



Mozambique
Cotton Supply Chain Rapid Risk Assessment

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I. INTRODUCTION AND METHODOLOGY

At the request of the Cotton Institute of Mozambique (IAM), this report is the initial step by the World Bank to identify options for providing specialized technical assistance in the area of agricultural risk management. This report is intended as an advisory note to the IAM to identify a strategy for addressing agricultural risks and to identify public investments with the goal of improving current risk-management practices in the cotton sector. The essence of the assessment is to understand the wide range of bottlenecks that affect different participants functioning along the various stages of the supply chain.¹

After fielding a technical mission from December 1–10, 2009, with various experts in agricultural risk management, the World Bank prepared this report to identify the major risks facing agriculture, rank those risks in terms of their potential impact and frequency, and offer a framework for improving current risk management practices. Insights and recommendations will provide a basis for follow-up planning work by the Government of Mozambique, the World Bank, and other development partners.

In order to make this rapid risk assessment for the cotton sector for Mozambique manageable, the following factors were taken into account:

- The initial time and resources available for developing a rapid assessment of the sector, basically relying on secondary documentation and a two-week field visit with various experts.
- Conducting in-depth interviews with groups of stakeholders (e.g., farmers in various cotton areas, agriculture input suppliers, cotton traders, ginneries, financial intermediaries, transporters, general service providers, government officials, universities, research institutes, etc.) of key cotton supply chain participants, whose risks are largely representative of each group of stakeholders.
- Based on the methodological framework for rapid risk assessments, the team: (a) identified major risks facing the various stakeholders; (b) ranked those risks in terms of frequency and intensity (loss potential); (c) identified capacity to manage risks; (d) drew a vulnerability matrix; and (e) identified risk management measures in terms of: mitigation, transfer, and coping.
- Addressing extensive key comments by the IAM, which is using the results of this rapid assessment to inform policy decisions and for priority investments.

The second section of this document contains an overview of Mozambique's cotton sector and its role in the national economy. The third section offers an identification of the main risks and capacity to manage them; and the last section contains the vulnerability analysis. In the end, the document suggests some next steps for further assisting the IAM in agriculture risk management.

This non lending technical assistance is provided by the World Bank under the European Union's "All ACP Agricultural Commodities Program" for Eastern and Southern African region. The World Bank team wishes to acknowledge the invaluable support provided by the IAM as a partner in this activity.

II. A SNAPSHOT OF AGRICULTURE AND COTTON SECTOR

Mozambique has emerged from decades of war to become one of Africa's best-performing oil-import economies. One of the poorest countries in the world at independence, the country has enjoyed remarkable recovery, achieving an average annual rate of economic growth of 8 percent between 1996 and 2006. This has been mostly driven by exports, good performance in the transport, communication, and construction sectors, and recovery in agriculture (World Bank 2008).

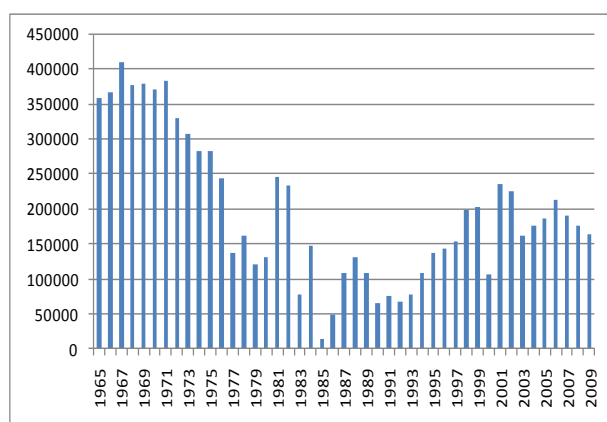
¹ For more consultations on the methodology for "Rapid Agricultural Supply Chain Risk Assessment" (RapAgRisk), visit the agriculture risk management website at the World Bank www.worldbank.org/agrm.

Agriculture in Mozambique is almost entirely dominated by smallholders. The agricultural economy is a major source of livelihood, and food represents about two-thirds of total consumption, especially among the rural poor. An estimated 70 percent of the 19 million people live in rural areas, with nearly 40 percent in the northern and central regions. The sector is dominated by 3.2 million smallholder families who provide about 95 percent of agricultural GDP, with the balance from a small number of medium and large commercial farms (World Bank 2006). Average cultivated area per household is only about 1.6 hectares. The latest agricultural census (Trabalho de Inquerito Agrícola (TIA) 2008) reported there were an estimated 3.7 million farm families cultivating some 5.9 million hectares. Agriculture employs over 80 percent of the labor force and contributes 28 percent of GDP; its recent steady growth (6.6 percent) is largely responsible for the country's achievement of lifting more than 3 million people out of poverty (World Bank 2008).

A particular challenge is the strengthening of smallholder agriculture, agribusinesses, and small and medium-sized enterprises (SMEs) that will have to occur for growth to be shared. Otherwise, growth generated by current megaprojects in extracting industries might benefit only a small part of the population. However, current patterns of agricultural growth are not sustainable, and rural incomes face a substantial risk of stagnating. Over the past decade, agricultural growth was almost entirely driven by farming more land with a larger rural labor force, with few technological improvements. Part of this growth is attributed to a post conflict catching-up effect that lasted up to 2007, when expansion of cotton areas have even started to decline (See figure 1). Improved agricultural technologies have only played a modest role in growth with yields showing only a modest trend increase. Cotton production, as the largest export crop (contributing to around 17 percent of agricultural exports), is not an exception.

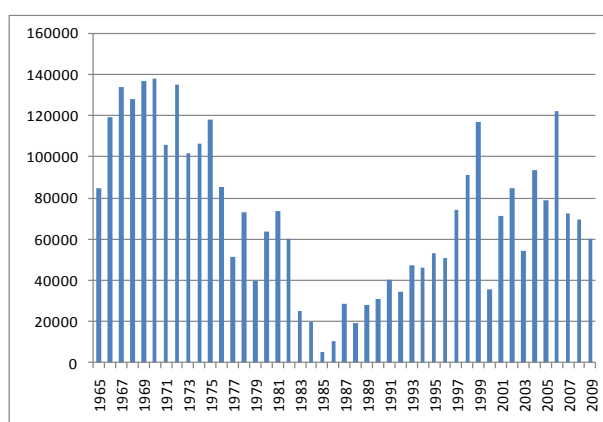
The cotton sector has been one of the most important agricultural export crops in Mozambique for most of the country's history, currently responsible for 20 percent of agricultural GDP and benefiting over 300,000 families (1.5 million inhabitants) according to IAM. In 2008, it ranked the country's third most important export crop, behind tobacco and sugar. The fluctuations in cotton production shown in figure 2 reflect drastic changes in political milestones and economic policies since 1960. The cotton industry reached historic production levels during the colonial period prior to independence—144,000 tons in 1974—followed by a period of political and economic instability lasting until 1994.

Figure 1. Seed Cotton Area Harvested 1965–2008 (ha)



Source: FAOSTAT and IAM.

Figure 2. Seed Cotton Production 1965–2007 (tons)



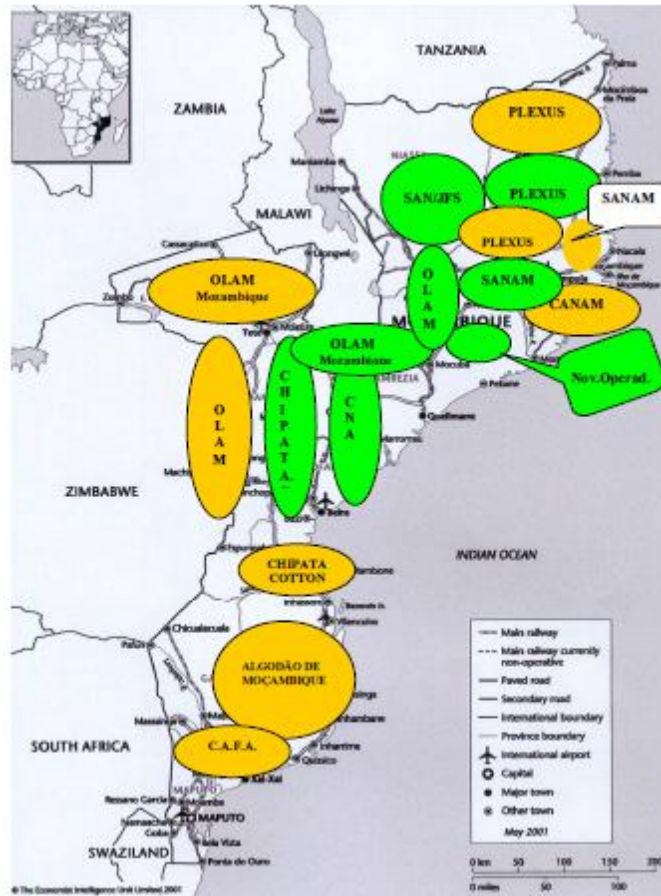
Source: FAOSTAT and IAM.

Since 1995, the regaining of political stability, introduction of economic reforms, and the return of refugees to agriculture stimulated cotton production into a new trend that reached its peak in the 2005–06 harvest with 122,000 tons. Since then, production figures show a clear downward trend until the 2008–09 harvest, reported to be 60,300 tons at the time of the field mission. This is explained by stakeholders as being due to large number of farmers changing from cotton to other cash crops like sesame seed, which poses a serious production risk to guarantee input supplies to the ginneries. The consistent drop in production since 2005 has

provoked serious concerns among the authorities and supply chain stakeholders about the sustainability of the current concessionary system.

Historically, northern Mozambique, especially Nampula and Cabo Delgado province, has always been the most important cotton production regions, contributing with the highest cultivated area, total volume produced, and investment in ginning factories. In recent years, however, these two provinces have recorded some of the lowest cotton yields in the country, and a number of ginning units are facing problems of underutilized capacity or obsolete machinery. Over half of 17 cotton concessionaries are newly registered firms showing renovated interest in operating in various cotton regions (Figure 3).

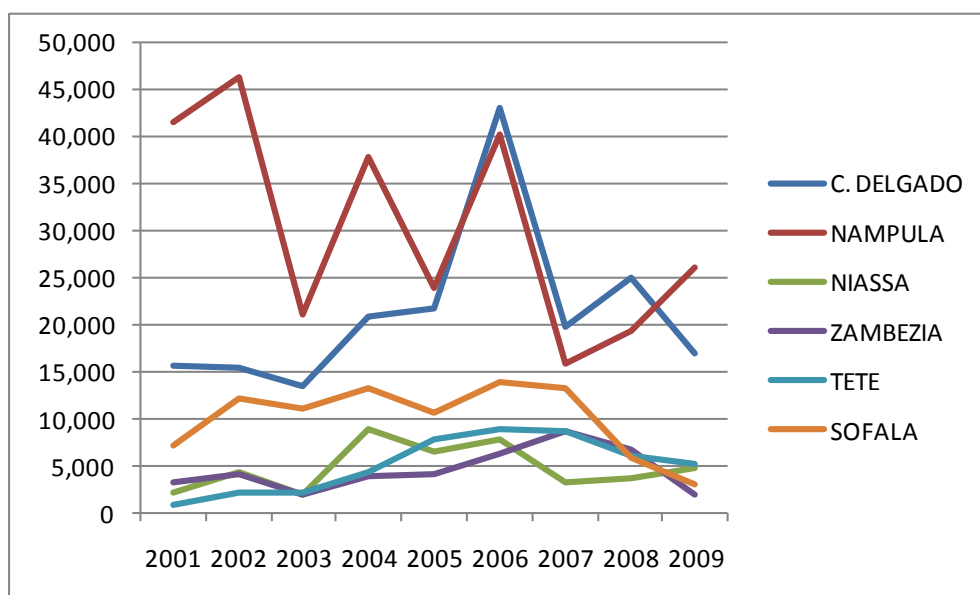
Figure 3. Geographic Distribution of Cotton Supply Chains



Key: Established concessions in green; new concessions in yellow.
Source: IAM.

As shown in table 1, northern Mozambique—especially Nampula and Cabo Delgado—has always had the highest levels of cotton production in the country at the farm level. Production in northern Mozambique also shows higher production volatility, partly explained by the recent periodic credit default crisis in the Nampula historic cotton belt and heavy conflicts between farmers and ginners.

Table 1. Cotton Production in Mozambique (2000–01, 2008–09)



Source: IAM

The ginning sector in Mozambique is currently characterized by underutilization of capacity and low productivity. With capacity utilization well under 50 percent, ginneries continue to face high fixed costs. Besides, the ginning outturn (GOT) ratio reported by IAM is currently 38 percent, largely due to dirty cotton caused by poor picking techniques; use of mixed seed varieties; and cotton mixing when bulking, resulting in inconsistent fiber quality. The current system dates back from the colonial period, where private concessions were granted to buyers with the exclusive rights to purchase cotton from a particular region. This monopsony system was briefly replaced by nationalization after independence (1975), but soon reverted back to concessions. Current concessions are characterized by a rapid entry and exit of ginning firms. Most of the firms under the current concession did not exist 10 years ago.

Problems of productivity, capacity underutilization, and complaints by farmers about services of the current concessionary system are being discussed between ginneries and cotton authorities, with the possibility of a restructuring that could introduce more liberalization measures to create competitiveness and introduce incentives to cotton farmers.

What is at stake is not the preservation of cotton as a critical component in the livelihoods of farmers, but also—and just as important—the disappearance of the only channel for accessing inputs and markets for most farmers, which has the potential to affect other cash crops as well. In less dynamic rural areas (lacking productive infrastructure and access to input and product markets), cotton earnings are the only cash crop that can be grown with a secured market, agreed price, and supplied inputs. However, in areas with more dynamic rural markets (improved road network, cell phone penetration, and market access), farmers are in a process of diversification to other cash crops that complement their incomes. However, the diversification process is being done at the expense of the cotton industry. If this collapses, it will also negatively affect the other cash crops that are benefiting from the cotton supply chain services, given that input markets in Mozambique are more or less nonexistent.

The ongoing large public investment in rural economic and social infrastructure presents the current concessionary system with new challenges. Particularly important are the targets shown in the current Poverty

Reduction Action Plan (PARPA II) that will continue changing the rural enabling environment landscape, pressing the cotton industry toward adopting a more competitive system of production and trade.²

III. COTTON SECTOR RISKS AND CAPACITY TO MANAGE THEM

There are a number of risks associated with the cotton supply chains in Mozambique, as perceived by the various chain participants. They are mentioned in various documents and identified during this exercise. These perceived risks are shown in table 2 below, listed and grouped in three main categories: production, market-related risks, and other risks; each is ranked in terms of its severity (potential to cause losses). In this table, there is also a preliminary identification of the group of stakeholders most likely to suffer losses from the realization of the risks.

The column referring to the potential to cause losses, classified in terms of high, medium, and low, is measured in terms of potential losses to the cotton industry as a whole rather than at business level (i.e., carrying large quantities of cash for payments to farmers could potentially pose a high risk of robbery for a particular farmer at a particular time, but it is classified as *low* in this exercise because the realization of this risk will not produce high losses to the industry as a whole in any particular season). The ginneries play a central role in the cotton concessionary system in Mozambique, practically functioning as input suppliers, extension agents, research facilitators, credit providers, processors, and exporters—virtually acting as an integrated chain. This unusual position, not surprisingly, also places ginneries as the potential bearer of most identified risks in this exercise.

Table 2. Preliminary Identification of Risks

Identified Risks	Intensity of Losses (High, Medium, Low)	Who suffers the most?
Production		
Pests and disease	H	Farmers, ginneries
Weather	M	Farmers, ginneries
Loss of soil fertility	M	Farmers
Market		
International lint cotton price volatility	H	Ginneries
Exchange rate	H	Ginneries
Ginneries credit default	M	Banks
Farmers credit default	M	Ginneries

² PARPA II targets: (a) increasing access to technologies, extension information, and selected agricultural inputs; (b) promoting the construction and rehabilitation of agrarian infrastructure, especially irrigation schemes; (c) improving access to information and input/output markets; (d) promoting the private sector, especially in export markets for cashew, cotton, and sugar; and (e) improving community access to natural resources in an equitable manner for sustainable use and management. There is a pressing need to use irrigation resources effectively and to expand and develop agribusinesses and exports. Recent work on biofuels could also open up significant new markets for the agriculture sector (World Bank 2008).

Other		
Crop substitution	H	Ginners
Sample testing delays	L	Ginners
Unreliability of transportation	L	Ginners
Carrying large quantities of cash	L	Ginners
Port delays	L	Ginners
Sudden change in orders for chemicals	L	Input suppliers
Transaction tax default/payment delays by ginners	M	IAM, Farmers

It is also necessary to contrast the identified risks not just in terms of the potential to produce losses to the industry, but also in terms of the frequency of such events. The combination of both variables (intensity and frequency) is captured in table 3 below.

The identified risks located in the darkest gray area (upper right corner) of table 3 represent the most important risks to pay attention to, because they can potentially cause high losses (even at catastrophic levels) and the likelihood of occurrence is higher than other risks. The second level of importance is represented by the light gray boxes, and the clear boxes (on the left side of the table) represent identified risks that either have low potential to cause damage or their frequency of occurrence is low (or both). In the following paragraphs, only those risks in gray shaded boxes will be addressed.

Table 3. Summary of Risks: Severity vs. Probability

	Potential Severity of Impact					
Probability of Event		Negligible	Moderate	Considerable	Critical	Catastrophic
Highly probable		Sudden change in orders for chemicals		Farmers credit default (chemicals)	International cotton price volatility	Crop substitution
Probable		Port delays	Weather (droughts, floods, etc.)	Ginners credit default Transaction tax default/payment delays by ginners	Pests (aphids, worms, etc.)	
Occasional		Carrying large quantities of cash Sample testing delays	Fire Unreliability of transportation market	Loss of soil fertility	Exchange-rate risk	

This risk analysis represents the assessment of risks as identified today. If the underlying conditions causing these risks change, the assessment of the risks may possibly also shift. Moreover, the rural economy is continuing to experience a process of market liberalization and modernization (i.e., investments in rural social and economic infrastructure) as part of PARPAII, which will probably shift risks in the cotton supply chain. Other risks might also gain a stronger presence. This rapid assessment is therefore based on the risk perception of the various chain participants acting in the current circumstances.

Production Risks

Production varies in response to rainfall, temperature, floods, farmer decisions, and pests and diseases. To minimize these risks, farmers typically choose crops and varieties that are best suited to local conditions, introduce agronomic mitigation measures, and improve management practices. The level of risk is, to a large extent, location specific, depending on the variety and the underlying agroclimatic conditions.

Pest and Diseases

Intensity: Critical

Frequency: Probable

Pests in cotton farming vary by geographical areas. Insect infestations are an important variable in variations in cotton production yields in Mozambique; aphids, jassids, and American bollworms are considered the most critical risks in this category. If not controlled in time, an outbreak of red bollworm or American bollworm can cause serious damage; outbreaks can often cause 30–50 percent or more of production losses in the affected areas. Aphids, in turn, are affected by rainfall, as they do not tolerate wet conditions; thus they proliferate in dry environments and during droughts. A farm-based, multiyear study has shown that timely application of pesticides by farmers improves productivity by more than 100 percent.³ Some of these pests can be controlled to a great extent by natural enemies, if farmers know how to control biological pests well (two examples of diseases that attack cotton pests are the *Neozygites* fungal disease, which attacks cotton aphid populations, and a similar fungal disease that attacks loopers).

However, some farmers in Zambezia have mentioned that inputs are often delivered late or the spraying pumps are not available during the critical window of time when spraying is needed. This problem is compounded by the high cost of chemicals, leading most farmers (more than 90% of farmers interviewed) to reduce the recommended application of five sprays to three. The correlation between timely pesticide applications and improved yields (thus earnings) has not gone unnoticed by ginneries. It is not only the high cost of inputs but also the high cost of pesticide sprayers and batteries (which is nearly half of the total application cost) and diverting inputs to other crops that has helped to create a culture of underspraying the cotton.

Controlling pests—particularly American bollworm—are among the most important activities to improve yields. Timely first sprays each season are particularly important in order to effectively kill sucking pests. Timely second and third pesticide applications kill pests at hatching, before they invade the cotton squares, flowers, and bolls. This can be achieved by appropriately sampling and scouting pest populations. There is sufficient knowledge and capacity to manage these risks in the public and private sector. Managing this risk is under the oversight of ginneries, extension services, and the IAM, and an Integrated Pest Management (IPM) Program for cotton has been identified and is being implemented. The constraints in implementing these controls include difficulties involved in reaching a large population of farmers who are scattered around large areas, difficult to contact, and currently diverting their attention to other crops.

Weather Risks

Intensity: Moderate

Frequency: From highly probable to occasional, depending on the specific weather risk.

Mozambique is a vast country with 10 different agro-ecological zones from north to south, with high variations in temperature, altitude, and rainfall patterns (see figures 5 and 6).

Mozambique topography is composed of mostly coastal lowlands, with some uplands in the center, high plateaus in the northwest, and mountains in the west, as shown in figure 5, practically serving as the

³ Interview with Luisa Santos, Eduardo Mondlane University, Maputo, December 10, 2009.

watershed from rainfall occurring in the eastern neighboring countries and draining towards the Indian Ocean. This topography leaves the country subject to significant flood risks. Rainfall patterns in the north are better defined, whereas erratic patterns are more common in the south.

Figure 5. Mozambique Altitude

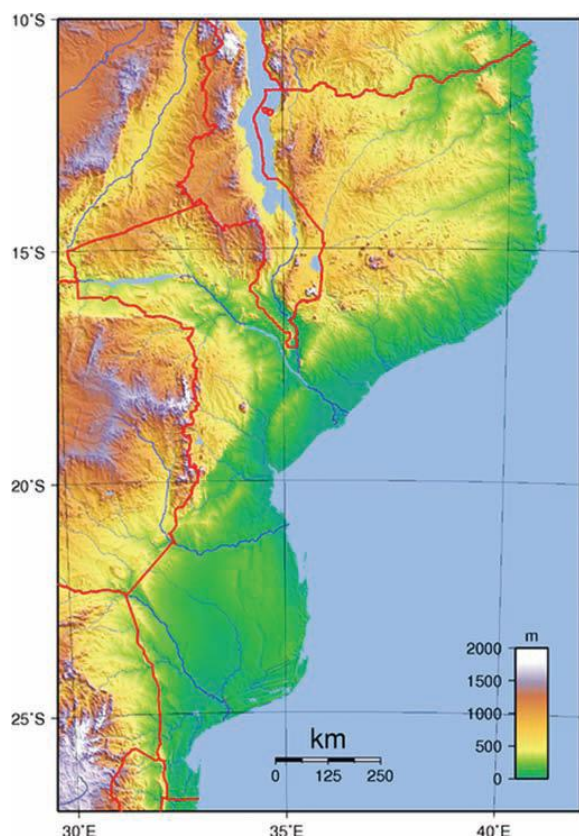
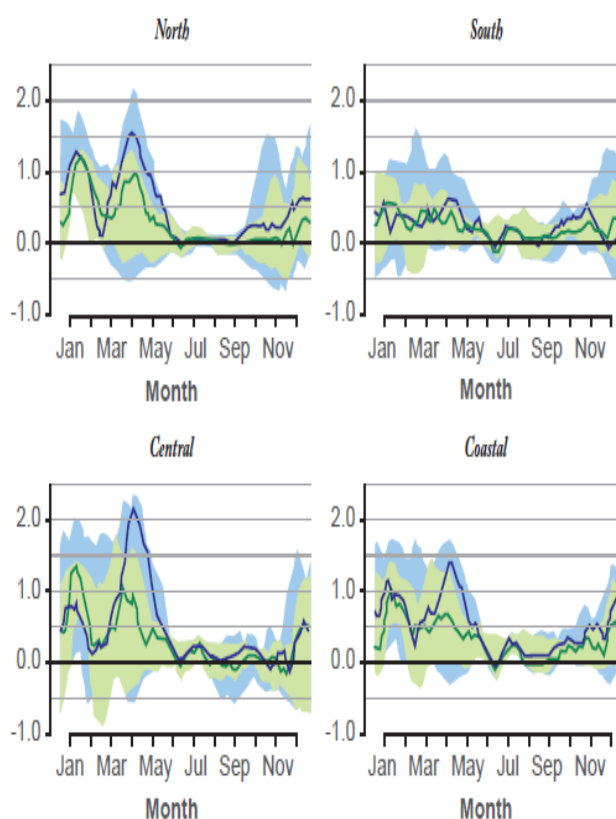


Figure 6. Mozambique Rainfall by Region



Source: Instituto Nacional de Gestão de Calamidades (INGC), 2009.

Whereas TIA (2008) did not capture the percentage of farmers reporting losses in cotton activities, the reported percentages for farmers growing other crops illustrates the types of risks agriculture is facing in Mozambique. The census reports that drought is the single most important risk for farmers, showing over 45 percent of farmers growing maize, sorghum, and millet reporting some type of loss and 38 percent of peanut growers reported losses due to drought. Excess rainfall and pests are reported as the second and third causes of reported losses, ranging from 6.9 percent up to 17.5 percent of farmers reporting some kind of loss for a group of crops, as shown in table 4.

Table 4. Farmers' Perception of Risks

Risk	Maize	Sorghum	Millet	Peanuts
Floods	7.9%	6.3%	5.3%	6.4%
Pests	11.8%	13.0%	16.3%	17.4%
Wild animals	9.6%	14.1%	16.7%	11.5%
Domestic animals	1.9%	1.4%	1.3%	1.1%
Diseases/decay	2.4%	3.6%	4.3%	3.1%
Excess rainfall	15.5%	14.8%	6.9%	17.5%
Deficit rainfall	44.8%	48.7%	48.5%	38.0%

Source: Trabalho de Inquerito Agrícola 2008.

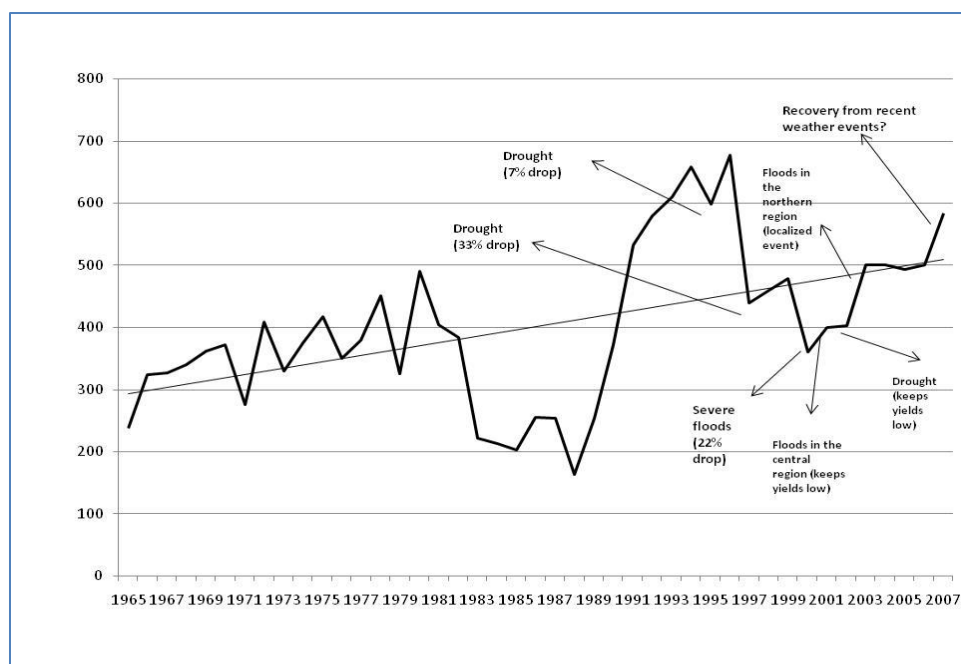
Though cotton copes relatively well with weather variations compared to other alternative crops (e.g., maize and sesame), weather is still a significant factor affecting cotton yields and overall production according to various stakeholders during the field interviews. TIA (2008) also reports varying percentages of farmers reporting losses by provinces—higher percentages of farmers in Zambezia and Sofala reported losses due to drought.

Various stakeholders in the cotton supply chain largely attribute yield variability to weather factors, particularly severe droughts in certain areas. The country was affected by regional droughts in 1994, 1996, and 2001; these negatively affected crop production in some provinces. Drought is more of a relevant risk in the southern region than in the central and northern provinces, where cotton is grown.⁴

Only 4 cyclones occurred between 1980 and 1993, but 11 took place between 1994 and 2007, according to the INGC study on climate change that claims there is an increase in intensity and changing of weather patterns. Likewise, two cyclones between 1980 and 1993 were classified as categories 3 and 5, compared to seven between 1994 and 2007. There is no available data on the effects of these events on the cotton industry. However, stakeholder interviews in provinces near river areas estimate flood-related losses suffered by cotton production to about 10–12 percent nearly every year.⁵ In some of the border regions (such as the border with Malawi), the low altitude in cotton-growing areas increase its vulnerability to flooding because of rains coming from neighboring countries.

The causes of yield variations shown in figure 7 are difficult to pinpoint without long-term historic weather and yield data for various regions, though it appears at first glance that some weather events can partly explain the behavior of yield volatility.

Figure 7. Cotton Yields 1965–2007 (kg/ha)



Source: FAOSTAT yield data, authors' interpretation.

⁴ World Bank (2006). *Mozambique: Agricultural Development Strategy: Stimulating Smallholder Agricultural Growth*, p. 17.

⁵ Interview with GAPI (financial institution in Quelimane, December 9, 2009). The Provincial Departments of Agriculture in Quelimane and Beira have identified excessive rainfall as the primary risk facing cotton (interview in Quelimane on December 9, 2009; interview in Beira on December 03, 2009).⁷

Observations of historic yield variability show some of the possible effects of recent weather events in the cotton industry. However, there are many variables that affect yields, and these preliminary observations need to be confirmed by conducting a specialized weather risk mapping exercise for the cotton areas. This has been identified as important for the IAM in their strategy to start applying weather risk management tools. If the volatility in yields shown during the pre-independence period (and lately between 1996 and 2005) could be proved to be largely attributed to weather factors, it would become clear that the weather has a large impact on the long-term trend in industry yields.

Preliminary correlation analysis of historic rainfall data from 1997 to 2007 for 13 available weather stations closest to cotton-growing areas show that only 3 weather stations—namely Beira airport, Cuamba, and Lichinga—can explain the volatility of national yields in 43 percent, 32 percent, and 11 percent respectively.⁶ This shows that weather (rainfall in this case) can only partly explain yield volatility in some cotton-growing areas, but not in others. This could be largely due to poor representation of cotton-producing areas in the weather stations chosen. IAM has clarified that of the 13 stations, only 2 are within the cotton-producing areas, and 4 are approximately 150–200 km away from cotton-producing areas. This explains the poor correlation between weather and crop yield. IAM has decided to increment the density of weather stations within the cotton-growing areas. It will be interesting to break down the regional crop yields and correlate them with the corresponding rainfall datasets registered by the closest weather stations and thus identify those regions where it is most urgent to introduce weather risk management practices, including weather insurance.

The weather station network of Mozambique has a density of one station per 29,000 km² (compared to 1 station/1,017 km² in South Africa), leaving large areas of the topography not covered, especially in the provinces of Gaza and Tete.

The current station network in Mozambique, while appearing to be quite widespread from maps alone—33 synoptic stations, 13 agromet stations, 48 climatological stations, and 7 AWS—suffers from missing data in most station records. Much of the missing data is from the country's civil war (1975–92). Many of these stations are likely not suitable for agricultural insurance purposes because they lack site security; furthermore, it is not clear that the data is of sufficient quality. This is not to say that the data is not useful, as it can be completed by filling in the missing data (e.g., through temporal and spatial interpolation using remote sensing satellite data) or used as a quality control check for nearby stations. The IAM has recently installed 13 weather stations in cotton-growing areas, thus increasing the density.

Domestic insurance companies have virtually no experience in agricultural crop insurance. Currently they offer coverage for damage to agricultural assets (including lint cotton) under property insurance for fire, goods in transit, flood damage, and theft (for ginneries). They may, however, venture into crop insurance if they get the technical assistance to roll over the products. South African insurance subsidiaries operating in Mozambique are willing to place some resources for developing insurance products that could allow them to expand the insurance market in the country.

Loss of Soil Fertility

Intensity: Considerable

Frequency: Occasional

Loss of soil fertility undermines the long-term foundations of productivity—not just for cotton but also for agriculture in general, affecting both farmers and ginners equally. Price pressures rising from the concession system and the low-price/low-quality competitive position are creating worrisome trends in regard to

⁶ The weather stations considered were Mocimba, Montepuez, Pemba, Lichinga, Cuamba, Marrupa, Nampula, Anghoche, Lumbo, Quelimane, Tete, Chimoio, and Beira airport.

sustainable use of land.⁷ Stakeholders, including some ginners, have confirmed that there is sufficient knowledge to manage soil fertility issues. Aside from the provision of seeds, ginners admit they cannot provide support for fertilizers due to high costs and risks of not recovering the credit from farmers, preferring instead to rely on other effective ways to nurture soils—such as crop rotation, fallow periods, and the clearing of land to maintain minimal fertility levels. This long-term risk is of a structural nature, resting its reversal on various factors related to farmers’ market access, infrastructure development, education, and overall agricultural productivity, and not necessarily a risk that is only exclusive to the cotton sector. Addressing these structural constraints needs to be considered within the overall medium- to long-term national agricultural policies.

Market Risks

Ginners are at risk from price volatility, as they generally take long positions because of their system of setting minimum prices for cotton seed purchases seven months before purchases commence. In addition, there is an ever-present risk of currency volatility and sharp movements in the exchange rate against the U.S. dollar that can potentially result in losses for the ginners. Both risks are addressed in this section.

Although current cotton prices are relatively high, there is a risk that farmers—who are currently producing cotton—may switch to alternative crops that they perceive to be more profitable. Farmers have previously been affected by persistent low international cotton prices, leading to periods where incomes may have been adversely affected. Interviews carried out with various stakeholders seem to confirm this reality.

Cotton Price Volatility

Intensity: Critical

Frequency: Highly probable

Mozambique has a national minimum pricing system for cotton that applies to all ginners who are awarded geographical concessions. The system used to be based on the establishment of a minimum price that was agreed upon with farmers 1.5 to 2 months before cotton procurement; but since 2007 the system was amended to an indicative price system where ginners and farmers agree on an indicative price as far as 7 to 8 months before procurement of cotton starts. The intention of this indicative price is to assist farmers in deciding on their cotton production plans and as an incentive to minimize crop substitution. However, the actual minimum price is indeed agreed on 1.5 to 2 months before procurement of cotton starts.

Whereas there has not been a downward revision of the indicative price since 2007, agreeing on an indicative price with farmers significantly in advance of their procuring seed cotton from farmers, clearly places the greatest risk of price volatility onto the cotton ginners and traders, as prices are indicated up to eight months before the cotton is ginned and delivered to clients.

Seed cotton is sold by farmers only to agents of the geographically agreed concessionary (ginners). The price paid to farmers is subject to a flat rate levy (the ginneries deduct this from the payments they make to farmers at the end of the season), partly to recover the costs of supplying sprays and chemicals to all cotton farmers and partly to meet the operational costs of IAM. The ginneries are responsible for procuring, processing, and distributing cottonseed (free of charge) to farmers for planting.

The price risk for ginneries starts in November, prior to sowing time, when the indicative price is agreed upon. The final price is usually announced in April just before the seed-cotton commercialization campaign. Cotton is purchased from farmers between June and October, with farmers generally being paid on the spot. The price derives from a formula whose general structure is accepted by the IAM and ginneries. The variables that are in the negotiations are the following: (a) Cotlook Index A and exchange rate (data of the last three

⁷ *Mozambique Competitiveness Report*, p. 44.

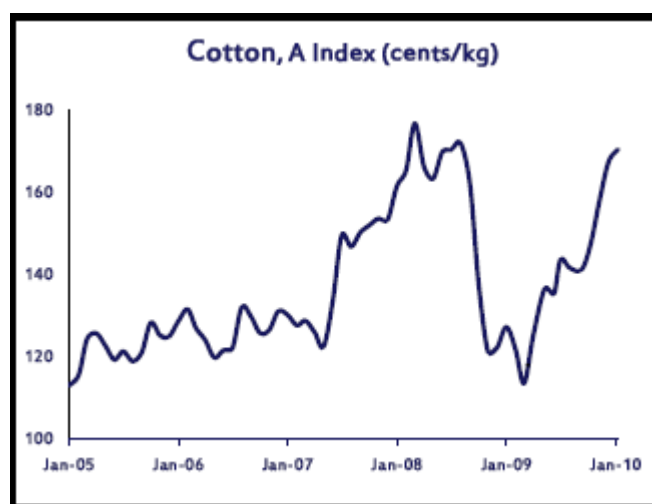
months before calculations); (b) estimated cost of freight between Mozambique and Northern Europe; (c) quality differential (average of the last three campaigns of the values of the Cotlook A Index and Mozambican fiber exports); and (d) sales of cotton seeds. However, each concessionary is free to set a higher price for the seed cotton they buy from farmers in order to encourage producers to grow more cotton. Their strategy is based on optimistic forecasts, according to which the cotton world price will remain high or increase—implying that, should prices fall, ginners and traders may generate losses. Those concessionaries usually belong to an international group and have fairly good knowledge of the world market as well as a lot of experience in fiber marketing—especially Plexus, Olam, CNA, and Dunavant. Others propose a price equal to the indicative price or slightly higher. They have a cautious strategy, as they are not backed by international traders to diversify risks (particularly in Nampula province).

This system of agreeing on minimum prices places the ginners and traders at risk of falling world cotton prices for a short period of time, as prices are set up to two months prior to purchasing and processing the physical cotton. Although world cotton prices play a significant role in setting the minimum price there is significant volatility, as shown in figure 9. This type of price risk is currently borne by ginners. Unexpected losses can occur when the world price, which is part of the minimum price formula, falls below the corresponding agreed-upon minimum seed cotton price.

The capacity of ginners and traders to manage such price risks varies markedly depending on their expertise, size, and scale. There are 12 companies currently operating in Mozambique, ranging from large international operators (Plexus, Dunavant, OLAM, CNA) to local family-owned conglomerates. The international operators have the capacity to hedge using financial instruments through their headquarters' teams (e.g., OLAM reported hedging 80 percent of their physical cotton volumes), while smaller companies are restricted to physical hedging strategies (forward sales agreements). These smaller traders currently have less understanding of financial price-risk management strategies.

Although the smaller traders were eager to learn more about financial price risk management strategies, this is complicated by the significant divergence in pricing between the Cotlook A index, which Mozambique traders sell at, and the ICE cotton derivatives, where any financial hedging would need to take place. Although it is possible for ginners to fix the physicals in the Cotlook A index and hedge using derivatives traded on ICE, this is a relatively complex operation and one likely to be beyond the capacity of smaller traders. As such, physical risk management (fixed-price forward contracts) remains the most appropriate means for managing the price risk exposure of such traders.

Figure 9. Cotton Price 2005–10



Source: World Bank. 2010, Commodities Markets Review, DECPG.

Foreign Exchange-Rate Risk

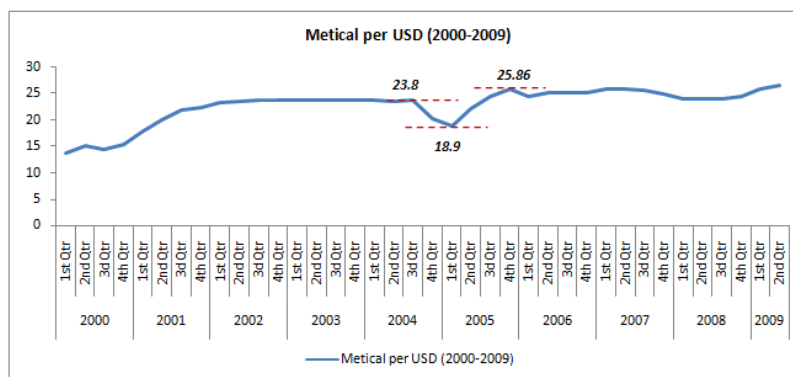
Intensity: Critical
Frequency: Occasional

Despite the recent stability of the Metical (MZM) and Mozambique's relatively stable foreign reserve position, cotton ginners highlighted their concerns over the exchange-rate risks, also known as currency risk. In particular, they mentioned the 2004 cotton season, which saw a rapid appreciation of the local currency from around MT23 per U.S. dollar at harvest time in 2004 to just MT18 per U.S. dollar by the end of the year (figure 10). During 2004–05, the metical experienced major volatility, first appreciating by 26 percent and then depreciating by 37 percent in less than a year. The result was that ginners suffered significant losses; their export proceeds converted in local currency had been slashed by 20 percent, resulting in several ginners going out of business.

Currency risk, or the fear of adverse currency movements occurring, affects overall lint revenues and ginners' ability to plan ahead. During a currency appreciation, ginners obtain fewer dollars for volume sold while costs are fixed in local currency; whereas it benefits ginners during currency depreciation periods. The exchange rate also affects the minimum price paid to farmers, as per the formula adopted by stakeholders.

When operating (cash) inflows and (contractual) outflows from liabilities (payments to farmers) are affected by exchange-rate changes, the general principle of prudent exchange risk management would be that any effect on cash inflows and outflows should cancel out as much as possible. This can be achieved by maneuvering assets, liabilities, or both. However, managing currency risks of the local currency in this way can be limited for domestic ginners, given liquidity constraints. Multinational firms manage their exchange rate risks through their headquarter offices, whereas hedging techniques for currency risks to *lock* the value of a particular currency has not been a tool that smaller ginners have found available and it might be possibly costly to obtain. Since 2006, the exchange rate—which is a managed float—has remained fairly stable, responding to supply and demand changes within a narrow band (World Bank, 2008). Agricultural input suppliers (composed by virtually one single large firm) and banks have transferred this risk to ginners by arranging transactions either in U.S. dollars or with clauses of payment in local currency valued at the foreign exchange rate of the corresponding payment date.

Figure 10. Exchange-Rate Fluctuations 2000–09



Source: Central Bank of Mozambique, 2009. (www.bancomoc.mz).

Credit Default

Intensity: Moderate (farmers credit default) to considerable (ginneries credit default)

Frequency: Highly probable (farmers credit default) to probable (ginneries credit default)

Credit default risks in the cotton industry manifest themselves in two ways. First, credit default risk by farmers that do not deliver cotton seed to the ginneries because of side selling or crop substitution leaves ginneries unable to get repayment for the inputs they provided to farmers at the beginning of the season. Ginneries can only exert limited control to minimize losses related to this situation, due to the difficulties of managing a very large number of farmers in an extended territory, apart from improving the services to farmers to keep them firmly interested in cotton.

While the dynamics of cotton production has been repeatedly documented in various reports on Mozambique's competitiveness and cotton supply chain analysis (World Bank 2005a, 2005b, 2006, 2007, and 2008), the recent substantial reduction in tonnage (to 60,000 MT for current agricultural season alone) is bringing the discussion on productivity, competitiveness, and the overall concession system back to the table. The cited reports agree, to a large extent, that most ginneries typically do not provide fertilizer to minimize risks, technical assistance provided is normally poor, outturn ratio (input-output) is not clear by farmers, and prices paid to cotton farmers are the lowest in the region. Producers, in turn, break contracts and, whenever they can (particularly in border zones), sell their production to other buyers if prices are more attractive at harvest time; and more and more often they deviate chemicals provided by cotton concessionaries to other crops.

However, given the poor penetration of the financial system to small holders in Mozambique (only 2.6 percent according to TIA (2008)), the cotton concessionary system has been the most successful instrument in extending credit to farmers, providing them with inputs and guaranteeing the credit payments by discounting the credit amount from the payments ginneries made to farmers at the end of the season. The average area cultivated by cotton producers is around 1 ha, and they receive at least U.S. \$20 per producer to cover five sprays per season.

The second credit default risk is by ginneries not being able to meet their obligations with banks or input suppliers at the end of the season. It has been disclosed by banks that the 2008–09 season has hit the industry so badly that some banks and input suppliers have not paid back their credit loans timely, some debtors are even over 12 months in arrears and others are restructuring their credit. Instability of ginneries is not new; the cotton industry in Mozambique has been characterized by a fluid entry and exit of cotton ginning firms. Most of the 10 ginneries running today did not exist 10 years ago. The cotton sector was able to survive—even thrive—in the past, despite alleged systemic rigidities from the concession system through its natural advantages of favorable coastal location, virtually free access to land, and cheap labor costs. Currently, some foreign concessionaries use cotton as an entry point to gain access to land to grow and sell other crops and products, illustrating the recent changes that are taking place in rural Mozambique.

The consequences of a monopsony (farmers being forced to sell to a single buyer) and the downward price pressure facing ginners (translating into low prices paid to farmers) translate themselves at times in the sale of cotton to neighboring countries such as Zimbabwe. In border regions, farmers often allocate part of the harvested cotton to neighboring countries when international cotton prices are more favorable rather than selling at a minimum lower price domestically. According to one estimate by a financial institution in Quelimane, transnational cotton sales are believed to affect 7–8 percent of total production.⁸ The potential losses of this risk has been classified as “moderate,” given that it only occurs in border areas and mainly affects Dunavant in the Zambezia region and EAVZ in the Manica and Tete provinces. The frequency of this risk is “probable” for the border areas, as transnational sales happen as often as market conditions are more favorable across the border.

The risk borne by the IAM (related to transaction tax default or payment delays by ginners) directly affects the IAM in its ability to raise the necessary funding for continuing its operations is classified as

⁸ Interview with GAPI (Quelimane, December 9, 2009).

“considerable” in the sense that potential underfunding of the IAM can affect the whole industry, given the key regulatory functions the IAM plays in current concessionary system.

Evidently, most market-related risks are concentrated on ginneries, mainly due to the key (and multifaceted) role they play along the value chain as input buyers; providers of inputs, technical assistance processors; and export traders. Larger multinational firms have the capacity to adapt and manage most of the risks; it is becoming clearer that they are positioning themselves not just as cotton buyers but also as being able to diversify their operations using the concessionary system as a vehicle. The situation is less clear for smaller local ginneries.

Other Risks

Crop Substitution

Intensity: Critical

Frequency: Highly probable

Given the concentration of activities on ginneries, the major risk facing the industry today is related to guaranteeing the supply of seed cotton from farmers as the central operators of the cotton supply chain. Supply availability is a leading risk factor to ginners, with production falling from 122,000 tons in 2005–06 to estimated 60,000 in 2008–09, the realization of this risk is worsening the underutilized capacity of ginneries to levels that is causing serious concerns among stakeholders on the structure and operational regulations of the concessionary system. The IAM and ginneries are already discussing options for restructuring the concessionary contracts—allegedly towards a more liberalized system. The IAM’s (2008) “Reflection on Cotton Promotion Models” foresees reforming the current concession system towards liberalization within the next seven years.

Interviews with provincial delegates from the Ministry of Agriculture in the cotton regions suggest that an increasing number of farmers are diversifying to other crops but are using the chemicals provided by cotton concessionaries, resulting in less spray applications for cotton. This scenario is apparently becoming so widespread that ginneries point it out as the main cause in the drastic drop in production for 2008–09 despite the recent recovery in international cotton prices. Securing input supply of seed cotton from farmers is by far the highest risk facing the cotton industry today. The potential collapse of some ginneries may negatively affect the production of sesame as well as some food crops, since cotton production plays a central role for most cotton farmers as the sole access channel to the market for input supplies and credit.

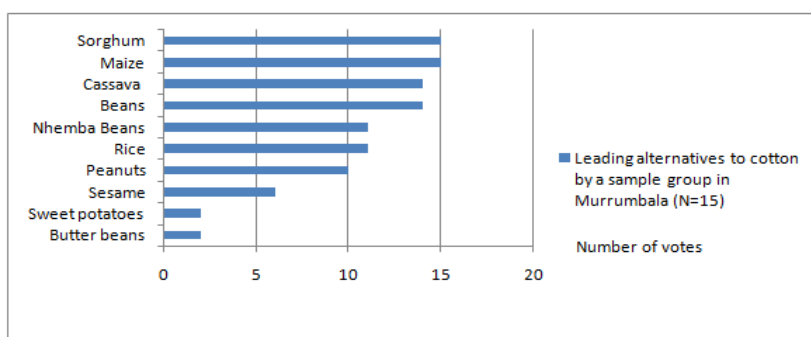
It is perceived that crop substitution by farmers has been facilitated by the long trend of low prices of cotton compared to other cash crops such as sesame (there was no comparative study available on the profitability of both crops to compare), national infrastructure development, and greater access to information in rural areas. Low productivity, market interventions, and fluctuations in yields are not new phenomena in the history of Mozambique’s cotton sector. What is different this time is that greater market access, facilitated by new roads and the penetration of wireless devices, and more rural market dynamism in general are exposing systemic vulnerabilities of the sector, making it easier for farmers to move toward other crops.⁹ In other words, the low input/low output factor that has historically been predominant is no longer a problem that can be ignored, as the stakes being raised for the survival of the cotton industry.

The alternative crops identified by interviews with various farmers in the Murrumbala region in figure 4, for example, do not really solve the problem of securing a cash crop with a guaranteed price and market for most rural families. Increasing attractiveness of alternative crops combined with easy availability of credit for pesticides under cotton concession rules are encouraging farmers to shift part of their inputs toward other

⁹ Mobile services penetration and number of subscribers in Mozambique have increased dramatically over the last 10 years, from 0.1 percent to 20 percent, reaching a total of 4.2 million subscribers in 2008. *Source:* Mozambique Technical Annex, World Bank Report No. T7719-MZ, 2009, p. 1

crops. Several cotton stakeholders—including a rural financial institution and a major ginner—pointed to the widespread practice of diverting pesticides for other crops, spraying less than the recommended amounts (e.g. spraying three times instead of the recommended five), directly affecting the overall yield.¹⁰

Figure 4. Farmers Identify Crop Alternatives



As noted elsewhere in the report, improved cell phone access and rural infrastructure in Mozambique is making it easier for farmers to identify other crops, facilitating the side selling of cotton and transborder transactions, despite the lack of agricultural produce price information (according to the 2007 TIA, only 35 percent of smallholder farmers received information on prices, sharply down from 47 percent in the 2003 TIA).¹¹

Finally, there is currently a lack of market information to help farmers to make informed choices about cotton versus alternative crops. For example, while sesame allegedly provides more attractive earnings per pound, there is very little reliable data on real earnings per hectare, or under what conditions farmers would benefit from cultivating one crop over another. A reliable system of gathering, synthesizing, and disseminating such information to farmers, so that they could make informed choices, would not only help build trust, but in many cases also help farmers realize the importance of cotton as a reliable and secure cash crop.

IV. VULNERABILITY TO RISKS

Based on the risk assessment and capacity to manage risks described in previous chapters, this section offers an additional step to identify the key weaknesses for each identified risk and group them in different levels of vulnerability—high, medium, and low. For the purpose of this exercise, we can define vulnerability as a function of the expected losses from an adverse event and the capacity to respond to this risk. For instance, vulnerability is high when both expected losses are high and the capacity to manage the risk is low. Vulnerability is low when the expected losses are low and the capacity to manage the risk is high. This last step in the analysis of risks not only allows a more comprehensive assessment of the level of risk, but also helps to identify priorities to improve current risk-management approaches. At this stage, the analysis seeks to pinpoint clear gaps in the prevailing approach(es) to risk management and/or circumstances where prevailing practices are unlikely to be sufficient given the potential severity of loss.

Even though at this stage the analysis is more qualitative than quantitative, the results shown here are useful for contrasting these findings with current risk-management practices by stakeholders in the supply chain. Based on the information that was collected during the December 2009 mission and background information, the current capacity for managing pertinent risks and the effectiveness of current practices have been reviewed and rated utilizing the 1–5 scale outlined in table 5 below. A rating of 5 means high existing capacity

¹⁰ Interview with Millennium BIM (Maputo, December 1, 2009), CNA (Beira, December 3, 2009), and the Provincial Department in Beira (December 3, 2009). Adequate spray applications could improve cotton yield rates by 100 percent (*Source*: Value-Chain Analysis for Strategic Sectors in Mozambique, Cotton Section, World Bank 2005, p. 29).

¹¹ 2007 TIA.

to manage risks, and scale 1 means low capacity to manage risks. Table 5 also ranks the risks in terms of expected losses, from high to low.

Table 5. Vulnerability to Risks on Expected Loss and Capacity to Manage Risk

	(-) -----Capacity to Manage Risks ----- (+)				
Expected losses	1	2	3	4	5
High	Exchange rate risk	Crop substitution Cotton international price volatility	Pests and disease		
Medium	Weather	Farmers credit default (chemicals)	Ginners credit default (banks) Transaction Tax default to IAM	Loss of soil fertility	Fire
Low				Carrying large quantities of cash Sample testing delays Unreliable transportation	Sudden change of orders for chemicals Port delays

The resulting matrix provides us with five sets of vulnerabilities to the identified risks in terms of their priority, from the highest risk vulnerability in the boxes with the darkest shade marked as T1 (tier 1, upper left corner), toward the risks ranked with lowest vulnerability shown in the boxes with the clear shades toward the right bottom side of the table marked as T5 (tier 5). In between there are three additional intermediate vulnerability levels in light shades. Though risks for tier 5 were not explicitly addressed in the assessment of each risk in this document, it does not mean they do not have to be addressed; they are also ranked here as they would need to be taken into account when designing an integrated risk-management framework. The importance of this matrix is that, through a process of prioritization, it is possible to identify those risks in tier 1 and tier 2 that are mainly responsible for causing volatility of earnings for the various stakeholders. Managing these risks will, to a large extent, reduce risks for the cotton industry.

Risk-Management Framework

Though it is beyond the scope of this Rapid Risk Assessment exercise to develop a comprehensive framework with detailed measures on how to manage the identified risks, an **illustration on how this next step can be approached** is presented in table 6.

In order to think in terms of a comprehensive risk-management framework, it is useful to classify the measures or tools for risk management in terms of three main groups:

Risk Prevention/Reduction (ex ante)—actions taken to eliminate or reduce events from occurring (e.g., water draining infrastructure, crop diversification, extension, etc.).

Risk Transfer (ex ante)—actions that will reduce the exposure of such risks. Financial transfer mechanisms will trigger compensation or reduce the losses in the case of a risk-generated loss (e.g., purchasing insurance, reinsurance, financial hedging tools, etc.).

Risk Coping (ex post)—actions that will mitigate the losses caused by a risk event (e.g., government assistance to farmers, debt restructuring, etc.).

Table 6. Illustration of Measures for a Risk-Management Framework

Identified Risks	Proposed Risk Prevention (ex ante)	Proposed Risk Transfer Tools (ex ante)	Proposed Risk Coping (ex post)
- Crop substitution (losing farmers in dynamic areas, side selling, transborder selling, crop substitution, farmers' credit default, collapse of ginneries, etc.)	- Revise concessionary system and incentives for different participants along the value chain		- Concessionaries diversify to other crops - Improve trust relationship between ginners and farmers (e.g., paying farmers and delivering inputs on time)
- International cotton price volatility		- Train smaller local ginners on price risk management tools, including physical risk management and hedging	
- Exchange-rate risk	- Analysis of anticipation of depreciation possibilities	- Consider possibility of currency risk management for ginneries whenever locking exchange rate tools exist and are cost effective	
- Loss of soil fertility	- Upgrade extension assistance targeted to: (i) Increase access to fertilizers (greater competition among input suppliers) (ii) Promote crop rotation (iii) Organic fertilizer		
- Pests	- Scale up IPM initiatives - Increase access to pesticide pumps - Enforce technical norms and regulations		- Postinfestation measures
- Weather risks	- Weather risk mapping for cotton sector by agrometeorological zone	- Design specific weather zoning maps for cotton areas using available high spatial resolution weather	- Efficient and transparent distribution mechanism for public sector assistance to

	<ul style="list-style-type: none"> - Designing a weather risk management strategy - Drainage plan for agriculture at watershed level - Efficient ex-ante mechanism in place for helping farmers after disasters - Specialized research and extension services to mitigate weather risks at farm level could go a long way - Strengthening IAM institutional capacity at CIMSAN for (i) drought resistant seed varieties, (ii) services for drought early warning systems, (iii) detailed weather cotton zoning, (iv) sowing timing and conditions, and (v) weather risk analysis for insurance purposes 	<p>data from satellites</p> <ul style="list-style-type: none"> - Quantify weather risks by identified zones, including value at risk (VAR) - Draw hazard curves for cotton zones identifying return periods - Train insurance industry in the design of weather insurance products - Consider piloting for Risk transfer insurance at aggregate level (ginneries as policy holders) with triggers for catastrophic events (severe droughts in specific zone drought related zones) 	farmers
- Ginners' credit default (Banks)	- Increase overall sector competitiveness (e.g. high yield, high price crop)		

The government Strategic Action Plan for Cotton Development (2008), recognizing the importance of acting upon the constraints faced by the cotton industry, has already incorporated a number of measures related to solving bottlenecks, promoting efficiency, and introducing risk-management tools. Among those measures, the following can be mentioned: (a) strengthen cotton Research and Development; (b) create a seed multiplication system; (c) support cotton companies; (d) support and strengthen farmers' associations; (e) modernize the fiber classing system; and (f) reform the cotton promotion system.

Next Steps

The World Bank, financed by the AAACP program, can further assist Mozambique in some specialized areas identified in this report. Planning for technical assistance in these priority areas will be done once this Risk Assessment is discussed among cotton supply chain stakeholders and the World Bank.

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