostly regional) markets, increasing the use of sorghum in animal feed, and improve processing capacity for easing food preparation through a better availability of cleaned and decorticated millet and sorghum grains and flour. There is a good opportunity to collaborate with WFP for establishing advance purchase contracts with links to productivity enhancements and improved marketing by farmer organizations. Regional export markets exist in Niger, Mauritania and Senegal. More market research could reveal additional market opportunities.

### UPGRADING TO MEET END MARKET OPPORTUNITIES

Improved contracting, especially forward sales contracts with producer organizations, for specified quantities at agreed upon market based prices is an important device for reducing market uncertainty and could enhance investments in the sector. Government policy towards exporters should become supportive for export to neighboring countries especially to Niger, Mauritania and Senegal where there is a demand to buy large quantities of these grains. WFP purchases from wholesalers could be used to ensure better prices for farmers and as encouragement to adopt improved technology packages. Improved storage and access to credit using the producer organizations can improve incentives by enabling the farmers to hold on to their crops to capture greater value as they sell later in the year, although price fluctuation has decreased over the recent years. The mechanism of warrantage (using the inventory as guarantee for credit) has been successfully used in a number of cases.

Post-harvest grain quality could be improved by using mechanical threshers as opposed to truck threshing methods. The bulk of sorghum and millet is threshed using a truck or a tractor driving over the cereals on bare ground without the use of tarpaulins with the result that the cereals for sale are full of sands and broken stalk, and unless cleaned again, unsuitable for large scale processing. To achieve this, medium term equipment credit facilities should be targeted at rural entrepreneurs operating a threshing business or alternatively farmer organizations who can finance and manage such equipment for their members. Farmer organizations may be encouraged to learn from their leading peers in this area. The use of guarantee funds for lowering the lender's risk in this area is important.

Value addition is possible by greater processing of these grains making them easier to prepare and use by urban households such as ready to use cleaned grains and flour. Improved post-harvest handling could better attract the large processors to increase their uptake of these cereals.

Once incentives are improved, interventions should respond to farmer demand for improved seeds and fertilizers. There is demand for productivity enhancement at farms that are producing increasingly for the market. Extension services using adult education methods could encourage the farmers to use higher yielding varieties and fertilizer. Improved seed varieties such as Toronion for millet (early maturing) and Tchiandogo for sorghum are available but not widely adopted. Producers need to increase the proportion of the crop that is marketed. Farmers need to be sensitized to raise production through an increase in the productivity of land (not through area expansion) by using improved certified seeds, fertilizer, improved water retention and soil conservation methods, and by better respecting the agricultural calendar.

Seed certification is a lengthy and expensive and must be streamlined with costs reduced. Market linkages between commercial seed companies such as Faso Kaba, and grain producers needs to be facilitated.

Feed production using sorghum and millet needs to be supported, and small to medium sized feed producers should be encouraged to source their raw material from millet and sorghum grain residues. Millet and sorghum bran are especially rich in proteins and vitamins and could easily substitute cotton seed for cattle and maize for poultry. Sorghum stalk can be used as a ready source of fiber which is required for the adequate digestive functioning of ruminants. Sorghum grains can be a partial substitute for maize in poultry feed.

## **CONSTRAINTS PREVENTING THE UPGRADINGS TO TAKE PLACE**

Wholesalers often have no formal contractual ties with farmers because of high transaction and information costs involved in such advance contracting methods. This creates marketing uncertainty. Poor access to finance and storage forces the farmers to sell most of their stocks at harvest time and wholesalers are the ones who have accumulated stocks during the year. Northern Mali (above Timbuctoo) is currently difficult to reach because of insecurity and this has cut a large market off for the wholesalers hence creating additional marketing difficulties. There are regional markets in Niger, Mauritania and Senegal, but due to government policy, exports are not allowed and only informal exports at high transaction costs can take place.

The cost of threshing machines (approximately \$5000 each) and the absence of credit facilities for such equipment is preventing the wider adoption of such machines which are needed for improving post-harvest quality. Tarpaulins are expensive and not easily available for use during truck threshing. In terms of processing, low volumes prevent women processors of grains into flour and ready mixes to achieve scale that can reduce their costs. Large processors have developed a perception that local grains have poor quality.

Fertilizer suppliers and banks consider these dry cereals as risky and highly susceptible to variation in rainfall. The financing for these crops must therefore be guaranteed from other income sources such as cotton. Farm level productivity has been stagnant at about 800 – 900 kg/ha for these cereals against a potential productivity of up to two to three tons/ha. The use of fertilizers with traditional seeds has not been adequately studied. Producers do not consider sorghum and millet as cash crops and do not regularly invest in improving productivity for these crops. Attempts to introduce improved high yielding varieties by IER and ICRISAT have had limited impact and have not acquired scale because of the poor market incentives facing the farmers. In Southern Mali, cotton prices and therefore area under cotton is inversely related to area under cereals and better cotton prices translates, at the margin, into less area under cereals. In Northern Mali, due to the better availability of land, the principal production expansion is achieved through an increase in area under cultivation and not through increase in yield or productivity per hectare.

Millet and sorghum are not considered as strategic crops by the government. As compared to the other main cereals, namely rice and maize, government agricultural policy has not been supportive of sorghum and millet that are not easily eligible to benefit from subsidized fertilizer or from extension. Farmers wishing to add chemical fertilizer to their sorghum and millet divert cotton, rice or maize fertilizer for use in sorghum and millet. The government justifies this exclusion due to the low yields and the poor response of traditional sorghum and millet seeds to fertilizer. Unofficial restrictions on exports of these cereals are due to legitimate concerns for national food security, and the absence of any financial support programs, has maintained both sorghum and millet as subsistence crops with few incentives for productivity growth.

## **RICE VALUE CHAIN**

### **END MARKET OPPORTUNITIES**

Rice has a strong end market and urban demand is increasing with income growth. Rice consumption has risen at 7.5% annually since 1995 and stands at 70 kg/head in urban areas. Urban consumers are consuming rice for lunch, and almost 45% of consumption is satisfied through imports. In 2013/2014, while rice production was 2.2 million tons, or 200,000 tons above the average of the previous five years, still over 180,000 tons of rice was imported acting as a barrier to the marketing of locally produced rice. There are different types of rice. Long, white, whole grain rice produced from Gambiaca is preferred although the bulk of local consumption is totally or partially broken rice. The premium domestic rice in 2014 is currently cheaper than the imported rice from Thailand and Vietnam. There is also demand for parboiled rice from neighboring countries. The key difference between local and imported rice is cleanliness and uniformity. The local consumers prefer the taste of the local rice although it requires a lot of washing and cleaning as compared to imported rice which is preferred for its relative ease of preparation although it is usually old rice treated with chemicals for long term storage. Local rice millers who produce quality small packaged rice are enjoying a fast growing market. Larger millers such as GMM, GMB, and GDCM need large and reliable supplies of paddy each season. They are the same enterprises that are importing large quantities of rice from Vietnam, Thailand, Pakistan, and Brazil. The principal end market opportunity is to substitute imported rice by improving the quality, the cleanliness, and the packaging of locally produced rice. There is also a market for exporting parboiled rice to the neighboring countries.

### **UPGRADING TO MEET THE END MARKET OPPORTUNITIES**

Given the large and developing market for rice, the upgrading recommendations are first, to improve cleanliness and consistency of white rice that is offered to the market. This could make the local rice more competitive with imported rice and make the consumers, who already prefer the taste and freshness of local rice, to purchase more local rice. This can only be done by a greater channeling of local rice to medium and large industrial hullers and away from the small scale mobile hullers that produce poor quality white rice. In addition, there is need to develop local rice brands with attractive packaging.

Second, there is need to ensure a timely supply of improved and certified seeds and appropriate fertilizer mixes that correspond to actual soil deficiencies. The mini-rizerie (medium size rice hullers) can act as intermediaries between fertilizer wholesalers and the producer organizations by providing credit in kind and receiving paddy for credit repayment. By increasing the share of the mini-rizerie with their superior hulling capacity and outturn, the quality of the locally hulled rice can improve hence enabling the producers to better compete with imports.

To ensure access to credit by producer organizations, banks are calling for extension services that can accompany the farmers in credit application and credit uses such that any release of the fertilizer stocks would effectively go towards rice production and the POs meet their credit obligations.

Third, there is need to continue introducing improved practices in the rice sector such as the rice intensification system and other Good Agricultural Practices (GAP). Rice intensification system packages including SRI are available and can be diffused among producers even under valley bottom semi-controlled conditions. Rice production in valley bottoms offers an important opportunity to help women farmers increase their income and nutritional level. High performing varieties such as Gambiaca, BG 90, and Adny 11 are available and widely used. New varieties such as SK 90 and WAS need to be further tested before widespread distribution. The WASA variety that distributed by q previous USQID project is highly zo;en producers but

Seed availability needs a better organization of the seed market and improvement in the certification process. National and regional seed market days and fairs are important for putting the seed producers associations, commercial seed companies, and buyers/farmer organizations in contact with each other. Seed certification laboratories must be decentralized so as to become more accessible.

The capacity of the public sector structures such as the Office du Riz Mopti (ORM) and Direction Regional de l'Agriculture (DRA) need to be strengthened. These structures have the required contacts and field presence and can be effective as extension partners for technology diffusion.

Rice residues especially rice bran is a major source of nutrition and protein for mixing in animal feed. The rice sector must get better organized for commercializing the rice bran for animal feed.

Farmer organizations, usually cooperatives, vary in terms of solidarity, governance and management capacity. The existing producer organizations have shown their usefulness to members using the services but a large percentage of the members are inactive and need to be encouraged to participate more effectively. Particular focus and customized training is needed to attract female members. Most women's groups involved in valley bottom rice production are reliant on a male secretary or advisor for day to day financial management. This is because of very low literacy rates amongst women in Mali. An adult literacy program targeted at women rice producer groups is urgently needed to strengthen these producer organizations.

## **CONSTRAINTS PREVENTING THE UPGRADING TO TAKE PLACE**

The constraint to improving the quality of local rice for making it more competitive with imported rice is first and foremost related to poor post-harvest processing of paddy caused by the use of small and inefficient mobile hullers that are prevalent in the ON area.

The second constraint in making local rice competitive is due to the absence of adequate packaging knowledge, packaging material, and packaging machinery. Local rice is rarely presented in small packages. Most retailers sell local rice from opened 75 kg bags and the customer cannot have confidence in buying open rice with no name, weight, and characteristics.

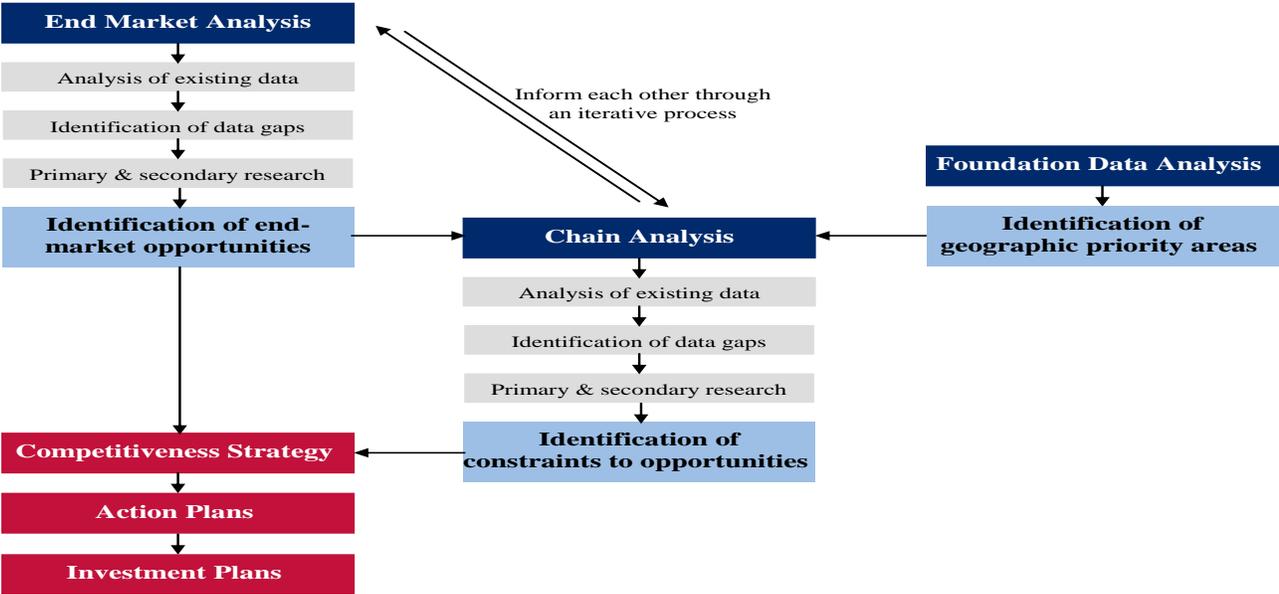
The principal constraint in increasing rice production depends on the type of production system. In the ON area, the area under production is limited by the size of the perimeters under irrigation and only higher yields through improved GAP and better yielding varieties can increase production. In inundated areas, the main constraint is the absence of adequate water control and the need for the river floods and the rains to coincide to ensure an adequate yield. In valley bottoms in Sikasso, managed by women groups, the main constraint is ploughing and timely access to ploughing equipment.

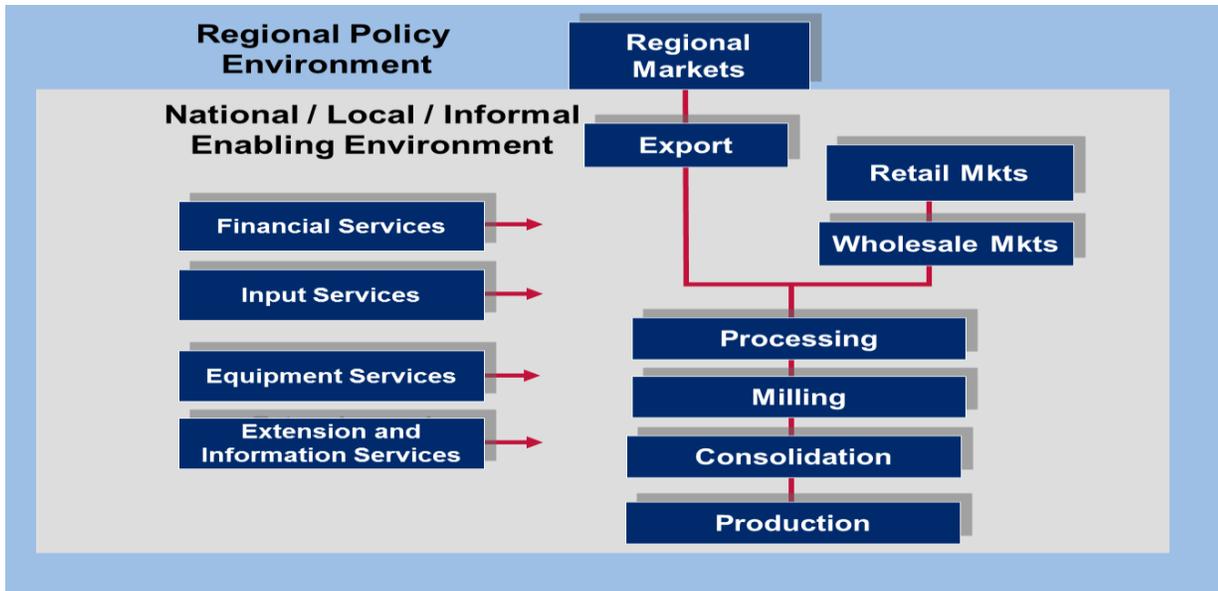
The main constraint to enable the mini-rizerie to provide credit in-kind to POs is poor financial planning and the non-availability of business plans and cash flows of their client POs. The main constraint for access is finance for purchasing the thresher and the diesel engine, plus its maintenance.

The principal government support to the rice sector is through the fertilizer subsidy which in turn has distorted the fertilizer market by restricting the supply to three large companies with links to the government. This policy has had the effect of reducing the prices paid to growers at the start of the season and increasing prices to consumers later on. Uncertainties in the market for Malian rice brought about by the government’s uncontrolled rice imports have lowered the flow of investments to the rice sector. Such tax free imports are designed to prevent high prices in urban areas. The strategy of warrantage at producer level can only be effective if the government policy is harmonized behind it. A supportive government trade policy is critical for enabling the expansion of production and yield enhancement in cereals. Emergency imports of cereals only dampen prices temporarily and may act as a disincentive to farmers.

# INTRODUCTION AND OBJECTIVES

This document presents a Value Chain Assessment (VCA) for rice, sorghum and millet in Mali. The value chain approach advocates “understanding a market system in its totality: the firms that operate within an industry—from input suppliers to end market buyers; the support markets that provide technical, business and financial services to the industry; and the business environment in which the industry operates” (Campbell, 2008). Value chain analysis considers the entirety of value creation activities that brings a product from the field to the table. End market determines the value created by an industry which is negotiated and shared all the way down the chain. The value chain may be defined as the series of actors and activities needed to bring a product (or service) from production to the final consumer. The following framework summarizes the VC approach.





The objectives of the report are to:

- a. Describe and analyze the opportunities in the sorghum, millet and rice end markets, how the market is supplied through the wholesalers, farmer organizations, local dealers, producers, and the suppliers of inputs, the factor conditions and endowments impacting the use and availability of resources, demand conditions, supporting industries and the policy environment shaping the playing field for competition of the value chain actors.
- b. Identify upgrading to meet market opportunities including market development and the components for developing a competitive sorghum, millet and rice industry in Mali.
- c. Highlight the constraints that prevent the upgrading to take place.

The report includes gender and poverty alleviation considerations including an assessment of the activities and locational factors and constraints related to women producers.

## I. LOCATION, DEMOGRAPHICS, AND AGRICULTURE

Mali is a landlocked country in West Africa bordering by seven countries namely Mauritania in the West, Algeria to the North, Burkina Faso and Niger to the West, and Senegal, Guinea and Cote d'Ivoire to the South. The land area is 1,240,000 sq. km with 7,240 km of borders (about twice the size of the State of Texas in the US). The country has an estimated population of 17 million (2014) with 2/3 of the population below 24 years of age and a median age of 16. About 35% of the population lives in urban areas and the annual urban population growth for 2010-2015 is estimated at 4.8% or 1.8% above the average population growth rate 3.01% (INSTAT, 2014).

Growth in urbanization in Mali is lower than in Burkina Faso and Niger, both with lower percentage of urban population in total population, but higher than Guinea and Senegal which have higher percentages of urban population. Generally, there is a negative correlation between urbanization defined as the growth in the percentage of urban population and the percentage of urban population in the total population. Considering this correlation, urbanization rate in Mali is similar to the neighboring countries. Mali, after Afghanistan, has the highest infant mortality rate in the world: 106.9 death /1000 births. Literacy rate is estimated at 43 % for male and 24% for female (Mali Country Fact Book, CIA).

Mali is the 25<sup>th</sup> poorest country in the world with an economy dependent on gold mining, raw cotton exports and livestock exports for foreign exchange revenues. GDP in 2012 was estimated at \$10.2 billion (\$637 per capita) of which exports constituted 26.5% (\$2.8 billion). The country was in recession in 2012 but it has now recovered.

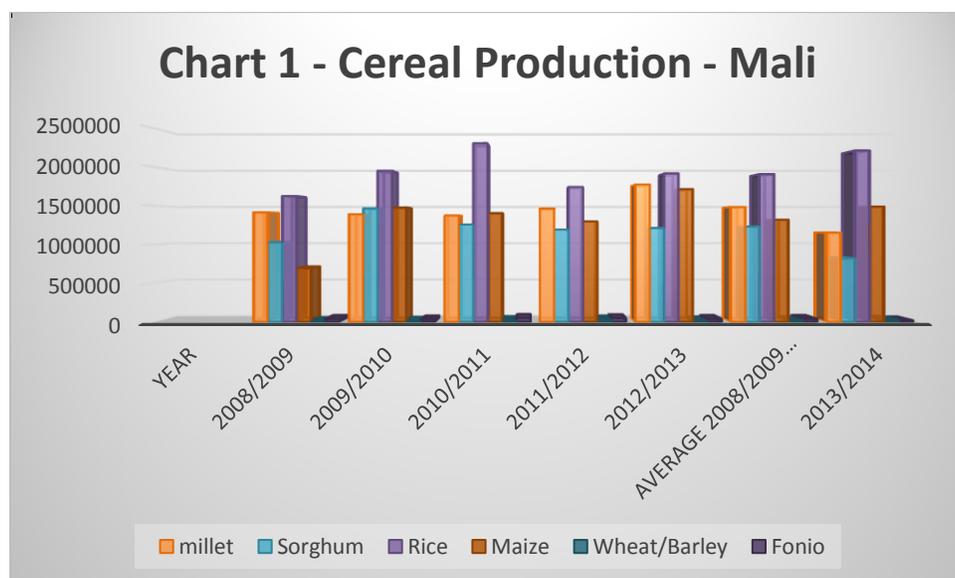
**Table 1 – GDP Growth**

Item	2011	2012	2013 est.	2014 for.
GDP Growth %	2.7	-1.2	4.0	5.2
CPI Inflation %	3.0	5.3	2.9	3.3

*Country Data, World Bank, 2014*

Agriculture is the largest sector in the economy employing 65% of the population and producing 40% of the GDP (CIA Fact Book, 2014, Mali). The principal agricultural crops are cotton, rice, pearl millet), maize, and sorghum, followed by vegetables, pulses, peanuts, and fruits, in addition to livestock such as cattle, sheep, and goats. The most important cereal crop in terms of volume of production is rice followed by millet, maize, and sorghum. Millet and sorghum play a major role in the Malian diet in rural areas although in the urban areas rice is the predominant staple food. Taking the average from 2008 to 2013 for millet and sorghum combined<sup>1</sup>, these cereals represented 71 % of the area under cereals and 45% of the volume of cereal production. For the same period, rice covered 15 % of the area under cereals and 32% of the volume of production (EAC/CPS-SDR, 2014).

The diagram below provides the latest information on the volume cereal production trends in Mali available from the MoA.



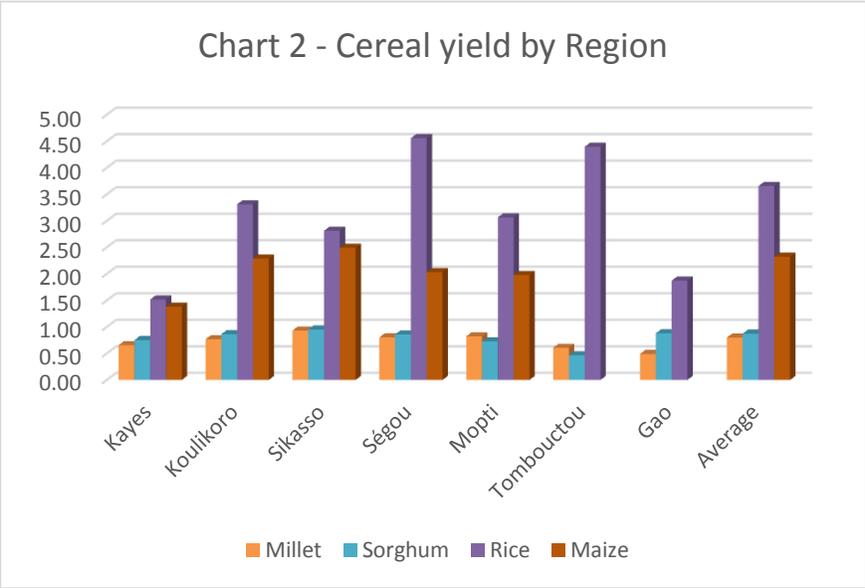
*Source: EAC/CPS-SDR, p. 11*

<sup>1</sup> - Technically speaking, there is large millet and small millet. Sorghum is a large millet, while what is known as millet, is a small millet. In Mali, farmers correctly refer to sorghum as “gros mil” and millet is called “petit mil” (Fuller and Weber, 2006). Fonio and Tef are also millets (FAO, Post-Harvest Compendium, 2001). In this study the term millet and sorghum refer to all millet varieties Mali. It is hoped that the CVC project could also support Fonio for which has a vibrant and growing commercial market in Mali.

Rice producers in Mali use a variety of production systems which include: (i) large-scale, gravity-fed systems with full water control in the ON zone and smaller fully controlled systems around the Baguinéda and Selingué dams; (ii) Small-scale irrigated perimeters using diesel pumps that pull water from the Niger River located mainly in the Tombouctou and Mopti Regions; (iii) Uncontrolled flooding systems through the rising river water most prevalent around Mopti and Ségou; (iv) Traditional uncontrolled planting on riverside flood plains, (v) Rain-fed valley-bottom rice with small-scale water retention structures in lowlands based in the cotton belt, an entirely female activity, (vi) Rain-fed rice on upland areas where rainfall exceeds 800 to 1,100 mm/year in the cotton belt, Sikasso Region, and in Kayes and Koulikoro. The constraints to increased rice production depend on the type of production system: access to equipment such as plows, access to fertilizer, access to seeds, water management and control, and understanding of the agricultural calendar (technical advice and extension).

Average annual production between 2008 and 2013 was 1.9 million tons. Rice yields rose from 1 ton per ha in the 1980s to over 3.6 tons/ha in 2014 (CPS-SDR). Average area per farmer has declined from 7 ha to 3 ha per farmer (FAO, 2013), and about 30 - 40% of the rice produced is brought to the market (IICEM estimate, Rice Value Chain, 2011) and the remainder is kept for family consumption.

Diminishing soil fertility and climate change are significant negative factors in the ability of farmers to expand production. Climate change has resulted in shifting rainfall patterns and drought, which has increased risks and has obliged many producers to sell assets such as livestock to survive. In turn, there is reduced availability of manure and animal traction resulting in further declines in yields. Malian farmers have traditionally maintained soil fertility by using manure from their own livestock. With a rapidly growing population and poor access to modern inputs (both in terms of availability and price), farmers have been expanding area under cultivation bringing more and more marginal lands under production and reducing or eliminating the fallow period with increasingly negative and unsustainable environmental consequences such as reduced tree, pasture and vegetative cover, increased water and wind soil erosion, reduced soil fertility and desertification.



Source: calculated from production and area figures in EAC/CPS-SDR

The chart above reveals the productivity of various cereals produced in Mali. Rice has made most progress largely due to water control, improved seeds, the use of subsidized fertilizers reaching an average productivity of 3.6 tons/ha with Ségou (ON) having the highest yields (4.5 tons/ha), and above all, a ready end market. Maize is in second place with

an average yield of 2.3 tons/ha with Sikasso having the highest yield (2.5 tons/ha). Maize also benefits to some extent from improved varieties and fertilizer with a good end market especially in the poultry sector. Sorghum, millet and fonio have the lowest cereal yields of 0.87 tons/ha for sorghum and 0.80 tons/ha for millet, with Sikasso having an above average yield of 0.95 tons/ha for sorghum and 0.93 tons for millet.

## **II. SORGHUM AND MILLET VALUE CHAIN**

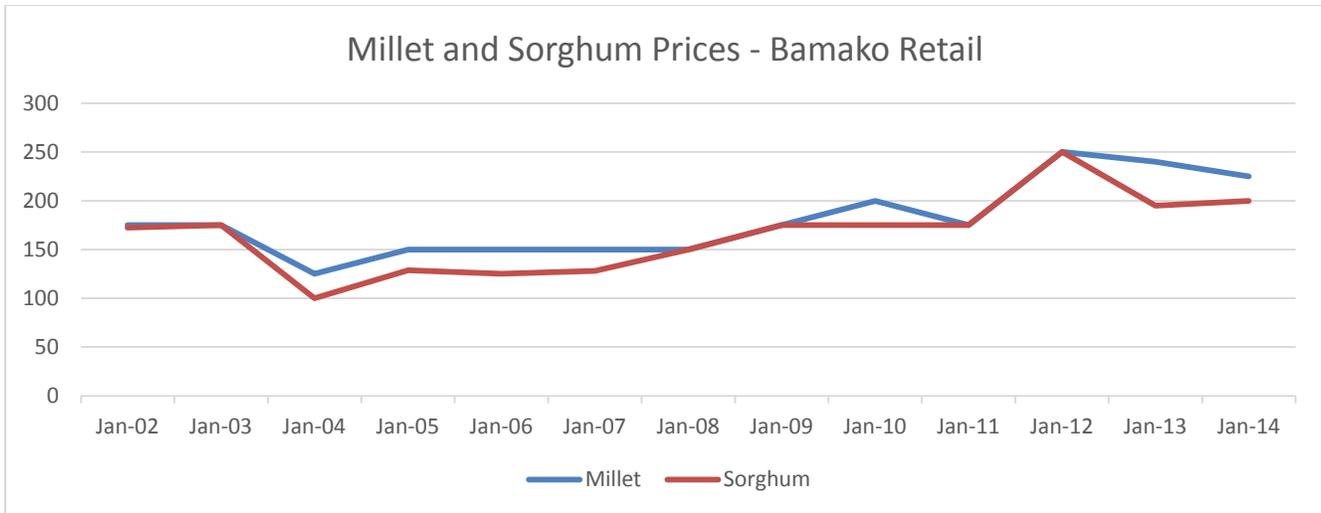
### **END MARKET OPPORTUNITIES AND CONSTRAINTS**

The urban population (35%) is approximately 6 million growing at 4.8% per year. The urban demand is not only from existing major urban centers such as Bamako and regional capitals, but also from many newly emerging towns with 10,000 or more inhabitants (Denis et al, 2008). The principal use of these cereals is for direct consumption by households as the quantities processed commercially are very small. Most Malians in urban areas consume millet/sorghum porridge or paste (tôt) at night. The three dry cereals (maize, sorghum and millet) represent 70 percent of consumers' cereal needs at 70kg/head and the rest is rice and wheat with a small percentage of fonio. Recent studies and work by INTSORMIL have shown additional possibilities for processed sorghum. Animal feed is a major area that has been rather neglected but offers a huge potential. Sorghum is well suited for poultry feed, and the stalks can be used as fillers. The pearl millet bran is low in mineral matter like that of sorghum, but it is remarkably rich in protein (17.1 percent) and is sold by women for animal feed. Sorghum and millet have nutritional advantages over rice and wheat. Sorghum has a lower evacuation rate from the stomach and can keep hunger away much longer as compared to rice and wheat. The average production of millet and sorghum over the past five years in Mali was 2.6 million tons and about 20% reaches urban markets (source: ECA/CPS-DCR, 2014, p. 13).

The urban market for millet and sorghum consists of non-decorticated or decorticated cereals requiring considerable preparation before consumption. Both millet and sorghum must be first decorticated, then cleaned, washed, milled into flour, and then transformed into a paste, or transformed into couscous or other local preparations requiring a significant amount of the women's time as compared to white rice that only needs to be cooked in water or maize that is already in flour form and needs some hot water to be ready, or a baguette bread that is ready to eat. The absence of ready-made products and the difficulties of preparation are a major constraint to end market demand for these cereals. Due to the absence of reliable supply and quality, none of the larger millers are interested in producing sorghum or millet flour for large scale distribution. Local brewers do not use locally produced sorghum because of quality and supply issues.

### **PRICES**

Millet and sorghum prices for the period 2002 to 2014 are presented below. Average prices for both cereals had been fairly stable from 2002 to 2008. In 2012 there was a price rise due to the general inflation brought about through the devaluation of CFA. Average millet price has been fluctuating around 180 FCFA per kg while average sorghum prices were 165.

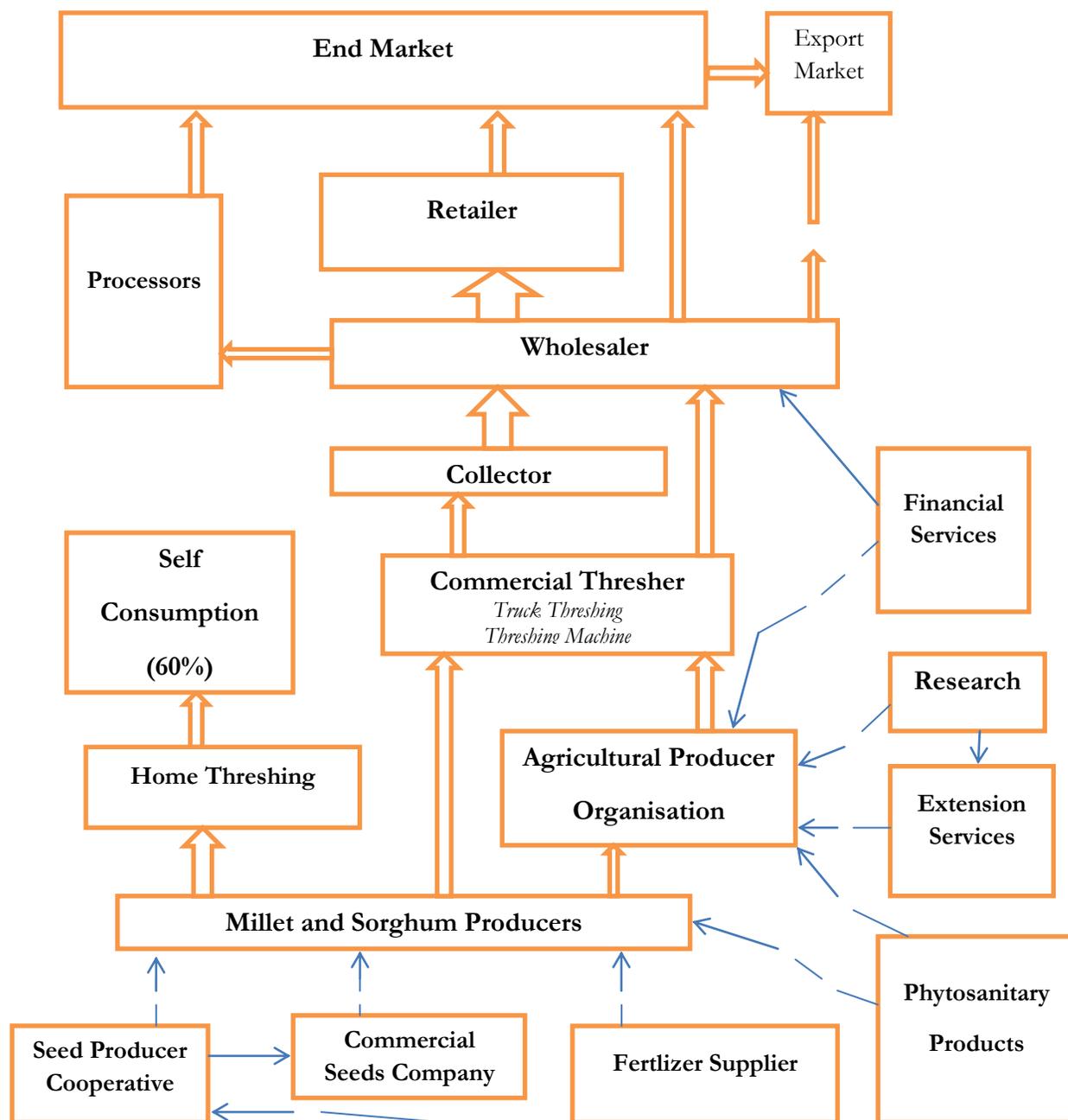


The Ségou market is the main millet aggregation center in Mali, and there are three periods in the price fluctuation of millet (sorghum follows closely). The average price over the past 5 years has been about FCFA 200/kg in the aggregation centers such as Ségou, Sikasso, and Mopti. Starting from the main harvest period in October/November, prices start falling and reach their lowest point in December to February. Traditionally, and starting from March, the prices start climbing up slowly to reach their high in August when the supplies are short (FCFA 250/kg for millet and FCFA 220/kg for sorghum). From September, when the farmers have a clear picture of the coming crop, old stock is sold before the new harvest enters the market and this is the reason for decline in prices before the harvest. (FCFA 200/kg for millet and FCFA 150/kg for sorghum) until April when the prices start climbing again (Source: FEWESNET, Mali Price Bulletin, March 2014). Sorghum in Sikasso and millet in Mopti (Pays Dogon) are the food security crops par excellence. Farmers can sell the rice, cotton and even livestock for cash, but sorghum and millet are the foundation for food security and the surplus is sold at harvest while any other amount is only sold slowly for cash needs after ensuring a sufficient supply at home. Based on OMA price data, the price fluctuation has diminished over the past five years.

OPAM, which is the government's arm for storage of cereal stocks, buys and stores these cereals to ensure food security. OPAM currently has a stock of 70,000 tons. WFP through international donations is also a major buyer of millet. WFP buys about 25,000 tons of sorghum and millet per year directly from individual wholesalers or from producer cooperative unions.

There are seasonal shortfalls of these cereals. There are also emergency donations in times of shortages. During the period of high prices, the government may issue permits for official tax free importation of these cereals especially as donations. During 2012/2013, Mali imported 4000 MT of millet, because of a 30% decline in production due to late rains and early stoppage of rains, which was used for humanitarian aid. Locally produced sorghum and millet are sold to collectors or to wholesalers both individually and through producer organizations. The principal buyers of sorghum and millet can be divided into the following groups: collectors, wholesalers, institutional buyers, and retailers before reaching the final consumer.

## Value Chain Map for Millet and Sorghum



## POST-HARVEST AND PROCESSING

Post-harvest handling is critical to ensure grain quality in terms of grain size, uniformity, purity, taste, odor, moisture content and above all, consistency. There are two stages in the processing of millet and sorghum. First is the threshing stage, where the grains are separated from the stalk. The second stage is the further transformation through decortication and milling into flour. Threshing can be done manually or by using a truck or tractor to run over the grains or by using threshing a machine. Manual threshing is tedious and labor intensive with low productivity. Truck threshing is much faster and more common, but the disadvantage is that the grains are often broken. Since the grains are spread on the ground, the final product is very dirty and mixed with small sand and stones with up to 20% impurities. The mechanical method using a truck or tractor is done during the harvesting season by individuals who own or rent these vehicles and are paid 1 bag for every 10 bags threshed. This is a seasonal business. Subsequent to threshing, winnowing or removing the husk is done manually by women.

The use of threshing machines, which are rarely available, would reduce post-harvest losses and result in improved quality and provide labor savings. Mechanical threshing is done by men. Threshing machines do in a few hours what is manually done in one week, which is the labor saving aspect. Wholesalers pay higher premiums for mechanically threshed millet and sorghum because it has fewer broken grains and fewer impurities in terms of sand and stones. The current FAO estimate for post-harvest losses in sorghum and millet is 15% of which 1/3 is due to poor threshing methods. By using a mechanical thresher, the post-harvest loss could be reduced to about 10% in addition to the major benefit is in quality improvements and labor saving. The main quality issues in sorghum-millet are cleanliness, grain size, and consistency. Impurities are the result of poor threshing methods, inadequate storage, and the absence of any controls over grain quality. The threshing machines are owned by individuals or cooperatives (donated by projects)<sup>2</sup>.

## DE-HULLERS AND MILLERS

After threshing, the principal processing for millet and sorghum is decortication, washing, drying, and milling to produce flour. The mills are operated by small entrepreneurs that operate as small businesses. These mills are busy most of the year since millet and sorghum is consumed and sold gradually throughout the year. Semi-industrial processing is dominated by female private entrepreneurs in urban areas who are mostly self-financed. They use equipment of medium capacity (usually a hammer mill) and the products are packaged. These enterprises are based in Bamako and include Danaya Cereals, UCODAL, Dado Production, and MAM COCKTAIL. Clients include grocery stores, individuals, and niche export markets. Due to quality issues, large firms, like Moulin de Sahel and Grand Moulin du Mali, who are also large scale grain importers, concentrate on maize and rice for domestic needs. The absence of large scale processors for transforming these cereals into quality flour is a major constraint on value creation and the expansion of demand

## BUYERS

**WHOLESALERS** – Wholesalers buy through the collectors whom they finance on a daily basis, there are major storage warehouses spread throughout the country, as well as in Bamako. Wholesalers reach agreement with the collectors about cereal quality and price levels on a daily basis. The collector's margin for sorghum and millet of about FCFA 10/kg is the difference between what wholesalers pay the farmers and what farmers charge the wholesaler (Fall, A., 2011). About 2/3 of the wholesalers have their own established network of collectors. Most wholesalers appear to be

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<sup>2</sup> - No information could be found on the volume of millet or sorghum that is threshed mechanically as compared to the truck method or the manual method.

self-financed, although they may get access to credit by mortgaging land or homes. Wholesalers use written contracts with their customers but work with the collectors using mostly oral agreement and trust. Wholesalers use their personal networks for purchases, and deal with repeat customers who are retailers and institutional buyers. The typical wholesaler has an average turnover of 800 MT to 1,000 MT per year. A wholesaler on average can spend between FCFA 100 million to FCFA 150 million per year for purchasing millet and sorghum and has operating costs of about FCFA 500,000 to FCFA 1,000,000. His net margin is around FCFA 20-25/kg for millet and slightly higher for sorghum (as per information collected during field visits) no women are involved as collectors. Sorghum margins are slightly higher because the purchase price for sorghum and millet are almost the same but sorghum fetches a higher price in the end market as compared to millet. The wholesalers also supply the institutional markets such as OPAM and PAM. Wholesalers have the highest margin in the marketing chain (*Sorghum and Millet Value Chain, IICEM, 2012*).

Under the previous USAID/Mali funded IICEM project, collectors and producer organizations worked together under contracts that established the forward price (seven months in advance of harvest). A quality premium of 10% was also agreed and added to the final price. The contract was not a binding sales contract but only an indicative agreement which established a reference price and facilitated the final sale.

**COLLECTORS/AGGREGATORS** – During the harvest season, collectors buy on average 2 tons of cereals. During the off-season, collection is reduced to about two tons per week. Collectors’ purchases are financed by wholesalers. The cost for purchasing and regrouping these cereals represents over 90% of the collector’s cost, transport takes 6% and other costs include bagging (which is the responsibility of the collector), day storage at the market, market tax, and longer storage before sale or transfer to the wholesaler. The collector’s varies between 8 to 12 FCFA per kg (*Fall, A., 011*).

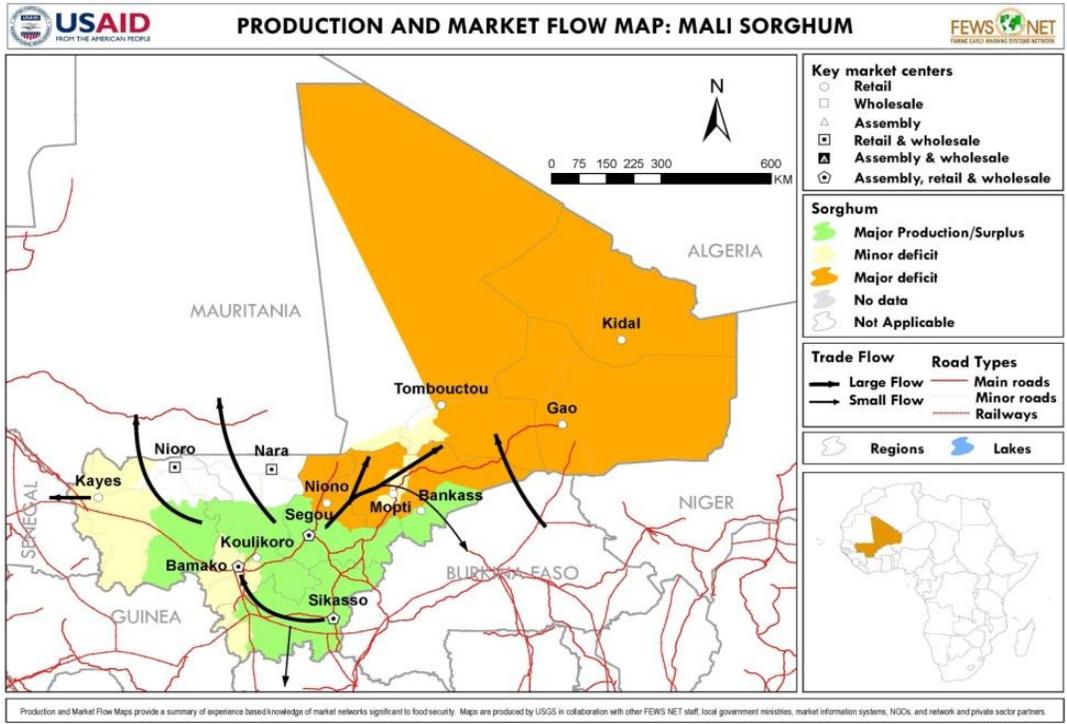
**Chart 3 - Margins in millet and sorghum**

Analysis of percentage value in each level of the value chain for millet is presented below.

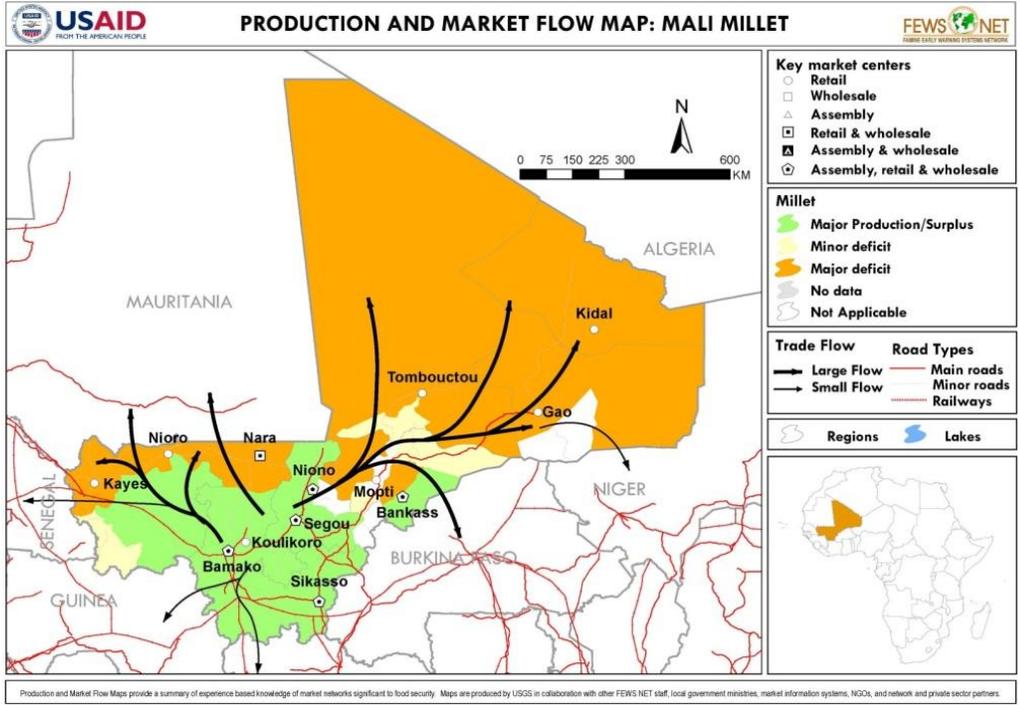


Source: Fall, 2011 updated by market interviews

The above margins are based on the purchase price of FCFA 125 per kg offered by the collectors to the farmers. This price can be even lower if it is paid in advance of the crop. The collectors work on behalf of wholesalers who sell the grain throughout the year on an average price of FCFA 175 to FCFA 200/kg. Retailers sell at FCFA 260/kg. The entire value created is, therefore, the end market value of FCFA 300/kg—which is divided according to the percentages shown above (*Source: field discussion with wholesalers*). The division of value favors the wholesalers and the retailers while the producers receive, at best, 50% of the actual value. This in part explains the disincentive created by this unequal division of value due to a somewhat oligopolistic structure of the market dominated by several crop wholesalers who buy the entire surplus for sale just before or during the harvest and stock the grains, hence reaping the benefits from price rises later in the season. The low prices received by the farmers can partly explain the low level of investments by the farmers for producing sorghum and millet.



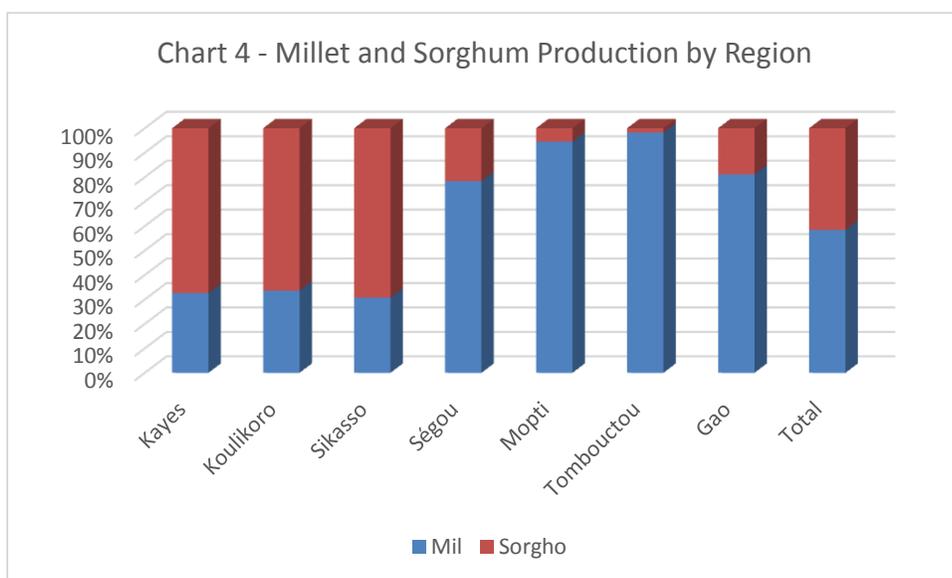
Sorghum is principally produced in the Sikasso/Koutiala regions. The main flows are from Sikasso to Bamako and to Ségou for further export to the North the West and to the neighboring countries.



## PRODUCERS

Sorghum and millet are rain-fed crops produced primarily for farmer’s own consumption and only the surplus over and above the family requirement (about 40% of the annual crop) is sold. In terms of commercial importance, sorghum and millet represent about five percent of the GDP and 15 percent of consumption. Both cereals are adapted to low rainfall and poor soil conditions of the Sahel with yields at around 800/900 kg/ha. About 40% of production is marketed and about 20% is consumed in urban areas. Over the past five years, the production of millet has fluctuated between 1.3 and 1.7 million tons with an average of 1.4 million tons (*EAC, 2014*). For sorghum over the same period, production has fluctuated between 1.0 and 1.4 million tons with an average of 1.2 million tons. For both cereals, the variation is entirely due to the timing of the rains that affect yields. Demand per head for dry cereals (sorghum, millet, and maize) is estimated at about 70 kg/head and demand is constrained by the availability of substitutes such as bread, rice, and maize that offer significant advantages in terms of food preparation, culinary appeal, convenience and price.

The principal sorghum producing region is Sikasso (Koutiala). The production systems are rain-fed Sahelian and agro-pastoral usually intercropped with cowpeas and peanuts, both as food and as a means of controlling striga weed. Sorghum is rotated with cotton in southern Mali and the area is inversely correlated to area under cotton<sup>3</sup>. In pays Dogon, the rotation is groundnuts, millet, and fonio. Millet and sorghum are rain-fed crops produced in 64% of the cultivated land area in Mali. With population growth and increasing demand for food and cash crops, more marginal land has been brought into cultivation. In the absence of improved seeds and more fertilizer use, overall yields remain at 800 kg/ha (CPS-SDR, 2014). Millet covers the greatest area of planted food crops (approximately 40%), but has the lowest yields per hectare compared to other food crops. Pearl millet is the common variety in Mali and it is one of the most drought-resistant varieties and is grown predominantly along the desert fringe.



Source: EAC/CPS-SDR, p. 11, 2014

<sup>3</sup> - During 2002 to 2009 period, the fall in cotton production was closely associated with rise in area under cereals including millet, sorghum and maize (information on cotton production from CMDT and information on area under cereals from FAOSTAT 2011). It is possible that due to a rise in cotton prices and better incentives by CMDT could reduce the area under sorghum and millet in the next agricultural season.

Sorghum and millet are well adapted to low rainfall and soil conditions in Mali which is a major regional producer of these cereals. They are the most important subsistence cereals.

**Table 2 - Production by Area for Sorghum and Millet in Tons (2013/2014)**

Region	Millet	Sorghum
Kayes	26 280	128 870
Koulikoro	134 349	230 800
Sikasso	172 783	340 264
Ségou	438 925	136 391
Mopti	458 761	27 525
Timbouctou	1 828	1 760
Gao	3 667	617
<b>TOTAL MALI</b>	<b>1 236 594</b>	<b>866 227</b>

*Source: CPS/SDR, 2014*

**Table 3 - Area in ha by region for millet and sorghum 2013/2014**

Region	Millet	Sorghum
Kayes	67 582	122 018
Koulikoro	180 054	316 839
Sikasso	148 041	326 110
Ségou	551 582	142 165
Mopti	431 186	28 057
Timbouctou	49 654	1 181
Gao	8 938	1 155
<b>TOTAL MALI</b>	<b>1 437 037</b>	<b>937 525</b>

*Source: CPS/SDR, 2014*

The main aggregation/trading centers for sorghum and millet are Sikasso, Koutiala, Mopti, Timbouctou, Koulikoro, and Bamako. Mopti and Ségou are the largest producing regions of millet and the principal trading centers for millet. Sikasso is the principal trading center for sorghum. In Koutiala, which is a major production area, almost 50% of the crop is sold. The priority for the farmer is first to ensure sufficient food supply for the year by filling up their own granaries, then to reimburse the input loans if they have any, and then sell the remaining crop. On average in a normal year, about 60% of production is consumed in the household. In a bad year like last year, household consumption can reach 100%.

In terms of activities, men control millet and sorghum seeds and decide on production. Women do the seeding and weeding. Men cut the stalks, while women collect and heap the stalks and transport to the granary. Men do the

threshing using a truck or a tractor (at a cost of 1 bag for every 10 bags of threshed grain), and women do the winnowing. Women take the grains to the local mill where they are turned into flour. Men control the keys to the households' grain store.

Main production areas receive between 400-1,000mm of rain per year. In Sikasso and Koulikoro, farmers benefit from rotating millet and sorghum on cotton fields that allows the crops to benefit from residual fertilizer on the cotton crop, giving a higher yield of millet and sorghum in these areas. In Sikasso and Koutiala, cereals such as maize, millet and sorghum are produced along with cotton, legumes and livestock using animal traction for ploughing and traditional manual cultivation techniques with animal manure, mixed with some chemical fertilizer.

For sorghum and millet, there are three principal production models namely traditional, cotton zone, and improved. As compared to the traditional model, the improved package for both crops offers an increase in the net margin. Costs and margins for different production models for sorghum and millet are presented below. For sorghum, improved technology includes higher density planting of improved and traditional seeds, weeding three times, use of chemical fertilizer, seed (100kg/ha), and additional labor costs for harvesting and post-harvest cleaning which results in an almost doubling of costs. The expected yield of 1.5 MT (as indicated in IICEM sorghum and millet study with improved sorghum) is a 50% increase as compared to the traditional method. The main factor for this improvement is access to certified seeds, fertilizer, and water retention methods and intercropping with nitrogen fixing plants such as cowpeas.

**Table 4 - Traditional and improved sorghum**

Sorghum	Traditional Cotton Area	Non-Cotton Area	Improved
Yields (kg/ha)	800,00	1 200,00	1 500,00
Price 2014 / kg	112,00	112,00	112,00
Gross margin/ha	89 600	134 400	168 000
Cost (FCFA) /ha	56 000	77 000	91 300
Net margin/ha	33 600	57 400	76 700

*Source: Fall, A. p. 21-22*

Sorghum using traditional seed and only manure has an average yield of 800 kg/ha. An early maturing variety which is drought resistant is CSM63E which together with fertilizer can raise the yield by 50%.

**Table 5 – Traditional and Improved Millet**

Type	Traditional	Cotton area	Improved
Yield (kg/ha)	800	1 000	1 500
Prix/kg	150	150	150
Gross Margin/ha	120 000	150 000	225 000
Cost/ha	51 000	58 000	94 000
Net margin /ha	69 000	92 000	131 000

*Source: Fall, 2011, p. 27*

Millet requires less yield increase than sorghum to justify the improved package because of its higher price. Less than 5% of millet farmers use improved technologies with a commercial orientation (*Fall, 2011, p. 25*). They typically use a chemical fertilizer dose of 100 kg/ha (as opposed to the recommended 200 kg/ha) in combination with organic manure and up to 50% certified seeds. The cost of production of this group is 94 000 FCFA / ha. The yield is higher than the traditional system reaching 1.5 tons/ha. The net margin is almost doubled to FCFA 131 000. These groups of producers can sell up to 50% of their harvest.

About 60% of the millet producers operate the traditional model with an average yield of 800 kg/ha with traditional seeds and some manure. The costs including hand harvesting, plowing, weeding and threshing amounts to FCFA 51,000/ha. The investment in organic manure is FCFA 5,000/ha. The net margin is estimated at kg FCFA 69, 000 FCFA/ha. The low income per hectare shows the principally subsistence orientation of these farms and millet is entirely for home consumption.

The millet producers in the "cotton belt" of Sikasso and Koulikoro represent about 1/3 of the producers. About 80% use organic manure and 20% also use chemical fertilizers while only 20% use certified seeds and the rest of the farmers use their own seeds. Millet from Koulikoro has the reputation of cleanliness and quality since 70% is threshed manually and 30% by truck driving over the millet. The cost of production is FCFA 58,000/kg with a net margin estimated at 92 000 CFA / kg. For this class of producers of millet, the highest production costs are plowing and fertilizing. About 40% of the millet is sold in the market.

## **PRODUCER ORGANIZATIONS**

A 2011 study by FAO and Faso Jigi of a sample of 80 producer organizations in the cereal producing areas of Mali including regions of Kayes, Koulikoro, Ségou (Niono), and Mopti (Bankass and Koro) found that out of the 80 organizations 65% were cooperatives, 25% were associations (non-profits), 5% were Unions of Cooperatives (concentrated in Ségou and Koulikoro regions), and 5% were other types of organizations. About half of the organizations were created during the 2005 to 2010 period and the other half were created in the previous five years. The average number of members was 200, while the majority have less than 100 members and the largest had 1,800 members. The study confirmed the use of chemical fertilizers for sorghum, less for millet, and the use of improved seed varieties (Toronion millet and CSM 63 sorghum) primarily in the Ségou, Sikasso and Koulikoro, but much less so in the Mopti or Kaye regions, although everywhere traditional varieties are predominantly used. The study further found a widespread use of pesticides on sorghum and millet by 50% of the POs in Ségou and Koulikoro regions. Only about 8% have borrowed from BNDA or microfinance while 20% have never borrowed. About 1/3 of the POs do not store after harvest and sell directly to the traders, 1/3 store the grains for between three and five months sale, and 1/3 store for more than five months with hope of selling later in the season.

There are some handful of cases such as the Union of Cooperative Producers in Dioila (Koulikoro region) with 1,700 members (25% women), Union of the Cooperative Faso Jigi (Ségou), where members have made a commitment to marketing their cereals (maize, sorghum and millet) through the organization. In return, they received access to credit amounting to 60% of the value hence enabling the farmers to wait so they benefit from higher prices later in the season through guarantees provided by the organization on their behalf. Moreover, they are guaranteed a negotiated price for their produce, which is typically higher than the price that individual farmers could fetch in the market. Faso Jigi is quite advanced the cooperative can arrange processing for its members. The key constraint for replicating this experience is the availability of adequate warehouse space at the local level and access to finance to relieve the immediate liquidity needs of their members. In some instances, cooperatives have entered into pre-established agreements or contracts with the wholesalers for forward sale or for input supply credit and forward sale. Cotton producer organizations in the South have members who produce sorghum regularly as part of the rotation after cotton and maize, but sorghum is not a central activity for any of these organizations. There is little demand for improved seeds, yet a significant demand for fertilizer and pesticides.

The degree of managerial capacity and group solidarity varies significantly among POs in spite of donor support and capacity building in the past. To use POs for marketing or input distribution would require accompanying measures in terms of training and supervision focused on both male and female members. Low member literacy, especially amongst women, is a major issue that needs to be addressed.

## SUPPLIERS OF INPUTS

**SEEDS** – Considering the total cultivated area for sorghum and millet and the volume of certified seeds passing through LABOSEM, less than 5% of farmers use certified seeds (*Source: calculated from CPS 2014 data on cultivated area for sorghum and millet and the volumes of certified seeds from LABOSEM and Fall 2011*). Information on annual seed demand is no longer collected systematically at the farm level, resulting in a poor estimation of demand for improved seeds. Most farmers do not have access to the varieties bred and certified by research partly because of insufficient and irregular demand and partly due to costs. A kg of improved seeds costs 600 kg per kg and not many farmers are willing to make the investment since to get good results, fertilizer is also needed and that raises the investment and the corresponding risks. Table 7 below shows the volumes of certified seeds as fairly stable, with a stagnant demand for improved seeds. Presently a seed company (Faso Kaba) is offering 350 tons of certified seed and are finding it difficult to find buyers.

**Table 6 - Total volumes of certified seeds 2012/2013/2014**

Certified volumes	seed	2012/2013	2013/2014 (March)
Sorghum (kg)		318	323
Millet (kg)		142	90

*Source: Direct communication from Labosem, Bamako, 2014*

The other local institutions involved in the seed sector are the Seed Association of Mali (ASSEMA), the National Seed Council (CNS) (who is in charge of the orientation and implementation of national policy for improved seed), and the Central Seed Laboratory (LABOSEM) in Bamako (in charge of controlling and certifying seeds. Seed certification is controlled by the government). LABOSEM in Bamako is the structure that certifies the seed submitted by seed producers. The process is centralized and takes at least a couple of months. IER and ICRISAT are involved in providing foundation seeds to seed producers.

Millet and sorghum seed is given, bartered, inherited, and transferred at marriage and passed on from farmer to farmer and even from generation to generation. For sorghum and millet, it is the head of the household who manages the seeds. Most farmers do not trust seed sources outside their village networks. Most sorghum and millet seed is supplied by farmers and is not certified. Seed provision from farmers' own harvests has the disadvantage of poor characteristics such as vulnerability to pests, diseases, and drought. Nevertheless, farmers reported that market purchases not only have the disadvantage of relatively high costs but also carry uncertainty about variety traits, seed quality, and availability when it is needed.

Agro-input dealers are not active in supplying certified seed for sorghum and millet. Improved seeds are produced by cooperative seed producers who supply the commercial seed enterprises. Cooperatives also sell directly to projects and to farmers, although the quality is not always certified. Seed enterprises have access to their own network of seed production cooperatives. Commercial seed enterprises such as FASO KABA, clean and package the seeds and ensure that it is certified.

The Red Cross, FAO, Oxfam, and other NGOs have been buying large quantities of seeds from seed cooperatives and seed enterprises for humanitarian redistribution in the northern regions. Last season's purchases were very poor quality, and some of the seeds did not germinate. Seed enterprises complain that even if these organizations buy from them, they do not distribute the seeds in its original packaging so the farmers cannot seed the source of the seed and no relationship is established between the farmer and the commercial seed enterprises. In 2013, the government launched a major bid for buying a large quantity of seeds financed by the Dutch Government. Unfortunately, the seed supplied was not of good quality and was not certified. ASSEMA (the National Seed Association) was not consulted. This effort was justified as emergency relief, but the result is not helpful for the development of a competitive seed sector. Reportedly, much of the seeds is not even planted, but merely eaten.

**FERTILIZER** – Organic fertilizer produced from crop residue and animal manure is commonly used by most producers including women. Often farmers are not aware that the nitrogen in organic fertilizers is not fully released within a season and more commonly 50% or more will become available in later years. This can lead to under or over fertilization (Van Ophusden et al. 2012).

Chemical fertilizer for irrigated rice, maize, and cotton is offered at a subsidized price of FCFA 12,500 per bag (50% subsidy) through suppliers and agro-dealers who then claim the difference between the market price and the subsidized price from the government. Total volume of subsidized chemical fertilizer in Mali in 2013 was 17,000 tons (*source: Toguna Industries, private communication*). This total largely excludes sorghum and millet since the government does not consider these cereals as a good use of subsidized fertilizer given their low and uncertain yields. There are local fertilizer factories in Bamako and Ségou for mixing NPK. Urea is imported directly from Ukraine through the Abidjan port. The main supplier/importers are Toguna industries, Faso Djigi, and SOGEFERT. There are 68 agro-dealers that serve as retailers, and represent importers/producers in the zones of production – they are predominantly men. POs buy the fertilizer from agro-dealers who are mostly agents of the large suppliers and distribute fertilizer to their members. There are some expired and altered products in local markets, and quality control is notably insufficient. Moreover, neither the private dealers, nor farmers, are adequately trained in the use of chemicals. The use of fertilizer does not correspond to the actual soil deficiency because soil analysis is rarely carried out before fertilizer application.

## **SUPPORTING INDUSTRIES**

**RESEARCH** – In the past couple of decades, ICRISAT, INTSORMIL, and the Syngenta foundation have supported agricultural research on sorghum and millet technologies. The principal local institution focused on seed trials/multiplication in Mali is the Institute d'Economie Rural (IER). Millet yields are still very low at an average of 800 kg/ha as compared to between 1.5 tons per hectare with new millet varieties (Toronion, Syn 0006 IKMV, Souna, Bobouni). Toronion pearl millet developed by Cinzana in Ségou is a landrace (indigenous) from Mopti purified by IER. Average sorghum yields have been higher as compared to millet yields at over 900 kg/ha and have risen to about 1 ton/ha over the past five years. The improved sorghum varieties include Grinka, CSM (E63, and 219), Tchiandougou, CE 151 and many others. Potential yield for sorghum with the new varieties is between 2 to 4 tons/ha. In Mali, soil nutrient deficiencies are widespread and the situation is getting worse with population growth and increasing demand for food from urban areas, near elimination of the fallow system, and water stress. This means that new early maturing cultivators alone without improved agronomy and inputs are unlikely to succeed in improving yields on a sustainable basis. Combined use of organic and inorganic fertilizer, higher plant densities, intercropping with nitrogen fixing trees and cover crops such as gliricidia and cowpeas, short cycle seeds, and water management especially using tied contour ridging for improved water retention and soil protection can increase cereal yields substantially (Ahmeda M., Sanders J., Nell W, 2000). At the Cinzana research station, farmyard manure and composted millet stalks were used to increase fertilizer content by 42%, without reducing the nitrogen content. Field experiments have shown that a 30-35% higher yield is possible using this simple fertilization technique (Cinzana, 2013).

As a result of research conducted by ICRISAT and IER, several varieties of short-cycle or early maturing millet (25 varieties) and sorghum (50 varieties) adapted to low and variable rainfall were planted in the 1990s (Sanders, 1996; Shapiro and Sanders, 1998). These varieties have the potential to routinely yield double the average yield obtained with traditional varieties. To obtain 1.2 t/ha yields, improved varieties require fertilization. ICRISAT results consistently show that combining moderate levels of N-P-K fertilizer (45, 20 and 25 kg/ha respectively) leads to higher yields on sandy dune soils (Shapiro and Sanders, 1998). While technologies exist to increase overall production, several factors are limiting the adoption of these technologies. First, the use of improved seeds is very low among millet and sorghum farmers. It is not clear yet whether this is an issue of supply or demand. Recent case studies suggest that millet and sorghum seed is the object of village-level exchanges that are, for the most part, non-monetized (Diakité et al. 2004; Goita, M. and Hamada. M., 2008; Sperling et al. 2006; Traoré 2006; Diakité, et al., 2008). Schemes designed to provide incentives to farmer based organizations and producer associations to multiply this seed and demonstrate the benefits of chemical fertilizers along with organic and water retention techniques could yield widespread benefits.

The use of chemical fertilizers is very low. Some farmers only use organic manure, and the quantity and quality vary greatly. At current fertilization levels, the introduction of improved varieties alone is not a sustainable strategy. Chemical fertilizers are needed along with organic fertilizers, especially in soils with high clay content. Millet is cultivated mainly in sandy soil while sorghum is cultivated in clay soil. This is the case in the Sudanian zone, where infiltration, crusting and water runoff are a problem. In the case of sandy soil in Sahelo-Sudanian areas, use of fertilizers allows for higher plant densities, which result in more organic matter and root development. This in turn increases the capacity of soil to retain water and the efficiency of water usage (Fussell and Serifini, 1985; ICRISAT, 1988; Reddy, 1988; Shapiro and Sanders, 1998).

A study by de Rouw (2004) shows that while research institutions have been working on strategies to improve yields and overall production levels, farmers are much more concerned about inter-seasonal variability of production levels. Use of improved seed varieties, use of fertilizers, high plant density and mono-cropping are designed to improve productivity levels, but not to reduce the frequency of crop failure.

**FINANCIAL SERVICES** – Access to direct bank finance for sorghum and millet producers is generally poor. In contrast to cash crops such as irrigated rice, cotton, maize, and sugar cane, millet and sorghum are generally excluded for input loans from financial institutions such as the Banque National de Développement Agricole (BNDA) and Banque de Développement du Mali (BDM) unless the loan is connected to a cash crop such as cotton.

Poor access to finance by producers and processors translates to poor access to improved farming technology and an inability to improve processing where most value addition takes place. Kafo Jiginew and Nyesigiso describe themselves as rural microfinance organizations, however, they are heavily oriented towards financing the cotton and maize sectors. Microfinance institutions and cooperative federations with branches in rural areas offer expensive loans (with interest rates over 24% per year), which are unaffordable for small scale farmers. Such loans are used for consumption and short term trading purposes. A number of cooperative federations or apexes are focusing on providing financial services to their members. For loans, they require three years' experience in marketing, collateral under village responsibility, and an interest rate of 12% per year. Even these requirements are often too prohibitive for small scale farmers or their organizations that require seasonal finance at costs that are more in line with returns in the sector and not in short term trading.

Wholesalers use their own funds and credit from other wholesalers, friends and relatives. Some of the larger wholesalers have access to formal finance, but due to its cost, this is not often used. About 70% of the funds by wholesalers is from personal sources, and 30% is mostly from informal sources such as other wholesalers, friends and relatives (Fall, 2011). Collectors have limited access to formal sources of credit and are mostly financed by the wholesaler who advances funds to collectors and gives short-term credit to the retailers, thereby, playing a key role in financing the marketing and distribution channel.

Currently the total loan arrears (bad debts) in the agricultural sector in the Mopti region amounts to FCFA 1.6 billion, out of which FCFA 1.3 billion is for BNDA, and the rest for other microfinance institutions. Much of the indebtedness are POs many of whom are in the rice sector and some of whom are POs supported under the IICEM project. BNDA has currently imposed a no lending policy for the Mopti region, which is likely to affect the possibility of financing agricultural inputs in that region for the upcoming 2014/2015 season.

## **UPGRADING OPPORTUNITIES IN MILLET AND SORGHUM VALUE CHAIN**

Productivity development and market development go hand in hand to bring about agricultural transformation. Upgrading opportunities must be induced by market development and based on a sustainable increase in demand for these cereals. Such upgrading opportunities include: the easing the preparation of sorghum and millet flour, post-harvest improvement for better cleaning of the grains to attract large millers, packaging and brand promotion of certified and reliable flour, product development in the use of millet and sorghum flour in bread baking and sweets, use of sorghum bran and stalk in animal feed, and expanded sorghum and millet grains purchases through institutional buyers such as OPAM/WFP including the WFP's P4P program. Additional gender based activities include support to women based millet processors through greater training, market information, organization, packaging and labelling.

An important activity to expand the market is the promotion of sorghum as animal feed in combination with other animal feed ingredients such as dried fish residues, cotton seed, groundnut shells, river shells, for a balanced animal nutrition and develop ready packed commercial livestock (including poultry) feed. Such development could be supported via microfinance institutions. Rural poultry and small livestock businesses operated by rural women, promoted through microfinance, could become a new source of additional demand that could induce investments at farm level. Sorghum can partially replace maize as poultry feed and it has a greater advantage because of suitability to Sahelian agro-climatic conditions. Recently (March 2014), the price of chicken feed (mostly maize) has doubled in Bamako (from FCFA 120/kg to FCFA 240/kg) while large stocks of sorghum are unsold remaining with wholesalers and not used for mixing in chicken feed formulas.

There is a need for improved targeted market information and promotion of market exchange through commercial contacts, fairs, expositions, workshops, and professional associations. These events could improve market presence and information for members. There events can also foster increased participation by financing entities, large institutional buyers, agro-dealers, traders and cooperatives in agricultural fairs. This could include improved contracting arrangements between producers and wholesalers especially in collaboration with WFP's P4P program for improving smallholder farmer's access to a secure market.

Interventions can also promote small mobile threshing machines and discourage the use of truck threshing for sorghum and millet. This can improve post-harvest quality. Microfinance and equipment credit products may be sought for the financing of processing machines such as threshers and mills targeted to rural entrepreneurs. Furthermore, technical interventions need to support the promotion of improved storage at village level through contact with financial institutions, the use the stock for warrantage financing and sensitizing producers on the need to improve post-harvest handling for market development.

The weak backward linkages between input suppliers, extension services and the producers of sorghum and millet may be addressed by the use of NGOs and the performance based contracts with some of the public extension services including CMDT and DRA. The issue of capacity and motivation of these structures needs further assessment. Some of the more advanced producer organizations and cooperatives in the CMDT zone and in the Mopti area could be contracted to provide extension and technical support to their members for improved agricultural practices in these cereals. Seed companies such as Faso Kaba that are offering high yield seed varieties need to be supported through business-to-business contacts, fairs, and through better contact with extension services. Agro-dealers involved in spe-

cific value chains need to be identified and promoted including the Association of Inputs Suppliers, Association of Seed Producers, and Association of Agricultural Resellers.

There is a need to promote water-retention techniques to optimize the use of both improved seeds and fertilizers. There are a number of techniques for retaining water including earth and rock bunds and “zai,” which are essentially holes in the ground to retain water. The combination of water-retention techniques with higher use of fertilizers—both organic and chemical—is necessary to partially recover severely degraded soil in the Sudanian zone. A combination of conventional low-density planting, application of organic and chemical fertilizers, planting of early maturing varieties, and use of water retention techniques is an approach that farmers under the marginal conditions of the Sahel would be willing to adopt as this package of activities not only increases yields but also reduces risk to crop failure.

The weak backward linkages between input suppliers, extension services and the producers of sorghum and millet may be addressed by the use of NGOs and the performance based contracts with some of the public extension services including CMDT and DRA. The issue of capacity and motivation of these structures needs further assessment. CMDT is primarily oriented toward cotton, and they need to conduct further trials before they could accept to extend the new varieties and adopt a more holistic approach to support sorghum and millet and engage in soil and water conservation methods. Some of the more advanced producer organizations and cooperatives in the CMDT zone and in the Mopti area could be contracted to provide extension and technical support to their members for improved agricultural practices in these cereals. Seed companies such as Faso Kaba that are offering high yield seed varieties need to be supported through business to business contacts, farm visits, and better contact with extension services.. Agro-dealers involved in specific value chains need to be identified and promoted including the Association of Inputs Suppliers, Association of Seed Producers, and Association of Agricultural Resellers. The agricultural research station at Cinzana (Ségou) in Mali, supported by the Syngenta Foundation for Sustainable Agriculture, is developing and disseminating improved seed for millet, sorghum, and cowpea, as well as adapting cultivation methods. There is a need to work closely with the Syngenta to spread the findings on sorghum and millet. As demand increases and as these crops become more commercial, farmer organizations could take a greater role in securing improved inputs and in the storage and marketing of these cereals.

## **VALUE CHAIN CONSTRAINTS IN UPGRADINGS MILLET AND SORGHUM**

Due to poor post-harvest processing and handling, the quality of the final millet and sorghum products are poor. The prevailing truck threshing method for millet and sorghum tends to mix too much sand and foreign material resulting in a higher percentage of impurities as compared to the manual method. To keep the grains clean from sand and dust during truck threshing, threshers need to use batches or tarpaulins, which are not readily available. The marketed sorghum and millet has high degree of impurities, including the containment of dust, stone, and broken stalk bits. Wholesalers need a clean product which in turn requires using mechanical threshing machines by farmers. In some reported instances, unscrupulous collectors empty the cereal bags on the ground to collect dust and sand in order to increase the weight. Quality issues have prevented large industries in relying on local production and large scale millers have shifted from milling local millet and sorghum to imported grains due to quality and availability issues. There are a number of women-owned, small and medium sized industries such as who have started transforming millet for the local market and for exports, although volumes and scale are too small to have a major impact on market development. A major constraint in these operations is the cost of drying. The price of 1 kg of ready millet flour produced by these enterprises is FCFA 600/kg as compared to FCFA 300/400 for uncooked broken rice. Ready millet flour does not conserve well either, and unless cold treated, small weevils can emerge inside the flour after about 60 days.

Currently, the sorghum and millet market has a large stock of unsold grains because it is still early in the season, and there is an unofficial government ban on exports. As of May 2014, one of the major traders in Koutiala has confirmed his stock of 2000 tons of sorghum and 1500 tons of millet. This is the stock that maybe carried over time until the “hungry season” in July and August, although the wholesalers with these stocks are facing financial constraints and

need to sell this stock as soon as possible. According to the same trader, last year he carried forward over 500 tons of unsold sorghum. Additional stock comes to the market as the farmers gradually release more grain over the season due to cash needs.

There is some seasonal price fluctuation for millet and sorghum especially during the “hungry season” which is around July/August each year, although in recent years this fluctuation has decreased. Farmers sell most of their surplus at or before harvest at a very low prices. The traders who have the resources to stock these grains benefit from price fluctuations.

The demand for improved seeds for sorghum and millet is estimated at less than 5% of the cultivated area with the total volume of certified seed for 2012/2013 amounting to 323 tons for sorghum and 90 tons for millet. Seeds are passed on from farmer to farmer and reproduced locally without undergoing any certification. Formal seed certification is a lengthy process. There is a under staffed laboratory in Bamako and all certification is done from this lab (LABOSEM). Seed enterprises such as Faso Kaba intermediate between producer cooperatives and the large institutional buyers and at present are facing difficulties in selling their stock of improved sorghum and millet seeds due to lack of commercial demand. At the same time, the institutional mechanisms for informing the farmers about the availability of improved seeds are poorly developed.

Agricultural extension is non-existent for millet and sorghum. Some NGOs, through donor support, have been active in promoting the use of improved seeds but the impact has been small and negligible. The use of radio for extension is insufficiently developed. There is need to convince the farmers of the effectiveness of the new varieties that are suitable for their needs, especially for food and for alternative uses in animal feed that can improve nutritional standards and female income. To increase productivity per hectare, the farmer must use improved seed varieties and fertilizer, which represents a monetary investment on his part. The uncertainties of yield, the low price at harvest, and the limited size of the end market have created major disincentives that are not conducive to increasing farm investments for these crops.

Access to credit for sorghum and millet inputs are much more difficult as compared to other commercial crops. Financial institutions such as BNDA, Kafo Jiginew and Nyesigiso are involved in agricultural credit to cotton and to maize farmers in the South but not for millet and sorghum, unless the farmer offers the cotton or maize crop revenue as security for repayment. BNDA and CMDT do not provide credit and extension for sorghum and millet even though these crops are also produced in cotton growing areas in rotation with the cotton crop. Kafo Jiginew and Nyèsigiso are cooperative federations with a wide network in cotton areas and in rural towns offering seasonal micro-finance loans at higher interest rates than BNDA and many farmers find such loans too expensive for profitable farming. In Mopti, BNDA and the other microfinance institutions offer seasonal credit for rice farmers, but not for millet.

Farmer organizations focusing on millet and sorghum are poorly developed. The farmer organizations in the South (CMDT area) are basically cotton producer organizations that are also used as a vehicle for sorghum. Due to the lack of demand for improved inputs for sorghum and millet, these organizations do not play a major role in facilitating access to improved inputs for these cereals. The farmer organizations in the North (Mopti) are focused on rice and not very active in sorghum and millet production. Producers in the Pays Dogon are mostly focused on inputs for onion production as the principal cash crop.

Government policies are yet to support and promote millet and sorghum. The GOM considers these crops as having low yields even with fertilizer application and therefore the fertilizer policy does not provide any subsidy for sorghum and millet. Moreover, in spite of ECOWAS declarations on free trade zones in the region, exports of these cereals are frowned upon. Wholesalers and traders find it difficult to obtain export clearance papers which further narrows the market.

### III. RICE VALUE CHAIN

#### END MARKET OPPORTUNITIES

Over the past 10 to 15 years, rice has become a popular substitute to millet in most urban households due to urbanization, population growth and income (FEWESNET, 2014). Ségou is one of the most important markets because of its proximity to ON production area. Bamako is an aggregation point as it receives rice from Koulikoro, Ségou, and Sikasso for consumption and redistribution. Rice produced from ON is the principal source of rice production. The local production of paddy rice in 2013/14 was estimated at 2.21 million tons equivalent to 1.3 million tons of milled rice (EAC/CPS-SDR, 2014, p.11). Rice consumption has risen at 7.5% annually since 1995 and stands at 70 kg/head in urban areas (Coulibaly and Havard, 2013). Mali is importing 45% of the rice consumed in urban areas and in Bamako alone, more than half of rice consumption is satisfied by imports (Coulibaly et al).

There are different categories of rice in the Malian market. There is the locally produced *Gambiaka* variety that can compete with premium imported long grain rice has about a 5% market share; the 40% broken rice represents about a third of the total rice market; over 40% broken has a 50% market share and the 100% broken, both perfumed imported rice or locally produced, is about 15% of the market. Parboiled rice has a small local market and much of it is exported to Guinea and Senegal. The key difference between local and imported rice is cleanliness. The local consumers prefer the taste of the local rice, although it requires a significant amount of washing and cleaning as compared to imported rice, which is preferred for its relative ease of preparation. Larger millers such as GMM, GMB, and GDCM need large and reliable supplies of paddy each season. They are the same enterprises that are importing large quantities of rice from Vietnam, Thailand, Pakistan, and Brazil.

**Table 7 - Rice Production and Consumption 2013/2014**

Item	Rice (Tons)
<i>Population in 2014 = 17.325 million</i>	
Total Paddy Production (million tons)	2,211,900
<b>Available Milled Rice</b>	<b>1,362,30</b>
<b>Consumption per head/kg</b>	<b>71,78</b>
Human consumption requirement	1, 243,65
Balance	118,65
Stocks	48,11
Surplus	166,76
<b>Planned Commercial imports</b>	<b>182,83</b>
Aid	11,4
Exports	1,58
<b>Excess Supply</b>	<b>359,42</b>
Available kg/head	99,38

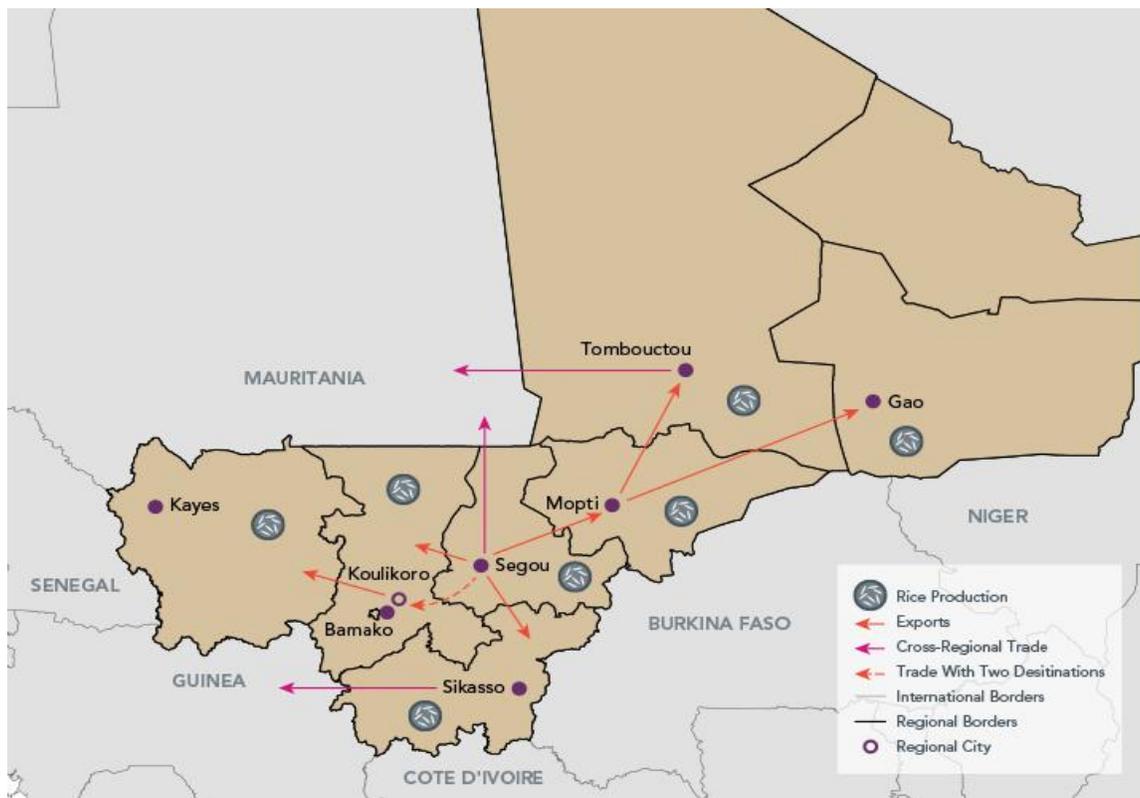
Source: CPS, 2014

The 2013/14 production was 15% above the 2008-2013 average rice production for Mali. The problem now is to find markets for the surplus rice currently with rice factories and wholesalers and not continue with further imports.

**Table 8 - Retail Rice Prices**

Bamako Market April 2014	Price FCFA/kg
Gambiaca top quality	500 – 550
Gambiaca 2nd quality – 25	400
40% broken	375
100 % broken	300
Parboiled – non broken	400
Aromatic whole Thailand/Brazil	800
Broken Vietnamese/Pakistan	300

**Rice production and flows**



Local rice prices have been largely stabilized due to imports. The long grain imported rice is at FCFA 800 per kg in Bamako and it is consumed by the more affluent consumers. Local rice is retailed between FCFA 300 to FCFA 600 per kg against FCFA 400 to FCFA 800/kg of imported rice which is exempted from tax by the Malian government to

enable an adequate access by the urban consumer. The domestic rice market is strong although it is currently facing large stocks of unsold rice as shown in the Table 7 above. The increase in population in the cities strongly influences the consumption and local production of rice. In 2013, Mali imported 182,000 MT of rice.

## **POST-HARVEST AND PROCESSING**

**MANUAL OR SMALL SCALE HULLERS** - In most villages rice is cultivated in flood plains, and threshing and winnowing is still done manually by women. In places where mechanized threshers exist, men do the threshing and women do the winnowing and cleaning of rice. There are de-husking factories in many locations where rice is de-husked. Due to insufficient availability of threshing machines, many women are still involved in hand threshing. After threshing, de-husking is done either manually for home consumption or in mini rice factories (mini-rizerie). A small de-husking unit can de-husk up to 200 kg per hour. In the Mopti region, rice is hulled manually or with small motorized engines in small quantities by wholesalers and farmers

**MEDIUM SIZE RICE HULLERS** – These operate in the production areas in the North (Ségou, Mopti, and Tombouctou) and work with organized rice producer cooperatives. Some of the factories provide inputs such as fertilizer and seeds and in return receive paddy. Some of the factories such as Planet Distribution and Kimbiri are agents of fertilizer suppliers such as Faso Djigi and Toguna industries.

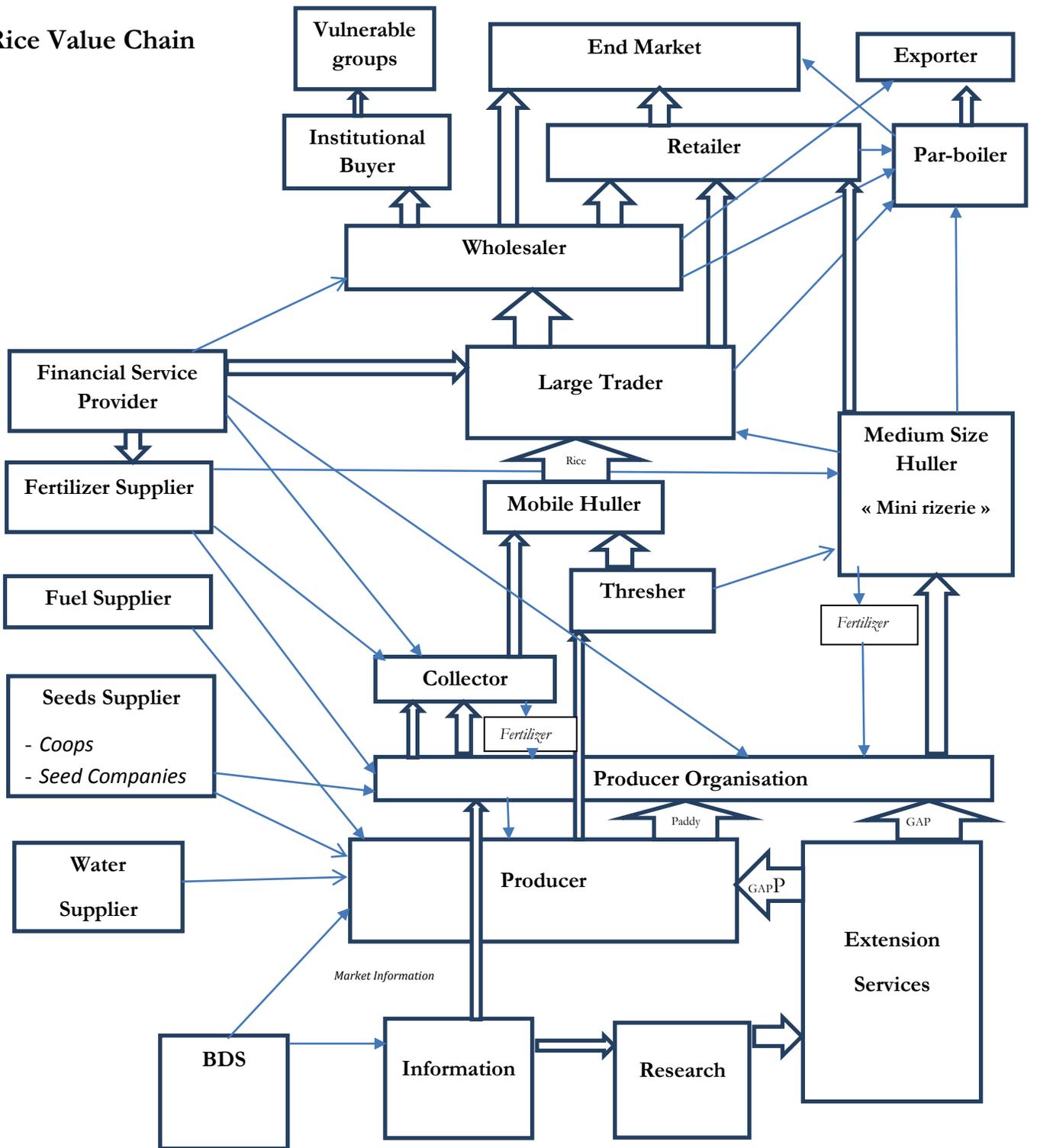
**SEMI-INDUSTRIAL DE-HUSKING FACTORIES** – These are larger and mostly located in urban areas. The equipment is larger with capacity ranging from 0.5 tons per hour to 2 tons per hour with a 65% to 70% de-husking rate. Such factories are also equipped with other equipment such as rice polishers, moisture meters, and scales. Examples are RIFAB and Planet Distribution. Rice is produced and put in pre-printed bags with logos. Rice is also packaged in plastic bags of 1 kg for retailers and supermarkets. These industries are usually owned by wholesalers and have their own collectors. An average cost for setting up a semi-industrial mini rizerie is approximately FCFA 100 million.

**LARGE INDUSTRIAL RICE HULLERS** – These are located in urban centers with large scale operations such as the Grand Moulin du Mali (GMM) factory in Koulikoro, GDCM-SA in Bamako, Grand Grenier du Bonheur (GGB) and MMM in Ségou. These factories use both imported and local rice. Their products include white whole grain rice, 40% broken, 100% broken, rice flour, rice husks, rice powder, etc. Some of the factories have major international investments such as financing from the West African Development Bank. They have large 1,000 ton silos for storage and use 50 kg or 100 kg polythene bags for bagging as well as 0.5 and 1.0 kg plastic bags for retailers.

## **BUYERS**

Buyers consist of collectors, rice hulling factories, industrial wholesalers, and large and small retailers as discussed below. Collectors work with larger traders or semi-wholesalers and can use their own funds or get traders to finance their purchases. Most often, they pre-finance the inputs such as seeds and fertilizers to farmer organizations and they collect the paddy in-kind as repayment. The collectors usually have access to mobile rice threshers and deliver hulled rice to the larger traders. The quality of the threshed rice under these conditions is often poor. In Niono there are many mobile threshers and hullers but the quality is poor. In Mopti there is not sufficient number of hullers and they have to sell to large hulling factories.

# Rice Value Chain



**SEMI-WHOLESALERS AND WHOLESALERS** - The difference between the semi-wholesalers and the large wholesalers such as the GGB and GMM in Bamako is the location, size of the revolving fund, scale of operations, and the potential markets. Semi-wholesalers are large traders that employ collectors and supply large quantities to retailers in towns and to institutional buyers such as PAM and GMM. The turnover of a semi-wholesaler is about 8,000 tons per year while the wholesaler such as GMM has a turnover of about 30,000 tons per year.

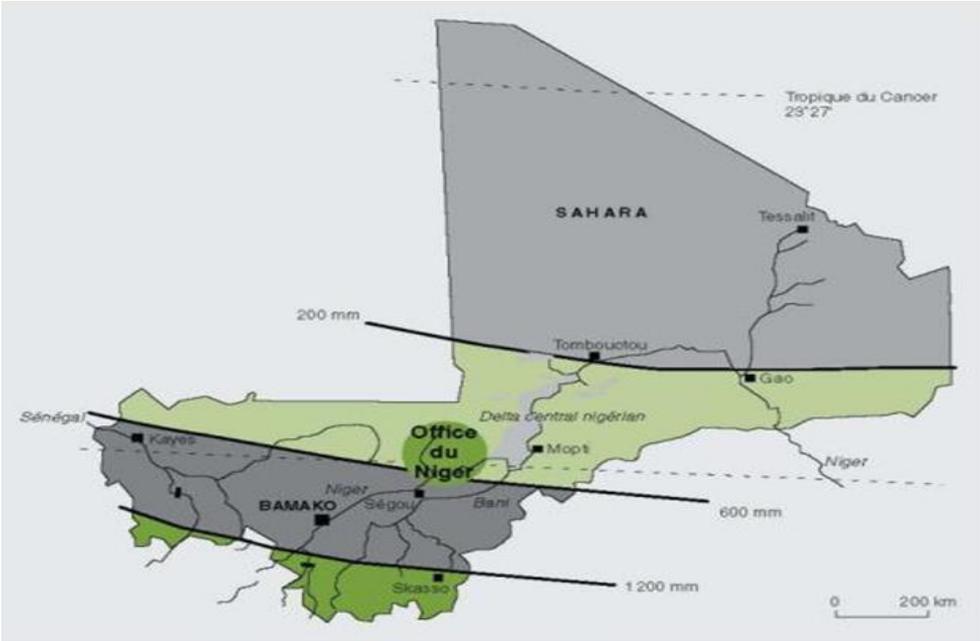
**Percentage of the actors of the end market value for white rice (Source: IICEM, Etude Riz, 2011 - updated)**



The wholesalers (principally men) have networks of collectors and get most of their supplies from weekly fairs. Transportation costs are high, sometimes more than 50% of the cost of the product, due to old and poorly operating vehicles and poor roads.

**RICE PRODUCERS**

Rice producers in Mali use a variety of production systems which are: (i) large-scale, gravity-fed systems in the ON zone and smaller systems around the Baguinéda and Selingué dams; (ii) Small-scale irrigated perimeters irrigated by pumps that pull water from the Niger River located mainly in the Timbuctoo and Mopti Regions; (iii) Controlled flooding systems through the control of the rising river water most prevalent around Mopti and Ségou; (iv) Traditional uncontrolled planting on riverside flood plains; (v) in the same zones where controlled flooding is practiced; (vi) Rainfed rice with small-scale water retention structures in lowlands based in the Southern cotton belt; (vii) Rainfed rice on upland areas where rainfall exceeds 800 to 1,100 mm/year in the cotton belt in the Sikasso Region and in Kayes and Koulikoro.



**Rainfall and rice production area – Office du Niger**

**Table 9 - Rice production margins under different systems**

Item	kg/ha	Price/kg	Gross return/ha	Cost per ha	Production cost per kg	Net return per ha	Net return per kg
Floor plain rice	1200	350	420,000	108000	90	312,000	260
Irrigated perimeters	3000	350	1,050,000	156000	130	894,000	298
PIV	2500	350	875,000	192000	160	683,000	273
River-fed submersion	2000	350	700,000	216000	180	484,000	242

Source: Rice value chain final report, IICEM, 2013

**WOMEN IN FLOOD PLAINS** – Women dominate flood plain (*bas-fond*) rice in the South. Female cooperatives operate in flood plains areas with a membership comprised of all women with at least one male facilitator, often the one who manages the cooperative’s warehouse. The key to the granary is kept by a male member of the household no matter how young he may be. It is culturally uncommon for a man to handover the key of the granary to a woman (source: field interview). Males are also generally more literate and are able to maintain the simple books/ledgers. The male facilitator of the cooperative may do any of the following: hold the key to the warehouse, assist with transportation to the market, facilitate equipment rental, run or hire a male to run the thresher, and serve as intermediary between the cooperative and financial institutions for receiving loans. The cooperative arranges credit for fertilizer, herbicides, equipment (purchase or rental).

**PRODUCER ORGANIZATIONS** – Many farmers belong to producer associations for access to bank finance and inputs and for finding buyers. None of the banks in Mali provide agricultural loans to farmers without the mutual guarantee of their groups/cooperative. The producer groups typically procure the inputs and seeds for their members. The irrigated village perimeters in the north known as *pîvs*, and the larger perimeters, have organized producer organizations. They manage water distribution for their members, secure seasonal BNDA credit for the members, and collect repayments. Some of the POs own rice threshers that are rented by members at the cost of 1 bag of paddy for every 10 bags of paddy threshed. Members of the POs contribute FCFA 500 each month to the association fund used for emergency needs. The degree of managerial capacity and group solidarity varies significantly among POs. It is difficult at this stage to compare the POs of the rice producing areas with POs in the sorghum and millet areas, especially because the POs in the sorghum and millet areas in the South are mostly cotton-based and quite advanced. This topic needs to be studied further under the CVC project.

## **SUPPLIERS OF INPUTS**

**SEEDS SUPPLIERS** – Improved seed availability has increased considerably over the past five years. Many farmers produce their own seeds, and there are a number of seed cooperatives such as Bewani, Farfasiso, molodo/Niono producing Gambiaca, BG, Adany11, Kogoni, Nionoka, and Watt 310, and SK 90. There are also specialized seed producing enterprises such as Faso Kaba, although commercial seed companies have tended to sell more to NGOs and the international donors than directly dealing with producers. The availability of certified seeds in the rice sector is no longer a major issue.

**FERTILIZER SUPPLIERS** – Most farmers use both organic and chemical fertilizers supplied by agricultural dealers such as Toguna Industries, Faso Djigi, PROFEBBA or Elephant Blanc in Ségou and Nyumani SA in Niono. Fertilizer prices are subsidized and sold at FCFA 12,500 per bag. The open market price is as high as FCFA 18,000 to FCFA 24,000

per bag. To access the subsidy, a producer organization or a farmer must get a technical approval from an extension officer. This approval (caution technique) may be sold and there is no guarantee that the fertilizer will be used in producing rice. Some of the fertilizer currently ends up in Burkina Faso or sold in Bamako. A considerable quantity of the subsidized fertilizer is also used on non-cotton crops, sold, or exported despite efforts to mitigate leakage.

## **SUPPORTING INDUSTRIES**

**RESEARCH** – IER through its autonomous regional research stations, CRRAs, is responsible for research on rice varieties and the production of G4 seeds to seed multipliers. The main issue facing these centers is insufficient financial resources resulting in less than 10% of the varieties becoming available for multiplication.

**EXTENSION** – Due to fiscal reasons, public extension services for rice are underfunded and lack up-to-date training and operating costs. These services operate under the Regional Agricultural Directorates (DRA). In parallel, there are the offices such as ON, ORS, and ORM that are in charge of water management and provide advisory services.

**AGRICULTURAL AND PROCESSING EQUIPMENT** – Animal traction is still the main form of ploughing. Threshers and mobile hullers are more available in the Niono area than in the Mopti area. In the Mopti area, there are 60 rice threshers (*Rapport Bilan Campagne Agricole, DRA, 2012/2013*). Locally manufactured threshers are available with a threshing and winnowing capacity of 800kg/hour. There is also a fabricator in Sevaré and machinery prices are competitive in price and quality with the imported machines.

**FINANCIAL SERVICES** – BNDA is active in financing rice producer groups for seasonal inputs in irrigated village perimeters with full water control. These producers have access to subsidized fertilizer. According to BNDA, the current situation in Mopti has reached a crisis point with the imposition of zero agricultural lending for this season until the loan arrears and bad debts owed to the bank are cleared up. Other microfinance institutions have similar bad debts of POs.

## **UPGRADING OPPORTUNITIES IN THE RICE VALUE CHAIN**

The principal upgrading opportunities in the rice value chain is to improve rice quality and size consistency by encouraging the producers to work with medium sized rice hullers and reduce reliance on mobile hullers to improve cleanliness, and consistency in size. Larger millers such as GMM, GMB, and GDCM need large and reliable supplies of paddy each season. They are the same enterprises that are importing large quantities of rice from Vietnam, Thailand, Pakistan, and Brazil. With the current glut in the rice market, there is an urgent need to improve contacts between the local producers and the larger hullers. As much as possible, there is a need to facilitate such contacts between large millers and producer organizations as well as introduce a program of training in packaging, labelling, branding and quality control to *mini rizeries* and small scale millers to improve marketing their rice in small packages.

The *mini-rizerie* and the semi-wholesalers are experiencing unsold stocks at the moment due to a large 2013/2014 crop, which exist in addition to large rice imports. Organization of a market fair can play an important role in facilitating the connection and information flow between the sellers and the buyers. There is need to monitor wholesalers and traders stocks and identify potential large scale buyers.

Technical interventions need to promote the use of the medium size rice hulling factories (*mini-rizerie*) so they can reach scale. Medium size industrial hullers known as “mini-rizeries” have issues with securing an adequate supply of rice at the right time. There is need to improve contacts between suppliers of rice (mostly rice producers and their producer organizations) and the medium size hullers. This could also involve in-kind credit arrangements through the supply of inputs such as seeds and fertilizer by the hullers and repayment in paddy by the producers. Promote the rice-hullers association to better organize, certify, and help their members in locating producers and in finding end markets.

Support to the professional association of rice par-boilers to provide the needed information and export contacts is also needed. The sharing of experience is necessary between the more advanced and the better trained women par-boilers of Sikasso and the Northern women par-boilers in Mopti, who are using archaic methods that damage the quality and produce a parboiled rice with an off-putting odor. To become export competitive, par-boilers also need improved packaging, including new packaging technologies.

The promotion of equipment leasing and credit for rice threshers, mechanical weeders is needed for the spread of SRI, and ploughs in valley bottom rice for women. Collaboration with BNDA is necessary to develop suitable equipment credit products. Additionally, there is a need to assist POs to better prepare business plans for access to bank finance Assist female producers through a functional literacy program

To enhance productivity, there is need for the greater spread of good agricultural practices such as SRI, DUP, and FMD. Promote the Intensive Rice System (SRI) and the micro dosage system to lower the quantity of seeds and fertilizer per hectare through an improved and earlier transplanting of the rice plants that boosts the root system and enhances yield. The SRI package requires the use of locally fabricated weed removers that need to become more available from the local fabricators. A need exists to emphasize productivity enhancement techniques specifically for improving the “bas-fonds” rice production areas for valley-bottom rice produced by women producer groups. Collaboration with research institutions and existing extension providers through sub-contracting arrangements and collaboration especially with CMDT, DRA, and ORM, and regional research services, is critical. Additionally, there is a need to provide adult literacy training combined with management and marketing training through SM4M methodology.

Collaboration with the banks is necessary to ensure that that the fertilizer in warehouses can be provided as seasonal credit. The role of a broker between the banks and the chain actors is needed to ensure that agricultural credit through farmer organizations is adequately supervised and furthermore, so that the inputs are received, correctly used and the credit is reimbursed on time. This intermediation is necessary so that the banks can build up confidence in the capacity of the POs. Currently, banks prefer supervision to a guarantee fund.

## **CONSTRAINTS IN INTRODUCING THE UPGRADING IN RICE**

Hullers are often used despite whether they are in poor mechanical condition and there is an insufficient number of mechanics for repairing and improving their performance. The larger hullers with more sophisticated machinery also complain of the absence of sufficient mechanical support for their operations. Local rice has a large percentage of broken rice reflecting poor drying and hulling methods. Most producers and collectors use local mobile rice hullers, which are old and inefficient.

Packaging is expensive and a major issue for reaching the premium market. Affordable packaging information and technologies with access to finance is needed for processors to address this issue. This information would help in improving the packaging knowledge of the local rice millers and packers to compete with imports. It is important to help the good quality local rice producers in getting adequate visibility by brand and logo promotion and make them stand out from the bad quality that prevails.

Research and extension services are underfunded and some of the high performing varieties that could increase yields are not made available to the producers. Some of the varieties are still at the pre-extension farmer field trial stage such as SK 90. Valley bottom rice for women gets least attention from extension, while it has the best potential for improving women income. Valley bottom women producers do not have adequate access to ploughing equipment at the right time.

Financial products suited for smaller actors such as *mini-rizerie* are not easily accessible. The *mini-rizerie* can play a major role in financing the seasonal inputs if they are enabled to play their role in an effective manner. Financial services for

POs and smallholders are generally experiencing a crisis of repayment and measures are needed to enable access to credit and roll over the debt until the next season.

## **IV. BUSINESS ENABLING ENVIRONMENT**

### **POLICY ENVIRONMENT**

The National Investment Plan for priority sectors in agriculture (PNIP-SA) 2011-2015 aims to ensure food and nutrition security in Mali. In doing so, it contributes to achieving food sovereignty in the country in order to assure the well-being of the population in accordance with the LOA and ECOWAS policy. PNIP-SA objectives include:

- Increased cereal production (maize, millet/sorghum, and rice) through the intensification and modernization of production systems and marketing
- Increased livestock production (meat, milk, fish) through resource management and intensification of pastoral and aquaculture production systems
- Improved producer incomes through increased economic returns on surplus production
- Improved nutritional status through better Information, Education and Communication (IEC) interventions.

These policy declarations, however, are not matched with effective activities in the field due to lack of projects and programs for translating these objectives into realities. Most government services are underfunded and poor governance and lack of effective financial supervision can bring about misallocations of available funds.

The principal support to the rice sector is through the fertilizer subsidy, which in turn has distorted the fertilizer market by restricting the supply to three large and favored companies such as Toguna and Faso Djigi with links to the government. This has removed competition on quality or performance while disrupting traders' cash flow through delays in payment and increasing transaction costs. The dominance in the market of three large traders who are financing the sector has the effect of reducing the prices paid to growers at the start of the season and increasing prices to consumers later on.. A more competitive rice sector could enhance access to working capital and stimulate competition amongst traders allowing producers to negotiate higher prices.

A harmonized government policy regarding imports is critical for enabling the expansion of production and yield enhancement in cereals. Poorly planned imports that lower prices during the “hungry season” can discourage group marketing activities, as was done last year. A strategic stock needs to be established that can maintain prices at levels that can give the farmers the required incentives. The key policy issue in the millet and sorghum market is the difficulty of getting an export permit by wholesalers. The government, although officially bound by regional agreements on free trade, discourages cereal exports by putting a lot of red tape to prevent such exports. The lack of predictability in the GOM's interventions in the price of inputs for millet and sorghum generates uncertainty and may well reduce rather than increase subsector productivity.

### **ROADS <sup>4</sup>**

Mali's primary and secondary road network is adequate and well maintained a compared to its neighbors. Business owners identifying road transportation as a constraint is only 20 percent, much lower than in other low-income countries in Africa. Mali has excellent access to the major ocean ports of Lomé, Dakar, and Abidjan. Regional roads are paved. Despite continued constraints in adequately funding the development and maintenance of the overall road

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<sup>4</sup> - The information on roads in Mali is based on IBRD's report on Mali's Infrastructure cited under *Briceño-Garmendia C., et al, 2011*.

network, Mali has clearly prioritized maintenance of key regional routes. Rural access roads are poor especially during the rains.

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