Cotton-cereal Systems in West and Central Africa:

Opportunities and constraints for revenue-raising diversification and marketing strategies[1]

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ACRONYMS

ACA :	Association Cotonnière Africaine
ACP :	Africa Carribean and Pacific
AFD :	Agence Française de Développement
AFDB :	African Development Bank
APROCA	Association des Producteurs de Coton Africain
AGOA :	African Growth and Opportunity Act
AICB :	Association inter-professionnelle du Coton du Burkina Faso
BACB :	Banque Agricole et Commerciale du Burkina Faso
BCAO :	Banque Centrale de l'Afrique de l'Ouest
CEDEAO :	Communauté Economique des Etats de l'Afrique de l'Ouest
CC :	Commodity Chain
CDDC :	Commodity-Dependent Developing Country
CFC :	Common Fund for Commodities
CIMMYT :	International Maize and Wheat Improvement Centre
CILSS :	Comité Permanent Inter-Etats de Lutte contre la Sécheresse dans le Sahel
CIRAD :	Centre International de Recherche Agronomique pour le Développement
CMDT :	Compagnie Malienne des Fibres Textiles
CNCR :	Conseil National de Concertation et de Coopération des Ruraux
ECOWAP :	Economic Community of West Africa Policy
FAO :	Food and Agricultural Organization
FONGS :	Fédération des Organisations Non Gouvernementales du Sénégal
GPC :	Groupements de Producteurs de Coton
HIV	Human Immunodeficiency Virus
ICRISAT :	International Crop Research Institute for the Semi-Arid Tropics
IFPRI :	International Food Policy Research Institute
IITA :	International Institute of Tropical Agriculture
INERA :	Institut National de l'Environnement et de Recherches Agricoles (Burkina Faso)
INRAB :	Institut National de Recherche Agronomique du Bénin
INRAN :	Institut National de la Recherche Agronomique du Niger
IO :	International Organization
IPPM :	Integrated Production and Pest Management
IRM :	Integrated Rice Management
ITC :	International Trade Centre
MDG	Millenium Development Goals
MFI	Micro Finance Institutions
NEPAD :	New Partnership for Africa's Development
NERICA :	New Rice for Africa
NCCS :	National Commodity Chain Stakeholders
NGO :	Non Governmental Organization
OECD :	Organization of Economic Cooperation and Development
OHVN :	Office de la Haute Vallée du Niger
PNGT :	Programme National de Gestion des Terroirs
PRMC :	Programme de Restructuraltion des Marchés Céréaliers
OPV :	Open Pollinated Varieties
ROPPA :	Réseau des Organisations Paysannes et des Producteurs d'Afrique de l'Ouest
SAED :	Société Nationale d'Aménagement et d'Exploitation des Terres du Delta du Fleuve Sénégal et des Vallées du Fleuve Sénégal et de la Falémé.

SOPROFA :	Société pour la Promotion des Filières Agricoles
SWAC :	Sahel and West African Club (part of the OECD)
UNPCB :	Union Nationale des Producteurs de Coton du Burkina Faso
UNCTAD :	United Nations Conference on Trade and Development
UNDP :	United Nations Development Plan
UNPCB :	Union Nationale des Producteurs de Coton du Burkina Faso
UEMOA :	Unité Economique Monétaire Ouest-Africaine
US :	United States of America
USAID :	United States Agency for International Development
WARDA :	West African Rice Development Association –now African Rice Center-
WCA :	West and Central Africa
WTO	World Trade Organization

Executive Summary

According to the defined results and the eligible priority activities of the *All ACP Agricultural Commodities Programme*, a new EU-funded programme, this paper aims at providing all the relevant and current background information for the cotton-cereal systems in West and Central Africa. This is done in the realm of revenue diversification and revenue-raising options for countries that are acknowledged to be economically dependent on few commodities and to face food security and rural development challenges.

Given this central purpose, we need to identify the most important constraints for crop diversification and new marketing strategies that are crucial for a rapid change in the management of cotton-cereal systems along the commodity chains and among the stakeholders. We also need to explore the various experiences and arrangements enabling to relax these constraints within different institutional and policy frameworks.

To address these points, we firstly present the technical components, challenges, and constraints of the cotton-cereal systems in West and Central Africa at the producer level. One important question is to understand the reasons for crop yield stagnation and constraints for technical change and improvement such as better practices, better use of inputs and adoption of new technologies. Another one is to account for commodity dependence with respect to the cotton sector, beginning by technical links between cereal crops and cotton. This is one of the major constraints to crop diversification when farmers rely on cotton for agricultural inputs and technical assistance. Then, we present the specific market components and organizations of the supply chain structures to characterize the role of horizontal and vertical coordination for market development, implementation of revenue-raising marketing strategies, and technical improvement. We will precisely examine how the organization of commodity chains and the existing institutional arrangements impact on risk-management decisions and risk-sharing, information sharing, and profit-sharing along the supply chains. Other impacts include the provision of key public goods –extension services and quality grading, education, health and rural infrastructures- and the implementation of further options.

The review of key institutional and policy components of these crop systems adds useful information and then deepens the previous analyses. The goal is to capture the specific institutional and policy features when analyzing the constraints for crop production growth, expansion of markets, and value-added marketing strategies along the commodity chains. One important point has to be made about the competition/coordination trade-off and the ways to overcome all the incentive and capacity constraints identified earlier. What institutional mechanisms –both formal and informal- can help overcome the market imperfections for cotton, grain, and inputs? What policy environments seem the most appropriate to foster institutional innovations and reduce market imperfections? Which public goods are crucial to support these dynamics?

In the descriptive section of technical features, we characterize cotton-cereal systems by rotating farming with cotton as a key element, and maize –progressively replacing sorghum- as the main staple crop. Other minor crops are niébé, beans, peanuts, and other legumes. Cotton has induced a change in farming with the adoption of animals (mechanization) and inorganic inputs in the region. However, livestock and crop activities often lack integration, and better practices are needed for conservation and fertility purposes. Agronomic and economic complementarities have beneficial repercussions for the associated crops, such as maize or sorghum. Cotton production impacts on cereal ones because of market linkages, as exemplified by input access and better extension services provided to cotton areas and cotton farmers. These strong interdependences call into question the sustainability of such farming systems when cotton production becomes less profitable. We observe that the stagnation of

cotton yields has to be associated to the ones of cereals. Hence, agricultural growth is mainly extensive in the region, which induces many challenges for soil fertility.

To face the previously stated constraints, many new options exist. One is a better concern about integrating livestock and crop activities into cotton-cereal systems. This addresses issues of soil conservation (with available organic fertilization) and animal feeding. Other techniques involve intercropping and alley cropping, improvement of inorganic fertilizers formulae, micro-fertilization, and pest management. Variety creation is also a crucial factor for improving-yield potential. Early cultivars for sorghum and millet, better rain-fed rice varieties, or new generations of maize varieties are promising. However, they have to be associated to specific cropping techniques and input application consistently to the needs of the variety. Technical improvement is not sufficient because determinants of adoption are also critical. Indeed, learning costs and perception of risks among untrained farmers may be strong constraints, in addition to liquidity ones. Improving farming systems is a gradual process where farmers incur risks and costs, according to experience, extension agents, and other social mechanisms. Capacity constraints are a strong limitation when access to markets (output, input, and seeds) and infrastructures are poor. Technology adoption can be fostered by new marketing strategies, and private arrangements involving value-addition to the production, extension services, and better access to markets. The policy environment is also determining as it can help improving markets and institutions.

In the section about the key market and commodity-chain organizational features, we highlight that cotton and cereal markets have very different characteristics. Cotton ones are well supported by institutions, better infrastructures and historical operators. Cereal ones have logistical disadvantages and big transport costs. This has been maintained by food policies that have privileged imports instead of investing in rural infrastructures and local production. However, urban demand exists for local products, if they could be adequate to the preferences of consumers (processed). Most of local traders –small ones- have no capacities to invest in working capital and business expansion is limited by institutional failures and the prevalence of the network economy. Access to inputs is much constrained for producers because of structural deficiencies, such as high transaction costs, liquidity constraints, and asymmetric information. Input credit is affordable under interlinked agreements such as outgrower schemes and contract farming (arrangement with buyers and processors), barter schemes (arrangements with input providers), and MFIs (village banks, and producers' organizations). The latter is an interesting sustainable strategy for non-cotton producers to access input credit, but also consumption credit to get more incentives to store (cereal banks and inventory credit). The role of extension services appear as crucial to assist farmers' organizations and to help set up viable input credit schemes. Supply chains have been deeply restructured after sectoral reforms, from the integrated fashion to more liberalized markets. Vertical relationships now entail specific arrangements between stakeholders and farmers for pricing issue, input credit, and provision of public goods. They are very different according to the degree of competition and existing capacities along the chains. These reforms have allowed farmers to better participate in profit-sharing while bearing a higher degree of risk (fewer guarantees on outlets and prices). However, they now face several marketing channels that may be beneficial for them if they increase their capacities (information, management, bargaining with traders, storage, and infrastructures). This is constrained by coordination failures, which are induced by inappropriate institutions and competition, threatening the provision of extension services and quality grading.

Apart from the purely agronomic risks on production, farmers bear several economic risks in the newly liberalized CCs. While cotton price and buyers are still guaranteed in the region, marketing cereals involves new risk-management issues. First, farmers have to choose

their marketing channel, then to decide when and how much to sell and when and how to store. Input access is also a relevant risk factor, together with the choice of crop portfolio. Risk-mitigation options comprise better information-sharing with the assistance of extension agents, and the involvement of farmers into new marketing channels (processing, transport to urban retailers) and storage activities. Finally, the development of new micro-insurance schemes may help farmers facing external shocks on production and on farm assets and income. Lack of infrastructures is highly responsible for low market integration and high economic risks faced by producers, together with capacity constraints. Communication and information need durable investments by private stakeholders and also public instances. Cost-effective ways to provide infrastructure may use existing infrastructures with the involvement of user communities. Better storage and transports will reduce food price variability, but this will ultimately rely on central markets.

Due to the lack of well-functioning markets, farmers rely on imperfect institutions to market their production, access inputs and public goods, and so on. At the local level, the community environment is very important for farmers, as exemplified by producers' organizations. We currently assist to a strengthening of the rural civil society and to the revitalization of rural communities. This movement help farmers have professional structures and involve as political actors. However, governance and management capacities are critical to this success, in addition to local social conservatism and other social norms. The current federative dynamics of producers' associations is linked to the growing participative nature of agricultural policymaking in the region.

Weak public institutions make enforcement mechanisms very informal, with several restrictions on business expansion and private investment in CCs. Hence, coordination of collective activities is very difficult (research, extension, quality) within CCs, and increasingly with respect to the number of NCCS. Many solutions do actually exist such as public-private partnerships, the establishment of inter-professional associations with involved farmers, and effective consensus-building institutions. Setting up self-regulated frameworks is a challenge for the future, which should be complemented by better information services that will improve vertical and contractual relationships. The institutional environment of NCCS should be understood in a broader way, accounting for the specific societal characteristics of WCA rural societies. The network economy is maintained by the ethnicity phenomenon, and the legal dualism, which hinder the application and the credibility of formal law. This implies information retention and restriction of economic differentiation, which limit private business incentives. The role of religion and gender is essential to go beyond these constraints.

The reforms of CCs have been subject to many criticisms, and many controversies about their effects still remain. However, several successes have been encountered, notably when governments did not involve through second-generation controls. In the cotton sector, the difficulties have arisen because policymakers failed to account for the institutional framework. Cereal liberalization has shown worse results when inconsistent food security policies have been kept, together with incoherent trade policies. Remaining challenges are capacity-building led by professional extension services with better organized farmers. Contradictory policies are explained by the specific political economy conditions in the region, which articulated around the social contract and frictions between governments and aid agencies. The commitment problem can be overcome by a specific institutional environment, as in Mali. The currently growing political involvement of farmers can, however, induce a change in the political economy conditions to align incentives of policymakers with those of the NCCS.

In the last section, we propose a strategic framework, accounting for all the stated constraints and existing options for revenue-raising, including diversification and value-chain developments, as well as policy and institutional options. We put an emphasis on the support of better extension and information services, and to foster the dynamics of professional farmers' group formation and federation. According to the relevant diversification options and value-chain developments, activities should focus on sorghum, rice, and locally-specific crops such as peanuts, sesame, cowpeas, Arabic gum, mangoes, tomatoes, onions, and niébé. Access to better-suited processing facilities is also essential, notably for cereals. Strategies to reduce risk and ease farmers' constraints should also be pursued: storage activities, micro-insurance schemes, inventory credit, training for information and economic management of farms and local cooperatives. These points are supported by the views of local NCCS. Finally, research and extension services need a more coherent framework and public-private partnerships. While the institutional framework calls for many improvements (out of the scope of the project), food security and trade policies should be cautiously designed so as to increase private incentives for the relevant CCs, and for agricultural development.

Our recommendations are mainly organizational, since the time frame of the project is too short to effectively involve in research and development activities. One reasonable goal would be to give the sufficient capacities for NCCS to set up the necessary arrangements so as to coordinate better within effective operational structures. Arrangements should comprise input providers (barter schemes), processors (producer-processor contracts), retailers, and farmers' organizations. Network-building among identified NCCS –and establishment of new private arrangements- could be supported by the activities of the project, with assistance and delegation to the relevant local organizations. Added-value would be fruitfully be reinvested in local infrastructures and extension services, with progressive increased capacities to access capital markets (MFIs and commercial banks), manage input and output stocks, provide quality grading and information.

One purpose is to make farmers less dependent of their cotton production to engage into other crops, while bearing less risk. This would foster technology adoption for better practices and improving-yield varieties and inputs. Links with urban markets and the animal feeding sector appear as very valuable to reach higher-value markets, but processing facilities should be improved so as to enable NCCS to involve into industrial transformation and commercialization of their products. Better-functioning arrangements will enable farmers facing a larger set of viable crop and technology choices, with more incentives to increase social and human capital. Extension services are again essential to foster learning and adopt the relevant risk-mitigation options, while processing and quality enhancement appear as a key challenge to increase profitability margins for all the NCCS.

The project may be worth keeping restricted around the existing commodity chains, because of time constraints. The development of the sesame CC, or the Arabic gum, for instances, should be supported in the existing production areas. Instead, the increase in capacities of NCCS and the development of new arrangements will ultimately allow several CCs to develop in the future and to better position on higher-value markets.

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1. Introduction

In developing countries, commercial commodities are crucial for the lives of millions of households and for rural employment, as well as public finances. However, these commodities are subject to big price volatility and structural decline, with very negative effects for the most vulnerable economies, and in particular, for the rural households.

The All-ACP Commodities Programme is a EU-funded initiative targeting solutions for the *commodity problem* through the support of commodity chains by the strengthening of the capacities of NCCS.

"The *All ACP Agricultural Commodities Programme*'s –budget €45 million- objectives are:

- To improve incomes and livelihoods for ACP[2] producers of traditional and other agricultural commodities
- To reduce vulnerability at both producer and macro levels with a special focus on commodity-dependent developing countries (CDDCs). The project should follow some specific recommendations, drawn on many analyses and consultations on which the programme is built: supporting the participatory formulation and implementation of commodity chain strategies, encouraging sustainable corporate practices and sustainable commodity production, advancing efforts to develop regional markets, policies and services in support of commodity sectors, supporting diversification efforts of CDDCs, extending access to market-based commodity risk management instruments, maximising opportunities for CDDCs in the multilateral trading system, and developing multi-donor cooperation and coordination in support of commodity strategies.**"**[3]

Many activities will be implemented, according to the stakeholders' expressed specific needs and constraints. For instance, activities may include supporting of strategy implementation such as institutional strengthening, capacity-building of chain actors, improved functioning of commodity-related markets, diversification efforts, commodity-risk management enhancement or either participatory development and identification of strategic options.

The strength of the project lies in its original features with the involvement of several international organizations (IOs) who shares their complementary expertise skills for the setting and the implementation of sustainable strategies. Its participatory nature with the association of IOs to NCCS (National Commodity Chain Stakeholders) along the several steps of the project and the focus on basic commodities may optimize the outcomes.

Within the ACP countries, the project focuses on few key commodities and on the countries that have expressed their interest in the participation and implementation of new strategies. The regions covered by the project include the small island developing states of the Caribbean and the Pacific, with a strong interest in fisheries and forestry, as well as semi-arid and sub-humid Africa with an interest in cereals, tubers, and cash crops. These regions are economically vulnerable because of strong commodity-dependence and environmental problems such as climatic variability, droughts and floods. In West and Central Africa, the semi-arid regions are characterized by the domination of cotton-cereal systems that are

[2] Africa, Caribbean, and Pacific regions.

[3] These objectives are in line with some of the Millennium Development Goals (MDGs) –namely the ones of extreme poverty reduction and diminution of malnourished people- in particular for vulnerable countries that highly depend on some specific commodities. It does involve poverty-reduction goals as well as improvement of living standards, food security, and economic development.

somehow linked to livestock systems while the sub-humid ones are either cereal-root crop systems or cocoa systems.

The cotton-cereal systems in West and Central Africa are characterized by a strong economic reliance on cotton revenues while local cereals are a major source of food for most producers and local rural areas. Meanwhile, food production is focalized around few cereal commodities with strong capacity constraints and an intense stress on natural resources. These farming systems also rely on breeding and animal products and their integration is still lacking but appears as a relevant strategy for a sustainable intensification[4]. Ecological constraints and lack of capacities for most of the NCCS are resulting in few alternatives for risk-diversification strategies, from the farmers' viewpoint as well as from the ones of other stakeholders. These strategies are further tightened by inconsistent policies and institutional failures.

The dependence on cotton earnings applies to several issues: national growth, export earnings and fiscal revenues, poverty-reduction strategies, and food security. These systems correspond roughly to the southern part of Sahelian areas, in semi-arid regions subject to moisture stress, soil degradation, and desertification. This limits the scope of food-crop diversification under input access difficulties with few seemingly profitable marketing strategies and low private investments in the agri-food local industry.

This being said, this apparent economic vulnerability is either worsened by a poor institutional framework, controversial policies, and/or poorly-functioning markets. The well-documented cotton success story, supported by a smallholder *peasant cotton revolution*[5] in French-speaking Africa has been subject to a critical reappraisal over the last decade, because of the difficulty to implement sustainable sectoral reform and the loss of competitiveness in the world market, where prices have appeared to be less remunerative. Even if some successful reforms have been experienced, such as in Burkina Faso[6], it is likely that relying on the cotton sector is far from being a secured strategy for agricultural development in these poorest areas of the World. However, cotton production still ensures most of cash earnings for farmers as well as most of their inputs and credit for other crop productions. Cotton earnings also provide funds for increasing capacities of smallholders' unions, agricultural extension services and research. The strong linkages between cotton and other crop productions must be bore in mind while not forgetting agronomic and economic complementarities that are harnessed in a very constrained environment for farmers[7]. How this set of constraints makes farmers and other NCCS dependent on cotton production and which constraints are critical in relaxing this dependency? How linkages could be fruitfully used for risk-diversification strategies when constraints are relaxed?

In the context of current favourable price conditions, new options may exist for cereals but we need to account for the following caveats:

- Prices may not always be so high and will probably remain very volatile
- Current cereal productivity stagnation has multiple reasons from which some might be responsible for a lack of supply response, namely capacity constraints. Therefore, improving cotton-cereal productivity should be a long-term endeavour

[4] While it is not part of the present study we recognize its importance and references to this dimension will be made when relevant

[5] See for instance, Bassett (2001) for an elegant historical survey on the cotton revolution in Côte d'Ivoire.

[6] See the work of Kaminski (2008a) for the analysis of the cotton reform in Burkina Faso.

[7] It includes poor access to credit, insurance, banking, poor infrastructures, cash constraints, unenforceable contracts, lack of information access, education, high transport and transaction costs, and so on…

- Supply response from new price incentives will also depend on the extent of price transmission to local producers[8]

New incentives could be generated for cereal production and import-substitution, if capacities are sufficiently built and coordination among improved institutions, stakeholders and farmers' associations would be more effective. High prices may be desirable for the rural poor within an appropriate policy framework which is also compensating net-consumers who bear the burden of high prices. Nevertheless, it would require a better functioning and integration of markets to yield the correct incentives for farmers and the private sector, together with supportive policies. Strengthening capacities and incentives would involve improving existing farming systems and marketing strategies, and establishing appropriate institutional and policy frameworks to perform on other commodity markets.

This background study aims at bringing the relevant background information of the cotton-cereal systems in WCA when examining options for revenue increases and diversification. First, we want to examine the current constraints to higher performance and productivity. Second, we aim to identify possibilities of diversification within and outside the cereal-cotton system. Finally, we make policy recommendations for improving production, marketing, and institutions for revenue-raising diversification options within these cereals-cotton systems. Through these three objectives, it would be worth identifying technical, institutional, and policy options toward better diversification, production increase, and value-addition by marketing strategies. The recommendations will apply to actions and strategies that are implementable at the market and institutional level to enable revenue-enhancing options

Given a set of identified characteristics and constraints[9] facing the cotton-cereal systems in the region, this report attempts to answer to the following central question: What are the realistic options that can be pursued at different levels to bring about a better performance for the system? This could be measured by higher revenues for producers, more stable and less risky incomes for the farmers of the regions engaged in cotton and cereal production, higher and less variable profits for value-chain stakeholders, and impacts on other sectors such as animal processing and livestock, input markets and other crop by-products.

This information will help us figure out what are the main constraints faced by NCCS and the different strategies to further explore. This will be done through a literature review and a multi-dimensional analysis. An analysis of the relevant sectors within an industrial organization approach will be led in order to capture the different elements stemming from vertical relationships and coordination issues among the different stakeholders. This could help identify what capacities are lacking for stakeholders to implement viable strategies. This will be documented and discussed relatively to the point of view of NCCS. We will indeed incorporate insights from stakeholders' consultations before making the final recommendations.

This analysis will cover the cotton cereal systems across several West African countries with significant cotton production. The countries covered are: Senegal, Mali, Burkina Faso, Côte d'Ivoire, Ghana, Benin, Togo, and Cameroon. Also, when appropriate, experiences from other non-cotton countries in the region will be referenced. Accounting for the heterogeneity of national and regional contexts will be a necessary –albeit far from being

[8] Crucial factors are transport costs and infrastructures, institutional governance, and organization of the supply chains and related markets.

[9] There will be common and specific characteristics and constraints. Some are inherent to the supply chains and apply to risk-management, marketing issues, information problems, capacity-building, market structure, and coordination problems. Some come from the market characteristics, the institutional (agrarian and regulatory institutions, and the legacy framework) and the policy frameworks.

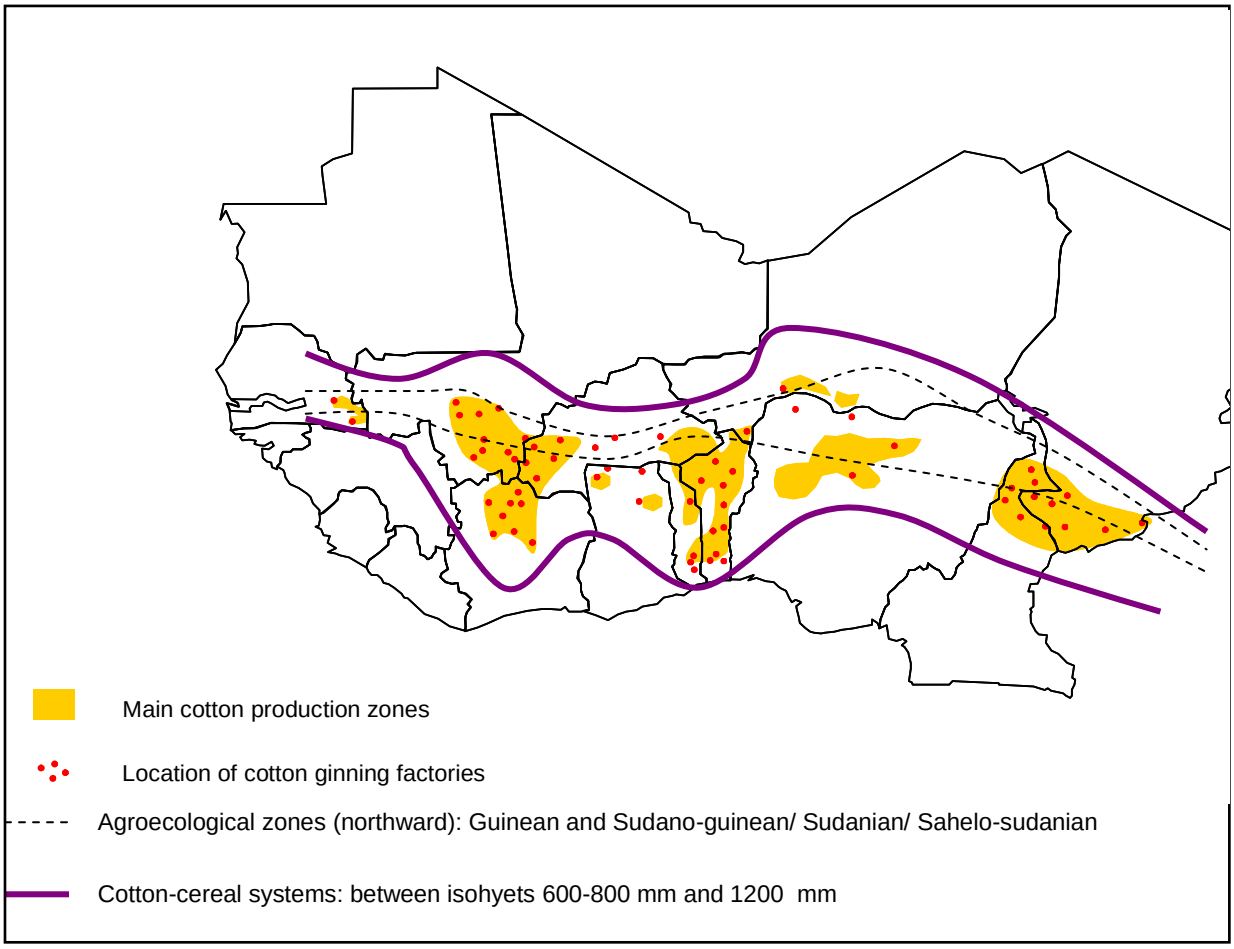
sufficient- step. The homogeneity of conditions for farming systems will allow us to disentangle the different issues of management and technical progress therein.

The paper sets out to analyse the cereal-cotton systems by examining:

- Farm and supply chain structures
- Risk-management decisions and further options
- Underlying technologies: degree of intensive/extensive production patterns
- Tying information and evidence about the functioning of these cotton-cereal systems at different levels will enable us to have an overall understanding of the key constraints and mechanisms along the commodity chains for revenue-raising options.

The remainder of this paper is as follows. Section 2 will review the basic features of cotton-cereal farming systems in our area of study focusing on underlying technologies and production constraints. This includes exploring the technology-improving options and their constraints for diffusion. Section 3 will analyze the market environment of stakeholders and the structure of supply chains. It will be fruitful to understand how these characteristics constraint the choices of farmers (crop diversification and input allocation) and how it impacts on risk factors and risk-mitigation options. Then, section 4 will bring the analysis to the institutional and policy environments faced by farmers and other NCCS. We will then conclude on the relevant institutional and policy options and recommendations.
Section 5 will discuss the identified diversification options well as value-chain options, to enhance productivity, reduce risk and improve incomes. Finally, section 6 will conclude the study and make recommendations for actions in the context of the project.

2. Cotton-cereal farming systems: technical characteristics, production constraints and possibilities



Source: SWAC (2004), Atlas de l'Afrique (2000)

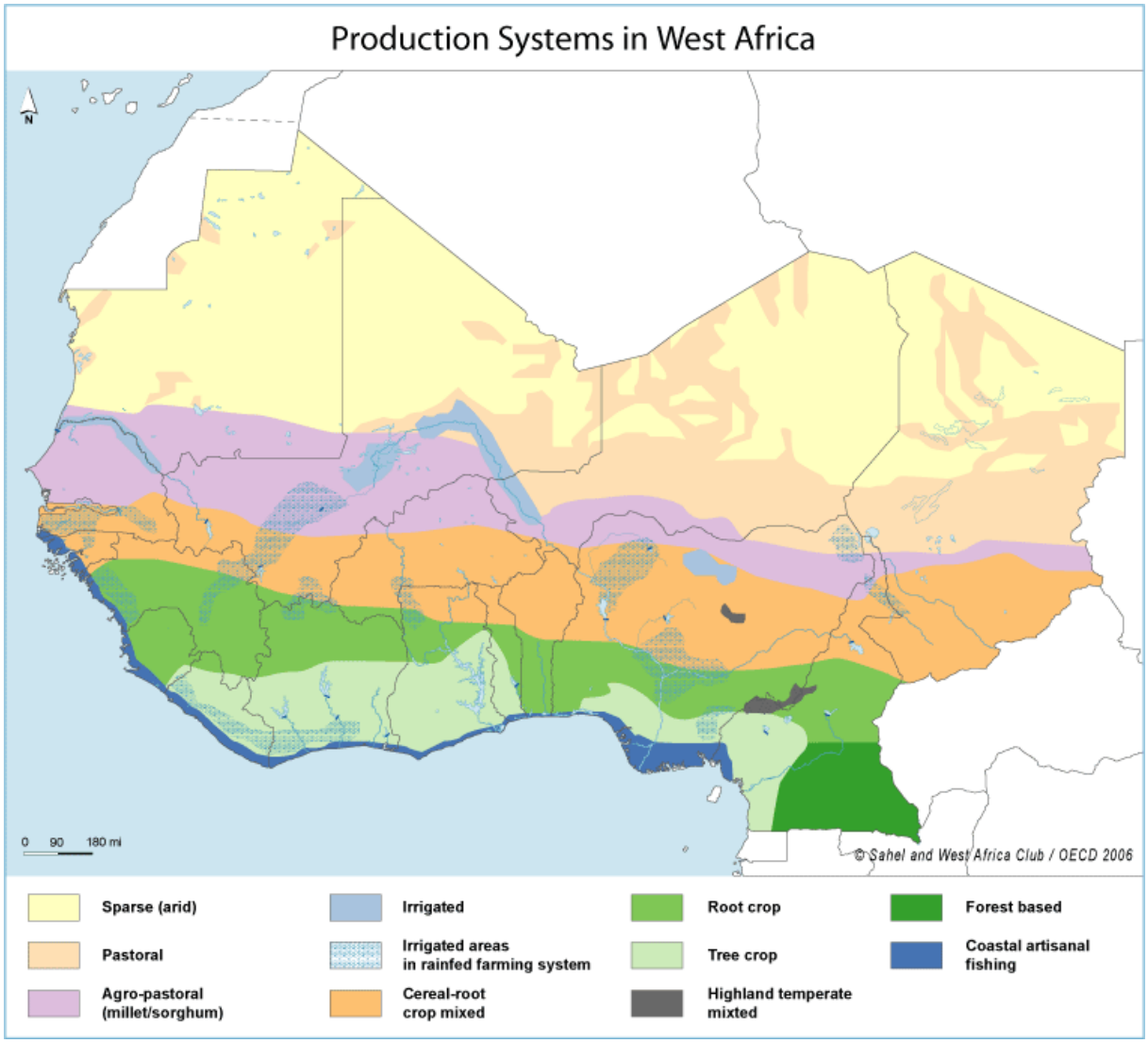
Figure 1. The relevant agro-ecological area of cotton-cereal systems in WCA

In West and Central Africa, cotton-cereal systems are located in semi-arid zones of production, where rainfall is generally larger than 600 mm a year. Starting from Sahelo-Sudanian agro-ecological areas, cotton systems over several agro-ecological areas namely Sudanian and Sudano-guinean and can sometimes be found in sub-humid tropical areas such as the Guinean area. This roughly corresponds to the dry savannas of West and Central Africa and to the uplands of Cameroon (see figure 1).

2.a. Cotton-cereal farming systems: description of technical elements

Cotton-cereal systems are characterized by rotating farming with cotton as a key element, and maize –progressively replacing sorghum- as the main staple crop. Other minor crops are niébé, beans, peanuts, and other legumes. Cotton has induced a change in farming with the adoption of animals (mechanization) and inorganic inputs. However, livestock and crop activities often lack integration, and better practices are needed for conservation and fertility purposes. Agronomic and economic complementarities have beneficial repercussions for the associated crops, such as maize or sorghum.

The first level of heterogeneity arises from the rainfall variability and associated agro-ecology. The cotton-cereal production systems goes southwardly from agro-pastoral (millet/sorghum) areas –where cotton production is marginal- to cereal-root mixed cropping system, crossing irrigated areas and areas with both existing systems. In Cameroon, the cereal-cotton systems are present in highland temperate mixed systems (see figure 2).



Source: FAO (2007)

Figure 2. Farming systems in the area of study

In the main cotton production area, cotton-cereal production is mainly organized through an efficient model of rotation-cropping of cotton/maize/sorghum in three equal parts for crop allocation on land. Because of households' own internal constraints, a typical land allocation is split between 40% for cotton, 25% each for maize and sorghum (sometimes replaced by millet) and 10% dedicated to Niébé and other legumes, fruits, sesame or peanuts[10]. As claimed by farmers, each crop has a specific economic and social function, which is internalized into the reasoning of their cropping choices. Sorghum is the main food component of rural food population and is used for animal feeding; maize is in large

[10] This is what has been reported in the main cotton production basins of West Burkina Faso/Mali/Côte d'Ivoire and Northern Benin/Chad/Nigeria

expansion and has the best agronomic complementarities with cotton. Cotton is grown for cash income and input access. Millet and sesame are often cropped to overcome input credit restrictions, as they require fewer inputs, and they have better linkages with other cereals. Sesame is under a strategy of a developing "niche market" [11] while millet production is decreasing because of decreasing demand in the cotton areas. However, millet is more grown northward in the Sahelian areas or semi-sahelian ones where it is associated with livestock in agro-pastoral areas. It remains marginal in cereal-root cropping systems. Rotation-cropping entails one-year rotation of crops on each plots of the household with a reduced time of fallowing and further from the homestead fields. Cotton and cereals successively alternate each other but these general rules can be adjusted according to the household needs (cash and food) and the local soil and edaphic conditions, as well as the market opportunities and complementarities.

The cultivation of cotton has induced a shift from traditional to transitional and modern farming systems that are based on different land management systems and input uses. Traditional systems involve extensive crop cultivation with labour-intensive techniques, application of manure, fallowing and migration with a low use of inorganic inputs. Classically, these systems call for a relocation of the farmer's homestead close to the cultivated fields after each cultivation phase, when population density is low and fallow periods are long enough to restore soil fertility. This classical kind of farming has become restricted to certain areas because of demographic growth, introduction of new technologies. Agriculture has transformed into a sedentary-based with more and more permanently cropped fields. Rotation-based farming systems have been introduced further from the homestead fields with integration of shorter fallows and the development of specialized fields or land use systems. Shifting cultivation now only exists at the margin frontier of rural areas, at the border of non-cleared vegetation. In these systems, livestock has been kept. This involves higher use of inorganic inputs and labour-intensive soil techniques. The general pattern in West and Central Africa has been a progressive exclusion of livestock from cropping systems to grazing lands and transhumant paths. But, as in many other parts of the developing world, livestock provides high social and economic value to rural communities: meat, saving accounts, participation to soil fertility, waste recycling, social and cultural obligations, and animal traction.

Improved farming systems should focus on a better integration between cropping and breeding because it is common practice for herders to arrange with arable farmers to graze stubbles or crop residues from harvested fields, in return for animal manure. Furthermore, in the Sudanian zone, cultivators arrange with pastoralists –between Mossis and Peuls for instance- to take care of their livestock and sometimes to graze them during the dry season in distant pastures. A future challenge thus will rely on a better integration between these activities, toward a "sustainable intensification" of agriculture. Current changes involve herders doing arable cropping and cultivators to make some pastoralism but demographic pressure exacerbates conflicts arising around land use and competition to land access. In Burkina Faso, FAO and INERA (2004) reports a southward move of cotton-cereal cropping with a northward counterpart move of animal inflow during the humid season. Here again, it is deplored a clear separation of crop and livestock activities on land inducing land degradation and conflict about land use. The integration between crop and livestock activites could be helpful overcome this *tragedy of commons* if arrangements between cultivators and herders can take place within farms with enforcing local institutions. Moreover, it could contribute to better organic matter replenishment in fragile soils without transfers from further grazing lands. Mixed farming just takes place between farms for now within cotton-cereal

[11] See for example, the sectoral strategy in Mali led by ITC (2006).

farming systems. New projects attempt to diffuse learning of integrated techniques with complementarities between animal feeding, cereals, and use of cotton by-products (e.g. PNGT in Burkina Faso). For more details about integrated systems and mixed farming, see box 1.
Even if better practices for soil conservation are applied today (more application of manure and no more complete clearing of land), the same constraints related to technical improvements and increased production apply to the integration of crop and livestock, namely physiochemical and biological factors, technical problems, and the ones arising from socio-economic conditions such as institutional, market, and policy factors (see later). Intensification of modern farming systems soil may, however, lead to a long-term degradation of resources –soil nutrients and water- if organic matter is not well regenerated by sufficient fallowing periods and application of organic nutrients to restore the equilibrium composition of soil nutrients[12]. The so-called 'soil mining' hypothesis has called many scientists into question whether modern farming systems lead to unsustainable land management involving desertification and soil depletion (see Eswaran *et al.* 2001). However, this narrative is based on static observations and do not account for the diversity of smallholder practices and the large number of ecosystem interactions on farms. Many scientists have observed that dryland farmers are keenly aware of the importance of maintaining productivity and coping with drought, and are skilled in indigenous techniques for doing so. An emerging theory is the 'borrowing' (See Mazzucato and Niemeijer, 2000; and Niemeijer and Mazzucato, 2002) view that basically involves that farmers are borrowing soil fertility (manure from grazing lands) to enrich the homestead fields where highest-value crops are cultivated. The development of markets may increase farmers' capacity to restore fertility of the most depleted soils (the outer

Box 1 : Mixed farming:

Mixed farming applies to the farming systems that are not specialized in one particular activity. Farmers have to divide their resources and effort to several activities, thus reducing economies of scope. It provides, however, reducing-risk strategies and the possibility to harness agronomic complementarities such as the ones from combining trees, grains, and livestock through animal feeding and soil fertility conservation, or larger input-savings crop rotations. Advantages depend on the local conditions and socio-cultural preferences. Mixing strategies are not an improvement in itself but sometimes a constrained choice when farmers can only rely on labour-intensive technology and not on external inputs because of market deficiencies or liquidity constraints. Weather constraints (e.g. drought) can force herdsmen to engage into cropping to feed their livestock

Mixed farming can take many forms according to these external factors but also to internal ones (household, soils, weather, education and skills…). Several forms include agro-pastoralist diversified livestock with different species and feed resources, cultivation of different crops on the same field, or the same crop with different species having different life cycles. Systems are either diversified or integrated ones, on-farm or between-farm mixed, and mixing crop and/or animal systems.

Between-farm mixing notably involves in WCA transportation of manure to livestock systems toward vegetable cropping areas, or animal labour force (ploughing, or weeding for instance) and milk. Exchange often occurs between specialized pastoralists and growers that give back grain, cash, and/or water rights to the former. Cultivators can also let their livestock taken care by pastoralists in return for cash, cropland, labour, or profit sharing on animal production. With land degradation and demographic pressure, conflicts between cultivators and herders are rising about land use and the decreasing amount of grazing land. Within-farm mixing involves crop rotation over and within years, with also intercropping possibility to take advantage of light and moisture. Animals can be mixed for feeding complementarities, diseases reductions or efficient use of resources and biomass by mixed grazing.

Integrated systems allow animals and crops to be used in interdependent production systems, enabling more efficient resource recycling. Many systems exist with different environmental concerns and they all exhibit advantages by using the animals to better control weeds, for labour, savings and using dung for land fertilization, together with improved fallows (leys). A nice example of a sustainable integrated system is provided by the Agro-forest villages in Java. Within cotton-cereal systems, integration of activities should be based on specific agro-ecological complementarities and possibilities. Through experience and experimental learning, a sound integrated model may emerge (see figure 11). *Source: FAO (2001)*

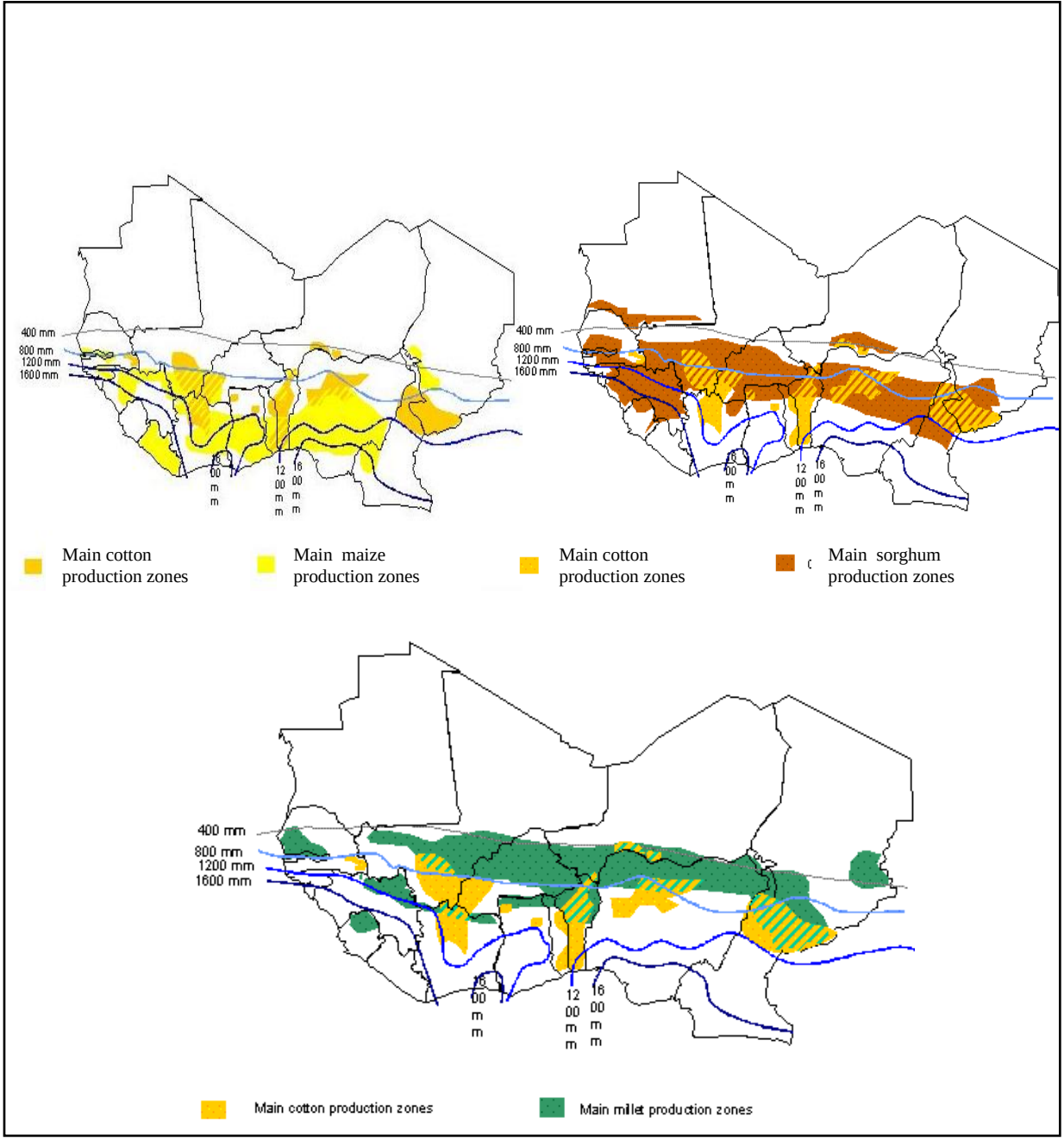
[12] See Harsmar (2004).

ones). Hence, soil fertility degradation must be understood as a dynamic process with rational risk-coping strategies and within an incomplete market environment. Furthermore, land tenure patterns may play a role for soil fertility when investment in land is constrained by lack of long-term projections if land rights are perceived as "insecure". We will explore the role of land rights and norms in the next section because they have further implications than the ones on fertility investments (e.g. diversification strategies). Moreover, they should be analyzed within the broader set of specific rural institutions that prevailed in cotton-cereal systems.

Cotton-cereal rotating systems benefit from agronomic and market complementarities[13] between cotton and cereals. In Semi-arid West Africa, there is historical evidence of a co-existence of food grain (millet, sorghum, and maize) and cash crop (mostly cotton, but also sesame, rice, or groundnuts) production into rotation-based farming systems in these areas[14]. The cropping, storage, trade, and use of cereals are common to the bulk of savannah countries. The association between cotton and cereals in the same plot within rotation-based systems allow cereals to later benefit from the background effect of cotton fertilizers. There is also a positive externality of cotton/maize rotation on soil fertility. Moreover, intensified cotton systems are more equipped with animal traction, involving better potential manure applications, which translates into better long-term fertility. Rotating systems allow households to better manage labour allocation because cereals and cotton do not require the same labour force over the agricultural campaign. Cotton needs early soil preparation and input applications while cereals require most of the labour force later in the humid season. The same applies to the labour management during harvest (cotton has an earlier harvest than cereals and other field crops).

Figures 3, 4, and 5 show the geographical production linkages between cotton and grain cereals in our area of study. As can be seen, millet and sorghum areas of production are overlapping with cotton ones while maize is more produced southward, as it requires more water rainfalls, but is also geographically associated to cotton.

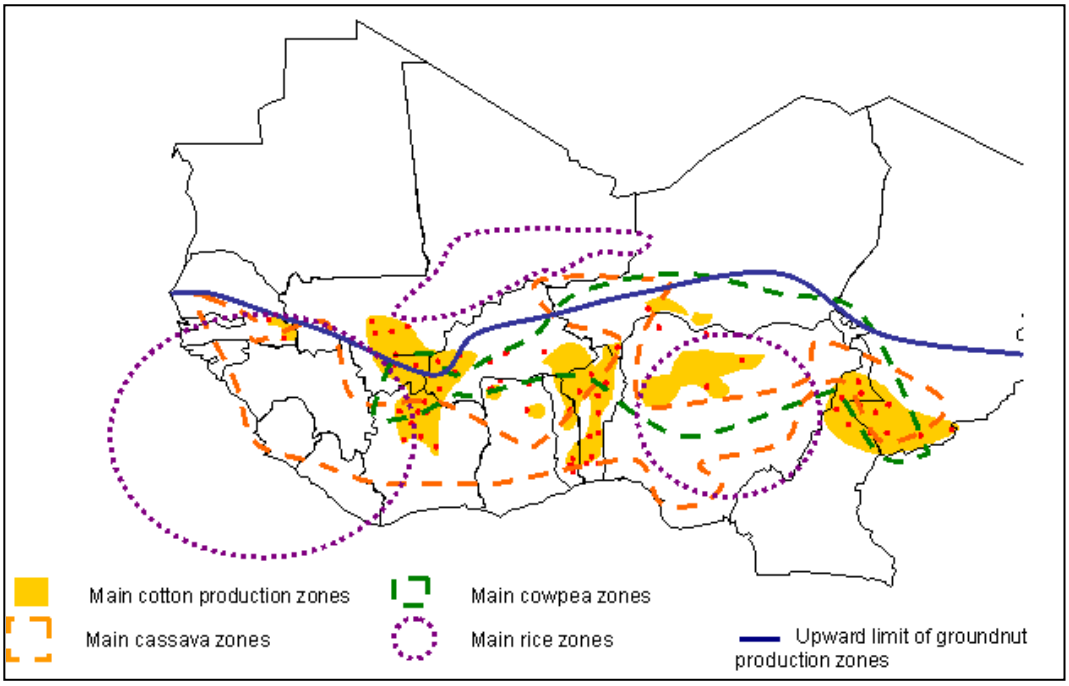
[13] Market linkages include the access to agricultural inputs and extension services. See next point.
[14] See for example Pourtier (2003): "La régionalisation en Afrique de l'Ouest".



Source: SWAC (2004), Atlas de l'Afrique (2000) and FAO (2004)

Figures 3,4, and 5. Juxtaposition of cotton and maize, sorghum, millet production areas in WCA

The links with other crop productions are less apparent but these could interfere with cotton production for the allocation of inputs such as land, labour or fertilizers, and they belong to rotation-based cotton-cereal systems. Figure 6 shows the location of other main crops in the relevant region for cotton-cereal systems. Rice is mainly concentrated around irrigated areas of Mali and Senegal, and in Southern rain-fed lowlands. Cassava and groundnuts are more widespread southward while cowpeas are grown in the drylands. Marginal other crop productions include sesame, legumes (fonio, beans, tomatoes, onions) and fruits (mangoes and bananas), other nuts and other tubers (yams, sweet potatoes).



Source: SWAC (2004), Atlas de l'Afrique (2000) and author's own representations

Figure 6. Cotton and other significant crop productions for the cotton-cereal systems

2.b. Production patterns and market linkages

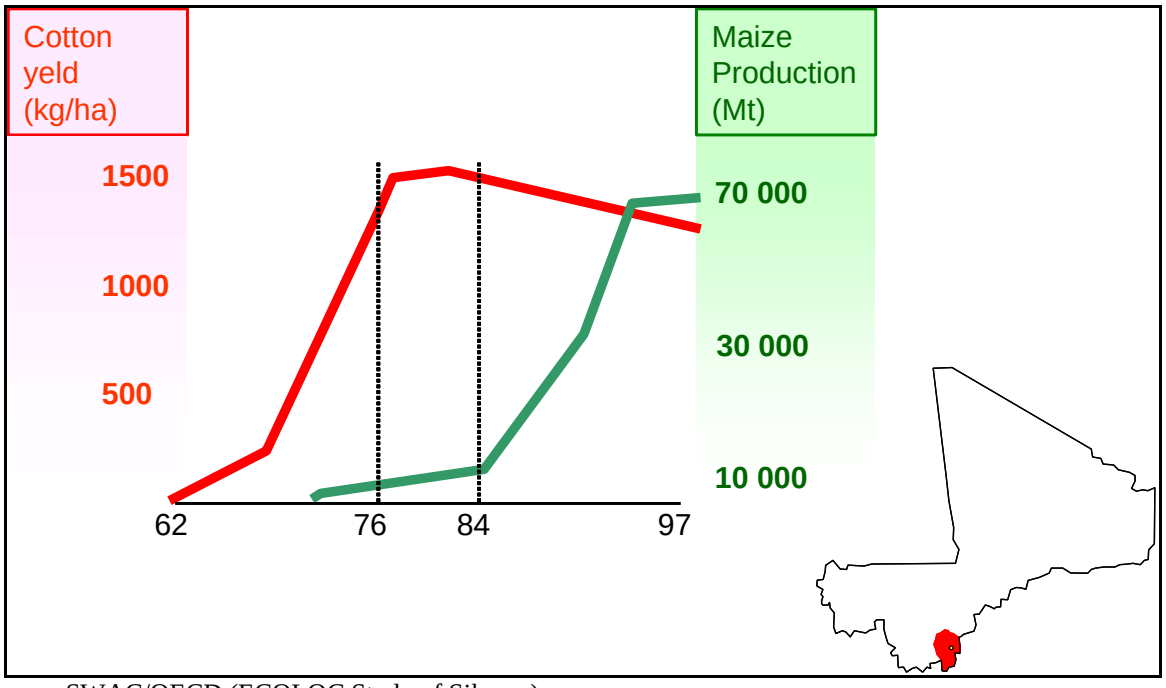
Cotton production impacts on cereal ones because of market linkages, as exemplified by input access and better extension services provided to cotton areas and cotton farmers. These strong interdependences call into question the sustainability of such farming systems when cotton production becomes less profitable. We observe that the stagnation of cotton yields has to be associated to the ones of cereals. Hence, agricultural growth is mainly extensive in the region, which induces many challenges for soil fertility.

Many studies[15] show that cotton and maize have followed similar patterns of production, as well as for traditional cereals –millet and sorghum- but that a divergence between cotton and cereal crops has occurred very recently. Rapid urban growth, rising demand in neighbouring countries and availability of inputs via the cotton support system have been key. This relationship principally arises through the sharing of inputs –mainly available on credit for cotton production-, availability of infrastructure –more reliable in cotton areas-, technical innovation (covariant for cotton/maize technologies), access to agricultural services and increased capacity to invest in agriculture due to cotton cash incomes. These examples also illustrate that smallholder agriculture can diversify in response to changing incentives and demand when the conditions are right. However, these conditions can deteriorate if the provision of services and capacity-building solely rely on the dynamics of cotton production and of the management of the supply chain, under the current lack of resources. In the long run, capacity-building and agricultural services should be somehow disentangled from the cotton chain and there is an urgent need to find alternative solutions for cereal commodity chains aside from cotton earnings.

So far, it seems that the linkages between cotton and cereal productions involve complex interactions based on the agro-climatic conditions, farming systems, rural markets,

[15] See for instances, ECOLOC studies in Sikasso, Korhogo, and Bobo-Dioulasso.

and institutions. Other linkages come directly from the policy environment, as experimented in Mali, Côte d'Ivoire, or Burkina Faso in the eighties and the nineties. The loosening of the regulatory aspects of the cotton production support framework in the mid-1980s (e.g. use of fertilizer for food crop fields forbidden) allowed farmers to freely manage the allocation agricultural inputs.



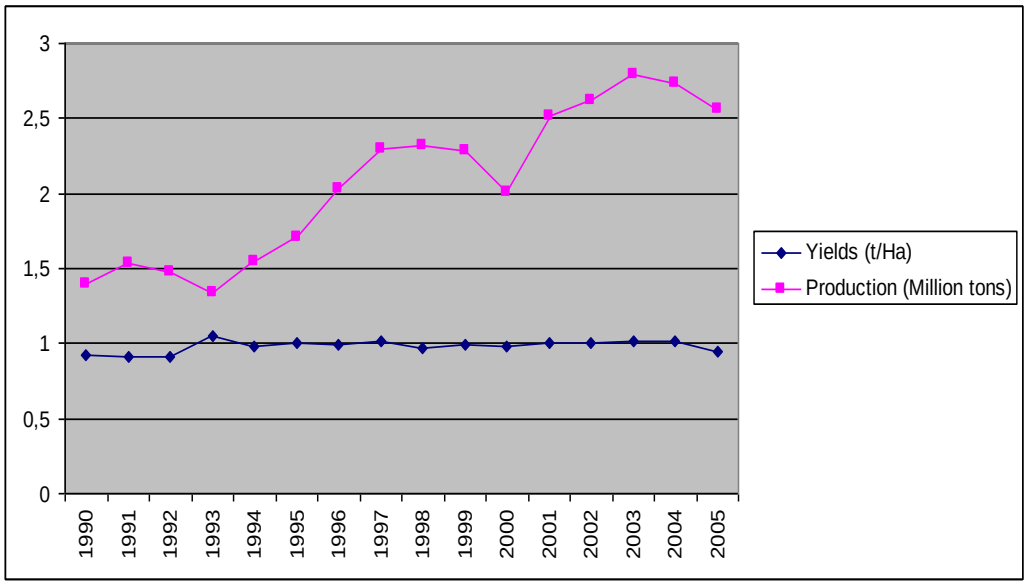
Source: SWAC/OECD (ECOLOC Study of Sikasso)

Figure 7. Links between maize and cotton production in Mali (Sikasso): 1962-1997

At the same time the CMDT (the Malian cotton parastatal) provided incentives to farmers to increase yields from 200 kg to 1,600 kg over time, encouraged limiting areas sown to cotton and providing fertilizer, which farmers distributed across different farm plots, they began to apply these to maize for which there was growing urban demand. Maize then became a major cash crop. Figure 7 displays some figures that support the description of this mechanism in Sikasso zone, Mali. Striking increases in maize and cotton production have followed with an initial ten years gap, which has been narrowing over time. Both productions have plummeted during the cotton strike in 2000-2001, caused by producers' dispute with government over the cotton reform. It is noteworthy that any threatening of the cotton production could have tragic consequences for maize and millet production because of these strong interdependences. Farmers increasingly used their animal-drawn ploughs to increase areas sown. Farmers expanded areas cultivated, spreading the use of animal traction from cotton to other fields, and increasingly integrated crop and livestock activities.

Agricultural transformation is accompanying this process, with the introduction of crop rotation and mixed farming systems that combine crop and livestock activities, replacing historic forms of itinerant farming. The current challenge is to introduce effective methods of soil regeneration and end fallow. In these areas, cotton farming has contributed to the emergence of mixed cropping, specifically: millet, sorghum and, for the last 20 years or so, maize. Indeed, maize has become the crop known to have the best results in association to cotton due to its use in phyto-sanitary products used for cotton and the existence of agricultural service providers that have promoted this crop association by providing access to inputs, support for post harvest activities and/or cereals marketing.

We now turn to the examination of production and productivity trends of cotton and other staple food crops, namely, millet, sorghum, maize and rice.



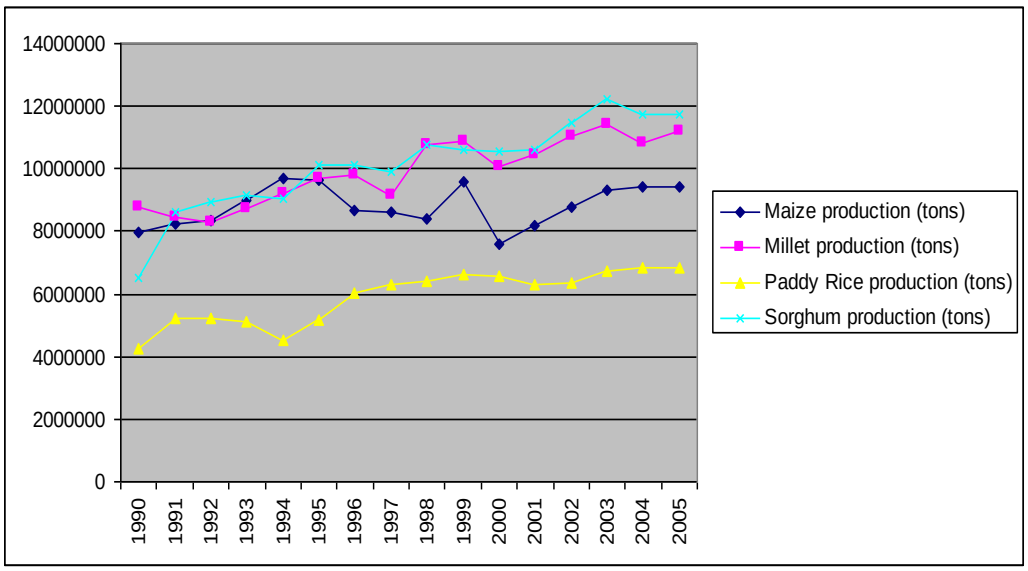
Source: FAO data and author's calculations

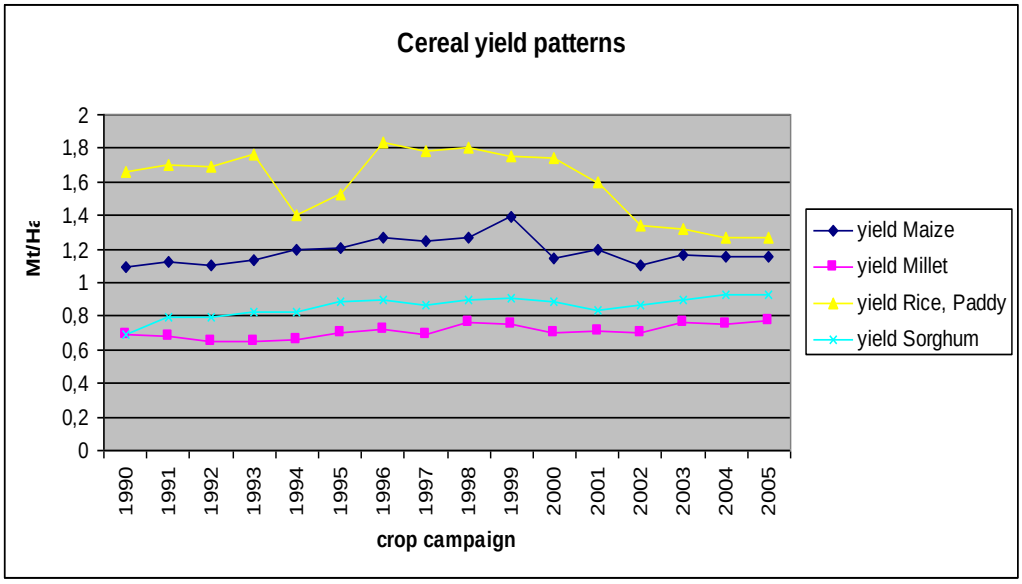
Figure 8. Cotton production and yields in the region

The overall pattern is quite clear: Stagnant yields and higher areas account for increased production. The yield stationarity for cereals is seemingly linked to the one for cotton, that is, a more limited access to inputs over the last years, with a decrease in soil fertility, offset by better management and technical skills (learning-by-doing and extension services) and better practices.

It has to be mentioned that some dynamic effect can also explain this trend. Under extensive growth of agriculture, the entry of less experienced farmers and expansion to more marginal land, and less access to capital, is likely to outweigh a positive static trend of land and labour returns. Hence, another component to analyze is individual productivity and efficiency, both for technical and allocation aspects. It is noteworthy to keep in mind that returns on labour are also influenced by nutritional and health status, and not only experience, technical skills, or access to inputs and capital markets. Impact of HIV has been shown to be very significant on rural labour productivity[16] and to hinder the household's ability to undertake labour-intensive cropping. Meanwhile, it requires more qualitative nutrition regime for infected people and the virus mostly impacts the most active part of the rural population. It is also a strong impediment to experience and know-how transmission to next generations. It can absorb a significant share of familial income for medical expenses and care, thus participating to a vicious circle of impoverishment.

[16] See Haddad and Gillespie (2001).





Source: FAO Data and author's calculations

Figures 9 and 10. Production and yield figures for the main cereal crops in the region

2.c. New technology options

To face the previously stated constraints, many new options exist. One is a better concern about integrating livestock and crop activities into cotton-cereal systems. This addresses issues of soil conservation (with available organic fertilization) and animal feeding. Other techniques involve intercropping and alley cropping, improvement of inorganic fertilizers formulae, micro-fertilization, and pest management. Variety creation is also a crucial factor for improving-yield potential. Early cultivars for sorghum and millet, better rain-fed rice varieties, or new generations of maize varieties are promising. However, they have to be associated to specific cropping techniques and input application consistently to the needs of the variety.

Many solutions are currently under practice or experimentation to solve for high-yielding cropping in a more sustainable way. While some solutions have clearly promising issues,

others may face difficulties to be implemented or may require additional conditions to work effectively.

About practices, many efforts should be devoted to a rapid expansion of crop-livestock integrated mixed farming systems. This will obviously require significant investment in the provision of extension services and in training staff for learning diffusion processes. This could be led together with the diffusion of other techniques aimed at improving crop productivities and soil fertility in a complementary or substitutive way. Concerning soil fertility, the main preoccupations are about the replenishment of organic matter, erosion fight when soils are less tree-covered and other nutrient deficiencies. Hereafter is presented a model of appropriate integrated mixed-cropping system where each separate component for practices can be independently applied. We will detail the different components just below.

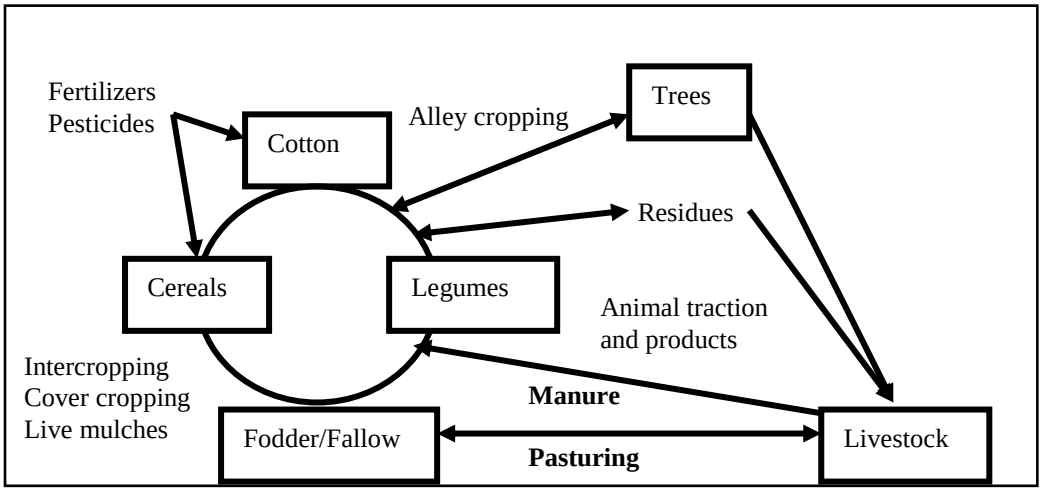


Figure 11. An integrated crop-livestock mixed farming system for cotton-cereal systems

In this system, the rotation between cotton, cereals, legumes and fallow or fodders allows a correct organic replenishment of the soil, while cereals benefit from fertilizers and pesticides applied on cotton, and legumes help fixing nitrogen that results in higher yields for cereals. Fodder species contribute to animal feeding in addition to other sources of grazing, and ensures a sufficient amount of land for livestock to stay in the same farming systems. Residues of crops can directly benefit to animals while manure is provided infield. Trees can increase resistance to soil erosion while tree products can be a source of animal feeding[17]. Trees can also be part of other labour-intensive organic techniques such as alley cropping. This consists of planting nitrogen-fixing trees between rows of staple crops such as maize, carrying nitrogen and providing shade for benefiting crops. Cutting back the trees to avoid shade for sun loving crops will provide wood while twigs and leaves can serve as natural mulch and fruits for animal feeding.

Alley cropping can also be used in agro-forestry where staple crops are grown in the periphery of a forest with tree-cropping and other vegetal production. This kind of organic agriculture can however be associated to the use of inorganic inputs such as fertilizers or pesticides, but specialists claim that a more reasoned and micro-utilization would be more beneficial when associated to alley cropping. Recent attention has concerned the sustainability and profitability of organic cropping in cotton-cereal systems and organic cotton production has shown promising results. Adoption of appropriate techniques will accompany the

[17] Interesting tree-livestock systems exist and one adapted example for WCA is the association between cattle, sheep, and acacias.

development of this "niche" production but new pest management techniques will be required to sustain an organic production without the use of chemical products. Extension services will be necessary as well as corresponding quality grading institutions to pay for additional added-value without disrupting the existing classic value chain[18]. The same could be done for cereals but it would be even more difficult to involve the private sector into marketing of new labelled products without the appropriate institutional framework.

Intercropping and cover cropping can be used when soil and water resources are very scarce; many crops can be cultivated in the same field if using some associations (shade/sun-loving crops for example) or some crops can be cultivated under a vegetal cover crop to avoid soil erosion problems and to better capture water or water rainfall. This could be particularly useful in some areas where soils have been subject to strong degradation and where soils are too waterproof. For fragile soils, new techniques for simplified soil preparation with a more superficial ploughing could be desirable. All these new techniques have been introduced within cotton-cereal systems or are under current experimentation. So far, their diffusion is severely limited by the lack of technical skills and trained extension agents on the field.

Yet, it is seemingly unrealistic that integrated farming systems will be rapidly adopted. Some long-term investment in land and other sustainable compatible techniques could however be proposed and implemented with extension agents. The application of organic manure is increasing in mixed farming systems where the bulk of manure is produced in specific village pits, added with phosphates. New released programs are currently in progress to decrease labour costs of maintenance of manure pits. Cropping fodder species should be developed but it will depend on seed availability, crop protection techniques and households' trade-offs with respect to land and labour allocation. However, fodder species can be intercropped to cereals with positive impacts on soil fertility and on soil erosion. This option could be applied to West and Central Africa on condition that fodder markets will develop and that the integration of livestock within cropping systems could be monitored and contractible between growers and herders. The compost option may not appear as doable now because of technical skills lacking, and livestock parks have not encountered much success.

One major issue still remains the use of fertilizers and pesticides. Large inefficiencies –both technical and allocative- have been deplored about the application of chemical inputs on cotton and cereals. According to ICRISAT, fertilization has much decreased since the nineties and there have been fewer development progresses. New fertilizer techniques involve attempts to improve fertilizer mixtures of nutrients adapted to early or new cultivars. The classic NPK formula, appropriate for cotton growing, has to be micro-dosed and applied fractionally for specific steps of the plant development. NPK is complemented by Super-Phosphate (SSP) and DAP (Diammonium Phosphate), with improved formulae. The use of micro-fertilization with manure together with more densely-planted seeds, with side-dressing or with new cultivars has shown promising results. However these techniques are more labour-intensive and their adoption will depend on profitability-risk trade-offs as well as demand-elasticity.

Same concerns have applied to the use of pesticides. Too often, chemical pesticides are applied mechanically, without any measures of phyto-sanitary pressures and disease risks. A large fraction of pesticides held by cotton farmers are often sold to other farmers and there is a big lack of technical skills and extension knowledge to improve pest management at a smaller cost. While some organic means have been studied, interesting in-progress initiatives lie in the implementation and application of the IPPM (integrated pest management) and the LTF (level-targeted fight) in the cotton-cereal systems. Adoption of these better management

[18] See the feasibility study for organic cotton in Burkina Faso by Helvetas Mali (2003).

practices would be supported by more effective extension services and enhancement of professional agriculture. It could also be implemented through the producers' cooperatives and more developed unions to facilitate know-how transmission and learning processes. In this fashion, more locally-specific management systems, together with information and communication technologies could enhance production efficiency of farmers in a more precise agriculture with locally-adapted solutions and an efficient use of input across time, land, and households.

Seed variety is the last but not the least issue in the realm of technological progress. In this paragraph, I review some of the technical specificities, innovations, and challenges.

Sorghum and millet are much less technologically advanced than other cash crops, maize, or rice, because of a lack of profitability margins and some political disinterest. But in the Sahel, they remain key crops and an essential food for rural population and feed for livestock. Sorghum and millet are associated to reduce risk, sorghum requires more rainfall than millet but both can be found in the Sudanian (semi-arid) and in the Sahelo-Sudanian zones. There are no specific labour constraints in the Sahel, except for punctual periods. Recent technology introduction has applied for water-retention techniques (organic fertilizers with manure or compost), labour-intensive farming systems and early cultivars. Ahmed, Sanders, and Nell (2001) reviews the technology introduction experiences in Sub-Saharan Africa and witness few success cases. Under the prevailing growing conditions, earlier cultivars that better resist to droughts do not exhibit higher yields. Hence, better seed technologies have to be complementary associated to higher input use such as organic and inorganic ones, irrigation schemes (such as the Gezira scheme in Sudan for the HD-1 variety). The low intensification of agriculture in the Sahel generally results in low –but significant- returns on variety creation, except for some cases[19] with low rates of adoption. The case of Mali is well documented by Sanders and Vitale (2005) where new cultivars have been associated to animal traction and ridging, enabling water-retention. The adoption of these cultivars together with mechanization was rapid while fertilizers and ridging were not because of strong liquidity constraints and a lack of access to capital (low-performing informal rural finance sector, low involvement of the formal sector).

Recently, there has been a new attention paid to the potential of millet and sorghum productions in the Sahel, while it was believed that low market opportunities were prevailing. Some studies have shown that new marketing strategies (such as processed sorghum, animal feeding or already-prepared millet meals) could be profitable and that increase in productivity could occur. The INTSORMIL program appears as one of the most promising projects for these strategies to be experimented then later implemented (See box 3).

Rice and maize have received much more attention because of a growing urban demand and higher yielding potentials, in addition to better complementarities with cotton-rotation based systems. However, technologies are very different and require much modern capital and production techniques. While maize has become a success in the past, known as a "maize revolution", which is revisited today, rice growing has encountered several difficulties and the whole continent has mostly relied on imports. The main production is localized in Nigeria, and some other areas cover Senegal, Burkina Faso, and Mali.

The rice sector is in a rapid expansion, thanks to the introduction of more appropriate cultivars compatible with Sub-Saharan agro-ecology[20] but has remained in its infancy for a long period. The main constraint for rice growing is water management. The application of inadequate Asian varieties has often constrained the yield potential of the region. The

[19] See for example, the successful introduction of S-35 in Cameroon.
[20] Many initiatives have been recently undertaken by WARDA.

dynamic production areas were located in natural watersheds (deltas and floodplains) where irrigation could be more easily managed and irrigation schemes became steadily profitable. It is what happened in Burkina Faso (Kou valley) as witnessed by Hébié (1984), and to a larger scope, in Mali[21] (Niger Valley) and in Senegal (Senegal river valley). Generally, the development of rice production firstly occurs in the lowlands *(bas-fonds)* which are the most easily irrigable or floodable ones in rain-fed farming systems. But rice is also grown in upper lands within rain-fed systems on plateaus and slopes (for terracing and better water control). Yields vary from 1 t/ha in uplands to 4.5 t/ha in irrigated areas in the Sahel. Rain-fed production still accounts for half of the total production. More details about rice ecologies and production systems can be found in FAO (2004).

Fisher *et al.* (2000) examines the case study of the irrigated rice sector in Senegal and the average and expected returns of new cultivars and technologies introduced by WARDA (West African Rice Development Centre) after 1994[22]. The productivity advantage is based on earliness, enabling farmers to double crop each year with higher yield potential. In a context of a high uncertainty, both on production, prices, and research costs, the authors convincingly demonstrate that internal rates or return and social benefits are likely to be very high. Hence, it put forward the interest of such locally-specific research programs. Double-cropping varieties are likely to be much more widespread across West and Central Africa but production will be constrained by labour shortages, and time management between dry and rainy seasons. Indeed, double cropping is possible with a very short period between harvest and sowing so that land preparation should be optimized and requires higher technical skills and knowledge.

A new research program led by WARDA called NERICA[23] (see box 2) has pursued the first technological improvements, as discussed above. A major breakthrough was based on crosses between African Rice and Asian rice and promises higher yields and less production variability for producers under both low and high-input uses for upland rice production

Box 2 : The NERICA project

NERICA varieties are already planted on more than 200,000 hectares of land in several African countries. The dissemination has been ensured through a participatory approach involving unions of producers and experimental processes to help them testing and selecting their own varieties. The application to the field is assisted by extension agents (more than 1200 already-trained technicians for 6,500 farmers) and technical management tools. The 5 year -$35 million funded- project help farmers selecting varieties from rice gardens with large numbers of local and modern O.Sativa varieties and NERICA ones, then evaluate their own selected varieties under their site-specific conditions and according to their needs. Diagne *et al.* (2001) shows that this participatory variety selection has led to increasing biodiversity, better soil management practices, and better yields, with high rate of technology diffusion.

So far, the project has been spread in about 30 countries, focusing on seven –Benin, Gambia, Ghana, Guinea, Nigeria, and Sierra Leone. It involves research and extension services provided to farmers, with better access to seeds, inputs, and credit. The participatory approach ensures farmers to have viable organizations and a strong adhesion to arrangements with the other stakeholders of the supply chain (credit schemes, trade, input provision for instances).

Results are impressive. Guinea has achieved a record harvest of 1.4 million tons in 2007, partly because of the strong government support to NERICA dissemination. In Nigeria, rice imports have dramatically fallen from two million tons to less than one. The same pattern has been experienced in Uganda, with import savings.

The future of rice farming lies in the dissemination of this experience to a larger scale, with new producers' organization further support, as the new Coalition for Africa Rice Development, which targets the doubling of rice production in the next decade. The arising challenges for WARDA are to increase the supply of improved seed available for sowing, fertilizers, and to improve crop management practices. Some operations are planned within the FAO Soaring Food Prices Initiative on the basis of action plans already developed for 11 countries.

Source: WARDA, FAO, and World Bank.

[21] See the nice work of Aw and Diemer (2005).

[22] Better adapted varieties to ecological conditions (birds, pests, and moisture): IKP/ Sahel 168 during the dry season, and Sahels or Jaya early cultivars during the wet season.

[23] New Rice for Africa. The project is supported by World Bank, FAO, the ADB, the Japanese government, the UNDP, and other regional partners such as SAED in Senegal.

systems. Earliness allows double-cropping and labour savings. All these elements can lead farmers to intensify their production systems and better manage soil fertility. The current strategy is to integrate NERICAs into the existing portfolio of cultivars of farmers, through a participatory variety selection approach. Considerable scope for yield improvement also exists in irrigated ecologies. The integrated rice management (IRM[24]) introduction has fostered production growth and yields without any significant increase in input use to fill the gap between actual and potential productivity. This scope also exists in the long term for rain-fed lowlands and would involve better water control and crop management but production systems are much more complex and diversified, so that learning and extension will be here even more crucial.

Maize is perhaps the crop that has experienced the most interesting production results with very high research efforts. According to Byerlee and Heisey (1996), research progress has been comparable to other smallholder maize systems in the developing world. Maize was one of the few agricultural successful stories in Sub-Saharan Africa in the past, together with cotton, which has been supported by smallholder farmers and their related social organizations, strong research efforts and a carefully established institutional set-up allowing a consistent use and availability of inputs. This occurred in West and Central French-speaking Africa with the same determinants as for the cotton story (see before). Maize and cotton rotations were benefiting from organizational linkages and more coordination efficiency among stakeholders in well-established commodity chains.

The involvement of public sector in maize research has allowed a rapid expansion of investment, together with the ones of international research centres[25]. Almost 300 improved varieties and hybrids have been released from 1966 to 1996, which allow a correct diversity according to the various agro-ecological conditions and in spite of fewer maize breeders per cultivated area. Open- pollinated varieties (OPVs) are more developed for smallholders while hybrids are used mostly by large commercial farmers even if they have been also largely adopted by smallholders in some countries. The latter involve purchasing seeds every year while OPVs can allow farmers to save seeds for further use without large yield losses. Improved OPVs have encountered many successes with large rates of adoption, such as the CIMMYT and IITA germplasms. The yield gains ranged from 30 to 40% from dry areas to more favourable ones for hybrids and 14 to 25% for OPVs over local materials.

Despite these successes, maize breeding programs have neglected some key aspects of the environment of production and many challenges still remain today. Byerlee and Heisey (1996) reports that crop management systems are somewhat inefficient due to labour constraints, risk considerations, and rotations with inadequate input use. Research programs have not paid enough attention to the evaluation of grain quality, storability, small-scale processing, suitability for intercropping (maize-bean or maize-sorghum, maize-cassava), according to the specific needs of farmers (food security and income goals). New research developments are now on-going such as working on drought tolerance, disease and pest management, improving soil fertility, and processing yields. Finally, other conditions are required for enabling the "emerging maize revolution"[26] such as more supportive infrastructures for the supply of improved seeds, better functioning of markets (decreasing shipment and transport costs), better availability of inputs, extension services, more appropriate policies, and institutional building[27]. Finally, other technical components should

[24] This system is developed with farmers and provides them with different options from land preparation to post-harvest interventions.
[25] Many programs were held by CIMMYT and IITA.
[26] See Byerlee and Eicher (1997).
[27] These factors will be further examined in the two next sections.

be taken into account to overcome labour shortages such as increased plant density, line planting, and animal traction. Adoption of improved technologies can indeed be constrained by labour shortages as they imply more severe labour demand peaks. Consequently, maize can be planted too late, or practices could be inconsistent with the technological package.

So far, the cotton sector has concentrated and experienced the most intensive technologies but there is a recorded stagnation in yields since a decade, as in Mali (Baquedano and Sanders, 2008), sustained by a low pattern of world prices. The introduction of Bt-transgenic cotton may have beneficial effects, as shown by Elbehri and Mc Donald (2005) with a release of labour shortages and better returns that also benefit food crop productions. However, it also involves new farming systems requiring more investment in extension services and management assistance, as well as a strong dependency with respect to seed distributors and agribusinesses, implying an increase in credit availability and tighter liquidity constraints for smallholders. Some information is clearly missing about potential external effects of transgenic crops on other ones and on insect and pest resistances. Moreover, other experiences about Bt-cotton introduction have clearly showed that more technical skill are required to harness the yield potential of the transgenic variety, and that a lack in human capital may have detrimental short-term effects on cotton production, incomes, and poverty, as witnessed by the story of Indian cotton farmers[28].

Cabanilla *et al.* (2004) conclude that the non-adoption of Bt-cotton in WCA would result in the non-competitiveness in the world market, with an unsustainable situation for farmers and agribusinesses in the region. Benefits appear quite important as up to US$40 millions in Burkina Faso and US$50 millions in Benin. Additional benefits could also be provided by an expected reduction in insecticide use. However, their model does not integrate other cost such as the provision of Bt-seeds and the high market power of international seed distributors over smallholders. Inefficiencies and information asymmetry in the seed market may make farmers worse off or could be detrimental to national cotton firms. Hence, some carefully set-up technology transfer schemes from multinational agribusinesses to local firms and stakeholders would be desirable.

2.d. Technology adoption and diffusion, and the environment of farmers:

Technical improvement is not sufficient because determinants of adoption are also critical. Indeed, learning costs and perception of risks among untrained farmers may be strong constraints, in addition to liquidity ones. Improving farming systems is a gradual process where farmers incur risks and costs, according to experience, extension agents, and other social mechanisms. Capacity constraints are a strong limitation when access to markets (output, input, and seeds) and infrastructures are poor. Technology adoption can be fostered by new marketing strategies, and private arrangements involving value-addition to the production, extension services, and better access to markets. The policy environment is also determining as it can help improving markets and institutions.

According to what has been explored so far, technology introduction is not an end in itself. Successful experiences suggest that the overall market, institutional, and policy frameworks matter and that the mechanisms of technology adoption by farmers have to be accounted for. As shown in many papers, technological change at farm gate is a result of households'

[28] Bad weather conditions combined to a lack of technical skills have resulted in lower income and inability of many farmers to repay more expensive credit.

internal trade-off driven by risk perceptions, expectations of benefits and costs, neighbouring effects and the institutional environment.

According to the Boserupian theory (Boserup, 1965), farmers will tend to increase their cultivated area when land is not a scarce resource before intensifying their production systems. Hence, profitability of technological change will be positively correlated with demographic pressure, and this proposition has been empirically validated in the most densely-populated areas of cotton-cereals systems in West and Central Africa[29]. The intensification process occurs when traditional inputs exhibit an exhausted capacity for production (labour, manure, crop residues, and local varieties). Following Abdoulaye and Lowenberg-DeBoer (2000), the adoption of improved technological process is a gradual process, with a first move to improved varieties and chemical inputs toward new varieties, use of SSP and a total package including urea and insecticides. Setting a model of optimization with a bi-dimensional objective function (harvest income then a food security goal), the authors validate their working hypotheses, showing that technical change is gradually undertaken by wealthier households. Implications can be drawn to relax farmers' constraints[30] so as to foster technological adoption. An important point has to be made about the transitional technical solution, which should not be overlooked by national policies and other extension agents.

Abdoulaye and Sanders (2005) identifies the basic determinants of fertilizer use in Niger with two stages of improvement: move from manure to classic inorganic fertilization, and move to micro-fertilization and side-dressing techniques. Controlling for the value to cost ratio for millet – price incentives- the authors show that learning and experience foster technological constraints according to risk-aversion and liquidity constraints. Demonstration trials have helped farmers turning to modern techniques. Yanggen *et al.* (1998) insists on the double problem of incentives and capacities for farmer to adopt fertilizers. Incentives are poor for sorghum and millet because of low value to cost ratios while they are high for maize and rice, as well as for cotton. Constraints on incentives arise from high marketing margins and transaction costs (see next section) while capacities are lowered by poor infrastructures and lack of human capital (capacity constraints). Indeed, fertilizer use is covariant with roads and rainfall. Other capacity constraints include cash constraints, and limited access to capital markets, poor access to complementary inputs. That has implications involving more extension, quality control and research work to foster fertilizer use on higher value crops, reducing risk for lower value ones. Finally, incentives and capacities may internalize non-farm activities, livestock such as to derive relative profitability for incentives as well as differential returns on capital and on capacity-building.

As introduced in the last paragraphs, technology adoption is fostered by human capital and social capital. This requires strengthening institutional frameworks to better accompany farmers on the road of modernization. The case of traditional cereals (sorghum/millet and cowpeas) in Niger is well documented in Mazzucato and Ly (1994). This paper outlines low adoptions of research-developed varieties, in spite of significant yield differentials (less than 12% in aggregate). It highlights the need for extension and research to monitor adoption as well as an institutional framework to deal with technology transfer. The major constraints to adoption are identified as education, low market prices, infrastructures, access to seeds, inputs, and credit markets as well as lack of resources for extension services. However, significant positive returns on research that focused on genetic breeding are recorded, which

[29] Southwestern demographic front in Burkina Faso and South Mali, Southern Niger, Northern Nigeria and Benin for instances.

[30] They notably report that modernization increases with more available capital, and decreases in the availability of sandy soils close to livelihoods.

shows the potential for technical progress. A big problem underlined is the lack of collaboration between INRAN –the national agronomic research centre- and other regional/ international research institutions. The authors deplore unproductive links between INRAN and the ICRISAT Sahelian Centre.

Learning is an essential component for technology adoption, as highlighted by Foster and Rosenzweig (1995) or by Conley and Udry (2000). Because lack of information or knowledge about technologies and markets is a significant barrier to adoption, these authors show that this barrier diminishes as farmer experience increases with the new technologies. Moreover, own experience and neighbours' experiences increases the profitability of this technology while farmers have been shown not to fully internalize the village returns to learning in adoption decision-making. As learning is a club good with knowledge transmission, the own investment in human capital has positive external effects for other village members, but since learning from experience is an individual decision, the village returns are not captured by individual farmers. This gives rise to group mechanisms where learning decisions can somewhat be collectivized. Hence, rural cooperation (through local organizations such as producers' groups, market-oriented organizations, village organizations…) is an essential concern not only for farmers' bargaining power, economies of scale or risk-sharing arrangements, but also for information access and learning. Social capital might be the key point of raising investment in human capital at local scale, and it could be soundly accompanied by extension services. Group mechanisms are highlighted in Conley and Udry (2000) about the learning process for imperfectly known technology where farmers adopt successful neighbour's practices according to clan membership, social ties, religion, credit arrangements, and common growing conditions. Investment in human capital has thus significant social components that have to be accounted for.

We will come back later to the institutional environment of farmers and the role of local norms, social customs, and rural communities for our major concerns. If institutions matter for technology adoption, it is also other production incentives and capacities that rely on institutional arrangements as means to overcome market failures and inefficiencies. The focus is not only on local institutions but on all mechanisms which allow stakeholders to work together under sufficient incentives when contracts cannot be enforced and other regulation schemes are ineffective. The role of social capital will be underlined. Hence, the overall analysis should account for those issues and even consider evolutive institutions as an endogenous outcome of policies, markets and the socio-cultural background.

Technology adoption has yet to be understood within the market, institutional and policy frameworks, which are developed in the next section. Some spillovers have to be found to increase returns on variety creation and adoption with appropriate policies and institutions. This has be the case for cotton and maize in the past for cotton-cereal systems and for millet and sorghum in Southern Africa and Sudan today. Ahmed *et al.* (2001) show that low rates of adoption for early cultivars in the Sahel are driven by no significant yield increase after the introduction of new cultivars if no improved agronomy is adopted with. The adoption then relies on risk-avoidance strategies rather than true profitability reasons, and the more the lower seed markets are performing and private marketing institutions operate. This could be due to inconsistent policies that aim to promote newly-created seeds but that somehow hinders the emergence of decentralized institutions. Private stakeholders may be lacking in enabling farmers to improve their farming systems thanks to any interlinked agreements or outgrower schemes increasing their capacities to access capital markets whenever cash constraints are quite severe.

Abdoulaye and Sanders (2006) shows the adoption of improved fertilizer techniques can be fostered under different options. For the case of millet, they use the marketing

Box 3: The INTSORMIL project

The International Sorghum and Millet Collaborative Research Support Program in West Africa aims at helping farmers to respond to growing demand for processed-sorghum and millet. To meet the requirements of the industry, the project want to foster technology transfer to producers for clean millet and grain sorghum of good quality. This has been led by the increase of demand by the food industry for steamed millet in yoghurt, couscous, arraw, degue, sankal, and thiackri, and the rising demand for poultry and poultry feed with sorghum. Sorghum is toxin-free and holds this advantage over maize for poultry feeding. A key component is to expand the links between producers and processors.

The project covers extension services and input access for farmers with the promotion of better practices -water management and ridging- to help water retention to reduce weather risks induced by poorly spaced rainfall. Profitability is enhanced by marketing strategies allowing higher prices thanks to quality improvements of the raw millet and sorghum meeting higher quality standards desired by processors (use of mechanical threshers to decrease the rate of impurities). Profitability is also increased by the use of inventory credit (warrantage) that encourages farmers to sell their products later in the season and retaining ownership of their harvested crops.

INTSORMIL encourages farmers to build their own group to better access inventory credit systems. It is also a way to improve communication and linkages with other stakeholders of the emerging value-chain.

Source: INTSORMIL Report.

strategies developed by the INTSORMIL project (see above) to raise profitability of millet production and incentives for fertilizer use. However, without a clear policy framework that enables farmers to make profit during the adverse years (when prices partly recover production losses), then new incentives are unsustainable and investment in technical change remains unsecured. Indeed, assuming lexicographic preferences of farmers (with income and subsistence objectives), the marketing strategies of INTSORMIL aiming at reducing between and within-year price variability –namely, widespread use of inventory credit[31] and agro-processing of millet- would foster the technology introduction process. But this could be sustainable only if there is a change in public policy with a reduction in cereal exports in adverse years that will dramatically increase farmers' revenues.

Marketing strategies having this role of increasing technology adoption, they become profitable only under sufficient market demand. One has not to forget that market alternatives have to be clearly elucidated under the pattern of local, regional, and international demand. For instance, technology introduction is clearly demand-driven for cotton, and in a lesser extent, for maize and some niche crops: green beans, flowers and pigeon peas. Irrigated rice in Mali does not experience any problems with price collapses. Because of a strong market integration and internal organizational arrangements, the production benefit either from export, parastatal arrangements or from local markets. Hence, the issue of market integration is of strong importance since it can help secure production and ensure technology adoption. We will explore the scope of marketing strategies once we will review the institutional, market, and policy environments and under expected demand conditions in the next section.

As shown previously, policies impact production and technological adoption. Furthermore, this is the case not only because of their effect on producers' incentives but also because of their effect on production efficiency. According to Vitale and Sanders (2005), the yield frontier is further from actual productivity levels for sorghum/millet than for maize or rice. Input use is not incentivized because of low prices and political bias against food crops (the social contract, see later) as well as poor marketing performances and opportunities, sustained by discriminatory policies (see next section). Hence, allocation of inputs is inefficient, because of distorsive policies, which is also combined with technical inefficiency because of low adoption rates of existing technologies. In Mali, Coulibaly *et al.* (1998) reports that the structural adjustment policies made it easier to adopt intensive sorghum technologies, even for the most risk-averse farmers (expected effects from the devaluation). Some liquidity

[31] Inventory credit is believed to have a within-year smoothing effect in the mid term (10 years) and if it is widespread among farmers. Otherwise, it helps farmers to benefit from higher grain prices later after harvest.

would be needed to expand input market access as well as credit even if it can be internally generated by selling some of the livestock. Ahmed *et al.* (2001) proposes a new policy framework for technology improvement. Escaping the social contract would give more incentives for farmers to increase input use and make cereals more profitable. Some reforms could be initiated with higher sorghum prices in Sudan or Southern Africa. No political willingness in the Sahel hinders the diffusion of new technologies because of discriminatory policies. Hence, the limited role of new varieties will not be exploited. It should also be accompanied by coherent trade and exchange rate reforms that can ultimately benefit the poorest rural households (next section). The role of the public sector should be to encourage research programs accompanied by agronomic improvements with organic and inorganic input uses, rotations, increased water availability, locally-specific fertility programs, and so on. The public sector could be a good initiator of improving the input distribution channel, of promoting agro-processing of cereals, storage facilities, distributing seeds until the private sector will take over these functions, once they become more profitable and less risky. In parallel, the need to improve the business environment as well is very important. Finally, Ahmed et al. (2001) pointed out the attention to the evolution of new uses in the product markets to compete with imported food, which can foster technology diffusion with food price stabilization and partially offset price decline owing to the technology introduction.

New technologies exploring the potential of the region should be kept in mind, and one big issue is the further exploitation of irrigation potential, together with the improvement of technical skills and extension staff quality.

We have seen that production and technological change rely on several mechanisms linked to the efficiency of markets, institutions, and policies. Key points have to be emphasized about risk issues, information ones, and market functioning, as well as the efficiency of existing institutional arrangements. On the incentive-side, they appear as to be the main constraints for production because they impact expected profitability of such technologies. On the capacity-side, the same ingredients apply and some key elements of markets and institutions have to be identified in the tightening of capacity constraints. This is precisely what we aim to do in the next sections.

3. Commodity markets and supply chain structures: arrangements and risk/profit sharing among stakeholders

3.a. Structural characteristics of commodity markets

Cotton and cereal markets have very different characteristics. Cotton ones are well supported by institutions, better infrastructures and historical operators. Cereal ones have logistical disadvantages and big transport costs. This has been maintained by food policies that have privileged imports instead of investing in rural infrastructures and local production. However, urban demand exists for local products, if they could be adequate to the preferences of consumers (processed). Most of local traders –small ones- have no capacities to invest in working capital and business expansion is limited by institutional failures and the prevalence of the network economy.

Because of historical reasons, physical characteristics, and different policies, cotton and cereal markets are not organized in the same way and exhibit different structural characteristics and efficiencies. Cotton markets were developed in colonial times and always had a good connection to the world market. They have inherited from better social organizations of farmers, public and private institutions, and better infrastructures for the

functioning of the markets[32]. Most of the cottonseed is produced for export and is a big source of fiscal revenues through implicit and explicit taxation and has often met government support because of a strong convergence of interests.

In contrast, cereal markets are often of limited scope and greater transaction and transport costs with bad-functioning institutions impede a process of market integration. Hence, cereal markets are often confined to rural areas, and urban markets partly rely on imports. Specific discriminatory policies have also hampered more market integration and more involvement of private stakeholders (see next subsections for the policy environment), which ultimately results in low incentives of production, technology adoption, and persistent national food grain deficits. Public investments in market infrastructures have been low, and only some rural cotton producing areas have been unlocked thanks to cotton benefits and the interests of agribusinesses. Unsurprisingly, the most integrated cereal markets are the ones located close to the most productive cotton ones, as they benefit from better infrastructures and institutions.

Cereal and cotton markets are somehow interlinked and before sectoral reforms began in the nineties, most of cotton and cereal markets were strongly integrated in the region. The cotton parastatals were also involved in other activities for cereals, and input and credit schemes for both commodities.

Unlike cotton, cereals have a low value/weight ratio, often resulting in high transport costs, and exhibit big price variability at producers' gate because of induced low market integration between surplus and deficit periods. This is also the result of well-known short-run low supply and demand elasticities. This within-year price variability could yet be overcome by more storage and transformation, but it becomes a matter of capacity constraints for farmers and traders to access to storage facilities and mills.

Local production of grain faces huge logistical disadvantages compared to imported ones: transactions costs, inland freight costs (2 to 3 times the ones of ocean freight costs), together with low quality infrastructures. High shipping costs affect the ability to export and production is often located far from cities, in landlocked or remote areas. The main potential for agriculture production is often far from coastal urban markets where it is cheaper to import from outside (and other developing countries/major producer countries) than from neighbouring countries or regions. What we can call a competitive disadvantage from inland with respect to coastal markets could be partly overcome if some resources and policies would be devoted to reduce transaction costs aimed at integrating local markets in more central and regional ones. It then could provide long-term substantial benefits to local rural economies as well as cheaper prices for urban consumers. According to Akiyama *et al.* (2001), there is a justification for government intervention if the overall regional surpluses are leading to non-remunerative prices (high import parity prices and low export ones), which needs price stabilization scheme because of adverse effects for both consumers and lowest-income producers (Pinkney, 1993). Other constraints are recurrently cited for the difficult access of local production to central markets: climatic disadvantages, low farming capitalization, and ecological factors (soil vulnerability).

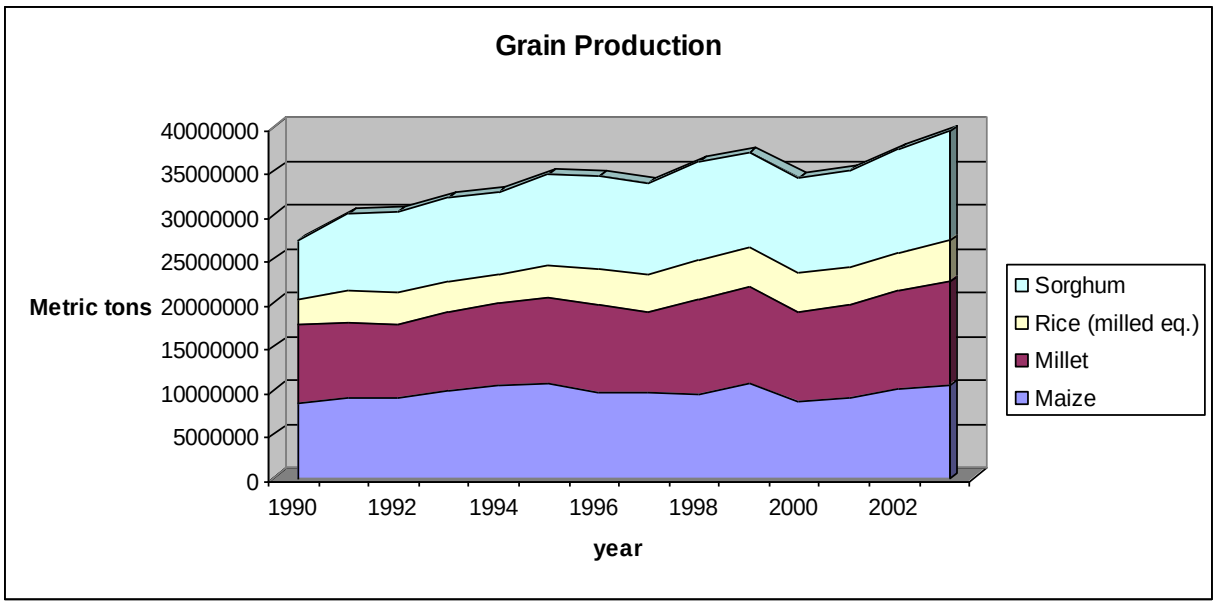
Apart from these market inefficiencies and supply-related problems, the demand of urban markets is mainly oriented toward imported products for several reasons: convenience in food preparation for wheat and rice, so that traditional cereals are not favoured by urban consumers, but also social and income effects. Hence, urban markets rely increasingly on import-substitution products, as can be shown in the above graphics. The region is a small player in the world market and a net importer with import-substitution strategies (mainly for

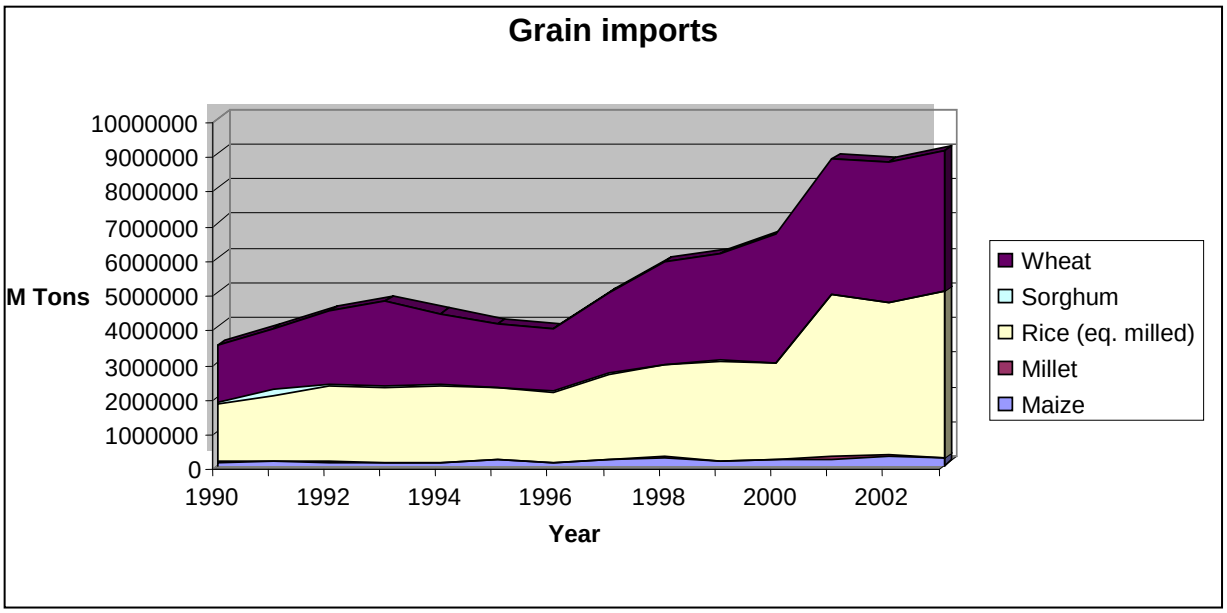
[32] See Bassett (2001).

wheat and rice), at the opposite of cash crop sectors. Figure 12 displays an increasing pattern of the ratio import/production from 13% in 1990 to 23% in 2003, even if exports have grown because of more regional trade.

This has been mainly driven by the rapid rate of urbanization, which has fostered import-dependency while rural markets have been appropriately served. This dual rural economy has also been the result of different policy outcomes (see next subsections). However, new marketing strategies could make local production more accessible to central markets, and meet the needs of urban consumers. Boughton and Reardon (1997) clearly show that elasticity for traditional cereals in the Sahel could be increased if coarse grain processing is to be promoted. This will notably include the following channels: more available market information for consumers about time and cost savings, and quality availability, more access to working capital for semi-wholesalers (mostly for dehulling), and decreasing costs of retailing by quality improvements in the cleanliness of grains together with the establishment of reliable grading institutions in the marketing system. Indeed, semi-wholesalers have the best connections to rural markets while minimizing costs of retailing to urban markets or selling to other retailers. The most promising potential applies to sorghum because of more rural demand, less required inputs, and less costly processing, together with better suitability for the animal feeding industry. Hence, one arising strategy is to increase capacities and market functioning in the sorghum commodity chain.

Trade in cereal markets has become very important after liberalization while it has a limited role in cotton markets. The challenges for markets reform involve private agri-businesses and coordination with farmers' associations. Because traders have no access to ginning capacities and to the world market, and the local cotton processing is still marginally producing, then they often only resell cottonseed directly to agribusinesses. Thus, they cannot be considered as a true different marketing channel. They can however propose higher prices to farmers to sell the cotton in more profitable areas when prices are not even more pan-territorial, leading to the so-called "poaching" phenomenon that disrupt the link between the payment of cotton and repayment of input credit.





Source: FAOSTAT (2007)

Figure 12. Grain production and imports in the region

In cereal markets, traders have better information about local and central markets, retailers, processing facilities, so they can benefit from this comparative advantage. But situations are very different across countries and regions. For example, in Ghana, most of the trade is in private hands. There has been the emergence of a large number of informal traders leading to short-term welfare-enhancing competition. However, this comprises dynamic disadvantages: no economies of scale, lack of investment in human capital and innovation, no long term contractual relationship with agribusinesses, low access to financial markets or banking, and no long-term storage abilities. According to Akiyama *et al*. (2001), markets work more efficiently when both small and large traders co-exist. With enforcement inability, information problem, and lack of capital availability, informal traders mostly rely on informal institutions through social networks and trust or social capital; making markets imperfectly competitive (Barrett, 1997). The network economy –retaining profits among insiders- tend to limit business expansion, as noted by Badiane (1997).

3.b. Input markets and arrangements to access farm inputs

Access to inputs is much constrained for producers because of structural deficiencies, such as high transaction costs, liquidity constraints, and asymmetric information. Input credit is affordable under interlinked agreements such as outgrower schemes and contract farming (arrangement with buyers and processors), barter schemes (arrangements with input providers), and MFIs (village banks, and producers' organizations). The latter is an interesting sustainable strategy for non-cotton producers to access input credit, but also consumption credit to get more incentives to store (cereal banks and inventory credit). The role of extension services appear as crucial to assist farmers' organizations and to help set up viable input credit schemes.

As already mentioned, the performance of output markets is also greatly influenced by the input ones. Cotton markets are often interlinked with input ones allowing farmers to access to working capital such as improved-seeds, fertilizers, pesticides, and equipment.

Interlinkages take the form of outgrower schemes under contract farming, which is the more widespread form of accessing input credit for smallholders in the region. However,

contract farming has been severely criticized for accentuating the gap between dynamic and poor farmers, and the one between cash crops and subsistence ones[33]. Performance of contract farming is also much depending on farmers' cooperation and local social capital (see next section), as shown in Coulter *et al.* (1999).

For non-cotton producers, it has become increasingly problematic to access input on credit under large liquidity constraints. Even in the case of cotton, the reforms have led to a reduction and rationing of input credit together with the rise in input prices with better control and monitoring of repayment issues. Then new arrangements are going to be undertaken for accessing input markets. This includes a new financial framework led by the microfinance institutions, and the development of village rural or development banks more aware of the specific needs of rural farmers. Arrangements are also applying to input providers and producers, as experimented in Southern Africa by barter schemes.

Finally, extension services could have a prominent role in helping farmers manage savings and accounts, and the diffusion of banking into villages. Some interlinked input arrangements are also directly managed by extension officers, as for the case of cotton in Zambia, by the so-called "distributor system". It is based on the delegation of the management of outgrower schemes from cotton firms to their extension agents. The latter provide input credit and extension services to farmers and are paid according to their performances: cotton seed's volume delivered and credit recovery rate. Hence, extension agents have incentives to carefully monitor farmers. In French-speaking Africa, another affordable solution is brought by the experience of Burkina Faso. In the current Burkinabè cotton industry, local monopsonies rely on well-designed group of cotton farmers and delegate them many responsibilities, such as monitoring and management. Unions of cotton farmers are guaranteeing credit repayment to cotton firms and have more credibility on their local groups of farmers. But why these arrangements are taking place and why the markets cannot work effectively?

Badly-functioning input and credit markets are the result of high transaction costs, repayment problems due to asymmetric information (moral hazard and adverse selection issues) together with low technical support: budget of extension services were downsized after structural adjustment. Lack of collateral from smallholders, high monitoring costs and informational problems make individual credit contracts unaffordable. Interlinked agreements then emerge as second-best contracts as a response to an incomplete market environment. They are based on a contract between a (exclusive) buyer of output production who lends "in-kind" inputs in advance to a group of farmers who are jointly-liable for their credit repayment. The joint liability provides a form of social collateral to the lender who also holds a guarantee on future production purchases. However, credit repayment is greatly influenced by the group cohesion, monitoring ability, effective credit sanctions in the future and its matching process. So far, the free-adhesion principle seems a necessary condition for group credit mechanisms to work effectively (see Kaminski, 2007). Another important condition is the vertical organization of producers' organizations and their relative bargaining power within supply chain structures.

Outgrower schemes are mainly based on export crops or high-value ones such as cotton, tobacco or vegetables (horticulture), and on a high bargaining power for agribusinesses who can benefit from an exclusive channel to market the farmers' products in exchange for input and technical assistance supply. In liberalized markets, the performance of outgrower schemes will mainly depend on coordination issues (see in the next sections), because of high opportunities for side-selling and business capture by small traders. Another problem is the enforcement problem. Apparently, there are no effective legal ways to enforce

[33] See Warning and Soohoo (2000), and Warning and Key (2002) for instances.

contracts (see next section) such as outgrower schemes when it could be problematic, as in the case of cereals and the cost of monitoring and credit defaulting is too high for agribusinesses. Under weak institutions, contracts could only rely on informal agreements: peer-monitoring, trust and reciprocity for instances. They may refrain from financing cereal production, keeping low productivity levels. Therefore, other kinds of arrangement for input provision are desirable to cope with these issues, such as the ones.

The availability of agricultural inputs mainly relies on cotton production, and there is an urgent need to develop new arrangements outside of the cotton existing ones. Another way forward is to make input and credit markets work more efficiently but it will require long-term structural enhancement led by new investments in rural infrastructures (see after). New options for credit and input access entail the development of new financial schemes and village organizations.

The financing of agriculture is commonly acknowledged to face a new paradigm, as reviewed by many studies[34] and by the emergence of micro-finance institutions and new financial institutions in place of former unsustainable public credit or development bank schemes. This is also coinciding with the dismantling of former parastatal arrangements in the course of market liberalization and the diffusion of banking and modern financial schemes in the village economies, and notably in the cotton economies. Many pitfalls and challenges have to be considered for future developments[35], expanding access, reducing transaction costs and interest rates, and provision of adequate products for specific farmers' needs. In West Africa, the growth of new micro-finance institutions is dramatically increasing over the last years.

Interesting examples in the region are provided by the tight relationship between farmers' organizations and newly established rural micro-finance institutions. Such examples, as the *Kafo Jiginew* in Mali or the mutual groups of *Caisses d'Epargne Villageoises* in Burkina Faso have helped farmers get a banking account (the "*bancarisation*"), secure their savings, and access credit. Cotton farmers in Mali and Burkina Faso now can access input credit or equipment credit out of cotton firms' outgrower schemes. For cereals, an interesting approach comes from cereal banks[36] that have allowed a better access to input credit, more remunerative output prices (with economies of scale and better bargaining ability over traders or millers), stabilization of local prices through inventory credit, more mutual learning, collective processing and sometimes own marketing of miscellaneous products from the farms. According to the expertise of SACRED Africa, the most important challenges for making cereal banks more effective and for improving their diffusion are issues of governance, regular monitoring, awareness about government policies, legal framework and financial markets, crop diversification, and value adding or processing. Experience in West Africa for cereal banks and inventory credit has been very challenging since most programmes have appeared as unsustainable with management abilities and marketing channelling lacking. Cereal banks and other village mutual banks working with better-organized farmers are a relevant strategy for the future.

[34] See for instance, Morduch (1999).
[35] See the special report from the World Bank (2008).
[36] See box 5.

Box 5: Cereal banks and inventory credit in West Africa

These two innovations have been introduced by several NGOs in the region, such as the Catholic Relief Services, ISCOS, or TechnoServe. Cereal banks are village organizations –tied to local communities- that buy, store, and sell basic food grains to address food security and market access issues with village-level emergency food stocks and better marketing services for farmers and consumers. Inventory credit helps farmers benefit from temporal arbitrage and food price inter-annual variability to enhance food security and income/profits through good market prices in the lean season.

Cereal banks are created with a committee which supervises the construction of a warehouse or its rehabilitation for storage purposes. The NGO generally helps financing this construction and provides training to the managers for grain storage and marketing techniques. A start-up fund helps the bank buying its first stock and treating it against pest. During the lean season, grains stocks are sold within the community at a discount rate and in other villages at current prices. Grain credit can be provided to the neediest households and the revenues from grain sales are used as a revolving fund for subsequent operations. Inventory credit is often set up by a NGO which arrange a commercial credit facility between a newly formed cooperative and a lender. After harvest, the borrower deposits its grain under predetermined quality standards in a community storage facility. A quality control committee then supervises storage treatment and the issued certificate is presented to the lender. Then the loan is granted to the cooperative, pegged at 75% of the prevailing harvest time market price. Managers monitor market prices, quality of stored products and market supply to determine the best time to release the stocks on the market. Sales are used to pay back the loan with interest of 30%, storage costs and the net proceeds given to the farmer.

Several experiences, notably in Burkina Faso and in Ghana (e.g. the Zongpiige Village Association or the NKN Society together with the NK Rural Bank) witness the strong difficulties in making these schemes sustainable and work without outside assistance of NGOs. The major bottlenecks involve lack of management abilities for risky grain speculation and for spatial arbitrage, repayment strategies, governance issues (theft of cash or grains from warehouses, cash escape by managers…) as well as a lack of incentives for considering activities as business although private benefits could be much higher. Nevertheless, inventory credit experiences suggest more promising issues since members find marketing margins much more valuable to make profit and acquire production tools and more capacities to market their own productions while not relying on other traders or wholesalers. In Ghana or Niger, inventory credit programs have been associated to farm expansion in size, more access to bank loan, more maize and sorghum marketing margins and investment in poultry and agro-processing. Interest rates yet remain very high and credit is delayed sometimes while government policies tighten marketing margins with food security programs.

The way forward involve a dynamic leadership for cereal banks to make them work as a business, training for management improvement, food security roles should be restricted, and assistance for more client prospecting. Storage should be more secure, drying, and quality reliable. Market knowledge should be improved with information systems, early identification of buyers and their requirements, better price risk management and stock insurance, appropriate screening for group formation, and improved production performances.

3.c. Organization of supply chains and vertical relationships

Supply chains have been deeply restructured after sectoral reforms, from the integrated fashion to more liberalized markets. Vertical relationships now entail specific arrangements between stakeholders and farmers for pricing issue, input credit, and provision of public goods. They are very different according to the degree of competition and existing capacities along the chains. These reforms have allowed farmers to better participate in profit-sharing while bearing a higher degree of risk (fewer guarantees on outlets and prices). However, they now face several marketing channels that may be beneficial for them if they increase their capacities (information, management, bargaining with traders, storage, and infrastructures). The coordination failures induced by inappropriate institutions and competition is threatening the provision of extension services and quality grading.

Like cotton, cereal markets were mainly controlled through parastatal channels before structural adjustment plans took place from late eighties. The system suffered from the same problems even if some advantages were the guaranteed pricing to producers, the storage facilities and food security control by the government. As witnessed by Shepherd (1999) for

FAO for the case of maize, "in many countries, the supply of credit was linked to the later sale of maize. Because there was only one buyer of maize, it was theoretically possible for agricultural development banks to lend farmers money for fertilizer and seeds and arrange to get repaid through the maize marketing board."

However, farmers also have the opportunity to retain some grain for their own consumption, to mill it by hand or at a local hammer mill, or to go through parallel marketing channels with traders, and other wholesalers if public prices were low (and smuggling to neighbouring countries). To capture most of the production, governments sometimes gave generous subsidies so that even farmers were more interested in selling all their production then buying back milled maize or sorghum/millet for their own consumption. Because of growing financial problems due to corruption, unsustainable policies, bad management of boards and storage losses, high transport costs, and huge arrears from bad repayment performances on credit schemes, the parastatal system was unviable and resulted in public debt and macro-economic instability (inflation).

Cereal markets liberalization has allowed parallel channels to become officially operating. Grain marketing is carried out differently according to time during the year, location and transport facilities, availability of market places, and size of the harvest within and between neighbouring countries (FAO, 1999). However, price variability has become widespread, with lower storage facilities, and lower availability of inputs and credit interlinked schemes. It has also let farmers manage a new set of economic decisions regarding the place and the marketing channel to sell its production, the gathering of price and quantity production information about local markets, traders and other wholesalers, the time to sell, and storage investments.

For cotton, countries that did not experience any reform are based on a monopsonistic industry, where the public sector is often the key stakeholder (e.g. Mali, Cameroon, or Chad). Others can be classified in three main categories:

- Local monopsonies (zoning)
- Concentrated, market-based (oligopsony)
- Multi-players

The organizational structures rely on formal and informal institutions to coordinate the decisions of major players and to regulate the industry. There are either formal such as rules and formal regulations (State), formal collective organizations -ginners' associations, partnerships, cotton unions- with decision-making and bargaining powers, or informal.

Contracts between cotton firms and groups of farmers involve the setting of a purchase price of cotton seed which is pan-territorial or locally specific (uniform pricing or not) at the beginning of the crop season and a charged price of inputs that can be borrowed and deducted from the value of cotton seed production after harvest. The purchase price of cotton can be completed by a bonus after the realization of production, according to specific rules. The prior setting of prices can be regulated (price-caps, rate of returns) so as to be linked to world prices or individually chosen by monopsonies. Another solution is that prices can be bargained within the industry without any public intervention. Input credit can be managed differently, depending on the functioning institutions and on the industrial organization of cotton sectors, and results in varying levels of screening and rationing.

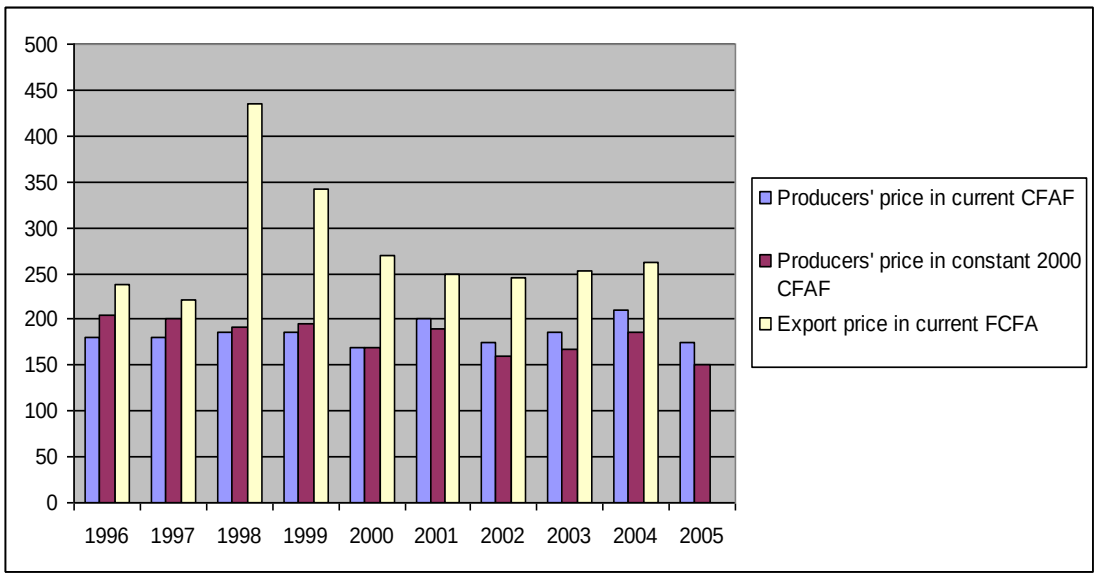
The provision of public goods is also related to the organizational structure of the industry and to the existing institutions. Regulating cotton sectors involve price regulation as well as collective arrangements for the necessary public goods such as input credit repayment, research or quality grading. Between cereal producers and other stakeholders, such price and other non-price arrangements rarely exist. In contrast, traders and other wholesalers buy cereals at local market prices and ineffective regulation impedes a stronger involvement of the

private sector in research, education, extension services or quality-grading. These could be somehow better taken in charge by producers' unions if financially viable. The case of Burkina Faso shows us that cotton unions are sometimes the best appropriate structure to ensure input provision and agricultural services for cereal farmers.

Because of these features, risk-sharing are of very different nature between cotton and commodity chains. What can notably be derived is that risk-sharing seems to be more balanced when profit-sharing is not. It is probably because economies of scope and profits are larger for cotton monopsonies that the latter can afford to provide farmers with risk-insurance schemes, notably for cotton price and input credit. The absence of risk markets forces farmers to internalize risk to profitability profiles of different crops. High transaction costs and low access to storage facilities make farmers particularly vulnerable to local conditions for cereal prices while they cannot benefit from temporal and spatial arbitrage. Traders benefit from cereal price variability and wholesalers/processors serve much more stable markets (urban markets for raw or processed products). They also have access to more storage facilities as well as to insurance markets. Let us now explore further the link between the industrial organization of commodity chains and profit as well as risk-sharing, as illustrated by cotton and maize.

In the zoning system, cotton companies are expected to supply inputs (with a credit scheme, most of the time) to all farmers within their concession areas. They have a local monopsony over the purchase of cotton seed. Public goods can be provided collectively, at the national level or locally and, same for the setting of prices. While universal credit access ensures high level of production with a secured purchase by cotton firms, the zoning system does not allow for significant price competition. This has enabled commercial farmers to engage into cotton seed purchase when prices were too low, as in Mozambique, or in Ghana, threatening the secured purchase of cotton ginners and causing input credit payment rates to plummet.

However, compared to a national monopsony, this system allows for more investment in capacity-building and in public goods, in principle. In Burkina Faso, the cautious setting of prior adequate institutions such as the strong integrated cotton union with a significant decision-making power and such as the partnership between farmers and cotton local monopsonies has led to an efficient degree of regulation through horizontal coordination. It has resulted in better price incentives for producers with no input credit recovery problems. The following figure shows that the experience of Burkina Faso is associated to higher relative prices for producers, mainly because empowered cotton unions have gained significant bargaining power in the new zoning systems, together with better management performances of the former parastatal.



Source : Ministry of Agriculture, Burkina Faso

Figure 13. Profit-sharing between cotton producers and marketing firms in the Burkinabè cotton sector during the reform period

In the oligopsonistic systems, competition is limited to some areas where the cotton seed production is the most concentrated. However, this organizational form is not present in our area of study.

In the non-concentrated industries, the coordination failures are the most severe and often result in very low repayment rates on input credit and under-provision of public goods. Some solutions have been found by cotton firms, as in Zambia or Benin (see in the next section). Prices are locally specific and less favourable for the most remote areas (higher transportation costs). The main problem is to keep a link between input credit and cotton production when it is actually very hard to know who provides input and who buy cotton seed. Financial establishments can be created as in Benin, or decentralized solutions can be adopted, as in Zambia..

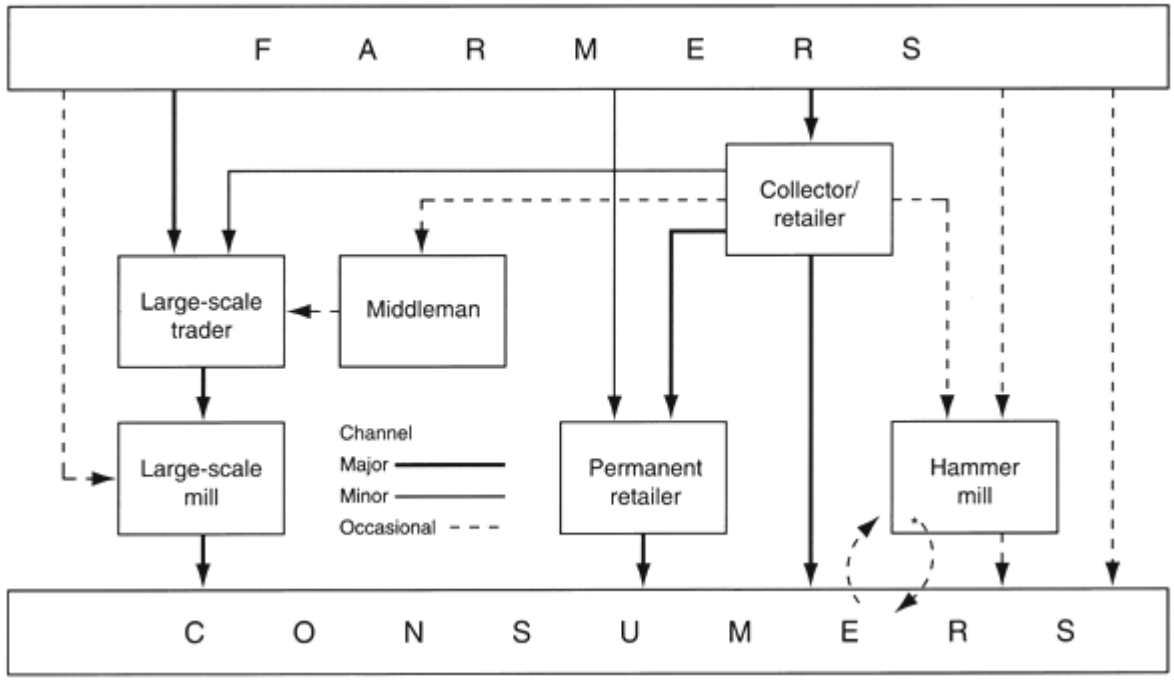
For cereals such as maize, the pattern has been slightly different while higher producer prices were not experienced everywhere because of a lack of transmission of the effects of competition or from central markets (see previous section). Spatial and temporal price variability have been enduring because of deficiencies in storage facilities access. However, the new marketing channels (box 4) and processing opportunities for farmers and traders have yielded new incentives and better profit-sharing. Risk-sharing has worsened and farmers now face a large range of uncertainties, which needs specific and appropriate extension services. As mentioned in FAO (1999), farmers have to know when to sell and store, what marketing channel is the most profitable for us, how to access cheaper inputs and so on (e.g. crop diversification according to available market information). In remote areas, farmers may be forced to take their harvest to the traders and not waiting for them and bearing more marketing margins because of more intermediaries. In this case, trading can be organized by farmers themselves and even processing can be carried out in a jointly-basis. Other decisions of farmers may account for the availability of market places and frequency, the time of the year, gathering information about neighbouring markets, and storage costs or existing facilities. Profitability of cereals is now depending on many supply and demand factors such as:

- Farmers' production, cash constraints, storage ownership and price distribution in the region
- Consumer demand and preferences
- Traders demand and storage facilities, influenced by price distribution in different part of the country and in neighbouring countries, as well as transportation costs
- Traders' networks and price discrimination
- Competition between traders and wholesalers, farmers organizations, and government policies (intervention or not, food security and trade policies, see previous section)
- Available information (see about market information services in the next section)
- Quality: formal and informal standards applied by traders and millers

Profit and risk-sharing have also changed for farmers because of reforms on fertilizer markets, with less access to credit so the need for village savings, village banks and extension officers has been increasingly growing. This is quite an urgent issue since input credit for cereals would more rely on cotton revenues and hence, increase the dependency linkage between cereal production and cotton cropping. While competition in input markets has allowed farmers gaining competitive margins (offset by higher world prices), the new system has introduced more risk with no more guaranteed inputs by governments or development banks and variable input prices. An interesting issue is the potential carrying of input provision by farmers' unions as experienced by cotton unions in Burkina Faso for cereals.

In the cereal commodity chains, as exemplified by maize, improving profit and risk-sharing lies in the improvement of marketing channels, which basically involves a reduction of marketing costs, the development of marketing by farmers (storage and processing) under innovative financial arrangements, and the need to access inputs more easily. Once again, the role of appropriate extension services, information services, research and strengthened institutions is of crucial importance.

Box 4: The marketing channels for maize



* Interaction between consumer and hammer mills
Source: FAO (1999)

Overall, profit-sharing has evolved over the different sectoral reforms in favour of producers and consumers but the former have often be forced to bear much more risk. Some mechanisms have been experienced with new-generation interventions of governments, but often at the expense of producers' incentives or processors (see previous section). As conjectured in the last sub-section, a prior strengthening of the institutional framework also appears as a necessary condition for more efficient profit and risk-sharing in a more complementary way. This is not only requiring more information services but also specific investments in infrastructures (to reduce transaction costs and the scope of market location) and the development of new financial schemes, such as inventory credit.

3.d. Risk factors and risk-mitigation options: the role of information and extension services

Apart from the purely agronomic risks on production, farmers bear several economic risks in the newly liberalized CCs. While cotton price and buyers are still guaranteed in the region, marketing cereals involves new risk-management issues. First, farmers have to choose their marketing channel, then to decide when and how much to sell and when and how to store. Input access is also a relevant risk factor, together with the choice of crop portfolio. Risk-mitigation options comprise better information-sharing with the assistance of extension agents, and the involvement of farmers into new marketing channels (processing, transport to urban retailers) and storage activities. Finally, the development of new micro-insurance schemes may help farmers facing external shocks on production and on farm assets and income.

As stressed in the previous sub-section, the newly liberalized sectors –mostly cereal ones- have enabled new incentives for production but also new risky decisions for farmers. By contrast, cotton production has often allowed farmers to benefit from guaranteed prices and input credit. This, in turn, could be a strong constraint to crop-diversification, detrimental to cereals. Let us now explore the risky factors and risk-mitigation options faced by farmers.

- Who to sell?

Farmers who live close to a city or with small quantities can sell directly to retail markets but it is time-consuming and with high risk (theft, degradation if inappropriate storage). Alternatively, farmers can sell to retailers in the market for wholesale at lower prices but with lower costs. They can sell to traders in town that own their stores close to larger markets, often at fix prices, or sell to visiting traders in the village, which is clearly the easiest option. The latter option involves many difficulties since prices could be much lower (but maybe not compensating transport costs), traders may not have sufficient cash and farmers may wait for a long time to get paid. This is why it could be more interesting for farmers to sell to a hammer or a large-scale mill. Some consumers prefer to buy maize (or sorghum) and take it to the nearest hammer mill for milling rather than buying already-processed grain[37]. From hammer mills, little production is marketed but it could change since the increase in the number of mills is associated to a decrease in profit for hammer mills owners. Commercial mills are an interesting outlet for farmers but they need to deliver large quantities and to organize transport to get higher returns than if they sell to visiting traders. Furthermore, they should ensure that quality requirements are achieved by their production, which is another source of risk.

[37] This has some cost advantages over large-scale mills and consumers often pay a fixed fee per bag.

Extension officers should help farmers to identify buyers and all marketing opportunities, together with the assistance for them to assess the risk-profitability of each channel, capacity-building for farmers' organizations and quality control. In a first place, it should be worth having a list of the larger buyers in production region with related terms and conditions and current prices. In some cases, extension workers could help farmers to arrange visits of traders if it is a profitable option. Then, they would have to know acceptable prices for farmers and traders, quantities to sell, commitment to arrangements with traders, and reliability of traders. It could also be worthwhile to organize for group transport, and information about transport companies could be useful..

Using market information may help farmers to sell to commercial mills or directly to wholesale and retail markets. Farmers have to understand why prices differ from information services to what traders offer in villages and should train to assess profitability and risk of each marketing channel. Information does not apply only to prices but also to conditions such as minimum quantities, quality standards, bags and packaging, or payment conditions.

- When and how much to sell? How to improve marketing?

These decisions must be based on individual situations and needs, price and storage opportunities, and marketing opportunities. Consumption requirements and cash needs have to be traded off for farmers not to sell too much at harvest, even under higher prices. They should be advised to store enough maize for their family's requirements while trying to save some money from grain sales for immediate needs after harvest. Cash needs are often identified as a major cause of low bargaining power of farmers with respect to traders. Storage can be fostered by inventory credit programs and cereal banking. Input needs are also playing the same role.

Storage is influenced by the expectations about price rises in the year so as to cover its costs and risks. Available data about past seasonal price trends may enable extension services having an idea about price patterns and storage profitability if they know the size of the harvest. Indeed, when the harvest is poor, the price upswing during the lean season is likely to be of greater scope. Selling later may also face marketing difficulties if traders have moved to other places, and farmers –mostly in remote areas- should consider selling before the rainy season.

Different ways exist to improve marketing for farmers, apart from direct assistance. Extension agents could participate in improving market information, making the marketing system knowledgeable for farmers with communication strategies, establishing new assembly markets and contributing to the maintenance of rural roads.

- When and how to store?

In the new liberalized environments, the length of storage has dramatically increased because of the time needed before sale arrangements and because of the willingness of some farmers to benefit from temporal arbitrage. Hence, storage and drying requirements have strikingly changed from open to closing-shelled stores with the use of pesticides to protect against diseases and insects. It is notably the case for hybrid maize, which is used both for trade and commercial milling.

To minimize post-harvest and storage losses, drying is essential for cereals. First, drying helps the plant not to loose too much dry matter when it is mature. Optimal moisture rate is roughly 13% for maize and below 20% for sorghum. Deterioration is exponential with moisture increase. Drying is firstly made in the "field on stalk" before harvest, and then after temporary storage following harvest and before husking. The crop needs to be protected from rain and other animals and rodents..Several methods exist on the field: sun-drying on a plastic sheet on the ground or in a drying tunnel for examples (see FAO (1999) for more details).. Suitable drying structures are illustrated by the rectangular crib, which can also serves as a

storage facility for bagged and treated grain. The crib allows a more uniform drying in six weeks.

Following shelling and treatment against insects, it is better to bag the grain and to store it in cribs or other improved storage facilities[38] for protection against ground and rain water, pests and animals, and heat. The maximum benefit of storage can be attained by a trade-off between storage costs and price differentials but extension agents must ensure farmers that price benefits could be reached thanks to reliable sale arrangements with traders, wholesalers or commercial mills.

- Accessing and using inputs

As stressed out many times in this study, commodity reforms have made input access more complex for farmers, and credit has been more rationed. But, as time goes, the emergence of numerous input private retailers has made input access easier under no big cash constraints and involves the same marketing decisions than for output marketing (see before: who and when to buy, under which arrangements, and so on). Furthermore, it has also implied that farmers should find alternative ways of paying for their inputs.

A major challenge is to benefit from competition on input markets with several improvements in information sharing among stakeholders and smaller transaction costs. Farmers should be encouraged to save through banking so as to be less reluctant to do it by traditional means (livestock, or village and other informal savings). Own farmers' bank establishment (village banks and cereal banks) can help then to self-finance for inputs. Alternative options are the use of outgrower schemes but they mostly work for cotton or other cash crops, arrangements with traders, barter arrangements with input suppliers[39], and arrangements with farmers associations.

Extension services could help farmers to assess the profitability of input application and to find financing sources or means once they have calculated their input requirements. Application rates have to be more specified across regions, crops, and according to expected value-cost ratios. However, this indicator is complex to calculate because of time and space output price variation as well as variability of input prices. Technical assistance should provide valuable information for farmers about prices and price patterns, marginal yields with input use according to weather forecasts, and about transport facilities. As for output marketing, extension agents may help farmers arrange for group transports. They can also assist them for any administrative needs and information about financial institutions, private companies and agribusinesses to get credit for inputs. Agents can organize visits of farmers to institutions, training sessions for administrative skills and estimating costs of production. A crucial role is the encouragement to save together with safety for farmers, avoiding theft or degradation (e.g. livestock).

- Diversification: why and how?

The new organization of markets and institutions for cereals and cotton no longer ensures profitability, input access and profitable outlets. This introduces multiple sources of risk that not only farmers face but also other stakeholders. Coping with higher risk but also numerous marketing opportunities entails the consideration of commodity diversification for production, marketing and processing. Many studies have highlighted that maize was the most profitable crop among cereals in the past, but a lot of opportunities have appeared today, and farmers are

[38] Brick bins and ferrocement bins are examples of improved-storage facilities which are also more costly than cribs or mud and cement-plastered baskets (more traditional). But traditional storage can be improved (see FAO, 1999).

[39] Farmers can exchange any acceptable crops for inputs, before the release of inputs. Some fertilizer companies are establishing more and more depots at district level, such as in Zambia, to improve access for smallholders. This interesting arrangement could be spread across countries and regions with the trustworthiness of input retailers and relationships among farmers and private firms.

strongly encouraged to explore and calculate the relative profitability-risk profile of each crop and marketing option. A combination of crops, marketing channels, and institutions may be specifically optimal for each farmer according to individual financial situations, learning spillovers, technical and physical capacities, extension services, available information, risk aversion and expectations, available technologies, and so on. While cotton remains a source of more stable income, its profitability seems to stagnate, and even to decrease relatively to other cereals with processing and other market opportunities.

Extension services have to emphasize crop diversification to avoid income dependency and vulnerability and one valuable way would be to draw on market and agronomic linkages. For example, maize or sorghum could worth being intercropped with nitrogen-fixing crops such as beans, soya or groundnuts. If urban markets are not too far, farmers may consider horticultural production. Farmers would be worth having more knowledge about market opportunities, availability of buyers and competition between them, demand for raw and processed products, production potential and production costs, transport and other transaction costs, and so on.

- Production and other non-market risks: the development of insurance markets

Finally, insurance and risk markets are often absent in rural areas and result in constrained choices of production as well. The same reasons can be invoked as the ones for credit markets. But more available insurance schemes, apart from risk-sharing informal agreements, could be one of the cornerstones of new production incentives and investment in agriculture. The absence of insurance markets is often explained by high transaction costs, geographical remoteness, and risk covariance at the local level. However, improving information about weather conditions will help set weather index micro-insurance schemes, as already experimented in Southern Africa, and provide farmers with new producers' incentives. Another fancy insurance scheme is the parametric insurance. Many insurance products are now experimented in different rural areas of the developing world, such as life insurance, health insurance, livestock insurance (for epidemics), crop insurance, property and assets, and so on. Although the development of such markets requires a strong financial framework to be established, enhancing information access through new technologies for information and communication could help spread these schemes and promising results are expected.

3.e. Infrastructures and challenges to improve market integration

Lack of infrastructures is highly responsible for low market integration and high economic risks faced by producers, together with capacity constraints. Communication and information need durable investments by private stakeholders and also public instances. Cost-effective ways to provide infrastructure may use existing infrastructures with the involvement of user communities. Better storage and transports will reduce food price variability, but this will ultimately rely on central markets.

Apart from pure informational and risk problems, the functioning of markets is much constrained by very high transaction and transport costs, which end up lowering the transmission channels between local and central markets. Low market integration translates into more price variability and more uncovered risk for producers, as well as for traders and other stakeholders. Hence, marketing opportunities are threatened and investment incentives are weakened. One obvious problem is the lack of reliable transport and marketing infrastructures, together with communication and information ones that contribute to risk increase for different stakeholders.

As noted by Platteau (1996), infrastructural constraints are a major cause of the low long-run supply response of farmers to price incentives, notably for transport and

communications. “Choices between improving prices and the need for infrastructure and other provision are not absolute since complementarities are important. Both, in effect, can compete for public funds.” With high cost of provision due to long distances and low population density, the author focuses on cost-effective ways of improving this provision so as to have the maximum impact on farmers. Investment in irrigation, research, extension services, roads and other public goods increase the marginal productivity of private inputs and conversely. So, price reform and structural public intervention are complementary. A substitution effect also exist as public investment in infrastructures has the same effect as tax reductions, but the impact on producers’ incentives may differ. As public funds are generally a scarce resource in the region, cutting taxes will decrease public funds (as agricultural taxation often goes to the State) and investing in rural infrastructures will increase taxation revenues due to more production. This policy choice is influenced by prevailing specific conditions and budgetary resources. Under structural adjustment plans, parastatal and other costly administrative structures have been dismantled, and some resource savings could now be used for public goods. Cost-effective ways to provide infrastructure may use existing infrastructures with the involvement of user communities (mainly for maintenance with own-managed funds). Productivity benefits could be achieved by improving off-road transport and intermediate means of transport with capital-savings techniques for road construction, using labour-based techniques to overcome usual problems related to equipment use and availability in the region.

Badiane and Shively (1997) explores the role of spatial integration on local prices (and price variability) and on transport costs, accounting for the transmission process between local and central markets. They notably show that wholesale markets for maize in Ghana have reacted differently to policy changes according to local and central market conditions as well as the degree of market interconnectedness. The price-adjustment process is determined by the degree of interdependence between local and central markets, as well as transport costs and their evolution. Price volatility is reduced by local storage and increased by central one, under significant interdependences between markets. For more isolated local markets, the paper suggests that improvements in local storage and transports will reduce food price variability but cannot estimate the extent to which reductions in transport costs turn to higher farm prices.

All these insights from the literature and from country experiences suggest that the current market environment can be improved both through higher incentives and higher capacities for the different stakeholders of the commodity chains. Accounting for the differences between cotton and cereal commodity chains is a key point to emphasize here, as it enables us to understand the linkages and the difficulties for cereal production to increase apart from cotton-production dependence and other interlinked arrangements. Improving incentives has been partly realized thanks to new institutional and policy frameworks (see hereafter) but infrastructures are still lacking and effective marketing systems are still needed for food production and cereal commodity chains to be better performing and connected to rural producers and urban markets.

The importance of effective marketing systems for food security is vital for rural welfare as well as to support urbanization and industrialization in the course of development. While the competitive new environment has allowed significant improvements with market expansion and progressive market behaviour in the different commodity chains and has helped reduce the market dualism by better access to urban markets, it has been offset by several cutbacks in governments transfers. This notably requires a coherent policy and institutional framework with macro-economic stability. This is quite an urgent matter to find new alternatives and arrangements to increase public investments or private investments in

public goods under sufficient incentives for the private sector. New arrangements should provide better capacity-building possibilities and overcoming the several highlighted market failures and/or deficiencies. Another complementary strategy is to increase the scope of market expansion to rely in a lesser extent on imperfect and less efficient arrangements (whether formal or informal). This involves better access to information, more competition, less transaction costs, better risk-sharing agreements or penetration of insurance markets and a better representation or involvement of producers in the structure of commodity chains. These two strategies call for institutional innovations and ensuring a certain degree of interests' convergence with political support. This is precisely our concern in the next section.

4. The institutional and policy environments and their impacts on markets, incentives, and capacities along CCs

The institutional environment of commodity chains comprises all that surrounds market and non-market relationships tying the different stakeholders of the commodity chains. Market institutions allow stakeholders to engage into economic activities under several market inefficiencies and non-market institutions define social rules and other norms when markets do not exist or when the relationship between stakeholders is outside market interactions. As reviewed by Fafchamps (2004), market relationships in Sub-Saharan African are often constrained by a lack of enforcing institutions for contract enforcement and conflict resolution by justice. Contracts are often oral and their enforcement are only guaranteed by social mechanisms such as reputation and social sanctions within personal networks where trust, reciprocity and long-term repeated interactions enable sufficient confidence among stakeholders to establish reliable relationships and sufficient incentives for contract taking and realization. But personal networks have been shown to be less efficient than non-personal ones, and they severely restrict the degree of competition, information, and business expansion.

4.a. The institutional environment for producers

Due to the lack of well-functioning markets, farmers rely on imperfect institutions to market their production, access inputs and public goods, and so on. At the local level, the community environment is very important for farmers, as exemplified by producers' organizations. We currently assist to a strengthening of the rural civil society and to the revitalization of rural communities. This movement help farmers have professional structures and involve as political actors. However, governance and management capacities are critical to this success, in addition to local social conservatism and other social norms. The current federation of producers' associations is linked to the growing participative nature of agricultural policymaking in the region.

However, solidarity networks allow *rational* farmers to establish risk-sharing agreements, to borrow inputs (with the use of social collateral under contract farming or informal credit), to save cash incomes (rotating savings), to invest in club goods, to cope with labour shortages or land access and to cope with traders for their crop production. As demonstrated by Coate and Ravallion (1993), mutual solidarity relationships can be sustained in the long-run if opportunistic behaviours can be limited when short-run deviations are deterred by long-run punishments. Voluntary participation in farmers' communities whether market-oriented or village-provided club goods ones, directly reflects the individual interests of farmers in these informal agreements. Hence, a special look at the different rural cooperative groups at the local scale is one substantial issue to understand the institutional

environment in the provision of incentives and capacity-building for farmers. Social capital here is here an imperfect substitute to physical one.

Farmers' organizations are very important institutions since they help farmers managing the marketing of their product, have more bargaining or information power with other stakeholders (traders or processors), can sometimes directly provide club goods[40], inputs, capital, marketing or processing facilities to farmers[41]. These institutions have been determinant in the cotton success story while largely ineffective for cereal commodity chains. However, the recent evolution of all farmers' organization, whether being commodity-specific, lobbyist, or more generalist provide promising expectations for more producers' incentives and participation in the commodity chains' services, profits, and political involvement. To this end, farmers' local organizations have to be integrated in empowered federations or unions with strong leadership. The resistance to different policy reforms during the period of structural adjustment plans has enabled a strengthening of the civil society and the revitalization of rural communities[42].

Village organizations, whether being farmers' organizations, market-oriented or community-oriented ones interact at the local scale and define an overall level of village social capital. In Tanguy *et al.* (2008), the authors assess the performance of village organizations in Senegal and Burkina Faso and show that these organizations are present in most of villages and gather a majority share of rural households. While community-oriented organizations are often captured by traditional authorities and local elites (for leadership and participation in benefits), market-oriented ones are much more democratized when elaborate administrative rules are established. Governance promotion help producers' incentives within market-oriented organizations but their diffusion is severely limited by social conservatism and geographical isolation. Management capacity and capacity in resources' access are also critical bottleneck for the performance of these organizations. Market-oriented organizations are more associated to ethnical and social fragmentation and to social heterogeneity. As shown in Kaminski (2007), the formation of GPCs[43] in Burkina Faso during the cotton reform has been fostered by the arrival of many migrants from Côte d'Ivoire, and the resulted social heterogeneity has translated into the creation of more GPCs, associated with more credit repayment performances and cotton production incentives. In contrast, in smaller villages with more homogeneous social composition, former village organizations have been adapted to become GPCs but no major change in composition, governance, and administrative rules has occurred. Because the emergence of market-oriented organizations[44] may threaten the traditional authorities and informal rules in place (see before) as well as the mutual insurance systems within the community, the latter will tend to resist to the emergence of the former.

Today, different federations are grouped at national level to participate to policymaking such as the CNCR in Senegal that has imposed himself has a major interlocutor for new agricultural policy designs. At regional level, the emergence of ROPPA has helped farmers gain credence at international level, notably during the WTO negotiation rounds. The action of ACA for cotton has revealed the capacity of farmers to enter into the political process when deposing a claim against the US subsidies to cotton farmers (by Benin, Burkina

[40] This includes social activities, extension services, environment upkeep, education, health training, school maintenance, women advocacy groups, water management, rural roads and others.

[41] Farmers' local groups can also perform other market-oriented groups not directly related to the main crop activities (cotton and cereals): handicraft, poultry, brick making, boat maintenance (for fishing), beekeeping, manure contracts with herders, and so on.

[42] See FAO and SWAC (2007).

[43] *Groupements de producteurs de coton*.

[44] This is generally inducing new rules of capital accumulation and social differentiation that allow more entrepreneurial behaviours and allow individuals to escape from elite capture and traditional status (as the Caste systems in Senegal or the gerontocracy rural society in Burkina Faso).

Faso, Chad, and Mali). This new context is now compatible with more decentralized and participatory approaches that give rise to more political support because of more involvement of farmers[45]. This is also an opportunity to foster coordination among the different stakeholders of commodity chains when farmers are more efficiently organized and willing to participate to a regulatory framework. For example, the establishment of the UNPCB in Burkina Faso –drawn on the introduction of free-adhesion based local groups of cotton farmers- has been associated to the only successful case study of cotton reforms in the region, as documented by Kaminski (2008a). Producers now hold shares in the ownership of cotton firms and have representatives in the regulatory institutions of the cotton commodity chain. The same approach has been promoted for Mali, with the introduction of new local groups but social conservatism has hindered the diffusion of these schemes, hence limiting the scope of a new institutional dynamism for a cotton union to be bottom-up established. The interaction between new farmers' organization effectiveness and prevailing local institutions and community-oriented groups has to be accounted for. Moreover, the effectiveness of farmers' groups can also be constrained by lack of funds, political unwillingness, governance quality, leadership issues, lack of trained staff, and other ethno-regional disparities.

Finally, the decentralization of rural development policies together with more participatory approaches contribute to a democratization process where responsibilities are gradually transferred from central administrations to newly established local institutions. However, capacity constraints are still very strong but regional and national cohesion can be fruitful with the increasing pattern of consultation of the different partners at different levels. The emergence and strengthening of both the civil society and the regional cooperation may foster the effectiveness of regional policies. The involvement of local actors appears a preliminary –albeit far from being sufficient- step since it is giving the responsibility of their own changes directly to the local actors. The experience of Malian cotton farmers show that the strengthening of local farmers' groups and their involvement in the political process has to be associated to more democratization and education at the local level, as pointed out by Bingen (1998).

Informal norms at the village scale are also part of the farmers' institutional environment. Land transactions are not often market-based in cotton-cereal systems. Property rights are partially communal and partially individual and based on customary rights including inheritance from matri-lineage systems. Other ways to access land are clearing of bush, gift or temporary letting. Secured rights occur as time goes, which is a typical process for migrant farmers. Land is not a very scarce resource in cotton-cereal systems but where demographic pressure is more severe, we currently assist to an expansion of land market transactions. However, informal norms often entail exclusion of some ethnic groups or more difficult access to the more fertile or more accessible land. Allocation of land hence might be politically and ethnically biased, implying allocation inefficiencies. Land tenure systems impact agricultural practices according to land rights' security. Other informal norms include solidarity norms such as informal risk-sharing agreements (joint-liability agreements for credit repayment, migrant remittances, informal insurance, collective and rotating savings and credit) or sharecropping, labour informal transactions, collective provision of local public or club goods, and so on. Informal norms, when ignored by new policies aimed at increasing the scope of the formal sector and market transactions, can sometimes be misleading. In

[45] See the analysis of the political appreciation of the cotton reform by Burkinabe farmers in Kaminski (2008b). It is shown that the most active local cotton groups involved in the political process were also the ones that the more appreciated the reforms' impacts, through the joint estimation on their subjective wealth and their own assessment of the effects of the reform on several welfare and technical variables.

particular, land reforms that have not been based on existing customary rights have often failed in being effectively implemented on the field.

4.b. Institutions, regulation and the competition/coordination trade-off

Weak public institutions make enforcement mechanisms very informal, with several restrictions on business expansion and private investment in CCs. Hence, coordination of collective activities is very difficult (research, extension, quality) within CCs, and increasingly with respect to the number of NCCS. Many solutions do actually exist such as public-private partnerships, the establishment of inter-professional associations with involved farmers, and effective consensus-building institutions. Setting up self-regulated frameworks is a challenge for the future, which should be complemented by better information services that will improve vertical and contractual relationships.

Under unenforceable contracts, regulation of commodity chains is problematic as weak formal institutions cannot prevent different stakeholders to renege on their contracts with regulatory institutions or other stakeholders. Self-enforcing contracts are a second-best solution but limit the scope of regulation that is yet essential to ensure a correct provision of public goods such as research and extension services, and other quality grading. Privatization of commodity chains can sometimes be argued to yield a more efficient private regulation than the prevailing public ones but needs a specific empowered institutional framework where the different stakeholders are correctly represented and can coordinate in a consensus-building way. Interprofessional agreements and other consensus-building institutions should be explored further as a key component of the institutional environment of commodity stakeholders.

As extensively shown for the cotton sector[46], vertical relationships are constrained by a lack of coordination among stakeholders when there is a significant degree of effective competition in the industry. The so-called competition/ coordination trade-off prevails in most commodity chains between farmers, stakeholders (processors and traders), and government because of ineffective regulatory schemes and asymmetric information. In this context, investment in public goods such as research or extension services can be subject to private capture and the role of government remains decisive. Lack of information on marketing costs and farmers' behaviour involve high cost of regulation and higher credit rationing when it is privately provided. Indeed, investment in quality, farming productivity, or extension becomes non-profitable when competition is allowed in the marketing/processing branches and when ineffective regulation cannot ensure horizontal coordination.

The main challenges entail:

- Appropriate provision of inputs when input credit repayment is critical
- Sufficient investment in research and extension services when benefits can be captured by local traders or new processors[47]
- Credibility of government in contract enforcement and public good provision under weak instiutions and non-benevolence, resulting in inefficient public regulation
- Difficulty to establish private and/or 'self-regulation' in most institutional environments

Hence, problems of coordination in a more competitive environment, ensuring better producers' and consumers' welfare could not often been overcome by regulatory

[46] See Poulton *et al.* (2004) or Kaminski (2008a).

[47] Investment in specific assets is vulnerable to opportunism and capture when no horizontal coordination can provide any assurance.

arrangements. Coordination failures, as witnessed by many cotton reforms in the region, involves less investment in public research, reduction in quality levels, and less extension agents while better producers' incentives because of higher prices are not sufficient enough to outweigh negative effects. Some of these problems can somewhat be overcome under a coherent policy framework. Decentralized rural development can help investment in research and provision of extension agents by the public sector and professional associations or NGOs. This notably requires carefully-designed public-private partnerships. The emergence of producers' unions with a significant bargaining and political power can help farmers accessing inputs, credit, and other facilities, such as storage or farming equipment. A change in the legal framework can also enable private actors to establish their own regulatory institutions and departing from ineffective public ones. The example of the cotton reform in Zambia is particularly relevant in this fashion. Indeed, private regulation has allowed Zambian cotton companies to introduce the "distributor system", with higher recorded level of technical assistance and better credit recovery performances for cotton inputs in a more competitive environment. Finally, the action of external actors should also be taken into account. The actions of NGOs and micro-finance institutions have been associated to better access to credit, inputs, and marketing facilities such as storage or processing (see cereal banks or inventory credit before) for farmers.

The most crucial issue here is informational problems. Moral hazard can lead farmers to strategically default on their credit, and the more the less farmers groups are not carefully organized or no credible sanctions or credit suppression is to be effective. Innovation in farmers' group formation can help reduce this problem. Regulation at the national level can also help other stakeholders coordinate for credit recovery. But improving the regulatory framework has to be based on better available and sharing of information between various stakeholders and farmers. Having stronger farmers' associations or helping them to be established as economic partners could foster this process or regulation effectiveness and better information-sharing. This has been experienced for the Benin cotton sector but the process is now in its infancy. It seems that a high degree of competition is difficult to cope with regulation effectiveness and a high regulation cost has been recorded in Benin, threatening incentives both for farmers and for the private sector. A more cautious approach with a progressive empowerment of incumbent actors such as farmers and former parastatals together with progressive entry could help to improve the way forward.

Many elements (see previous section) show that universal credit access and competition in the output market seem incompatible because of standard informational problems on seasonal credit -information sharing is unrealized with many actors- and no screening effectiveness. Competition is associated with rationed input credit, and universal credit access with local monopsonies. This is one application of the so-called competition/ coordination problem. One other application is the difficulty to have competition and sufficient investment in public goods. These two tradeoffs both impact the producer's profitability. According to Poulton *et al.* (2004), for English-speaking Africa, producer's profitability is higher in concentrated industries than in non-concentrated ones while profit-sharing is more unbalanced. The smallest level is attributed to local monopsonistic industries. However, in French-speaking one, the latter perform the best, thanks to a strong involvement of producers, and the non-concentrated industries the worst. It can be concluded that the most performing organizational form depends closely on the institutional framework.

Studying the cotton reform in Burkina Faso shed some light on one way to overcome the competition/ coordination problem. As mentioned in the previous paragraph, the more cautious approach of the Burkina Faso cotton reform has been associated to more effective regulation and less informational problems. The consensus-building approach is based on a

reinforcing of prior institutions or the building of new ones before any market reforms. The latter are then better discussed among stakeholders with better information-sharing. As demonstrated for the case of the Burkinabè cotton sector, the timing of reforms with institutional ones before market ones has been associated to higher production incentives together with better farmers' capacities. In Kaminski (2008a), the author shows that the presence of an empowered cotton union before the cotton sectoral privatization has allowed better regulatory schemes with the establishment of public-private partnership ensuring a sufficient level of coordination and a maintaining of investments in agricultural services while price incentives became higher for producers. Hence, the competition/coordination trade-off seems to be partly overcome when it is possible to support more transparent institutions and better governance, together with better represented stakeholders. However, this involves specific investments and a political convergence of interests, with an effective and targeted support of donors. This story has also been documented for the case of irrigations schemes in Mali (Aw and Diemer, 2005) or for maize in several parts of Eastern and Southern Africa. The story of cereal liberalization in Mali is very interesting. Staatz *et al.* (1989) shows that the emergence of the PRMC (see last section) helped donors, government and stakeholders to commit on a reform plan with good governance level records. This has notably fostered incentives for the private sector with entry of numerous big and semi-wholesalers among which several ones were operating illegally before the reform. Legalization has resulted in more storage facilities with more transparency, less transaction costs for grain purchases supplemented by credit consumption to improve food security concerns. However, entry is still constrained by lack of working capital, political connectedness and trade riskiness because of lasting-ineffective regulatory institutions to enforce contracts and rely on markets instead of personal networks.

An interesting solution for coordination-building is the role played by inter-professional associations. Inter-professional agreements and associations provide another "tool for value-chain development", as demonstrated by Shepherd (2008). These associations or institutional arrangements between existing associations of different stakeholders at different levels of the commodity chains have been established for a particular problem faced in a particular industry (credit repayment, input access, quality, or pricing issues for instances) and lack of coordination among the different stakeholders. As for the AICB in Burkina Faso, some of the inter-professional associations have been created to be an umbrella organization to cope with the effectiveness of the industry in newly deregulated marketing environment. Either members are associations that represent different functions or stages in the commodity chains *(the French approach*) or membership can be given to individual or companies and even government organizations. The structure can comprise a supervising assembly where stakeholders are represented following different rules and where producers' associations generally predominate. The assembly elects an administrative council which implements the decisions of the assembly and supervises the executive committee (staff and secretariat). Policy discussions, product promotion and quality development are substantial issues. Training is often organized and carried out as well for technology transfer and market information-sharing. Other activities comprise logistics, research, quality control and grading, pricing and contract farming practices, facilitating direct loan transactions and other interlinked arrangements.

Inter-professional associations are also an interesting tool for the relationships between "insiders" stakeholders and other participants of the commodity chains. This includes labour unions, insurers, micro-finance institutions, chambers of commerce, government agencies, and donors. In the discussion of Shepherd (2008), the emergence of such associations is ambiguously favoured from outside or from value-chain participants. While outside agencies

can facilitate their establishment when communication among stakeholders seems to be a critical bottleneck, it is also more difficult to ensure a sustainable organizational structure with the acceptance of full cost participation. It is clearer, however that such associations be "associations of associations" as it would be very difficult to make participate farmers, input suppliers, or other agro-processors on their own. Sometimes, inter-professional arrangements foster the empowerment of other member associations such as weak farmers' organizations but it can jeopardize the inter-professional approach. It seems that better results are achieved when farmers associations are solely representative bodies than when they undertake business activities, as carried out by cooperatives. It should be preferable if associations would be able to raise or generate their own funds but many difficulties have been encountered in numbers of cases to find funding sources and efficient ways to collect those.

Consensus-building institutions are extra-professional arrangements that can allow commodity stakeholders and other donors or governments to deal with policy implementation and development project under more participation and information-sharing among the different actors. The establishment of the PRMC in Mali has been a successful case study of how the government has been able to commit to a reform plan in a coherent way without deviating, enabling the cereal liberalization process to boost producers' incentives with a limited scope of interventions and a proper defining of actions.

Countries	Functional agricultural survey	Existing Market Information Services
Benin	No	Cereals
Burkina Faso	Yes	Cereals and ineffective for livestock
Cameroon	No	Cereals
Côte d'Ivoire	No	Food crops
Ghana	Yes	Food crops
Mali	Yes	Cereals and livestock
Niger	Yes	Cereals and livestock
Senegal	Yes	Cereals and livestock
Togo	No	Food crops

Table 1. Situation of information systems for each country

Last but not least, another way to improve coordination and contractual relationships between the different stakeholders lies in better information services, in particular market information services. In liberalized environments, it is often difficult for farmers to know local market prices, cost of own milling or transportation and this lack of information is a source of more economic risk, which ultimately results in less production incentives and/or more constrained developments of existing channels.

Shepherd (1997) reviews several experiences of market information services in developing countries and highlights the main constraints and challenges. He also points out that market information reduces transaction costs and risk bearing, and increases the market power of farmers and trade opportunities, allowing small traders to enter the market[48]. Hard information includes historical trends and price fluctuations on regional, central and local markets. This needs to be implemented by extension services to manage data in a more cost-efficiency way. Soft information could also be profitable to farmers on when to sow, when to sell, storage prospective profits and so on. It could help public services for the early warning of food shortages, livestock diseases, and the management of food reserves not to disrupt

[48] Only large traders who rely on personal networks can have profitable trading activities because of their own-network privately-provided information and scale effects for cost-savings on information gathering.

commercial transactions but it requires good governance rules. Experiences have witnessed the huge difficulties faced by several countries for the maintenance of market information services, training of staff, collection and dissemination, equipment, infrastructure and use with possible political interference, and challenges to increase information transparency and hence, credibility. Above are displayed the state of market information studies in our region of interest.

4.c. The institutional legacy and constraints on further improvements

The institutional environment of NCCS should be understood in a broader way, accounting for the specific societal characteristics of WCA rural societies. The network economy is maintained by the ethnicity phenomenon, and the legal dualism, which hinder the application and the credibility of formal law. This implies information retention and restriction of economic differentiation, which limit private business incentives. The role of religion and gender is essential to go beyond these constraints.

The *institutional legacy* (Platteau, 2007), such as inherited from pre-colonial and colonial periods has been shown to be linked to major governance problems impacting ultimately growth in Sub-Saharan Africa. Platteau shows that the emergence of the nation-state did not coincide with the disappearance of kinship ties. The relationship between ethnicity and the state looks like a bidirectional causality where the logic of ethnicity have prevented modern states to emerge and the behaviour of state agents has reinforced the enduring role of ethnicity. The post-independence period has then coincided with a progressive capture of the state by ethnic groups, religion or regions and democratization has exacerbated ethno-regional divisions. The coexistence of informal rules and social norms together with the modern law has resulted in the "legal dualism". This is weakening the modern formal institutions which "lack the required credibility". Modern law has often been implemented without considering or in contradiction to the traditional customary rights and norms which has led to the ignorance of the former (e.g. for land titling and property rights). The role of religion is a substantial issue as it helps bridge the gap between formal and informal institutions thanks to loyalty and identity building beyond the ethno-regional ones. Reaching a larger community, religion can foster the adoption of values and norms that differ from customary ones "based on traditional order and status ranking considerations". Kinship ties indeed are also a strong constraint for entrepreneurship since they "hinder socio-economic differentiation and individual capital accumulation" through norms of redistribution and common beliefs. Information about clients' trustworthiness is not shared among processors other than direct recommendation by common acquaintances and trust mechanisms entail high transaction costs impacting retailing prices.. Hence, religion can help entrepreneurs get the incentives to expand their business as norms can be respected by different ethnic or regional groups. Religious authorities provide institutional arrangements to better enforce contracts.

Finally, the role of gender is crucial as women are believed to essentially participate to food security and nutrition through agricultural production and health for their household. Yet, social norms and rules still discriminate women for accessing land, inputs, and education. Women could increase crop yields up to 30% if they would have the same amounts of experience, education and farm inputs as men. So far, it seems that the involvement of women and religion could be fruitful to expand market mechanisms and/or improve the prevailing institutional mechanisms.

As for markets, huge differences between cotton and cereal institutions are observed. The peasant cotton revolution has been supported by efficient social organizations of farmers,

high-quality research and extension services, and better quality in infrastructures (rural roads, education, irrigation, communications and electricity). While this institutional environment has inherited from colonial interests, it has been reinforced by the post-colonial policies and self-interested politicians depending on cotton export earnings and financial revenues through implicit (parastatal arrangements) or explicit taxation. In contrast, production of cereals has definitely lacked the sufficient investment in physical, social and human capital with badly-organized farmers, discriminative policies under the social contract, political disinterest and weak institutional arrangements. The only effective institutions were often linked to the ones of the cotton sector, such as interlinked agreements between cotton production and agricultural inputs and credit. We now turn to the examination of policies and the policy framework for cotton-cereal systems to supplement the institutional analysis.

4.d. Commodity reforms and the political economy of cotton-cereal systems

The reforms of CCs have been subject to many criticisms, and many controversies about their effects still remain. However, several successes have been encountered, notably when governments did not involve through second-generation controls. In the cotton sector, the difficulties have arisen because policymakers failed to account for the institutional framework. Cereal liberalization has shown worse results when inconsistent food security policies have been kept, together with trade policies. Remaining challenges are capacity-building led by professional extension services with better organized farmers. Contradictory policies are explained by the specific political economy conditions in the region, which articulated around the social contract and frictions between governments and aid agencies. The commitment problem can be overcome by a specific institutional environment, as in Mali. The currently growing political involvement of farmers can, however, induce a change in the political economy conditions to align incentives of policymakers with those of the NCCS.

Cotton and cereal sectoral policies have long differed over time and across countries because of their different political interests and concerns. Government focal points have often been driven by a focus on the cotton sector with neglect on cereals. This has been translated into discriminatory policies against cereals ensuring cheap food for urban consumers (with import subsidies) and low levels of public investment in local infrastructures and research. Moreover, producers' prices have remained low because of trade restrictions and no political willingness to reduce transport and transaction costs to reach urban markets. In contrast, the cotton sector has been well supported with strong political commitment and investment in public goods. Governments have been interested in cotton export earnings and their substantial importance in terms of public finance.

Both commodity chains were organized on a single-channelling basis under parastatal arrangements with the consequences that producers often bore a high tax burden (implicit or explicit taxes) with public monopolies. However, it enabled farmers to access subsidized inputs and credit and benefit from guaranteed prices and outlets. Even if some successes have been experienced until late eighties (for cotton and maize) thanks to successful research programs with appropriate extension services, the systems have shown several weaknesses with low price incentives for farmers and financially unviable arrangements.

Today, all sectors have been partly liberalized or their reforms are under discussion. Structural adjustment plans have entailed the pressure for government to withdraw and reduce their interventions while dismantling official boards and other parastatals. While it has been mostly applied to cereal markets, French-speaking countries have been much more reluctant

to liberalize their cotton sectors. This has not prevented governments from new interventions that have been sometimes inconsistent with the new market organization because of political concerns about food security. Consensuses have been much more difficult to yield with better organized and politically-voicing farmers and more public interests. To understand the diversity of situations, we now turn to a more detailed overview of cotton and cereal policies in the course of reforms and second-generation controls.

Cotton reforms: controversial results and the key role of institutions

Following Akiyama *et al.* (2003), the goal of cotton reforms was to improve the efficiency of the industry through a reduction of commodity price distortions, allowing higher producer prices. Measures have varied across countries but their implementation has often been based on the elimination or privatization of government marketing agencies and government-owned assets, reduction in implicit and explicit taxes, elimination of administered prices and introduction of some degree of competition in input, marketing and trading markets. The controversy comes from the fact that marketing reforms have preceded institutional reforms, therefore leading to huge problems of coordination among the different actors of the industry: problems of incentive and control, lack of commitment and enforceability and credit market failures. Even if some authors such as Kherallah *et al.* (2000) think that "the road is half travelled", the lack of properly designed institutions to face a new economic environment is a strong argument for reforms leading to unintended consequences.

The reforms initiated in the nineties were expected to increase relative producers' price to border price levels but the benefits of this relative rise were hidden by declining international prices[49]. Liberalization has also benefited producers in more accessible areas whereas more isolated rural zones still suffer from low relative prices. Another perverse effect from reforms was the increase in price volatility and this typically affects producers that do not have access to insurance schemes or effective risk-sharing arrangements (see before). Supply responses have differed across countries but they do not depend specifically on relative prices and may diverge according to time horizons. Lack of supply responses were often the result of poor marketing institutions and physical infrastructure (Poulton, 1998) that led to poor or risky investments. Akiyama *et al.* (2003) argued that effective private markets have emerged after the end of monopolies but experience in marketing was insufficient in some cases and the experience of former parastatal staff was sometimes crucial. Provision of credit has been problematic in some countries because past contractual arrangements could not be sustained after reforms ("in-kind" credit). Cooperatives were expected to play a more important part in the industry, notably in input markets, credit and sales but most of them did not achieve that goal. Finally, some policymakers have successfully included some representatives of the private sector in policy formulation, regulation building and control committees, resulting in a greater level of efficient coordination in the industry.

Badiane et *al.* (2002) focuses on strategies to sustain the evolution of cotton sector with the same goals as Goreux (2003). The paper emphasizes that the productivity boom of cotton in Western and Central Africa has been driven by the CFAF (the common local currency) devaluation in 1994, good yields in production of gross cotton and ginning, good level of public investments combined with a good functioning of credit contracts, a good organization of village associations under a system of guaranteed prices. One interesting strategy is to reduce the cost of credit intermediation with a private recovery system that keeps the link between debt repayments and cotton sales and that excludes ginning companies from the distribution of inputs. Another strategy is to give more power to producers' associations so

[49] This was caused by distortionary subsidizing policies in developed countries, the growing and cheaper use of chemical fibres in the textile industry, the rise in world cotton seed productivity and several trade policies such as trade quotas on Chinese textile imports).

that they will improve their bargaining power in contracting with ginning companies. It would imply better collaboration that would lead to agreement on some stabilization devices: insurances schemes, prices and incomes stabilization instruments, and so on. The next step would lead to contract farming for cooperatives (with sufficient technical skills) but it would require the elimination of monopoly power –either global or local- of companies. Other measures would involve raising enforcement capacity of governments, privatization of parastatals and regional openness to competition, private importation and distribution of fertilizers and pesticides as well as the establishment of an efficient system of production, multiplication and distribution of seeds.

Price policies are a central theme within those papers. One of the purposes of reforms would consist in a good distribution of price risk among producers, ginners and government. Some stabilization mechanisms (as *Caisses de Stabilisation)* seem to work well only when they are owned by producers. Otherwise, they lack transparency (e.g. CMDT in Mali). For the moment, prices are often posted at the beginning of the crop season by government or collusively decided upon among ginners. But prices should be regulated by auditing ginners in order to avoid too low prices. The actual system lies in a first payment computed on an expectation of the world price and a bonus, deducted from financial results of ginneries. Some authors propose that this bonus should be based on the difference between actual and expected world price rather than on the financial outcomes of the firms.

In Burkina Faso, SOFITEX has recorded positive net profits until the 2002 period (fall of world prices) but the good management has ensured to used past profits (financial surplus) to secure prices paid to producers (contributing to the *fonds de soutien* and distributing *ex post* bonuses) and to cover small deficits. This cautious policy has secured producers' incomes through a rise in the share of world price received by growers as world price has fallen (from 24 to 72 %). The price policy has remained based on a floor price announced before sowing and a bonus delivered to producers in the following season when profits are made.

Beninese price policy looks like the Burkina Faso's case but bonuses are never offered to producers since financial results are worse. Indeed, it is shown that overall production and marketing costs are higher (plus high administrative costs). However, world price's share get by producers has followed the same pattern than in Burkina Faso. The pattern of cotton production has been following a downward trend since 2003 with increasing defaulting on input credit (farmers escaping the CSPR credit recovery scheme and selling to private traders) and less overall input provision.

As their neighbours from Burkina Faso, Ivorian producers have seen their world price's share rising to 65% (due also to the depressive trend of world prices) and price policy is also based on a two step floor payment even if bonuses are not given anymore due to financial difficulties of ginneries. Reforms have appeared to be more costly than profitable for the moment but the conflicting situation effect and the depressive world price effect need to be isolated from the reform effects to make any conclusion. Indeed, substantial unrecorded cotton has escaped Côte d'Ivoire to neighbouring Mali and Burkina Faso where producers' prices are higher. After the 2008 reconciliation, new regulatory schemes are envisioned to restore national production dynamics and potentialities.

In contrast to all French-speaking cotton producing countries, Togo has introduced cotton far more recently (in the seventies) and the organization of the sector has appeared as less rigid than its neighbours. Indeed, the parastatal company SOTOCO parastatal company sells half of the purchase cotton seed to three private ginneries with a fixed share related to their ginning capacity. In addition, the government does not tax nor subsidize the sector so that public interference is limited. After the world price decline of 1999, the parastatal company reacted by reducing its operating costs and the purchase price of cotton paid to

cotton growers (no stabilization fund has been established). No reform plan has been planned even if some discussions have taken place recently.

Cereal liberalization and the remaining challenges

Cereal markets and institutions have been subject to a unilateral –but not uniform- reform movement since the eighties to reduce state intervention and encourage private trading, as part of structural adjustment plans, but it has often been implemented reluctantly by governments.

Former interventionist policies generated a heavy burden on public finances and macroeconomic stability, together with biased credit policies favoring the parastatal sector. This burden was supported by political interests (see hereafter) and by the prominent role of grain markets for economic development and political stability (Jones, 1998). Indeed, the majority of small farmers and consumers still depend on few surplus-generating big producers or on the world market (up to 50% of their income)[50]. Market characteristics entail locally-variable prices and the need to use trade to ensure food sufficiency to benefit from spatial arbitrage. However, national objectives were often in contradiction to that point with the implementation of pan-territorial pricing, consumption and input subsidies, as part of the social contract (see hereafter). This led to low incentives for private investment in grain marketing and re-encouraged government intervention.

The impacts of liberalization have been positive on price issues for consumers and farmers (more profit share of the overall added-value), on quality and diversification on products and on streamlined public finances. No overall impacts on the level of production have been recorded so far. More price incentives have been offset by more price variability and less access to inputs and technical assistance because of the several market and institutional deficiencies examined before. Consequences have been very heterogeneous between countries. Production drop has occurred in the countries where governments promoted high-yielding varieties and provided the more services to farmers and facilitated input use. This has been at least partially attributable to severe droughts and to incomplete liberalization efforts (involving contradictory political approaches). However, marketing systems are found to have been unable to provide incentives and means for intensive agricultural systems, as experienced in Zambia or Zimbabwe (see Jayne and Jones, 1997). The impact in Western and Central Africa seems to have a more positive picture (see Ghana or Mali) thanks to more political commitment devoted to strengthen the institutional framework. The impact for producer's prices stem from the removal of heavy taxation in West and Central Africa (while more support in southern and eastern Africa), so the impact on producers was more significant in the region, and mostly for accessible areas, near to market access. It has been, however, largely offset by larger increases in the prices of purchased inputs (and the removal of former subsidies).

While the change in market structures was believed to help farmers get competitive input prices in a liberalization context, the removal of subsidies could have induced a better allocation of inputs on land to better cope with soil degradation under land pressure. In Kormawa *et al.* (2003), the authors examine the case of Benin in cotton-cereal areas where the SONAPRA cotton parastatal gave up input monopoly in 1997 in favour of seven private dealers for procurement and distribution. They show that cotton inputs are more available although farmers perceive a higher profitability for maize, and even more in non-cotton areas. Constraints to use involve a limited number of brands and fertilizers' formulae. In consequence, rates of application are often far below the recommendations, but higher in cotton-producing areas. Input diversion often occurs from cotton to maize. This is however

[50] The small producers are not necessarily net consumers but, because of their harvest income goal (see previous section), they need to buy food in the lean at higher prices when they have no storage facilities.

influenced by social capital and the degree of market-orientation of farmers' groups. Regional disparities linked to cotton production (in the North) and to trade (mostly concentrated in the South) translate into spatial price variability for inputs, hence influencing input demand. Finally, input demand is also characterized by complementary effects stemming from synergic effects between fertilizers and other inputs such as pesticides and seeds. Raising input use is hence conditioned on the availability of higher-quality seeds, better seed distribution systems, as well as for pesticides.

Country	Year	Major changes	Areas of incomplete liberalization
Benin	1990	Parastatal downsized to minimal food security function	Continuing regulation of fertilizer importation, distribution, and pricing (with parallel market) Local movement restrictions remain and periodic trade bans
Ghana	1990 1993	End of minimum producer prices Government starts encouraging private storage and exports	Parastatal overstaffed and unreformed Discretionary provision of import permits and duty exemptions Ad hoc government intervention in trade lending and fertilizer imports Weak crop forecasting and market information system
Mali	1981 1987	Liberalization of coarse grain trade Drastic downsizing of parastatal (OPAM) to manage national security stock and complementary functions Range of "accompanying measures" to develop domestic trade	No major policy contradictions
Senegal	1994 1995	Parastatal (SAED) relinquished control over paddy marketing All rice marketing margins liberalized, import monopoly (CPSP) dismantled, and SAED privatized	No major policy contradictions (but no private suppliers of seasonal credit had emerged by 1997)

Source: Badiane et al. (1997)

Table 2. Liberalization policies and incompleteness in cereal sectors

About price stability, liberalization means seasonal price variability, which is supposed to provide incentives for farmers to store crops, but the carrying costs are often far from being recovered because of the variability in spot wholesale markets and bad infrastructures for storage. Many causes are involved in this failure of storage capacities: uncertainties about speculative storage profitability, the disposal of remaining public stocks and food aid, future policies and related expectations, weak systems of crop forecasting and no information on private stockholding (information problem), weak financial frameworks and banking sectors, infant warehouse receipt systems (inventory credit, see before), shortage of creditworthy customers (no collateral, information problem, credibility problems), farmers' cash constraints or risk-aversion towards storage losses due to insects, rodents, or molds, and so on. One interesting counter-example is provided by Mali with good recorded storage of millet and sorghum for several years. Information on the overall cereal stock in the economy is difficult to assess when there are numerous small farmers and traders but some transparent trade market should be promoted with a low level of public stock (minimizing the "overhang effect"). Allowing stock-in-trade to be collateralized would be also a valuable step but it will require setting up a credible system of warehouse receipts.

As stressed by Newbery (1989), food price stabilization is politically essential because of distributional adverse effects of cereal prices on rural households –whether net consumers or net producers-, food security and equity concerns. In contrast, cash crop prices have an equal impact on farmers and the most salient issue lies in the variability of world prices, calling for smoothing schemes and inter-annual stabilization strategies. Depending on the

social objectives of government, additional public storage together with compensation for producers might be socially desirable, if it is financed through a "food grain progressive taxation". The necessary condition is that income elasticity of grain demand should be smaller than relative risk-aversion for storing consumers. However, selling targeted rations under normal price can be more effective because of too costly public storage. As fertilizer markets are unsuited for hedging, rations act as an imperfect substitute.

Public finances have exhibited major savings when complete liberalization (Mali) has been implemented, but there has been an associated high cost for incomplete ones (Zimbabwe). In Zambia, in spite of elimination of maize subsidies, fertilizers have remained being subsidized with official credit programs, leading to higher costs than before the reform process, with possible inflationary consequences (e.g. Zimbabwe). In the above table, the main cereal liberalization policies are displayed for 4 representative case studies in the region.

Stringfellow *et al.* (1996 and 1997) highlight that the public provision of agricultural services has not been filled by traders and agribusinesses after structural adjustment plans. Local groups appear to bring the most useful scale economies for marketing, transport, processing while being the most connected to traders and other wholesalers. It is however crucial that group mechanisms should be successful for rural cooperation since groups are not always formed on a viable basis. So far, successful matching and farmers' cooperation seems to be influenced by management skills, governance, access to financial resources and markets, and activity profiles. However, it is conditioned on the ability of the public sector to support agricultural services with other activities to promote market integration and to pilot new institutional arrangements when agri-businesses seem reluctant at first glance. For instance, new credit schemes could be piloted by public agencies when private firms fear a poor credit discipline from farmers' groups, under the assistance of local NGOs for training, improving business skills. Public extension systems might also be involved to complement the poor private ones and to adapt project planning to the nature of farmers' cooperation.

Trade reforms: Contradictory policies lead to economic inefficiency

While the removal of trade barriers for cotton export was implemented coherently with domestic sectoral reforms, it was not the same for cereals.

It seems that there has been a low political concern or willingness to rely on cross-border trade to smooth prices swings because of grain markets' characteristics, the fear of food deficit or political blaming, which has often resulted in trade restrictions (export ban for instance). In this configuration, a viable strategy of reducing transport costs and accessing urban markets with better logistical means (less costly) would help consumers not to suffer from too high import or domestic prices, and have a relevant alternative to import-substitute food. Moreover, cross-border trade is mostly informal (parallel market) as a result of discouraging trade policies (highly distorsive taxes or bans), which inhibits long-term production planning and more formal marketing programs[51]. The rice trade is a good illustrative example. Many informal traders have been recorded to import rice from low-tariff countries then contraband/ smuggling into highly-protective ones, escaping from customs' control. Incoherent trade policies are also characterized by a larger scope for rent-seeking activities involving politicians, officials, and other merchants (see Coste *et al.*, 1991). Uniform trade policies across countries could however help but they are very problematic to implement. Even if there are arguments for a regional infant-industry protection or antidumping measures, lack of political interests' convergence and institutional capacities render difficult to apply coherently trade policies in a uniform way for a relevant regional area (e.g. UEMOA).

[51] They are based on a secured access to neighbouring markets with quality and quantity control.

The characteristics of cereals demand call for adequate trade policies that may help local farmers to reach urban markets. Cereal protection, as examined in Reardon (1993) is a valuable issue but the burden bore by consumers should be overcome by compensation policies or more appropriate local production, such agro-processed sorghum and maize as already mentioned previously and drawn on Boughton and Reardon (1997). Rice consumption is not decreasing with higher prices and it not only hurting the richest consumers. The time needed for coarse grain production to respond and to grow appears as quite long because of structural difficulties and because some producers are also net buyers. This could even lead to long-term price increases for locally-produced coarse grains. However, maize could be more potentially adapted with a stronger demand potential. A rice tariff policy does not seem to be appropriate when coarse grain processing and transport are not yet developed or affordable. Hence, a "policy-led intensification" of the maize (or sorghum) sub-sector may appear as the best short-term strategy with public investment and private tax credits for transport and milling/processing infrastructures. Increasing food security and price stability could also be driven by more intra-regional trade (with coherent trade and transport policies) among and within Sahelian and Sub-humid areas.

Last, trade policies in developed countries also represent a substantial burden for cereals and cotton production in West and Central Africa, because of an approximated 30% depreciation on world cotton prices and cheaper imported cereals (around 15% less on average). In Rosegrant *et al.* (2005), it is shown that the region would likely benefit from a full trade liberalization because of more production incentives for farmers under higher prices thanks to higher world price levels and less taxation, together with less competition from subsidized imports. Yet, as Baquedano and Sanders (2008) point out for the Malian case, the focus on local productivity gains would yield much more short-term benefits than the claim against US cotton subsidies at WTO, and even under higher world prices .The stagnation in cotton yields is an even more important concern in the sustainability of cotton-cereal systems and in the cotton Western African success story.

The political economy of cotton-cereal systems

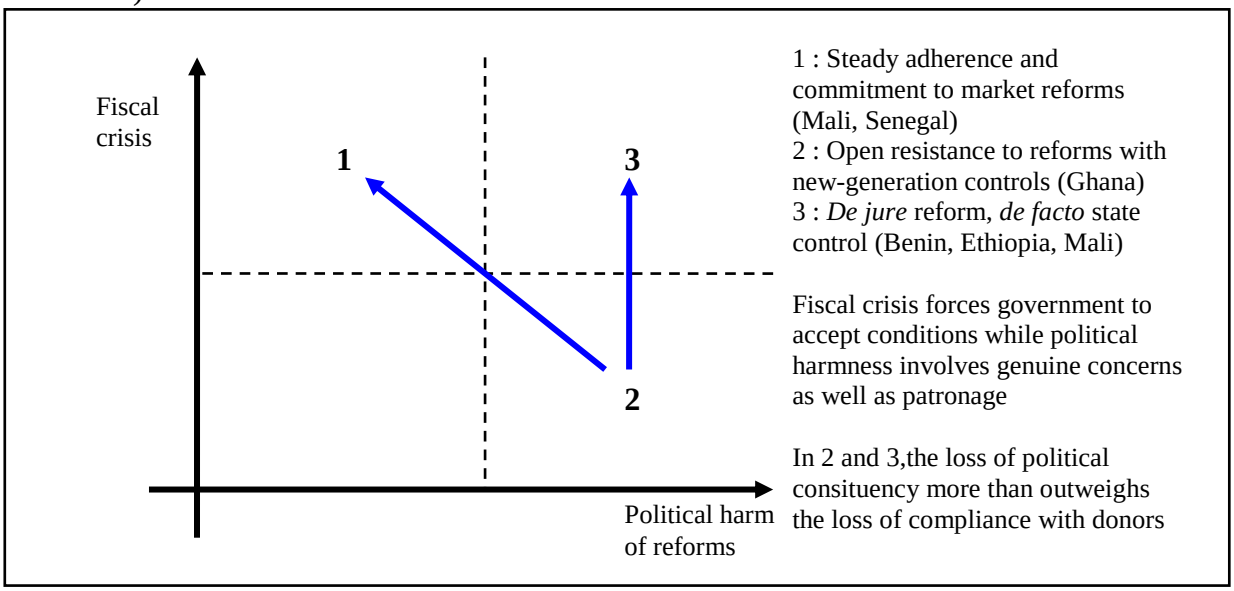
In the newly independent States, the political economy of cereal markets was based on national food-sufficiency with administered prices –pan-territorial pricing- to ensure farmers having profits when selling their grains and subsidized input prices. Subsidizing trade by parastatal arrangements allowed urban consumers to access cheaper food imports instead of investing in transport and infrastructure utilities to foster the urban markets access for local producers. It was politically supported by urban and rural elites. Single-channel controls indeed enabled the subsidization of a privileged group of urban consumers through implicit taxation detrimental to farmers, at a high cost to maintain these systems. In contrast, it was less politically costly to implement cash-crop sectoral reforms because of fewer interest groups, more export earnings and less pricing issues. As a result, cereal liberalization was never fully realized with contradictory measures that could somehow lead to big inefficiencies.

Politicians' objectives articulated around the *social contract* ensuring sufficient farm income for rural households and cheap food for consumers, together with no divisive pricing policy among ethnic groups. In spite of the big created burden by such a policy, successes had been experienced in raising smallholder income and consumer welfare in addition to incentives for technology adoption. This has even been one of the factor associated to the green revolution in Southern and Eastern Africa, as pointed out by Jayne and Jones (1997). As times goes, this has however appeared as an unsustainable approach that led to growth slowdown: low repayment rate on credit, costly input and transport subsidies, and doubtful

debts (corruption of public agents). Macroeconomic instability was one of the most negative long-term policy outcomes.

Because of unrecoverable debts, international organizations had a pressure force on national policies to make governments adopt structural adjustment plans with strong withdrawal of the State from grain markets. A new game has been ongoing between international financial institutions and national governments: extractive low pricing policies. Because of political interests, reform implementation has often been undertaken only under pressure. Frequent policy reversals or second-generation interventions have occurred. Commitment to market reforms can be classified in the following two-dimensional diagram (see the below figure).

Reluctance to policy implementation was not only characterized by a lack of genuine commitment from decision-makers but also by bad-performing new marketing boards, no willingness to free up cross-border trade, uncoordinated and somewhat unconditioned international support (lack of commitment device), weaknesses in the policy environment (institutions) and in the financial sector.



Source: Jayne et al. (2002)

Figure 14. Commitment to market reforms and evolution

The commitment problem is of multiple sources. It takes different forms such as the use in an unintended way of food reserves and food agencies, the lack of leadership to carry through reforms, and the government's incredibility to apply rules. This has dramatically threatened investors' confidence, thus reducing the scope of the liberalization prospective benefits. Government's discrimination for some actors in Ghana or in Benin still entails a preferential access to some products, taxes reduction or exemptions, quotas, etc. Different reasons did not include only ideological reasons, or political processes but also bureaucratic failures. A second generation of controls (Jayne *et al.*, 1999) also led by NGOs has undermined incentives for traders because of implicit input and output subsidies. In addition, private incentives have been jeopardized by entrepreneurs' fear of government intervention and by the unsecured political environment. Less private opportunities create a scope for a larger government occupation, which, in turn, has contributed to this vicious circle.

According to Jayne *et al.* (2002), there is no clear evidence that significant market-supportive investment has been undertaken by governments during cereal or cotton reforms, because of short-term bad effects on public funds.

The common view by bureaucrats about substitution between markets and state has led to a lack of investment in public goods for market support and lack of information on rules with retroactive changes, therefore hindering private incentives. Thus, the need to articulate the rationale for reform was essential. As shown by Dembelé and Staaz (2002) for Mali, education for bureaucrats and more involvement of the public sector in the reform process could be fruitful. Patronage activities during the reform process have been a strong impediment to the effectiveness of liberalization, including private benefits of price supports, opaque systems for licensing, and private stocks reserved for officials in liberalized clusters.

An encouraging political environment is provided by the example of Mali and its democratic regime. The PRMC has a regulatory role to help emerging a consensus between donors and national policy-makers with international aid's conditionality as a last resort, which mostly overcomes the commitment problem. This institutional framework for consensus-building has also enabled coordination among donors, which is an essential issue to resolve potential contradictions in the liberalization process (see Coulter, 1994).

Governance issues also include commitment at the local scale. Village, district or regional administrative taxations can indeed hinder marketing activities. Liberalization has eased the burden carried by traders in some countries but controls have remained significant at the local scale in number of situations, even if national situation has not followed the same pattern.

A new policy framework should be established with stronger committed governments, lying in a new social contract that might include:

- An improved legal framework for market liberalization: abrogation of past laws on state control
- Making producing and distribution grain more profitable: transportation, transaction, financing costs need to be reduced: establishing powerful associations of farmers to contract with banks and agribusinesses (see BF case), improving market information services, develop low-cost dispute resolution services, warehouse receipts system…according to a 'policy-led intensification strategy'
- Allow cross-border trade and a coherent international trade regime
- Minimal food public stocks
- Diversification on the base of comparative advantages and market/trade opportunities
- Within a regional-based approach: ECOWAS for our area of study

The fear and experience of policy reversal is a strong factor of disincentives for the private sector. What are the future challenges for policymakers to improve the policy environment?

- The need not to assume policy impacts when implementation is not fully realized, which is calling for counterfactual comparisons to assess what are the net benefits of going over the *status quo*
- The building of new political support for effective market reforms to improve the legal framework and regulatory arrangements: need to build new coalitions, improve aid governance and going over ineffective conditionality[52], as well as local governance
- Sustainable input, credit, and output markets to raise smallholder productivity: need public investments and regulation to decrease marketing costs, to diminish the scope of personalized and kin-based trading networks, and to improve credit access with institutional innovations, information-sharing, and so on

[52] Aid conditionality has been shown to face several difficulties with commitment problems from local policies and national governments with *de jure* implementation, and *de facto* deviations. The voluntary-commited approach allowing the aid program to generate its own constituency is an interesting innovation forward.

This section has put forward the main idea that most policy experiences in the region have hampered crop and revenue-raising diversification opportunities for farmers because of a weak or inconsistent institutional environment and discouraging policies, except for cotton. New policies could focus on institutional innovations and market-supportive actions to further encourage private initiatives and investments (as the case for cereals or irrigation in Mali, and cotton in Burkina Faso). Political stability and support will help reduce risk and informational problems on markets, together with accompanying the development of new financial schemes for farmers. Diversification opportunities could also be expanded by the development of business networks, if the legacy framework is improved.

The next section will review the different options that have come up so far. We will discuss the various constraints and the global challenges and the possible actions to lead implement. This will be compared to the priorities expressed by the involved stakeholders of the project during local consultations and workshops.

5. Implementable actions and strategies with institutional and policy options

We propose a strategic framework, accounting for all the stated constraints and existing options for revenue-raising, including diversification and value-chain developments, as well as policy and institutional options. We put an emphasis on the support of better extension and information services, and to foster the dynamics of professional farmers' group formation and federation. According to the relevant diversification options and value-chain developments, activities should focus on sorghum, rice, and locally-specific crops such as peanuts, sesame, cowpeas, Arabic gum, mangoes, tomatoes, onions, and niébé. Access to better-suited processing facilities is also essential, notably for cereals. Strategies to reduce risk and ease farmers' constraints should also be pursued: storage activities, micro-insurance schemes, inventory credit, training for information and economic management of farms and local cooperatives. These points are supported by the views of local NCCS. Finally, research and extension services need a more coherent framework and public-private partnerships. While the institutional framework calls for many improvements (out of the scope of the project), food security and trade policies should be cautiously designed so as to increase private incentives for the relevant CCs, and for agricultural development.

In this last section, we present a strategic framework for revenue-raising diversification options and value-chain developments in WCA cotton-cereal systems. According to our previous analyses, we state several strategies to improve institutional and market mechanisms, and enhance technical skills and farm productivity. We also look carefully at the profitability of diversification opportunities, their current constraints and potentialities. This enables us to derive an overall strategic frame with implementable actions.

Finally, we discuss these strategies with respect to the views of local actors, based on several field consultations. This confrontation of issues leads to a restriction of the strategy set, with the definition of relevant actions in which actors are willing to participate. The conclusion of this study is then a proposition of doable activities in the frame of the All-ACP Commodities Programme, under current constraints, together with institutional and policy options.

5.a. Diversification opportunities: potential and profitability

According to the ITC expertise[53], the main actions should focus on: cotton (because of comparative advantages on world markets), sorghum and maize (mostly for local consumption, animal feeding, and transformation) as the main components. Crop-diversification could also entail the development of the sesame value-chain with specific technical assistance for sesame growers[54], and locally-specific strengthening of the vegetable/fruit commodity chains: beans or Niébé in Burkina Faso for example, onions in Mali and Niger, tomatoes and peanuts in Senegal, and so on. These latter diversification opportunities have to be associated to value-chain developments (transformation, labels, and higher quality standards), and can serve either local, urban, or regional markets. Finally, strong support should be devoted to rice systems and in particular, in rain-fed systems for import-substitution strategies. Several marketing strategies should be explored together with a stronger support to research and extension services, which seems to be the major issue to make crop-diversification effective and profitable. First, we present a set of marketing strategies that would help crop-diversification and then, turn to the new institutional arrangements to surround these strategies. Finally, we propose a strategic frame with all the options that have been discussed so far, including policy options and supply chain organizational strategies.

5.b. Marketing strategies and options by crop of interest

In several countries (the cotton-dependent ones), cotton may stay a major source of cash earnings and of input access with a strong attention from public instances. Thus, it is needed to increase profitability with a better use of inputs and more elaborated technical leading of cotton crop. Developing alternative technical systems -organic and Bt cotton- together with the adoption of better agricultural practices for soil and water conservation would help reduce production costs. Revenue-raising options include the development of by-products in the value chain with cotton seed oil and the increase of the local textile handicraft or industry, together with the possibility to support regional programmes. A crucial issue is to surround the emergence of stronger cotton farmers' associations and village banks for their own access –independently to cotton firms- to capital markets, inputs and agricultural capital. Another one is to establish effectively-working private regulatory schemes with representative farmers, competition and coordination control and workable smoothing scheme, together with better information-sharing (non-market) mechanisms.

Sorghum has a high potential both for animal feeding, rural and urban demand but a first priority should be to increase the access and the building of processing facilities for semi-wholesalers, the farmers' input access independently of cotton production and better arrangements among stakeholders. A promising area is arrangement opportunities between farmers, traders, and poultry processors –through producer-processor contracts- with the prior establishment of professional and inter-professional associations.

As for sorghum, it is needed to increase the production of processed maize, but it would be mostly for urban markets. Consequently, the challenges are quite the same as the ones for sorghum but the links between stakeholders may be more oriented towards urban markets. This involves arrangement between farmers, wholesalers and urban retailers. Processing could be taken in charge either by wholesalers or by urban retailers directly. It also could be developed directly for urban restaurants or the tourism industry. Arrangements may involve farmers contracting with wholesalers or with urban retailers directly. It can be conjectured that the former might be more profitable because of greater economies of scope

[53] See ITC (2008). The different used criterions are production potential, domestic and international market potential, and regional agro-ecological potentiality.
[54] The same can be applied to the shea butter value-chain.

and better connectedness to rural production and urban markets. For both sorghum and maize, input providers might worth being included within the arrangements between farmers and processors or retailers.

Rice has to be developed along several dimensions among which several from the NERICA project seem very relevant. For rain-fed systems, rice production needs better trained extension agents and a sound thinking about the way to integrate rice with other crops. For irrigated systems, the concern is more about ensuring high-yields by institutional innovations, such as experimented in the Niger Valley of Mali by *Office du Niger*.

For all cereals, the scope of market should be increased by a decrease in transaction costs, better information services, and less price variability with the expansion of storage facilities and inventory credit/cereal banks. It is also needed a regulatory scheme for government intervention in the realm of food security concerns and better information services with significant feedback to farmers.

The development of niche markets requires more technical capacities for the extension of new crops with specific technical schemes to be respected for labelling (organic production or fair trade for instance), or for new crops such as sesame, and for processing: shea butter, drying fruits, sesame oil, and so on. The links with the world market have to be strengthened within a learning process for emergent processors and traders. It could be helpful to work within a regional context to better understand and provide connection to the world market and trade concerns (price and non-price barriers to exports), together with local certification opportunities. It would be a way to gain at more bargaining power with respect to major buyers and processors in the world market, as well as to benefit from economies of scale.

Legumes production needs technical enhancement and better connection to urban and regional markets. A strong concern is about contract farming, access to irrigation, and integration into cotton-cereal systems. Another way of questioning is whether the production should be specialized in specific regions, closer to urban markets and apart from cotton-cereal systems. Some linkages seem to be fruitful between cotton, cereals and several products such as Niébé or Beans, but generally, profitability is very low. Higher profitability margins should be pursued by a common strategy led by farmers, research institutes, and technical agents.

For livestock and meat, extension services could foster the adoption of integrated cereal-livestock systems, and develop markets for manure and animal traction. The meat commodity chain needs a more elaborated organizational structure, and institutional arrangements between stakeholders may be required to improve market relationships. Linkages between livestock and cereal production may be harnessed for marketing, input access, technical schemes in a coherent institutional framework. Information services are severely lacking, more than cereal markets (see table 1). Local markets for animal feeding have to be developed, and politically supported, while the institutional framework should be strengthened to avoid major conflicts between herders and cultivators and to harness economic and agronomic complementarities between the commodity chains.

5.c. Institutional and policy options: general findings and illustration

Apart from specific production strategies, common actions and options have appeared throughout the various analyses. Improving institutional arrangements and market efficiency would help to harness existing incentives and to relax current constraints (liquidity and other capacity constraints).

Market efficiency has only been improved when clear and transparent policy frameworks have been carried out, which involved the different stakeholders quite representatively. However, it was not sufficient and specific institutions still need to be

established in order to foster coordination together with better governance rules and new involvement of the State.

First, market efficiency requires much more investment in rural infrastructures (roads, health, education and communications, and quality-grading), as examined earlier and as mentioned by Platteau (1996). This will allow more market integration together with a decrease in transaction costs. This has to be supplemented by more information services and extension ones in order to foster information-sharing and reduce asymmetric information. Risk issues should be tackled by a support to new programs led by micro-finance institutions and smoothing schemes adopted by associations of different stakeholders, as in the case of the cotton sector. Food price stabilization can be improved by more investment in storage facilities, a support to inventory credit and cereal banks, and by subsidies on targeted rations instead of trade restrictions. Modern farming systems can only emerge if their related profitability can be harnessed when food shortages can occur. Food rations and food aid hence should be use with very cautious. Improving information access, together with a reduction in transaction costs will be correlated to the development of risk, input, and credit markets. Then it will be possible for farmers to escape from cotton outgrower schemes for input credit and notably for cereals and crop allocation would not be constrained by such market inefficiencies. In their presence, new institutional arrangements have to be implemented to improve profit and risk-sharing and to solve for the competition/coordination problem. Indeed, liberalization, when it has been transparently carried through, has been proved to increase farmers' incentives as well as the ones for the private sector.

However, a lack of regulatory institutions has been a strong impediment to coordination among stakeholders, and notably for strategic investments in public goods or for the development of more suited marketing strategies. Hence, market reforms have to adapt over time and as long as legal and informal institutions evolve, together with the capacities of different stakeholders and their related organizations. One prior development is the establishment of stronger farmers' associations that are willing to join private or public-private partnerships for commodity-chain expansion and development programs. Another condition is government commitment in the reform process and in policy support, together with the research of more convergence of interests. Strategic priority has to be set among government and stakeholders and national agricultural policies could incorporate these main challenges and other targets. Extension services and other public investments in rural infrastructure would be fruitful in fighting against local social conservatism that somehow hinders the emergence of market-oriented organizations and rural cooperation. Together with the support of promising marketing strategies (see right after), more social capital with less social conservatism will help build stronger institutions coping with new policy environment and more market efficiency. More effective farmers' organizations are also likely to be the basis for private regulation within commodity chains as long as legal institutions are not working. Private regulation and coordination among stakeholders could also be the point of ensuring the best private incentives with sufficient investment. However, competition should be controlled to specific degrees not to threaten coordination issues while this new policy framework should be left to generate its own constituency in order to find more political and public support.

Institutional capacities are interestingly improving in the region with the emerging willingness of NCCS to develop markets and to boost farmers' incentives, to invest in farm productivity, marketing opportunities –whether trade or processing-, to improve rural livelihoods and to participate to rural development. This convergence of interests can be illustrated by new regional approaches such as the one promoted by ECOWAS, the

ECOWAP[55] frame. The goal is to provide institutional and technical support to policymakers for common economic objectives, together with the development and the integration of regional agricultural markets. This notably involves common trade policies with the ease of circulation for commodity products and inputs. Another goal is political coordination for trade negotiations at the WTO. Finally, this regional policy frame also envisions technical cooperation in research and extension services, harmonization of information services and common policy support to micro-finance institutions. Though the scale of these actions is not directly related to the ones of the All-ACP Commodities Programme, it could be useful to define a line of coherence between the several implemented activities of the project and the ones of ECOWAP. Accordingly, activities targeting on commodity chains need to be envisioned in a global framework where political efforts will be more devoted to rural market integration and to more coherent trade policies.

These propositions and the impact of future policies should be subject to an assessment process in order to adjust and to adapt over time and over the specificities of different regional and commodity chains. Many criteria could be used and we propose here to focus on a restricted set of indicators to assess the evolution of system performances.

Concerns	Indicators
Production	Growth, Yields, and land use
Quality	% completion of international norms, grading system and effectiveness, sanitary problems, processing yields, remuneration of higher grades
Risk and profitability	Returns to producers, share of the national or world price for each stakeholders, transaction costs, public earnings on production, consumption and trade, storage facilities, price variability and effectiveness of stabilization schemes, % of diffusion of insurance markets and micro-insurance schemes.
Research and extension	Public and private investments, returns on research and adoption of new cultivars/techniques, quality of extension staff
Input credit	Credit rationing, rate of indebtedness, repayment rates, expansion of inventory credit (warrantage)/ cereal banks programs
Capacity-building	Literacy rates, farming techniques and practices, rate of adoption of technical innovations and new marketing strategies
Institutions	Evolution of land rights and regulatory institutions, village organizations and emergence of market-oriented ones, bargaining power of farmers' associations, leadership and consensus-building within NCCS.

Table 3. Performance indexes for the assessment of market and institutions improvement in cotton-cereal commodity chains

Commodity diversification and marketing strategies should be led according to several specific factors and they can be facilitated by innovative institutional arrangements that provide alternative ways for farmers and traders to market their product, to decrease their transaction costs and help them having access to credit and inputs. These arrangements could enable farmers having better information and bearing less risk on new technical and crop adoption. A big challenge is to increase yield and to promote the adoption of appropriate and profitable technologies. In the very fragmented and incomplete market environment, it seems

[55] The Economic Community of West Africa Agricultural Policies.

that interlinked contracts are still valuable but they should not be restricted to cotton contract farming or to the cotton production. Processor-producer contracts may help harness linkages between production, credit, and input for farmers with the value-chain downstream. For sorghum or maize, the processors could propose attractive prices and cheaper inputs on credit while avoiding side-selling or strategic defaulting on credit because other traders could not propose such profitability. For cereal processing, the crucial stakeholders could be semi-wholesalers serving urban retail markets or meat producers who buy processed cereals for animal feeding. Considering the evolution of local demand for meat, poultry processors might be worth contracting with cereal processors and (or directly) with farmers' groups. Anyhow, there are multiple ways of thinking about improving market relationships for production incentives and agricultural transformation. The institutional environment critically matters.

In this regard, the SASAKAWA global 2000's experience[56] provides many insights. As Nubukpo and Galiba (2000) show, the dissemination of yield-improving packages in our region of study have resulted in very positive results and can serve as "a successful example to the national extension system and a network of rural savings associations". However, in the most fragile ecosystems (in Sahelian areas), rate of adoption have been lower because of risk-averse strategies in a more risky environment. This mainly applies to Sahelian areas where price variability is higher, social capital is lower and marketing infrastructures are poor. In Ghana and Benin, a 300% yield improvement was observed for maize and sorghum experiments while the introduction of new technologies in the semi-arid areas of Burkina Faso and Mali did not found so much success. Sasakawa project also applies to water and soil conservation techniques in Mali together with the development of legume production.

The main challenge applies to the rain-fed production in Sahelian areas where improved varieties are not used, and irrigation and chemical products are of little scope. Moreover, soil quality and poor seed selection are severe constraints (because of high risk) on new technology adoption. Hence, improving soil quality by new available techniques and practices (such as the ones discussed in section 2) should be recommended. Apart from agro-ecological constraints, the experience of Sasakawa has clearly demonstrated that the institutional factor was a key determinant of agricultural transformation, which corroborates our insights from the previous section. Input-intensive packages bring out moderate returns because of high costs as well as weather and price risks (about fertilizer responses and yields). Hence, risk perception and attitudes should be well understood through the analysis of surrounding institutions such as social organizations and the village social structure and through the assessment of market performance. Indeed, the existence and viability of upstream (inputs) and downstream (trade, processing, and consumption) stages of the commodity chain are necessary conditions.

A research program was led in the Sahel to understand when and how a new technology has been successfully introduced. The participatory approach of Sasakawa helps understand why farmers are willing to involve in an intensification program and the conditions enabling technical progress toward agricultural change and modernization. The experimental design aims at measuring the degree of continued participation in accepting a package and financial returns when controlling for factors affecting yield variability. Risk-management strategies and risk perceptions as well as returns expectations are incorporated into the analysis. Adoption decision has been shown to be associated to more information

[56] In early 1990s, the Sasakawa Association for Africa (Japanese) and the Global 2000 of the Carter Center entered into a partnership to create this NGO. The aim was to carry out agricultural projects in Africa and to transfer new technologies for food production increase. The approach has been based to a close collaboration with governments and the Ministry of Agriculture, the direct involvement of farmers by participation in technology transfer, and the promotion of agricultural intensification with appropriate and financially viable technologies.

processing by participant farmers and to more efficient risk-sharing arrangements within institutional environments. Adoption is also linked to a learning process that diffuses through neighbouring and social networks. The functioning of input and output markets and the performance of village organizations are also strong factors that influence adoption, other things being equal. Experimental processes with the involvement of farmers as free participants help reduce the information gap and the adoption of new technologies. The critical trade-off is whether input-intensive or input-efficient technologies should be promoted. This should be decided according to local specificities, perceptions of farmers and the institutional environment. Accounting for the recent evolution of input prices, and the need to invest on land and on sustainable farming systems, the second option appears more relevant in most cases.

Howard *et al.* (2003) compares the Sasakawa experience between Ethiopia and Mozambique for high-external input technologies applied to maize. The authors shows that local conditions matter much in the success of program implementation together with adequate funding. The replication of such programs in less favourable zones with less available extension services or integrated rural development projects is subject to caution. The transferability of the project to local organizations requires a high degree of social capital and reliable institutions. These issues are not only influenced by local conditions but also by trade policies and trade prospects, and by collaborative opportunities between local research and extension programs, input companies and farmer organizations. Finally, investments in transport and communication infrastructure will favour the project expansion and its transferability because of marketing cost savings and less risk.

Kelly *et al.* (1999) points out that effective input and output markets together with well-functioning credit systems, extension services and input-responsive technologies are vital to sustain the adoption of more intensive practices. As previously mentioned, vertical coordination is necessary to serve farmers with inputs and ensures output marketing as well as credit repayment, but is hard to find for cereal commodity chains. However, the pace of structural reforms has not yet coincided with a strong involvement of the private sector in input commercialization. Input marketing has only been developed in few countries (e.g. Ethiopia) but, where it has been the case; farmers have been stimulated in using improved inputs.

The role of the public sector remains crucial since it could help make markets more transparent with better access to reliable information, and specific interventions. There is a need to wonder about how to decrease unit costs of inputs (with economies of scale), how to sustain outgrower schemes and keep the valuable spillovers for other crops, how to find other institutional arrangements for input access to cereals, and how to facilitate collaboration between NCCS and NGOs to reduce marketing, extension and credit costs. Finally, it should be worth thinking about the mix of crops, technologies, and institutions suited for cost and risk reduction among farmers and other stakeholders. Hence, the concern would be more on input efficiency use with improvements in the market and institutional environments than on input intensification.

This discussion has put forward the main idea that institutional and market-supportive policy options will be relevant in the All-ACP Commodities programme, and that they may be used complementarily. While the improvement of rural markets is not the target of the project, the current state of existing (and non-existing) related markets for commodity-chain developments and for the implementation of diversification options should be accounted for. This will be useful in order to implement specific activities for better market access, value-chain developments, and better institutional arrangements among NCCS. Institutional arrangements can also be envisioned within a global framework where local infrastructures

can be provided to increase information access and integrate local markets to regional ones, together with actions for the strengthening of local farmers' groups and extension staff (building storage capacities, political involvement of farmers, technical skills and research projects,...). More importantly, it is necessary to find cost-effective ways to sustain these actions and these arrangements, while the improvement of local organizations of farmers and local markets will reduce farmers' risk-bearing and will bring the necessary capacities to benefit from higher economic incentives and improving technologies.

5.d. A strategic proposal

We present general strategies and current constraints with some propositions of actions to implement, according to our previous results. This strategic frame is then discussed with respect to several insights gathered on the field during consultations of the NCCS. It has to be mentioned that all the propositions are not obviously doable within the frame of the All-ACP Commodities Programme, but appear here as a condition for strategic coherence. It is also a way to see how activities could be connected to other recommendations and policy options.

Field	Strategy	Current constraints	Implemented actions
Research and extension	Collective research effort at regional level Involvement of producers New schemes for extension services: promotion of better practices (soil, water, inputs) and farm integrated management	Technology diffusion Low perceived profitability and high risk Low benefits for private extension systems	Coordination between research programs by crop/ ecological areas (more costly-effective) linked to training programs Public-private partnerships for extension services Coordination with producers' unions for technology transfer and implementation of new practices
Technology adoption	Improving practices and new technology adoption	Lack of human and social capital High-risk burden for producers because of low information and training capacities	Training of cooperative leaders and communication strategy Using community organizations at the local scale for information-sharing about costs and benefits of new technologies Learning-by-doing sharing experiences among farmers
Improving market performances	Increase regional and urban market access for local production Improve information-sharing and access Reduce transaction costs	Inconsistent policy framework Lack of public resources and private incentives Personal relationships and low enforcement abilities Market concentration	Need a consensus-building policy framework (e.g. Mali) for cautious food security programs and sufficient trade opportunities Develop Market Information Systems: focus on data availability, update and accuracy Broader risk-sharing arrangements
Input access	Develop micro-finance schemes Rural banking New contractual arrangements	Unviable schemes High interest rates Low adoption rates Low adequation with farmers' needs	Experiment viable inventory credit schemes and cereal banks Rely on producers' organizations to set up rural banks Develop barter and distributor schemes Experiment micro-insurance schemes
Rural infrastructures	Improve capacities of local production by market expansion: improve roads and communication networks	Low political willingness Low private incentives	Platteau (1996) Find private agreements and public-private partnerships
Crop	Increase production and trade	High -formal and informal-	Links with the poultry processing

diversification	incentives for traditional cereals' production Increase rice yields Develop niche markets –sesame, legumes, shea production- Develop beans, peas, and Niébé in the relevant areas Develop oil production: peanuts, seed cotton, and sesame.	tax burden for cereal trade Farmers' cash constraints Low supply and demand elasticity for cereals High dependence on cotton earnings and inputs Low business networks for niche markets	industry and with urban markets Develop storage utilities and inventory credit schemes Find alternative arrangements for inputs outside outgrower schemes for cotton Develop interlinked agreements for niche markets to cereal ones to expand the business network and market connections
Value-chain options	Milling cereals Oil cakes Processed products Labelled exports Develop textile industry	Uncertain demand conditions Low marketing abilities Low market connectedness	Find partnerships with international agri-businesses Use business networks of semi-wholesalers Links with the tourism and restaurants industries Establishment of independent certification agencies Increase available information for urban consumers
Supply chain structure and coordination	Stimulate competition in a regulatory setting Adjust socially optimal the competition/coordination trade-off	Poaching and strategic opportunistic behaviours when numerous actors Contract enforcement problems Unbalanced risk-sharing between farmers and traders Input repayment Capture of privately-provided club goods such as infrastructures or research	Encourage the establishment of intra-professional associations Build private partnerships with financial, business and producers' stakeholders Integrate input providers Delegate responsibilities, ownership and administration to producers' unions with financial arrangements to support their structures Set up formal risk-sharing and insurance schemes
Producers' organizations	Increase bargaining power Increase leadership abilities Foster the emergence of local market-oriented organizations	Village social conservatism Lack of human and physical capital Social and ethnical fragmentation of the rural society	Foster local cohesion between community-based and market-oriented organizations: participation in local public goods and training programs Need technical and managerial assistance Change the law for local group formation (e.g. Burkina Faso)
Institutional options	Improving-governance programs Improving the legacy framework Solve the 'legal dualism'	Social conservatism Education Private non-benevolent political interests	Adapt formal law and rules to traditional rights and customs Use technical agents as a tool for improved-governance practices Use religion as a vector of social cohesion and women involvement
Policy options	Transparent trade policies consistent with national food security goals Regulation of privatized and liberalized markets Involvement in rural infrastructures, a new social contract	Non-transparent political regimes Political coalitions detrimental to farmers Corruption Political contradictions and low government commitment ability	Promote regional approaches (ROPPA, ECOWAP, NEPAD) 'Policy-led' intensification Increase policy monitoring New aid policy approaches Decentralized actions and strengthening of the civil society Agrarian reforms Transparent regulatory agencies

Table 4. A general strategic frame for cotton-cereal farming systems in WCA

5.e. The views of NCCS about diversification options and strategies

We discuss here the stated constraints and strategies proposed so far, with respect to the views of the players. We tackle the various issues addressed by NCCS during the kick-off workshops and field consultations[57], with respect to our previous insights.

In the main cotton production basin of WCA, cotton and maize markets are the only ones well organized, with well-connected farmers to markets and to inputs, endowed with performing local groups and national unions. Maize markets are more integrated in cotton areas and farmers benefit from higher prices and higher yields. However, diversification options still appear weak, because of many uncertainties about profitability, technical learning, and sustainability. This is also because commodity chains are not efficiently organized to provide market access to farmers, and resources to invest in capacity-building and learning spillovers.

In the other regions, farmers have weak production incentives due to low access to markets and non-organized stakeholders –mainly farmers-, low access to working capital and inputs. Value-chain enhancement and development are undertaken in few cases, but their scope could be much more increased. The most promising area applies to horticultural products, fruits, and cereal processing, as well as cotton by-products and oilseeds. Processing needs to be organized under arrangements with stakeholders and retailers so as to be accessible to farmers and to be carried out at a larger scale with appropriate equipment, and not only in a traditional fashion.

A shared concern among NCCS is the key role played by cereal storage, market integration, and the need to rely on better information services to decrease the economic risks faced by producers. Cereal production and private incentives suffer from subsidized imports and low connection to urban markets. It is notably the case for local rice production though many rice farmers' organizations have been shown to be able to provide farmers with inputs and to access urban markets. Yet, food security stocks are often housed

Because of high market and institutional failures, together with an inadequate provision of rural infrastructures –information, communication, and extension services- most of diversification opportunities appear today as too risky or unprofitable to farmers. However, several developments have shown encouraging results. In Burkina Faso, the new hybrid varieties launched by INERA for cereals have appeared as profitable, as well as oilseeds commodity chains such as sesame and cowpeas. The potential for rain-fed rice production is very important in Mali, with opportunities to expand the cultivated areas under wheat. Revenues from Arabic gum (acacia trees in association with cereals) could be substantially increased, notably in Mali, if producers were better organized and land use rights more accessible to women. Horticultural production could also be expanded, in irrigated areas of Mali or in Senegal, with better market access and more efficient value-processing. Finally, market information systems effectively work and have achieved diffusion of both hard and soft information, but they still lack financing resources for frequent diffusions and to expand the outreach of producers.

According to most of NCCS, cotton production is far from being a panacea as a current poverty-reduction strategy, and most of the rural population is still economically vulnerable. The current strategies lie in making diversification options be an affordable reality for farmers, with better connection to markets, information, extension services, and inputs (and

[57] The consultations (1st to 15th October, 2008) were led by a ESTT Team, under the supervision of Aziz Elbehri. The purpose of the mission was to conduct a series of consultations and briefings with local organizations as part of the ALL-ACP EU-funded commodity development project. The mission was a follow-up to the kick-off workshop held in Dakar, Senegal from the 27th to 29th of May, 2008.

input credit). The actions undertaken by the INTSORMIL project are expected to be upsized and should serve as an example of needed arrangements to be set up between producers and other NCCS, such as processors, wholesalers, retailers, and other traders, with efficient technology transfers.

About technical improvements, the introduction of Bt cotton and new cultivars for sorghum/millet with better market access and established stakeholders (and farmers' organizations) is a crucial issue. However, Bt cotton is believed to have mixed results, with high learning costs and few profitability margins for producers. New rain-fed rice (NERICA) with market-supportive policies (better management of food aid and food consumption subsidization) could be a sound strategy. The support of existing research programmes (out of the scope and the time scale of the project) is essential, as well as the continuation of training programmes for the implementation of better practices, including conservation techniques for water and soils. However, NCCS think that the All-ACP Commodities Programme cannot be effectively involved in research and extension. In contrast, it could be worth working on technical adoption and its mechanisms to provide more incentives to farmers: market information systems, organizations of farmers, extension services and local infrastructures.

Many diversification options do exist for NCCS, even if they currently faced critical constraints.

Maize has better organized farmers and benefits from cotton production and better prices in the market. The market is more developed and is experiencing more growth horizontally (growth in production) and vertically (processing) compared to other cereals. The SASAKAWA Global 2000 initiative developed a maize variety intended for transformation. Maize sub-products include grain for poultry, bread, beer, and pre-cooked meals. However, transformation is often carried out in a traditional fashion, and it will be profitable to develop further these value-chain options.

Sorghum and Millet, only grown for local consumption does not seem to be considered as viable diversification strategies by NCCS. However, sorghum may have a strong potential for the animal feeding sector, and processed sorghum and millet may serve a significant share of the urban cereal demand.

Sesame is a promising option as a niche and has proven to be remunerative (exported for its oil) so far but needs solid organizations among producers to guaranty significant growth. The production of sesame is not as demanding as cotton and can be very easily implemented as a secondary system. Sesame can be produced in many colors which provides differentiation opportunities that highly appreciated by buyers. There are already external investments in the industrial sector of sesame from Asiatic countries in Senegal. However, in Mali or in Burkina Faso, several investments are still needed for processing capacities of potential stakeholders, and producers need to be efficiently organized.

Cowpea production is much less input (labor, fertilizer, water) intensive, which makes it a good candidate for diversification in systems of more input intensive products such as cotton. Many farmers exploit cowpea as their primary production as well. Difficulties in stocking and pests can be addressed.

Groundnuts production is major in several areas (e.g. Senegal) but marketing is not always ideal and much of the output is generally self-consumed. Sharp fluctuations in production are not only caused by the vagaries of the Sahelian weather but also exacerbated by the erratic marketing and distribution system in place (after privatization of former parastatals), and unorganized farmers lacking input and resources. Oil processing could be done in a larger extent.

Gum Arabic is increasingly becoming a source of revenue for a large number of producers and collectors for export (mostly in Mali). Collection has become mainly an

opportunity for rural women to earn income; men take care of the marketing. Cereals are grown within the Acacia trees when they are at a young age. The tree is productive after 20 years. The local uses for the gum include confectionary, traditional therapeutic treatment, and wax in textiles. The sorted raw product is usually exported to Europe. Producers are not yet fully organized.

For horticultural production, the most profitable options are tomatoes, onions, and mangoes. Critical constraints entail a sufficient access to business information on the prices of fruit and vegetables on international markets to enable traders and exporters to negotiate prices for their products. Information about norms and quality standards is also crucial. For now, several well-functioning associations do exist, but lack financial resources and means of production and transformation. However, several products have already been labeled under higher quality standards (organic agriculture and fair trade). They thus represent higher-value products for export. Tomatoes and onion producers are often well organized.

Value-chain developments comprise transformation of raw products (industrial) for maize and sorghum (producer-processor contract), and processing. One interesting idea is to extend the actions of the INTSORMIL project, and to reach more quality certification for mangoes, onions, and sesame.

Maize, millet, and sorghum transformation are still mostly traditional (powder, biscuits, poultry feed, etc). ICRISAT and INTSORMIL Collaborative Research Support Program in West Africa support the growth of the sorghum and millet value chain through technology transfers. There is a need to develop these value chains to have finished products (i.e. *tô* powder from millet) ready in the market. A growing urban demand is willing to pay for these products (also the animal feeding sector) and less than 5% of cereals are currently transformed or processed. Other products might be more processed to meet local demand such as rice couscous, *juka jalan* made with fonio and groundnuts, or *dégué* made with yoghourts and processed sorghum or millet. Some associations are trying to encourage the banking sector to invest more in processing through three channels: traditional cooperatives, medium-size trading companies or traders, and modern firms. This movement definitely needs to be encouraged further.

Cotton sub-product opportunities include the use the refined cottonseed oil as vegetable oil. The unrefined cottonseed oil can be used as pesticide, although not very efficiently. Cotton stems are able to produce charcoal, therefore a source of energy. This notion is practiced in Mali.

Rice husking and marketing are experiencing a lot of success in Mali and Senegal. Strategies are needed to have the incentives of big players aligned with those of the farmers.

Mangoes have received a lot attention (World Bank, USAID) and has been experiencing a lot of growth and value addition activities: packaging, certification (organic, fair trade), processing (juice, and drying). There is a room for more growth, definitely.

Several enterprises have small fruits and cereals processing units making various finished products ready for consumption. The problem with these enterprises is they have not the capacity to satisfy actual demand. To boost their capacities, they need more financing for space and equipments. Another issue is the assurance of quality when it comes to acquiring input from farmers as a lot are perishable and are destroyed at the farm or during transportation. Quality norms are neglected by farmers and transporters and there is no credible enforcement of it. To assure consistent good quality, processing companies contract only with few cereal providers and offer higher than market prices. That is an example of strategies that are necessary to align incentives along the supply chains. The net return must be taken into account during contract negotiations instead of speculations and unfair bargaining.

To set up viable arrangements between farmers and the other NCCS, there is a need for better organizations of farmers for technology adoption but also for making diversification opportunities work, and value-addition developments profitable. (i) Federating the existing organizations and (ii) building the capacity for farmers to get themselves organized. In a lot of areas, storage establishments already exist; capacity building is required to teach usage (management and control) and maintenance of storage. Several arrangements have been shown to be unsustainable because of a lack of communication of key information between NCCS and farmers. The example of SOPROFA for rice in Burkina Faso is particularly relevant in this respect. SOPROFA was unable to guaranty supply contracts set up with rice producers as producers sold in the market whenever the market price was higher than the price agreed upon in the contract. Farmers also reported that the agreements failed from downstream contract renegotiation after collection by trying to lower the price or only giving part of the payment at the time of transaction and promising the rest for a future date. Whichever way this occurred, the system failed because of the absence of credible contract enforcement mechanisms. Taking into the account the high illiteracy rate among producers, the real terms of the contracts must be fully explained to farmers before any signing occurs as farmers deviate from the terms only when they feel cheated at the time of execution. Information and training should then be a necessary prior to any successful arrangement.

The last point is the difficulty to access capital markets, either farmers or processors and traders. In spite of a progressive diffusion of micro-finance schemes and institutions, MFIs still lack financing outside savings from their members. Commercial banks usually refinance the difference. There is an overall concern that rural finance products may adapt to the specific needs of farmers and stakeholders over time, and that institutional innovations should support this process and the involvement of commercial banks. This is calling for sustainable inter-professional associations able to provide strong guarantees to the financial sector, with enhanced organizational forms and professional capacities.

Finally, there is a general concern that the project should bring the necessary capacities for CCs to be operational and viable after ending. Focusing technology transfers and on organizational actions could be a good start, together with the establishment of innovative arrangements including programs with technical assistance, market access, and value-chain enhancement options.

6. Conclusion and recommendations

This study has put forward the many difficulties and constraints for the implementation of diversification strategies within WCA cotton-cereal farming systems. Yet, many profitable diversification and value-chain development options exist, but still lack the appropriate institutional and policy frameworks to be further explored and applied. Beyond institutional and policy constraints, the All-ACP Commodities Programme should focus on the development of human capital and technical capacities to help better-performing organizations to establish so as to make diversification less risky within sound private arrangements among NCCS. New added-value options may be explored with these previously established arrangements and the positioning on more profitable markets should be tied to re-investment in extension services, communication, and information infrastructures.

The previous section has shown that the policy and institutional frames could be improved much, and that many options might indeed be helpful to increase capacities and incentives for technology adoption and market access. However, the project cannot address all these options and may rely on the willingness of the main stakeholders to participate to

activities involving the strengthening of CCs and the development of private arrangements. According to our findings and to the views of local NCCS, we propose the following action plan.

A strategic action plan as a result of local interactions with stakeholders

The need to support the building of professional organizations of farmers and new arrangements with other NCCS to develop:

- Provision of local infrastructures and extension services for technology adoption, better information access and risk-management, progressive implementation of better agricultural practices and improving-productivity techniques, reduction of transaction costs (transport, information, and financial ones). This will also increase:
- Market access: increasing the scope of local supply and connection to urban and regional markets, as access to inputs
- Value-chain developments: professionalization of traditional transformation, increasing the scope of processing, producer-processor contracts and links with the feeding sector
- Rural finance: ensure the viability of existing micro-finance schemes and improve the management of outgrower schemes and other private arrangements so as to foster the involvement of commercial banks in the agricultural sector

Specific activities may entail (mostly organizational ones):

- Support of the establishment of market-oriented organizations for key commodities: sorghum, rice, and niche markets (sesame, Arabic gum, legumes, and mangoes)
- Support of private arrangements with different NCCS, according to specific projects:
    - Arrangements with the poultry processors for sorghum to access better price and serve the feeding industry (growing demand for poultry in urban markets)
    - Arrangements with semi-wholesalers for maize to serve the urban demand for processed maize
    - Arrangements with oil processors for oilseeds, including sesame, peanuts, and others
    - Arrangements with processors and other producers for legumes and vegetables: niébé, onions, tomatoes, mangoes
- Assistance to processors and retailers to reach urban markets (information for consumers) and to develop exports, with certification for higher-value processed products
- Support of inter-professional associations and of the overall organization of commodity chains: ensure the viability of farmers' organizations and the effective regulatory and consensus-building roles of umbrella organizations and inter-professional bodies. A key point has to be emphasized about the role of governance and coordination among NCCS to involve into the provision of professional extension services and the management of input credit repayment, as well as quality grading, research, and carrying of value-chain developments. For example, the processing of raw cereals or oilseeds may be collectively organized for individual processors (to provide economies of scale at the beginning), with the proportional financial participation of each.
- Use the complementarities with other programmes (research institutes and governmental plans) by the means of partnerships

These arrangements may include some guarantees for farmers with respect to outlets, output prices, and access to inputs. Added-value should be re-invested for the private provision of extension services to enhance the diffusion of better practices and new techniques, for the increase in storage capacities (setting up cereal banking and inventory credit to a larger extent) and for the provision of other local infrastructures, mainly information and communication ones. Extension services may also focus on the managerial support of local market-oriented organizations and households, with specific assistance for storage management, information access and treatment, and risk assessment.

However, the critical constraints would remain social and human capital. Indeed, extension services and technical agents lack technical specific skills for the development of new or infant commodity chains, and new value-addition techniques. Moreover, the effective implementation of better-performing private arrangements will ultimately rely on the local organizations of farmers, their management, and their commitment to participate and involve.

Hence, one big concern is the scaling up of these related lacking capacities. First, activities should comprise the training of technical agents for several issues: specific technical skills according to the related CC (not only for farmers but also for storage and processing), and also managerial skills. Second, the assistance to the establishment of market-oriented local organizations of farmers and professional organizations of farmers is also essential. These two activities are the necessary conditions for the effective implementation of new private arrangements, including larger market outreach for higher-value markets.

This project may ensure the necessary functioning of new organizational forms with higher capacities (both technical and managerial) and performing private arrangements to be sustained after the three years. The goal is to provide NCCS with the necessary structures to have the correct incentives to invest and adopt new technologies, invest in the necessary local public goods (extension, research, quality, communication, and information, and training), progressively build professional networks to connect local farmers to urban and regional markets, and to develop higher-value production.

The project may be worth keeping restricted around the existing commodity chains, because of time constraints. The development of the sesame CC, or the Arabic gum, for instances, should be supported in the existing production areas. Instead, the increase in capacities of NCCS and the development of new arrangements will ultimately allow several CCs to develop in the future and to better position on higher-value markets.

A step forward is the extra-professional one, where the representative inter-professional bodies of each CC would be willing and able to set up arrangements for investment in local public goods and infrastructures. It is likely that some economies of scale are underlying, and that many complementarities among CCs could be harnessed, notably at the farmer scale. This extra-professional coordination could be fostered by market-supportive public policies and consensus-building institutions, such as experienced by the PRMC in Mali. The role of government is also essential to maintain a correct level of private incentives, and to organize the collective provision of research and extension services. Hence, the cautious shaping of food security policy remains a big challenge, as well as the one of trade and fiscal policies. The improvement of public institutions is another one. Overall, the "policy-led intensification" strategy should also be induced by decentralized actions that will ultimately give the technical and managerial capacities to NCCS to be politically more active and influential.

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Appendix: Tables

Year	Country	Seed cotton : Yield (Hg/Ha)	Seed cotton : Product (mt)	Maize - Yields (Hg/Ha)	Millet - Yields (Hg/Ha)	Rice, Paddy - Yields (Hg/Ha)	Sorghum - Yields (Hg/Ha)
1990	Benin	11923	146406	8954	5889	13961	7307
1991	Benin	11705	177123	9281	6173	13423	7818
1992	Benin	12011	152849	9771	6518	13344	7687
1993	Benin	17884	272182	9778	6586	13177	7637
1994	Benin	13939	260436	10228	6799	15666	7778
1995	Benin	13297	328227	11737	7481	16654	8205
1996	Benin	11993	430398	10818	7126	18498	7620
1997	Benin	10057	377370	12020	7594	18827	8061
1998	Benin	9650	364127	11143	7479	20822	8245
1999	Benin	10139	375586	12518	7777	19384	8180
2000	Benin	10645	339909	11481	8213	21114	8796
2001	Benin	11017	393060	11002	7567	20714	9053
2002	Benin	11744	485522	8829	8338	22232	10101
2003	Benin	11200	420000	11899	7817	23143	9400
2004	Benin	11039	425000	11799	8225	26137	9038
2005	Benin	11039	425000	11799	8225	26137	9038
1990	Burkina Faso	11399	189543	14612	4393	20783	5827
1991	Burkina Faso	9979	242200	16868	7021	21444	9092
1992	Burkina Faso	9965	172400	15238	6510	18831	9437
1993	Burkina Faso	9569	114764	13722	6953	21630	11027
1994	Burkina Faso	8910	177127	16042	6339	19582	7793
1995	Burkina Faso	10346	150451	11441	7197	19249	8758
1996	Burkina Faso	10093	202630	15521	7527	23883	9095
1997	Burkina Faso	12390	343106	15185	5231	15750	6804
1998	Burkina Faso	9695	324557	13919	7821	19388	8541
1999	Burkina Faso	12132	257121	16241	7362	24824	8857
2000	Burkina Faso	10164	212545	17543	6373	25675	8295
2001	Burkina Faso	11431	395031	18115	7627	18795	9278
2002	Burkina Faso	10658	439247	17381	7158	19010	9252
2003	Burkina Faso	10636	471945	15284	8420	19997	9604
2004	Burkina Faso	10267	535367	12666	7778	15047	9731
2005	Burkina Faso	10267	535367	12666	7778	15047	9731
1990	Cameroon	12075	113260	18543	10500	49999	8489
1991	Cameroon	12728	114363	19800	10500	36400	7692
1992	Cameroon	12743	125702	13974	10000	35000	7600
1993	Cameroon	12294	126556	11267	10345	29000	7647
1994	Cameroon	10833	152815	11644	10000	36200	7292
1995	Cameroon	10349	195400	15450	10154	35300	8679
1996	Cameroon	11686	223100	18750	10105	31391	8286
1997	Cameroon	11205	193000	20267	10000	33636	8889
1998	Cameroon	11285	194690	18911	10000	35467	11111
1999	Cameroon	10884	197000	25907	10000	33095	11239
2000	Cameroon	10274	204000	24615	10137	30103	12000
2001	Cameroon	10420	207354	24404	10000	30242	12024
2002	Cameroon	9479	200000	20679	10060	29699	14129
2003	Cameroon	11050	200000	19908	10000	29484	13371
2004	Cameroon	13872	179600	19166	11429	29387	12654
2005	Cameroon	13077	170000	19000	11321	29412	12500

1990	Cote d'Ivoire	12001	241685	7195	6184	11545	5750
1991	Cote d'Ivoire	13155	261139	7266	6125	10512	5956
1992	Cote d'Ivoire	10173	193769	7847	6220	10169	5957
1993	Cote d'Ivoire	11728	238784	7774	6386	13360	5994
1994	Cote d'Ivoire	11780	258343	7941	6471	11228	5800
1995	Cote d'Ivoire	10588	216000	8058	6364	11754	4808
1996	Cote d'Ivoire	8808	217261	8246	5900	23641	3800
1997	Cote d'Ivoire	10750	265145	8200	6957	26713	3872
1998	Cote d'Ivoire	13667	337097	8186	7368	24845	4034
1999	Cote d'Ivoire	12901	399933	11639	7222	23686	4491
2000	Cote d'Ivoire	12095	399138	9896	7979	24137	5172
2001	Cote d'Ivoire	10246	287000	8186	7684	23765	5000
2002	Cote d'Ivoire	13804	392979	9158	7368	22970	4552
2003	Cote d'Ivoire	12004	396146	9036	7500	23002	5000
2004	Cote d'Ivoire	14536	300000	9100	7059	23000	5000
2005	Cote d'Ivoire	14286	300000	9100	7059	23000	5000
1990	Ghana	9127	13150	11889	6008	16510	6310
1991	Ghana	9958	20143	15260	5391	15901	9193
1992	Ghana	10138	29400	12040	6357	16499	8422
1993	Ghana	9875	39500	15092	9725	20389	10604
1994	Ghana	8405	23350	14933	8778	20062	10825
1995	Ghana	9306	26290	15020	9843	20192	10765
1996	Ghana	8531	34636	15153	10195	20496	11245
1997	Ghana	8209	40249	15285	8441	16746	10278
1998	Ghana	7993	45665	14850	9517	14847	11656
1999	Ghana	8473	38127	14557	8589	19919	9689
2000	Ghana	7101	35503	14578	8144	21589	9692
2001	Ghana	5002	17506	13150	6963	20185	8499
2002	Ghana	9538	18313	14900	8036	22799	9375
2003	Ghana	7813	15000	16272	8506	20411	9759
2004	Ghana	6800	17000	15794	7891	20253	13395
2005	Ghana	6800	17000	15794	7891	20253	13395
1990	Mali	13443	276023	11566	6074	14360	6571
1991	Mali	12656	272430	13824	8280	17274	10898
1992	Mali	12960	319424	10050	5491	17583	6449
1993	Mali	11990	240244	11029	5261	17350	7534
1994	Mali	10878	293021	11347	6394	16518	7641
1995	Mali	12073	405907	12843	5497	15484	8345
1996	Mali	10754	452046	15845	7897	19140	9990
1997	Mali	10507	522903	16965	7294	17554	9765
1998	Mali	10278	518415	16416	8933	21991	9737
1999	Mali	9533	459792	14541	8784	22366	9397
2000	Mali	10657	242772	13322	7038	21052	8368
2001	Mali	10736	571335	11583	6938	20095	7370
2002	Mali	9790	439722	11460	5105	19712	6950
2003	Mali	11545	635000	10005	6520	22954	7239
2004	Mali	11111	600000	10010	6722	15922	6641
2005	Mali	11111	600000	10010	6722	15922	6641
1990	Senegal	10319	44723	11411	5837	24825	9101
1991	Senegal	11452	50577	11324	6739	23497	7838
1992	Senegal	10617	47533	10907	5764	24065	8884
1993	Senegal	8862	38769	12694	6710	24809	7841
1994	Senegal	8444	28664	10133	5853	20869	8672
1995	Senegal	8957	31363	10881	7485	22497	8579

1996	Senegal	7633	38399	10438	6189	20157	8948
1997	Senegal	7481	40279	9695	5193	23254	7658
1998	Senegal	2410	11628	8255	5582	27204	5927
1999	Senegal	6837	14649	9388	6700	25018	6405
2000	Senegal	9167	20411	11114	7127	23454	8691
2001	Senegal	10869	34237	12040	5868	27734	8042
2002	Senegal	11057	39228	7434	5061	22676	5854
2003	Senegal	11907	54964	22834	7329	26397	9108
2004	Senegal	9107	39668	27194	4713	28086	7754
2005	Senegal	12187	46580	29250	8604	29044	10105
1990	Togo	12450	99600	9653	4063	13098	6229
1991	Togo	11908	93000	9060	3746	15665	7378
1992	Togo	12488	99900	10140	5561	18509	7757
1993	Togo	12400	93000	11599	5029	11975	6442
1994	Togo	13868	131750	9304	3747	9498	5383
1995	Togo	10591	102050	8553	6724	12223	8652
1996	Togo	13556	146400	9404	4725	13320	6263
1997	Togo	9726	176200	10676	5212	26977	7338
1998	Togo	8890	180000	8673	4525	20441	6697
1999	Togo	8718	134000	11979	4650	21254	8019
2000	Togo	8306	117400	12020	4696	19223	8267
2001	Togo	9667	145000	11433	5249	19836	7716
2002	Togo	10625	170000	11502	5305	19783	7681
2003	Togo	9189	170000	11498	5291	19457	7709
2004	Togo	9250	185000	12763	5291	19457	7826
2005	Togo	9250	185000	12763	5291	19457	7826

Statistical table for figures 9 and 12

TOTAL MAIZE Imports (Mt)	TOTAL MAIZE Production (Mt)	TOTAL MILLET Imports (Mt)	TOTAL MILLET Production (Mt)	TOTAL RICE Imports (Mt)	TOTAL RICE Production (Mt)	TOTAL RICE Imports (Mt)	TOTAL RICE Production (Mt)	TOTAL Sorghum Imports (Mt)	TOTAL Sorghum Production (Mt)	TOTAL Wheat Imports (Mt)
97061	8545345	18674	8876514	1677761	2894749	2515385	4339954	39794	6633564	1635784
153877	9152115	0	8583876	1854825	3574623	2780848	5359255	178124	8860454	1750405
96264	9091652	18678	8445197	2177873	3571939	3265181	5355230	57491	9209254	2112399
98213	9929503	4459	8935474	2139562	3499937	3207740	5247282	42629	9480920	2455204
71841	10606935	2291	9362178	2230346	3127238	3343848	4688513	36648	9361252	2038772
154884	10667863	1590	9866212	2107341	3592630	3159432	5386253	6138	10507282	1816719
99813	9699586	3401	9998734	2021855	4152180	3031269	6225156	12933	10503081	1802643
155588	9596704	10018	9289348	2486118	4347932	3727313	6518639	933	10236428	2323740
238932	9448170	33498	10948115	2655247	4398433	3980882	6594353	4820	11132398	2946365
120264	10617794	341	11058239	2886216	4546249	4327161	6815967	24411	10882927	3079606
168734	8602389	27792	10249246	2742099	4534462	4111091	6798295	14299	10847978	3715053
190115	9115601	90548	10559178	4658795	4388568	6984701	6579561	20076	10893320	3870975
259823	10047265	43118	11186445	4404204	4428858	6603004	6639969	14084	11773344	4019066
202933	10566881	375	11782606	4817150	4667816	7222113	6998224	5645	12503763	4039134

Statistical table for figures 9 and 12

Contact interactions: Contact list of the author

Organization	Links/Location	People
Banks and MFIs		
AFDB	Tunisia	
WORLD BANK	BF	M Goldstein (or successor)/ Mr. Nébié
BACB	BF	Mr. Koalaga
Other commercial banks doing provision of financial products for farmers		
BCAO		
MFIs : Village banks, Village savings, NGOs, and other schemes for agricultural production		
PlanetFinance, AFMIN, PARMEC		
Producers' associations		
CNCR	Senegal	
ROPPA	Senegal	
PROPAC	Cameroon	
APROCA	Benin	
UNPCB	BF	Mr. François Traoré (or successor) Mr. Boureima Sanon
CNPC	Benin	
OPCC-GIE	Cameroon	
ANOPACI	Côte d'Ivoire	
URECOS-CI	Côte d'Ivoire	
AFFICOT-CI	Côte d'Ivoire	
PFAG	Ghana	
UN-SCPC	Mali	
FNPC	Senegal	
FNGPC	Togo	
Other coops (outside cotton unions) and farmers' unions and *faîtières*		
Professional organizations and agro-processing firms:		
CDI-COTTON	Switzerland	
DAGRIS	France	
SOFITEX	Burkina Faso	
FWS	Senegal	
ROESAO		
Interprofessional partnerships e.g. AICB in Burkina Faso		
Agro-processing agribusinesses outside cotton		
Parastatals, boards and governmental agencies		
SONAPRA	Benin	
CMDT	Mali	
SAED	Senegal	khass81@hotmail.com
OHVN	Mali	
DGPSA	BF	Mr. Kaboré
Ministère du commerce	BF	Mr. Yaméogo (suivi de la filière cotton)
INSD	BF	Mr. Yago
ARECA	Côte d'Ivoire	Mr. N'Cho
Other parastatals and government agencies		
NGOs/ International organizations:		

AFDI	BF	Mr. Sere
IFDC	BF	Mr. Roy
AFD	BF	Mr. Tissier (son successeur)
UNECA	Ethiopia	
FAO	Ghana	
IITA	Nigeria	
FONGS	Senegal	
ECOWAP		
CILSS		
CMAAOC		
Other NGOs and organizations involved in local expertise of farming systems and functioning of commodity chains for cotton-cereal systems		
Research and Academics		
CORAF	Senegal	
ISRA	Senegal	
CAPES	BF	Mr. Zonon
CIRAD	BF	Dr Pagès
Université Ouagadougou	BF	Mr. Bitibali, Mr. Tiemtoré, Mr. Lankoandé, Mr. Bambio
INERA	BF	Zoundi Sibiri
Université Cotonou	Benin	Mr. Soglo
INRAB	Benin	
LARES	Benin	
Université Abidjan	Côte d'Ivoire	Zié Ballo: zieballo@hotmail.com
WARDA	Côte d'Ivoire	
Université Niamey	Niger	Mr. Amadou
INRAN	Niger	
CILSS	Mali	Mr. Kako Nubukpo
Other local and regional research institutes, other local experts (academic scholars)		
Other actors (maybe more informal) Traders (urban and rural markets) and wholesalers Breeders Retailers, grocers Consumers Professional associations of traders Quality grading institutions Input suppliers and retailers Consumers' unions (if relevant) Local craft workers for textile and/or food processing/ animal feeding		

List and contacts of the interviewees during consultations

State representatives, research institutes

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Producers' organizations

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-Mr. Diallo Ousmane, Mr. Ouedraogo Moumouni, Secretaire Permanent, Mr. Bassiaka Dao, Confédération Paysanne du Burkina Faso (CPF).
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Banks and MFIs

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-Madame Toné, Directrice du Credit, BACB.

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Interprofessional organizations, research institutes, parastatal agencies

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Questionnaire used for consultations in Ouagadougou, Bamako, and Dakar

Banks and MFIs:

- **Financing opportunities for farmers, traders, and processors**

Q1: What are the limitations of cotton outgrower schemes?
Q2: How far should we go to finance cereal inputs with cotton production?
Q3: What initiatives are undergoing for rural finances services to farmers?
Q4: What prerequisites should be envisioned for farmers' organizations?
Q5: As far as you are concerned, what is for you the best strategy to follow to expand viable credit schemes to farmers outside of interlinked contracts?
Q6: Which capacities should be built upon as priorities?
Q7: How to develop mid-term and long-term farm credit (equipment, vehicles, capacities), which institutions and guarantees are needed?
Q8: Which arrangements with input suppliers, cotton firms, agro-processors, farmers' unions and government work the best for viable credit schemes?
Q9: How realistic is the establishment and diffusion of inventory credit (warrantage)?
Q10: How to finance capacity-building for traders and wholesalers?
Q11: What kind of other savings and insurance schemes could be developed in villages? Is the establishment of village banks by farmers a viable option? Which limitations?
Q12: Is credit available for large business entrepreneurs willing to invest in the agro-processing sector? Is there a strong demand for small entrepreneurs?
Q13: Is there a strong demand for retailers?
Q14: Do you think financial services are adapted to the needs of cotton-cereal commodity chains? What prevents you from developing more appropriate services?
Q15: For you, what are the best diversification strategies for NCCS of cotton-cereal systems on which you would be willing to financially support?

- **Rural finance markets and institutions: what works and what does not and why?**

Q1: Please define for you what are the main faced constraints for the development of credit markets and other rural financial services? Information, risk, market structure, institutional failures, transaction and transport costs?
Q2: Define your relationships with other stakeholders. Is this playing a significant role in providing financial services?
Q3: How do you access information about farmers and NCCS needs, capacity to repay, collateral and risk-taking?
Q4: What is the level of competition in the banking sector?
Q5: What infrastructures are lacking to reduce transaction costs? What investments have to be undertaken?
Q6: In the macro-economic and regulatory environment, what is lacking to improve the functioning of credit and financial markets and their access to cotton-cereal NCCS?
Q7: What are the main interest rates for your financial products?
Q8: How strong is the level of credit rationing?
Q9: How is the evolution of savings and banking for farmers? Did you observe a behavioral change? Are people more aware or educated with having an account?
Q10: Do you think MFIs are more able to provide farmers with credit?
Q11 Would you be ready to work with government, and other financial institutions to improve the access of farmers and other NCCs to financial services?
Q12: By which means: information sharing, infrastructures investment, risk-sharing, competition and regulation policies, institutional capacity-building…?

Producers' associations:

- **Organization and integration into the vertical structure of the CCs**

Q1: Please define the organizational structure and the activities provided to farmers
Q2: Please define the leadership structure and the organizational efficiency?
Q3: Where are the main coordination problems in your organization?
Q4: What are your main capacity constraints?
Q5: Do you feel correctly integrated into the vertical structure of the industry?
Q6: Do you think having a significant impact in the management of the supply chain?
Q7: Do you thing your negotiation rights are effective?
Q8: How are contracts negotiated with other stakeholders?
Q9: Do you think having an influence over government policies? Do you feel involved into the policy-making process?

- **Collective action**

Q1 What is lacking in your organizational structure and funding to be more active?
Q2 What activities would you like to develop for farmers?
Q3 What kind of partnership do you or would you be willing to belong?
Q4 What kind of political action do you or would you be willing to undertake? What could trigger these actions?
Q5 What are the future objectives of your organization?
Q6 Are local farmers' groups efficiently organized?
Q7 What is the main problem of collective action at the village level? At the meta-one?

- **Strategies for farmers' diversification and production incentives**

Q1 What are the critical constraints for farmers' production? Incentives and capacities?
Q2 Is interaction with traders subject to conflicts or disadvantages?
Q3 How do you think farmers could diversify their production, and which markets should be developed?
Q4 Under what kind of contractual arrangements?
Q5 What are the current initiatives to improve the performances of farming systems? Which ones are the most promising?
Q6 What are the actions to undertake as priorities?

Professional organizations and agro-processing firms:

- **Vertical relationships and coordination**

Q1 Please define your relationships with other NCCS: contacts, bargaining, regulation
Q2 Where are the main coordination failures in the industry?
Q3 How would you envision the provision of extension services to farmers?
Q4 Are you undertaking contract farming and other outgrower schemes?
Q5 How do you think farmers should better access inputs?
Q6 How are you interacting with traders and wholesalers?
Q7 How are you interacting with government officials and banks?
Q8 What are the main constraints in the regulatory and macro-economic environments for the well functioning of the industry?

- **Market and institutional environments**

Q1 How are markets structured: trade, wholesale, retail, transformation?
Q2 How are you connected to local, regional, and world markets?
Q3 What human and physical capacities are you lacking?
Q4 How do you access information about quality, prices, demand, and supply?
Q5 How economic risk is shared along the commodity chain?
Q6 How high are transaction and transport costs and how it limits business expansion?

Q7 Are there an effective interprofessional body or consensus-building institutions that help solving contractual and policy-making problems?

Q8 Which innovations and reforms would be required to improve these environments?

- **Marketing strategies**

Q1 Which new products, quality improvements, packaging, and other industrial options are you exploring so far?

Q2 What linkages between cotton and cereal productions should be kept, even in the realm of production diversification? Which ones are inescapable?

Q3 How are you involved in technical assistance, research and development? Who should bear these investments?

Q4 What are the undergoing projects to which you are associated? Which initiatives are the most promising?

Parastatals, boards and governmental agencies

- **Policies and institutions**

Q1 How are you involved in agricultural policy-making?

Q2 What is your current role in the regulation and interventions in commodity markets?

Q3 How are you involved in input and output markets: food security, transaction controls, subsidies, trade restrictions or taxes, input subsidies…

Q4 What kind of supportive policies and institutions are necessary to increase incentives for the private sector?

Q5 Is a market information service effectively working?

Q6 Are quality-grading institutions functioning?

Q7 How do you envision the future of regulation and competition policies for CCs?

Q8 How are you thinking about improving the legal framework? Which institutions are lacking to improve the business environment

Q9 How the macro-economic environment impacts business incentives and capacities?

Q10 To which extent the management of CCs should be decentralized?

Q11 Are you currently or willing to participating in consensus-building institutions to support the participatory adoption of policies?

Q12 What do you think of market-based instruments for risk management?

- **Improving the performance of commodity chains**

Q1 Please define your relationships with NCCS

Q2 What are the critical constraints along the commodity chains for cotton-cereal systems? Information, risk-sharing, transaction costs, capacities, market power…

Q3 How risk could be more efficiently shared?

Q4 What are the most promising diversification options, which new commodity markets, or marketing products would you be ready to financially support?

Q5 How are handled the provision of basic public/club goods: extension services, quality standards and research, Will you be ready to devote some financial support?

Q6 What are the key technical priorities for agricultural development?

Q7 What are the best suited current initiatives?

NGOs/ International organizations:

- **Local expertise of the performance of commodity chains**

Q1 What is your point of view about the critical constraints for production of these commodities?

Q2 How do you think farmers should diversify their production, under what conditions?

Q3 Which innovations are doable to overcome those constraints?

Q4 Did you experience some evidence that can support some success stories and failures?

Q5 With what welfare and poverty-reduction implications?

Q6 How the political economy matters for the overall environment of production along

commodity chains? (legal framework, and macro-economic environment)

Q7 For technical environment, risk, and business environment? Dynamic considerations?

Q8 How are evolving market and information accesses for NCCs? Under which market structures and regulations?

- **Current initiatives and challenges**

Q1 Are you currently involved in any action plan or project related to cotton-cereal systems?

Q2 What are for you, the most promising areas of development?

Q3 How should be organized research and which project will you be attached to support?

Q4 What institutions or organization could help fostering coordination and implementation of different project and activities?

Q5 What physical and human capacities are firstly needed?

Research and Academics

- **Technical and economic expertise**

Q1 What are the relevant constraints in the industrial organization of commodity chains?

Q2 What are the main technical constraints?

Q3 What is not working at the policy level?

Q4 What is your expertise of the local situation for the scope of diversification and productivity increase for cotton-cereal systems? What future for cotton, and for traditional cereals? Which other relevant commodities can come into play?

- **Research priorities and research agenda**

Q1 Are you currently involved into a research project (at the experimental or field stages)?

Q2 Are you currently or have you recently worked with agri-businesses or other NCCS on a research project for quality enhancement, seed variety, marketing strategies?

Q2 What are the promising areas of study and of technical development for cotton-cereal systems: long-term fertility, yields, varieties improvement, credit schemes, equipment, irrigation, contractual arrangements, institutional innovations…?

Q3 What is lacking in the organization and financing of research?

Q4 What is constraining farmers to adopt new technologies?

Q5 Which new commodity markets are paying much attention?

Q6 What capacities and incentives have to be reinforced to make innovations work and improve welfare?

Q7 Are you willing to participate to any common research project or inter-professional agreement involving a participatory approach of the main stakeholders?

Other actors (maybe more informal)

Q1 Please define your relationships with other NCCS?

Q2 For you, what are the main constraints in your economic activities?

Q3 What capacities will you need to be better connected to markets and information?

Q4 What are the critical constraints along the commodity chain?

Q5 Which new products or processes would you be willing to purchase/invest on?

Q6 What are your own main concerns about the situation?

Q7 How do you foresee the evolution of cotton-cereal systems and which strategies will you be willing to pursue?

Country profiles

Country	Economy	Farming systems	Agricultural dev	Challenges/ strategies
Benin	Primary (30%) Trade with Nigeria (30%) unrecorded & transports (55%)	Root crop (humid) or Cereal-root crop (dry subhumid) + cotton + intercropping	Cotton-led growth (livelihood for 2 million) + oil palm, cashew + develop shea, coffee and cocoa + groundnuts	Variability of cotton production and bad reform framework Poor road and market infrastructure Land tenure conflicts Support entrepreneurship developments, trade expansion, investment promotion, new markets and infrastructures & rural develpt
Burkina Faso	Agriculture (cotton and livestock), mining, manufacturing and trade & transports (40 %)	agro-pastoral millet/sorghum (sahel) + cereal-root crop mixed (dry subhumid) with cotton	Cotton highly dependent Diversification cotton to oléagineux (sunflowers) + sorghum/millet and maize growing + public investments in irrigated rice	Difficult environment Lack of modern farming techniques Fertilizers mostly applied to cotton Cereal production linked to cotton Diversification and market development: agro-sylvo-pastoral supply chains (as in cotton), irrigation and marketing infrastructure and improvement of the business environment with a legal and regulatory framework
Cameroon	Agriculture, fishing and forestry Petroleum and industry Communication and transports	Tree-crop + forest-based + root crop and cereal-root crop (with cotton): mixed or intercropping in the highlands, craft fishing in the coast (with additional crops)	A key sector even if oil/pipeline has a star role (with timber) Food self-sufficient + many cash crops: cotton with the SODECOTON monopoly and coffee/cocoa with small landowners More technical and financial support to farmers for cocoa/coffee + rural infrastructures and empowered farmers	Reduction of fallowing periods with population density growth Poorly performing farmers' organizations unable to deal with liberalized markets Lack of effective extension services Low industrial capacity Successful reforms: banking, forestry, public utilities, transport Regional trade strategies with CAR and Chad to improve transport infrastructure and access to world markets Sustainability of land and resources management Political governance Increase food security and rural infrastructures (roads, irrigation)
Côte d'Ivoire	Agriculture (26%) and timber Industry (22%): agro-processing and petroleum Trade and transports (50%)	Tree-crop Root-crop Cereal-root crop (with cotton) Craft fishing	Cocoa: 40% of the world + coffee+ cotton cassava, yams, sweet potatoes, maize, millet, sorghum, rice and plantains, and sugar cane Mostly smallholders Cotton production decrease since 2002, and some escape to Mali & BF Tropical fruits	Recent political conflict with no more food security and threatening of living standards and pre-conflict healthy situation Lack of land access, population displacement and land conflicts in the cocoa region World Food program: seed protection ration + agricultural inputs for 20,000 households
Ghana	Agriculture, forest (timber) Mining Industry Services Top-ranking in Africa	Tree-crop farming Root-crop Cereal-root crop (with cotton) Craft fishing	Industrial growth and services Cocoa in the south, cotton and food in the north, maize letting sorghum/millet northward + legumes and yams horticulture and pineapple Traditional land use for cash and staple crops (slash and burn), most	Food crop with low intensive farming systems and no irrigation Low rate of mechanization Diversification endeavors with minimal results, project for domestic processing of cassava No food self-sufficiency, inadequate storage and agro-processing capacities, protein malnutrition World food program to be sustained by local production

			agriculture under small-scale farmers	Lending program under discussion for agriculture, investment in the transport sector, environmental governance and decentralization
Mali	Agriculture (35%) Gold Transport and telecommunications services	Pastoral farming Agro-pastoral millet/sorghum Mixed farming Irrigated Cereal-root farming	Growth led by gold more than cotton Cotton, rice, maize, legumes, peanuts (south, Niger basin) and livestock (north), most food and cotton produced in the Niger basin (& sorghum) Complex (institutional schemes) irrigation system (ON) with lower poverty Frequent shortages of grain due to climatic conditions but better political environment Self-sufficient in rice since 80s half by rainfed and half by irrigated agri.	Vulnerability to climatic conditions and terms of trade, dependence on ports and concentration on exports Unexploited irrigation potential World Bank projects an institutional framework for agricultural services, producer organizations empowerment, promoting private sector Improvement in the performance of supply chains for a range of agri, livestock, fishery and gathering products Irrigation Scheme Intensification project (Baguineda canal) with rural development issues Agro-pastoral development projects
Senegal	Agriculture Industry: agro-processing, mining Services and trade (50%), tourism	agro-pastoral millet/sorghum and coastal craft fishing	Growth led by services, historical hub of economic activities Millet/sorghum Rice in the Senegal river valley and Casamance Cotton in East with groundnuts Combination cash/ food Add cowpeas and maize Basic techniques small-scale farming Dynamic horticultural sector (large-scale) from contract farming to estate (with wage labor) and industrial sugar and tomatoes	Limited use of irrigation with variable availability of inputs More financial resources in the groundnut sector with a worsening supply deficit Poor performance of the carreau-usine system between farmers and Sonacos for selling and transport A reform for the groundnut sector announced by the Interprofession WB: access for smallholders to agricultural services, innovations to diversify and increase food security with strengthened farmers' organizations Program for agricultural markets and Agribusiness Development: domestic distribution for crop and livestock products, irrigation investments for agribusinesses and expansion of non-traditional exports: horticulture, nuts, oils and spices, and processed foodstuffs
Togo	Agriculture 42% Mining (phosphate) Trade and transports 42%	Root-crop Cereal-root crop mixed	High underexploited agricultural potential (mostly subsistence farms) Cash crops: cotton, forest, and fishing Food: maize, millet, rice, beans, groundnuts, yams, cassava and sweet potatoes in stagnation Self-sufficient except in rice and wheat Food shortages sometimes caused by smuggling, leading government to establish food security agency to release stocks on the local market	Low-performing cotton sector Coffee and cocoa underdeveloped Deteriorating soil resources Lack of irrigation and fertilizers Shortage of rural credit and infrastructures Reform of the cotton sector with a repayment of arrears to cotton farmers with a process of the implementation of a reform agenda