Platform for Agricultural Risk Management

Madagascar

Agricultural risk assessment in the Madagascar maize and groundnut value chains

Main report

March-September 2023

A Nitidæ report for the Platform for Agricultural Risk Management (PARM)

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Objectives and methodology

This study, *Agricultural risk assessment in the Madagascar maize and groundnut value chains,* was commissioned by the Platform for Agricultural Risk Management (PARM) for the Malagasy Government through the Ministry of Agriculture and Livestock (MINAE) and conducted by a team from NITADAE. It is the first phase of the Madagascar PARM process, whose roadmap was defined by PARM and MINAE through an aide-memoire signed in April 2022.

This agricultural risk assessment in Madagascar is based on a holistic methodology with a value chain approach and focuses on maize and groundnuts as both food and nutrition commodities and agricultural exports. These two value chains were selected for inclusion in the overall national agricultural policy framework, as they are among the six priority value chains identified by the Government in the Food and Agriculture Delivery Compact, validated in June 2022.[1] They were chosen through selection process based on the dynamic of value chains and their risk exposure. The maize value chain is a food and commercial value chain that rapidly grew throughout the country in the 1980s due to the combined effect of human and livestock consumption and industrial use (notably in the brewing sector). The groundnut value chain also witnessed significant growth for a decade, propelled by the export demand from Asia. The two value chains are present throughout the country but are especially important in the south and west – regions historically the most vulnerable to climate risks, locust invasions and food price volatility.

The purpose of this study is to identify and prioritize the main risks in the two value chains, using quantitative and qualitative techniques to identify efficient tools for managing these risks. It was prepared by the NITADAE team under the direction and supervision of PARM, using the platform's value chain methodology, a holistic approach that addresses the various agricultural risks in an agricultural value chain. This approach allows for cross-referencing of the available qualitative and quantitative data to estimate the frequency and consequences of agricultural risks. Unlike the situation in other countries (Burkina Faso, Niger, Senegal, etc.), the available data for estimating the probability of risks materializing and their economic impact are deficient and differ at both the risk and value chain (maize and groundnut) level. In contrast to other agricultural risk assessments that PARM has launched in other countries, this assessment of agricultural risks in Madagascar is more complicated, as the value chain approach involves not only different actors but links between interdependent actors with varied interests. The study also contains a gender analysis that takes sex-specific differences into account to better understand the impact of a particular risk and the capacity to respond to such gender-related risks.

Despite the data availability constraints, the risks in the groundnut and maize value chains (cyclones, droughts, floods, plagues, crop diseases, access to credit and inputs, security risks) are analysed using national data, data gathering in the field (national organizations, the private sector, producers, etc.). These data are then used to rank the risks and estimate the probability of their materializing in each value chain so that tailored tools for agricultural risk management can be proposed.

The preliminary results of the study have benefitted from the local knowledge and expertise shared in a workshop held in Antananarivo from 4 to 5 May 2023, where the risk management tools were presented, discussed and validated. The tools identified were divided into two main

[1] www.fao.org/faostat/.

categories: (i) cross-cutting activities to support agricultural risk management in the two value chains; and (ii) activities specific to each of the two value chains (maize and groundnut).

National context

With 70.3 per cent of the land devoted to farming (FAO 2020[2]) and 64 per cent of the jobs concentrated there (ILO 2019[3]), agriculture plays an outsize role in Malagasy society and the economy, even though it accounts for just 24.7 per cent of the gross domestic product (World Bank 2024[4]).

The country's bioclimatic diversity, the result of its geographic location and varied topography and elevation, is especially rich, with significant rainfall and temperature variations. This territorial heterogeneity has fostered to the development of highly diverse agrarian systems throughout the country, with crops suited to humid tropical climates, arid tropical climates, high-altitude tropical climates, and to a lesser extent, temperate climates.

Madagascar's specific characteristics also guarantee its global leadership in certain niche crops with high value added, such as vanilla, cloves, and even ylang and lychee.

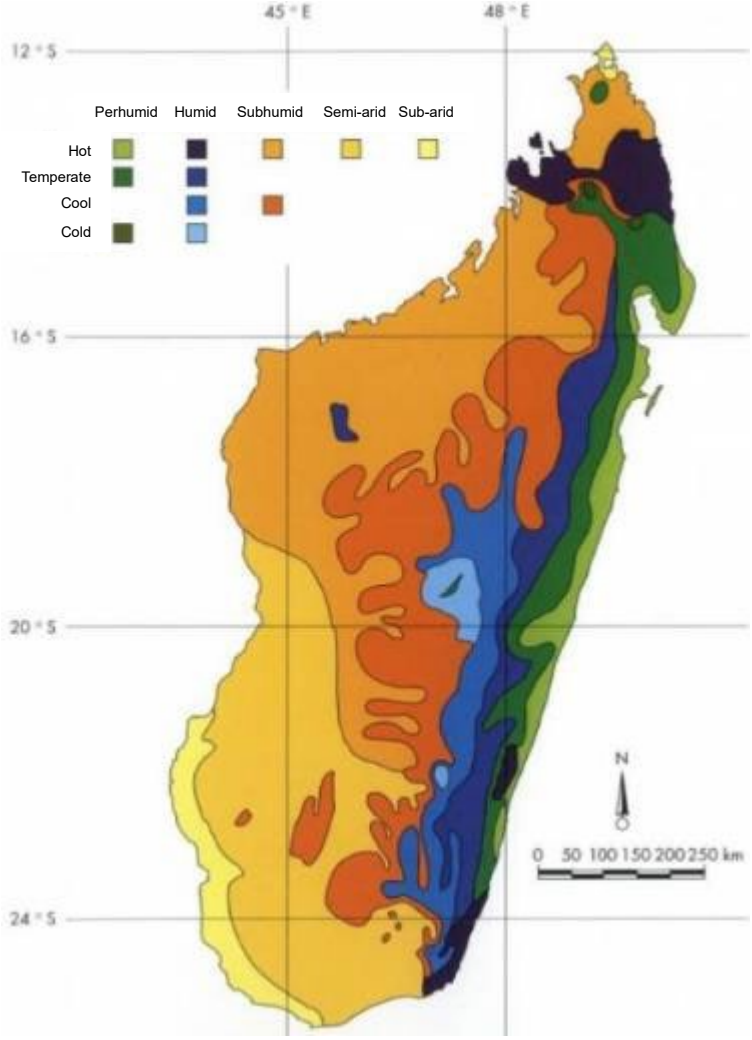


Figure 1: Bioclimatic zones of Madagascar (Source: S. Chenteau. Atlas of plague in Madagascar, IRD 2006, adapted by J. KOECHIN et al. 1997)

Essential oil exports from its highly diverse crops and non-timber forest products (NTFP) also constitute the third largest agricultural export sector after vanilla and clove and before seafood products and cacao.

Malagasy agriculture also has an important livestock sector in which more than half the farms participate, enabling the country to import very few products of animal origin (with the exception of dairy products). However, even in the dairy sector, local production (estimated at some 50,000 and 100,000 tonnes) is much higher than imports, which stood at around 15,000 tonnes in 2022. The country's largest trade deficit in terms of food is in the edible oil sector. Local production of vegetable oil is, in fact, fairly undeveloped, obliging the country to

[2] www.fao.org/faostat/
[3] https://www.ilo.org/global/statistics-and-databases/lanf—en/index.htm
[4] https://data.worldbank.org/

import around 175,000 tonnes of oil (mainly palm and soybean oil) annually to cover its shortfall (domestic consumption of vegetable oil is estimated at 225,000 to 250,000 tonnes).

Thanks to the heterogeneity of Madagascar's territory and its relative self-sufficiency in amylaceous (starchy) crops (grains and tubers), which cover more than 80 per cent of the market, the severe food insecurity rate calculated by FAO in recent years has been clearly lower than that of most of the neighbouring countries and close to that of South Africa.

Note, however, that the prevalence of food insecurity has been growing since 2018 and significantly since 2020[5] due to the inflationary effects of the COVID-19 crisis, a severe drought that hit the south of the country in 2021 and 2022 and particularly violent cyclone events. Furthermore, while for most of the population, access to the minimum daily caloric intake is guaranteed, the malnutrition rate is relatively high, especially among children, pregnant women and nursing mothers. In fact, the available caloric intake and its diversity are either insufficient, especially in the south and certain mountainous areas in the east, or it comes mainly from cassava.

Figure 2: Prevalence of severe food insecurity in Madagascar and some neighboring countries

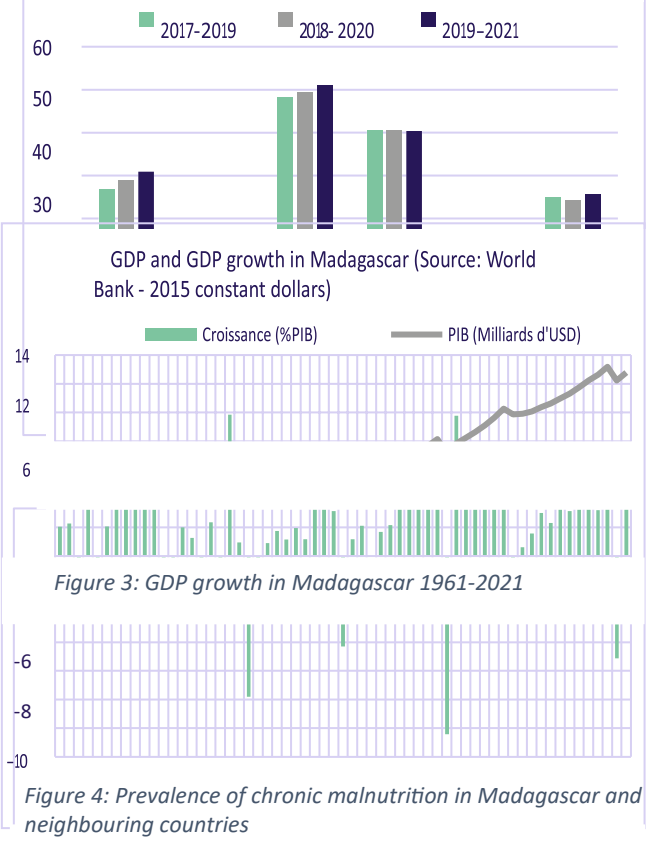
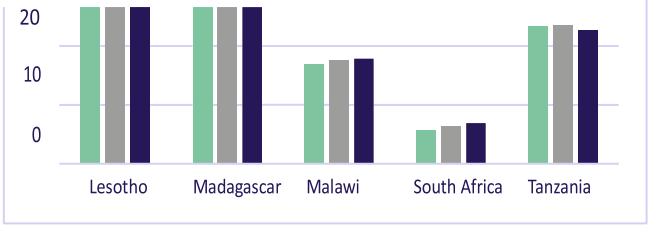


Figure 3: GDP growth in Madagascar 1961-2021

Figure 4: Prevalence of chronic malnutrition in Madagascar and neighbouring countries



Access to vegetable and animal protein by the country's poorest households is relatively limited, since only half the country's farms have livestock, and oleo-proteinaceous crops (groundnut, coconut, oil palm) and to a lesser extent, proteinaceous crops (green beans, peas, soybeans) are not sufficiently cultivated and part of the crop is reserved for export.[6] Paradoxically, therefore, Madagascar is a country that benefits from a rich diversified crop, livestock and fishery sector that can meet the bulk of domestic demand, but due to vast social inequalities between and within regions, much of the population has access to a diet that is inadequate in terms of quantity, quality and diversity.

In its country overview,[7] the World Bank indicates that after the COVID-19 crisis, 81 per cent of the Malagasy population was living below the international poverty line (US$2.15/person/day). Madagascar also numbers among the countries with the greatest inequalities in both the world and Africa (GINI Index of 49.2, according to the World Economics website, last measured in 2019[8]). The outlook is even bleaker, as economic

[5] https://openknowledge.worldbank.org/entities/publication/1936ebd0-e15a-5833-9b56-ed5eee82c4c8
[6] Plan National d'Action pour la Nutrition-III 2017-2021, Republic of Madagascar, published by UNICEF
[7] https://www.banquemondiale.org/fr/country/madagascar/overview
[8] https://www.worldeconomics.com/Inequality/Gini-Coefficient/Madagascar.aspx

growth remains low and erratic, and Madagascar is already one of the African countries most impacted by climate change.[9] Within this context, it is especially important to approach Malagasy agriculture through the lens of agricultural risk.

Analysis of risks in the value chain

Maize value chain

A total of 18 risks were identified in Madagascar's maize value chain. The diagram to the right lists these risks and the actors directly impacted.

Weather and phytosanitary risks primarily impact producers, causing drops in production, and processors, whose principal raw material is maize and who are particularly vulnerable to variations in production.

Market risks impact virtually all actors but in different ways.

While drops in prices largely penalize producers, and to a lesser extent, input suppliers, by reducing the purchasing power of producers and the collectors and processors who maintain the stocks and see their value diminish, price increases have an even greater impact downstream in the value chain – that is, on processors and distributors, whose need for working capital and higher resale prices increases and who potentially face a drop in their sales due to the higher costs for the end consumer (households and stock raisers).

Logistical risks primarily affect input suppliers, collectors and processors, as they are the ones responsible for the transport of funds, inputs and maize across the country.

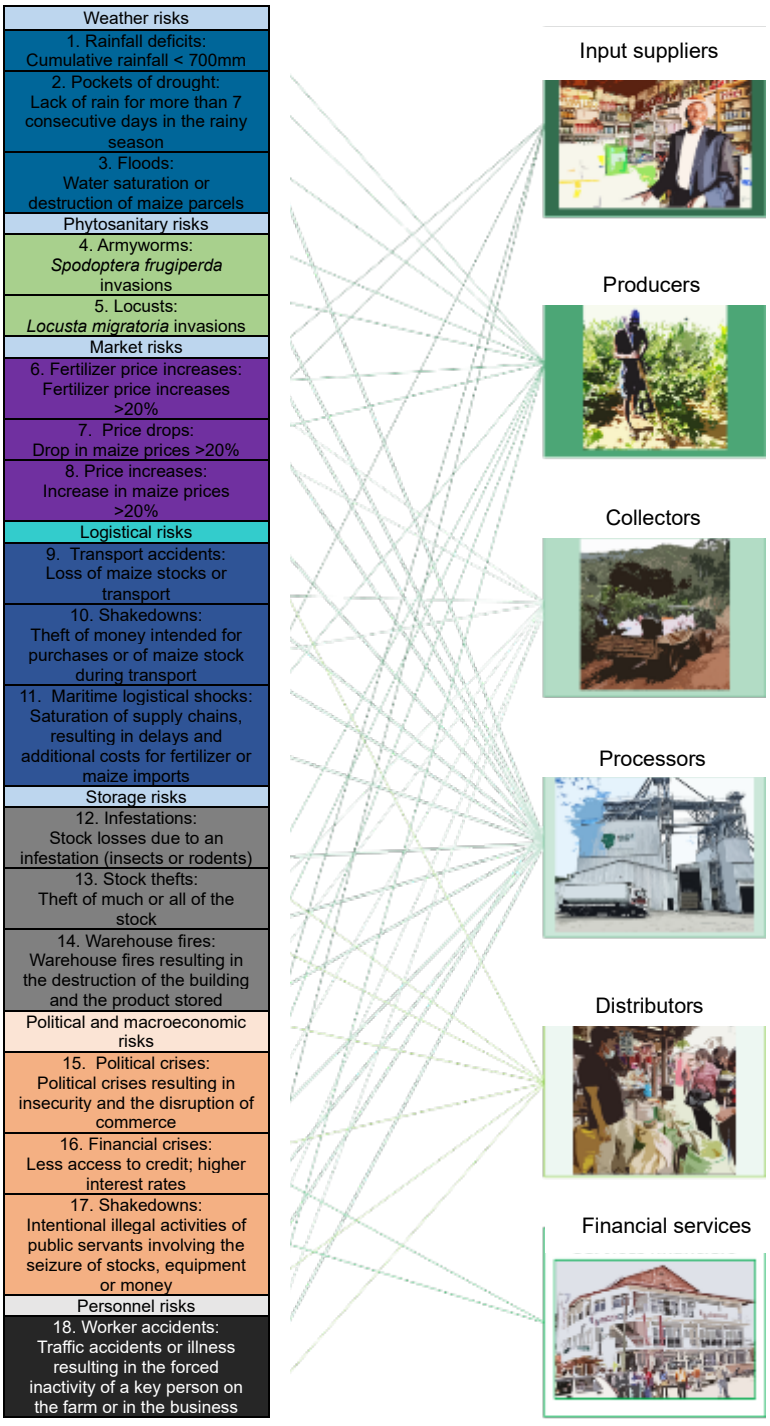


Figure 5: List of risks identified and their direct impact on actors in the maize value chain

[9] https://handicap-international.fr/fr/actualites/madagascar---l-impact-humanitaire-du-changement-climatique

Storage risks primarily affect the actors who store products for lengthy periods – that is, merchants and processors, and to a lesser extent, producers and distributors. Political and macroeconomic risks potentially affect all actors but have a greater impact on input suppliers and actors downstream in the value chain, processors, distributors and financial services, whose activities are heavily impacted by tensions in urban and peri-urban areas and who are more exposed to the discretionary action of government agents.

Finally, personnel risks primarily affect small economic units (producers, aggregators, small processors), which are highly sensitive their workers' ability to work, and large processors, when a highly qualified technician or manager or one with a great deal of responsibility is involved. The PARM methodology was then used to assess the risks identified in terms of their frequency (probability score), their average intensity for each of the affected actors (average impact score) and extreme impact, when their intensity reaches the maximum level (maximum impact score).

The risks of the entire value chain were then ranked, calculating the actors' average risk score for each of the risks identified. From this ranking, it was found that the main risks affecting operations in the maize value chain are: (i) armyworms; (ii) worker accidents; and (iii) all weather-related risks. The actors in the value chain with the greatest risk exposure are: (i) processors; (ii) producers in the south and west of the country; and (iii) producers in the centre, east and north of the country.

Category	Risk	Input suppliers	Producers (South and West)	Producers (Centre East North)	Aggregators	Processors	Distributors	Financial services	Value chain
Phyto	Armyworms		7.75	7.75	2.75	10.25	2.5	2.5	**4.79**
Personnel	Worker accidents	3.75	5.75	5.75	5.75	5.75	4.25	1.75	**4.68**
Weather	Interrupted rains		7.75	7.75	2.75	5.25	2.5	2.5	**4.07**
Weather	Rainfall Deficits		8	2.5	2.75	7.75	2.5	2.5	**3.71**
Market	Price drops	2.75	5.25	5.25	2.5	2.75	2.75	2.5	**3.39**
Weather	Floods		2.75	7.75	2.75	5.25	2.5	2.5	**3.36**
Macro	Financial crises	3.75	2	2	2	5.75	2	5.75	**3.32**
Stock	Warehouse fires	4.25	3.5	3.5	3.5	3.5	3.5	1	**3.25**
Stock	Stock thefts	3.25	3.5	3.5	3.5	3.5	3.5	1	**3.11**
Phyto	Locusts		5.25	3	2.75	5.25	2.5	2.5	**3.04**
Market	Fertilizer price increases	5.5	2	3.75	1.75	3.75	1.75	1.75	**2.89**
Market	Price increases				2.5	10.25	3	2.5	**2.61**
Logistics	Maritime logistical shocks	5.5	2	2	2	2	2	1.75	**2.46**
Macro	Political crises	3.25	2.25	2.25	2.25	2.25	2.5	2.25	**2.43**
Macro	Shakedowns	2.75			2.75	5.75	2.75	2.75	**2.39**
Logistics	Transport accidents	3.75			5.5	3.75	1.75	1.75	**2.36**
Logistics	Hold-ups during transport	3.75			5.5	3.75	1.75	1.75	**2.36**
Stock	Stock infestations		3.75	3.75	2	2	2	1.75	**2.18**
Average per actor		**3.84**	**4.39**	**4.32**	**3.07**	**4.92**	**2.56**	**2.26**	

Groundnut value chain

Right now, input suppliers have virtually no role in the groundnut value chain, because none of them supply groundnut seed and fertilizer use is non-existent, as is the sale of inoculum.

The value chain therefore begins directly with producers. A total of 17 risks were identified in this value chain.

With regard to weather, groundnuts are less sensitive to rainfall deficits but highly so to excessive water, particularly during seed formation and maturation. They are rarely attacked by armyworms but in 2023, were hit hard by leaf miner larvae, whose particular species we were unable to identify, causing losses of up to 80 per cent on parcels in the Atsimo-Andrefana region (and appeared to impact other regions as well).

In comparison with the maize value chain, the groundnut value chain is subject to potentially greater price volatility because of its direct link to the international market. Since about half of domestic production is exported, prices in the domestic market are linked to international prices, as well as the exchange rate and costs and disruptions in maritime shipping.

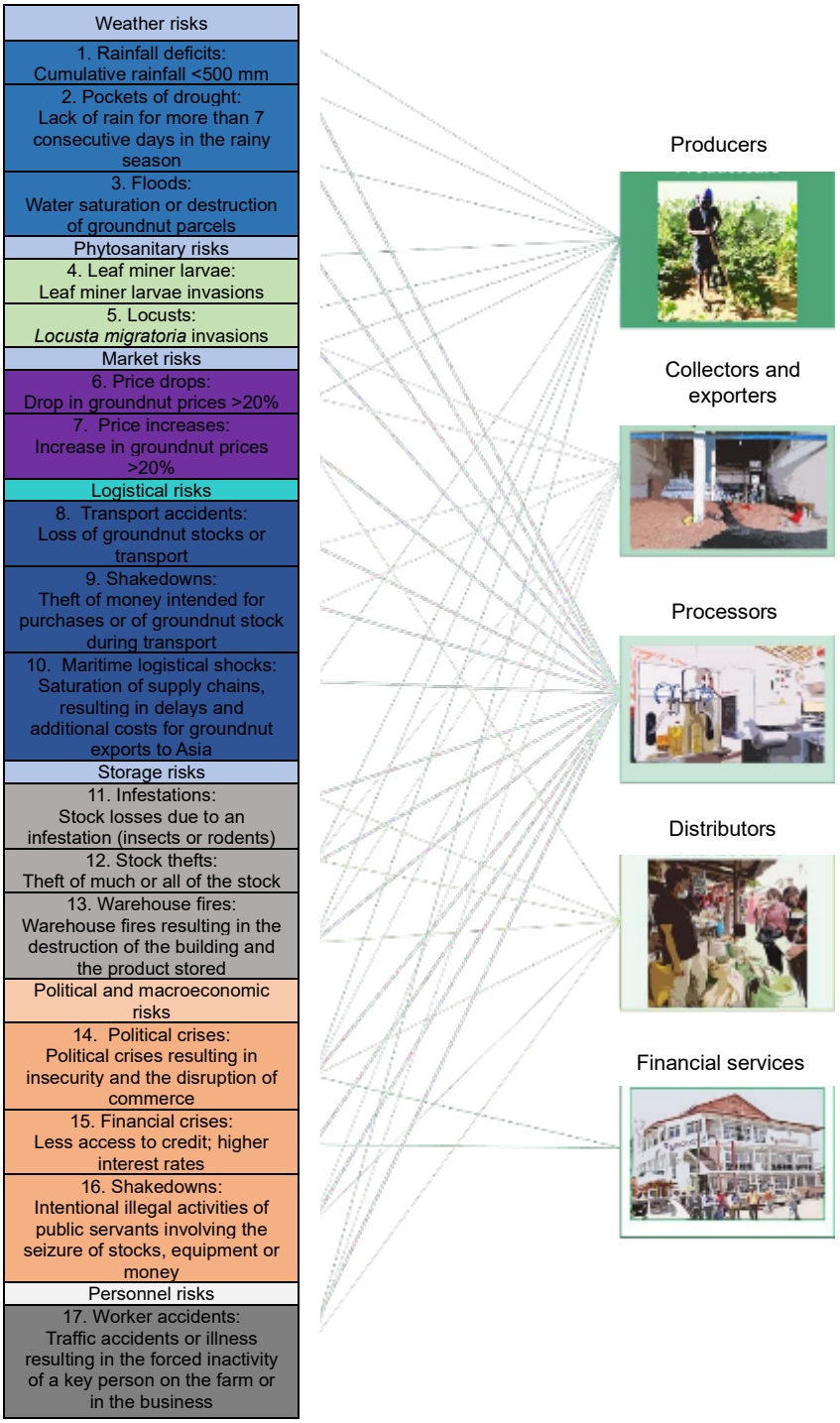


Figure 6: List of risks and their direct link with actors in the groundnut value chain

The other risks (storage, logistics, personnel, political and macroeconomic) are comparable to those in the maize value chain. As with maize, the risks were analysed in terms of their frequency, average intensity and extreme intensity.

Across the entire value chain, the risks that affect the most actors and have the most negative impact are those that impact production (phytosanitary pressure, interrupted rains and floods in particular). These are followed by market risks, which are far greater than in the maize value chain due exogenous volatility factors linked with the international market,

and personnel risks, because many actors in the groundnut value chain are one-person ventures or microenterprises that are highly dependent on their creator.

Processors, the majority of whom are women and artisanal, are the actors with the greatest risk exposure, because they are heavily impacted by production and price variations, as well as security risks (shakedowns and theft, in particular). They are followed by producers, but in contrast to the maize value chain, it is those in the most humid areas who have the greatest risk exposure because of the groundnut's sensitivity to excessive rainfall. Aggregators and exporters also have greater risk exposure than merchants in the maize value chain because of the greater unpredictability of price movements and logistical risks in the export chain.

Category	Risk	Producers (South and West)	Producers (Centre, East and North)	Aggregators and exporters	Processors	Distributors	Financial services	Value chain
Phyto	Leaf miner larvae	7.75	7.75	2.75	10.25	2.5	2.5	**5.58**
Personnel	Worker accidents	5.75	5.75	5.75	5.75	4.25	1.75	**4.83**
Weather	Interrupted rains	7.75	7.75	2.75	5.25	2.5	2.5	**4.75**
Weather	Floods	2.75	10.25	2.75	7.75	2.5	2.5	**4.75**
Market	Price drops	5.5	5.5	2.75	2.75	2.75	2.5	**3.63**
Phyto	Locusts	5.25	3	2.75	5.25	2.5	2.5	**3.54**
Macro	Financial crises	2	2	2	5.5	2	5.75	**3.21**
Market	Price increases	0	0	2.75	10.25	3	2.5	**3.08**
Storage	Stock thefts	3.5	3.5	3.5	3.5	3.5	1	**3.08**
Storage	Warehouse fires	3.5	3.5	3.5	3.5	3.5	1	**3.08**
Logistical	Maritime logistical shocks	3.75	3.75	3.75	1.75	1.75	1.75	**2.75**
Storage	Stock infestations	3.75	3.75	2	2	2	1.75	**2.54**
Macro	Political crises	2.25	2.25	2.25	2.25	2.5	2.25	**2.29**
Macro	Shakedowns	0	0	2.75	5.25	2.75	2.75	**2.25**
Logistical	Transport accidents	0	0	5.5	3.75	1.75	1.75	**2.13**
Logistical	Hold-ups during transport	0	0	5.5	3.75	1.75	1.75	**2.13**
Weather	Rainfall deficits	2.25	1.75	2	2	1.75	1.75	**1.92**
Average per actor		**3.28**	**3.56**	**3.24**	**4.74**	**2.54**	**2.25**	

Analysis of vulnerability to risks

Maize value chain

Under the PARM methodology, the calculation of vulnerability is based on the differential between the risk exposure scores (frequency, average intensity and extreme intensity) and the risk management capacity scores.

When several risk management options can be adopted for the same risk, the capacity to adapt to these specific risks is the average of the score of each option that enables their management. The tables below present the following for each actor:

1) The previously calculated risk exposure scores.

2) The risk management capacity scores for each of the 18 risks identified.

3) Vulnerability, calculated by weighting risk exposure by 60 per cent and risk management capacity by 40 per cent. In summary, the higher the risk and the lower the adaptation capacity, the greater the vulnerability. Conversely, if the risk has a low impact and/or the adaptation capacity is high, the vulnerability will be moderate.

Risk exposure scores

		Input suppliers	Producers (South and West)	Producers (Centre, East and North)	Aggregators	Processors	Distributors	Financial services
Weather	Rainfall deficits		8.0	2.5	2.8	7.8	2.5	2.5
	Interrupted rains		7.8	7.8	2.8	5.3	2.5	2.5
	Floods		2.8	7.8	2.8	5.3	2.5	2.5
Phyto	Armyworms		7.8	7.8	2.8	10.3	2.5	2.5
	Locusts		5.3	3.0	2.8	5.3	2.5	2.5
Market	Price drops	2.8	5.3	5.3	2.5	2.8	2.8	2.5
	Price increases				2.5	10.3	3.0	2.5
	Fertilizer price increases	5.5	2.0	3.8	1.8	3.8	1.8	1.8
Logistical	Transport accidents	3.8			5.5	3.8	1.8	1.8
	Hold-ups during transpor	3.8			5.5	3.8	1.8	1.8
	Maritime logistical shocks	5.5	2.0	2.0	2.0	2.0	2.0	1.8
Storage	Stock infestations		3.8	3.8	2.0	2.0	2.0	1.8
	Stock thefts	3.3	3.5	3.5	3.5	3.5	3.5	1.0
	Warehouse fires	4.3	3.5	3.5	3.5	3.5	3.5	1.0
Macro	Political crises	3.3	2.3	2.3	2.3	2.3	2.5	2.3
	Financial crises	3.8	2.0	2.0	2.0	5.8	2.0	5.8
	Shakedowns	2.8			2.8	5.8	2.8	2.8
Personnel	Worker accidents	3.8	5.8	5.8	5.8	5.8	4.3	1.8

Risk management capacity scores

		Input suppliers	Producers (South and West)	Producers (Centre, East and North)	Aggregators	Processors	Distributors	Financial services
Weather	Rainfall deficits		5.3	5.3	7.3	8.0	5.2	5.4
	Interrupted rains		5.1	5.1	7.3	7.3	5.2	5.4
	Floods		5.3	5.9	7.3	8.0	5.2	5.4
Phyto	Armyworms		5.5	5.5	7.3	8.6	4.8	4.9
	Locusts		5.5	5.5	8.3	8.3	5.3	5.3
Market	Price drops	5.2	4.9	4.9	8.7	8.6	6.4	7.0
	Price increases	5.2			8.7	8.6	6.4	7.0
	Fertilizer price increases	6.0	5.0	5.0	7.2	7.5	6.2	6.7
Logistical	Transport accidents	7.7			9.0	7.7	3.7	8.3
	Hold-ups during transpor	6.7			8.0	6.7	3.7	5.7
	Maritime logistical shocks	6.7	2.7	2.7	5.7	5.0	3.7	5.7
Storage	Stock infestations		5.2	5.2	8.5	9.0	6.3	9.0
	Stock thefts	7.7	4.0	4.0	8.0	8.7	5.0	9.3
	Warehouse fires	8.7	5.7	5.7	9.0	10.7	6.7	10.7
Macro	Political crises	4.0	4.0	4.0	5.3	4.0	5.0	6.7
	Financial crises	4.7	4.0	4.0	6.0	4.7	5.0	7.3
	Shakedowns	5.3			7.7	5.3	6.7	7.3
Personnel	Worker accidents	7.0	4.5	4.5	9.0	8.5	7.5	12.0

It is clear from the risk exposure and risk management capacity standpoint that maize producers are the most vulnerable actors (see figure below). Producers are highly exposed to risks and have very little capacity to manage them apart from diversification. While maize processors have and employ numerous risk management strategies and tools, they are also highly vulnerable because of the specialization of the activities around maize as a raw material and at the same time, their sensitivity to production risks and the macroeconomic and political risks that influence the sustainability and profitability of their activities. Input suppliers are likewise vulnerable, because, while less dependent on the maize value chain, they are exposed to numerous risks due to their business activities in rural areas, dependence on a volatile fertilizer market and logistics subject to regular shocks.

Vulnerability scores		Input suppliers	Producers (South and West)	Producers (Centre East North)	Aggregators	Processors	Distributors	Financial services	Value chain
Weather	Rainfall deficits		7.5	4.2	3.5	6.3	4.2	4.2	**5.0**
	Interrupted rains		7.4	7.4	3.5	5.1	4.2	4.2	**5.3**
	Floods		4.4	7.1	3.5	4.8	4.2	4.2	**4.7**
Phyto	Armyworms		7.3	7.3	3.5	7.5	4.4	4.4	**5.7**
	Locusts		5.8	4.4	3.1	4.7	4.2	4.2	**4.4**
Market	Price drops	4.4	6.0	6.0	2.8	3.0	3.9	3.5	**4.2**
	Price increases				2.8	7.5	4.0	3.5	**4.5**
	Fertilizer price increases	5.7	4.0	5.1	3.0	4.1	3.4	3.2	**4.1**
Logistical	Transport accidents	4.0			4.5	4.0	4.4	2.5	**3.9**
	Hold-ups during transpo	4.4			4.9	4.4	4.4	3.6	**4.3**
	Maritime logistical shocl	5.4	4.9	4.9	3.7	4.0	4.5	3.6	**4.5**
Storage	Stock infestations		5.0	5.0	2.6	2.4	3.5	2.3	**3.4**
	Stock thefts	3.7	5.3	5.3	3.7	3.4	4.9	1.7	**4.0**
	Warehouse fires	3.9	4.6	4.6	3.3	2.6	4.2	1.1	**3.5**
Macro	Political crises	5.2	4.6	4.6	4.0	4.6	4.3	3.5	**4.4**
	Financial crises	5.2	4.4	4.4	3.6	6.4	4.0	5.3	**4.8**
	Shakedowns	4.3			3.4	6.1	3.8	3.5	**4.2**
Personnel	Worker accidents	4.3	6.5	6.5	4.7	4.9	4.4	1.1	**4.6**
Average per actor		**4.6**	**5.5**	**5.5**	**3.6**	**4.8**	**4.2**	**3.3**	

Finally, it is clear from this analysis that the greatest issues for the maize value chain in Madagascar are those related to weather and the phytosanitary pressure of maize growing, which affect production (and thus, the economic activity and revenues of all links in the value chain).

Macroeconomic and political risks (which impact the entire economy, including the maize value chain), can also produce very heavy losses for all actors. Their impact is even greater, since by affecting financing and purchasing power capacity downstream in the value chain, they can cause particularly violent disruptions across the entire marketing chain.

Finally, the maize value chain is especially vulnerable to personnel risks that many actors, particularly in rural areas, have little capacity to manage and that can result in enormous losses for farms and other actors in the value chain.

Groundnut value chain

The vulnerability assessment below, like that for maize, is based on the comparison of risk exposure (risk score) and risk management capacity (risk management capacity score) for each risk. As seen earlier with the maize value chain, when several risk management options are available for a single risk, the management capacity score is the average of the different scores.

Risk exposure scores

		Producers (South and West)	Producers (Centre, East and North)	Aggregators	Processors	Distributors	Financial services
Weather	Rainfall deficits	2.25	1.75	2	2	1.75	1.75
	Interrupted rains	7.75	7.75	2.75	5.25	2.5	2.5
	Floods	2.75	10.25	2.75	7.75	2.5	2.5
Phyto	Leaf miner larvae	7.75	7.75	2.75	10.25	2.5	2.5
	Locusts	5.25	3	2.75	5.25	2.5	2.5
Market	Price drops	5.5	5.5	2.75	2.75	2.75	2.5
	Price increases	0	0	2.75	10.25	3	2.5
Logistical	Transport accidents	0	0	5.5	3.75	1.75	1.75
	Hold-ups during transport	0	0	5.5	3.75	1.75	1.75
	Maritime logistical shocks	3.75	3.75	3.75	1.75	1.75	1.75
Storage	Stock infestations	3.75	3.75	2	2	2	1.75
	Stock thefts	3.5	3.5	3.5	3.5	3.5	1
	Warehouse fires	3.5	3.5	3.5	3.5	3.5	1
Macro	Political crises	2.25	2.25	2.25	2.25	2.5	2.25
	Financial crises	2	2	2	5.5	2	5.75
	Shakedowns	0	0	2.75	5.25	2.75	2.75
Personnel	Worker accidents	5.75	5.75	5.75	5.75	4.25	1.75

Risk management capacity scores

		Producers (South and West)	Producers (Centre, East and North)	Aggregators	Processors	Distributors	Financial services
Weather	Rainfall deficits	5.3	5.3	6.8	4.6	5.5	5.4
	Interrupted rains	4.5	4.5	5.6	4.6	5.5	5.4
	Floods	4.6	4.9	5.6	4.6	5.5	5.4
Phyto	Leaf miner larvae	4.3	4.3	6.0	4.8	4.8	4.9
	Locusts	4.4	4.4	6.1	4.9	5.3	5.3
Market	Price drops	4.6	4.6	7.7	6.1	5.6	6.6
	Price increases			7.7	6.1	5.6	6.6
Logistical	Transport accidents			7.7	5.0	3.7	8.3
	Hold-ups during transport			6.7	5.0	3.7	5.7
	Maritime logistical shocks	2.8	2.8	7.6	6.0	5.0	5.6
Storage	Stock infestations	4.8	4.8	6.4	5.4	6.3	9.0
	Stock thefts	4.0	4.0	6.7	6.0	5.0	9.3
	Warehouse fires	5.7	5.7	7.7	7.0	6.7	10.7
Macro	Political crises	4.0	4.0	4.0	3.3	5.0	6.7
	Financial crises	4.0	4.0	4.7	4.0	5.0	7.3
	Shakedowns	3.7	3.7	5.3	4.7	6.7	7.3
Personnel	Worker accidents	4.5	4.5	7.0	6.0	7.5	12.0

Like producers in the maize value chain, groundnut producers are the most vulnerable actors, as they are exposed to extremely high risks and have very limited capacity to manage them beyond crop diversification. Also remember that, as a rule, farms managed by women and young people, as well as those newly created by migrants, have vulnerability levels even higher than the average for farms in the value chain. Processors are also vulnerable, due their very high risk exposure and, in the context of the groundnut value chain, their relatively limited risk management capacity.

The risks to which the value chain is most vulnerable are production risks (phytosanitary shocks and weather events) and market risks (rapid exogenous price increases), which can result in significant losses for many actors across the value chain. Moreover, the different links in the value chain are highly vulnerable to the risk of worker accidents, as most of them are small farms with few workers and one-person ventures or enterprises with very few salaried employees.

Vulnerability scores

		Producers (South and West)	Producers (Centre, East and North)	Aggregators	Processors	Distributors	Financial services	Value chain
Weather	Rainfall deficits	4.1	3.8	3.3	4.2	3.7	3.7	**3.8**
	Interrupted rains	7.7	7.7	4.2	6.1	4.1	4.2	**5.6**
	Floods	4.6	9.0	4.2	7.6	4.1	4.2	**5.6**
Phyto	Leaf miner larvae	7.8	7.8	4.1	9.1	4.4	4.4	**6.2**
	Locusts	6.2	4.9	4.0	6.0	4.2	4.2	**4.9**
Market	Price drops	6.3	6.3	3.4	4.0	4.2	3.7	**4.6**
	Price increases			3.4	8.5	4.4	3.7	**5.0**
Logistical	Transport accidents			5.0	5.1	4.4	2.5	**4.2**
	Hold-ups during transport			5.4	5.1	4.4	3.6	**4.6**
	Maritime logistical shocks	5.9	5.9	4.0	3.5	3.9	3.6	**4.5**
Storage	Stock infestations	5.1	5.1	3.4	3.8	3.5	2.3	**3.9**
	Stock thefts	5.3	5.3	4.2	4.5	4.9	1.7	**4.3**
	Warehouse fires	4.6	4.6	3.8	4.1	4.2	1.1	**3.8**
Macro	Political crises	4.6	4.6	4.6	4.8	4.3	3.5	**4.4**
	Financial crises	4.4	4.4	4.1	6.5	4.0	5.3	**4.8**
	Shakedowns			4.3	6.1	3.8	3.5	**4.4**
Personnel	Worker accidents	6.5	6.5	5.5	5.9	4.4	1.1	**4.9**
Average per actor		**5.5**	**5.5**	**3.6**	**4.8**	**4.2**	**3.3**	

Conclusion and recommendations

The maize and groundnut value chains have massive risk exposure. Value chains historically developed in peripheral regions of Madagascar. The intensity of environmental (weather and phytosanitary pressure), health and security risks has caused production, marketing and processing to relocate to the plateau areas in the centre of the country, where risks are lower and access to markets is better.

The main risk mitigation strategy employed by maize and groundnut producers over the past two decades appears to be internal migration. The second most important strategy is to shift from these two crops to more resilient ones (cassava, black-eyed peas, sorghum and millet). Thus, it seems essential to devise a risk mitigation approach in Madagascar's western and southern production zones, where the risks are more numerous, more intense and more frequent, and to support risk management in the intensification zones of centre and north of the country, which are home to many migrant farmers. The task is enormous, and the Malagasy State and value chain and agricultural development actors clearly have insufficient means to control all the risks. It is therefore critical to address several gaps to strengthen these actors' capacity to manage them.

This study of risks and vulnerabilities in the Madagascar maize and groundnut value chains, confirmed by the conclusions of the cycle 1 workshop for knowledge sharing, highlights three main risk categories to which the two value chains are especially vulnerable:

1) Production risks, including extreme weather events and regular shocks from phytosanitary pressure in Madagascar, where actors in the two value chains have few options for adaptation;

2) Market risks, which involve price volatility in production zones and the domestic market and the impact of the international market via fertilizer imports in the maize value chain and groundnut seed exports in the groundnut value chain;

3) Structural risks, which are the result on the one hand, of the State's limited capacity to invest in its infrastructure (roads, ports) and institutions (police, justice, rule of law, social security) and on the other, of the limited diversification of the Malagasy economy, which subjects actors in the two value chains and all actors in agricultural value chains to high levels of insecurity and disruption that heavily impact their revenues and medium- and long-term forecasting and investment capacity.

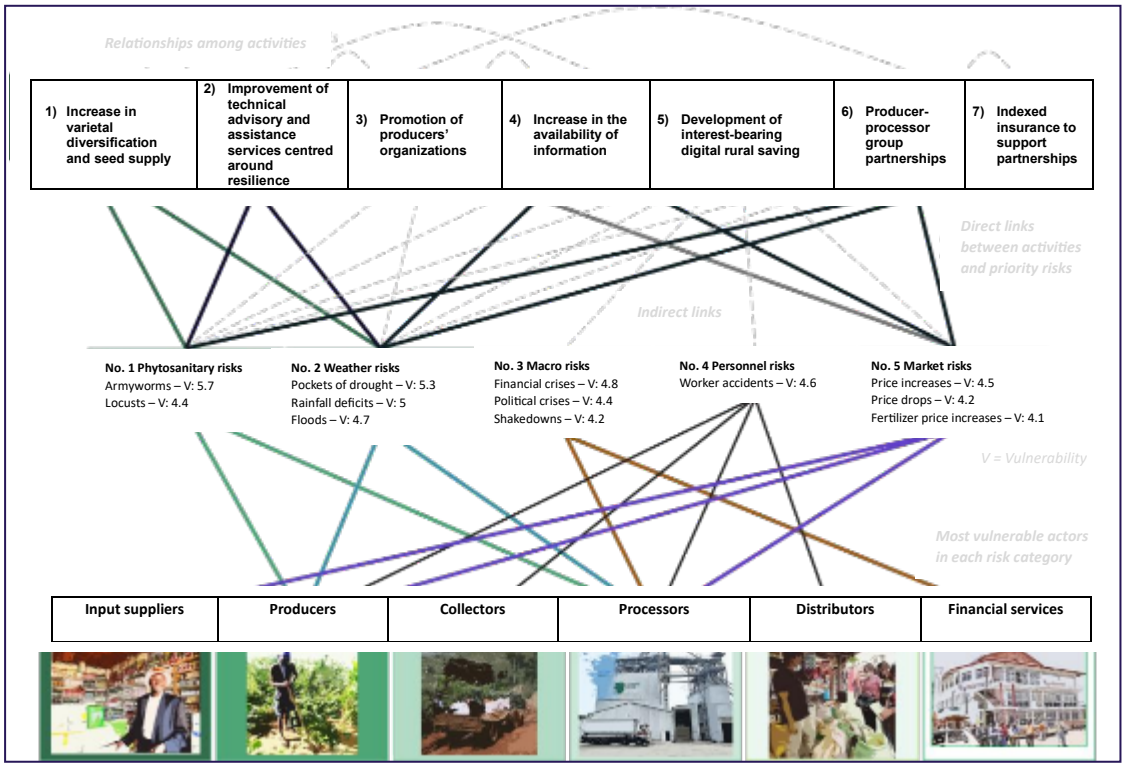
It is hard to address this third risk category through an agricultural risk management (ARM) programme, which is why it is essential for the proposals that follow to focus on the first two categories.

Note, however, that a number of actions, particularly those involving the strengthening of producers' organizations, the improvement of production and the dissemination of independent, useful information to the actors, indirectly contribute to reinforcing the structure of the Malagasy economy and thus, marginally reduce these structural risks. Moreover, thanks to an agricultural risk management programme, development of the maize and groundnut value chains can help to diversify the agricultural economy and the Madagascar economy in general.

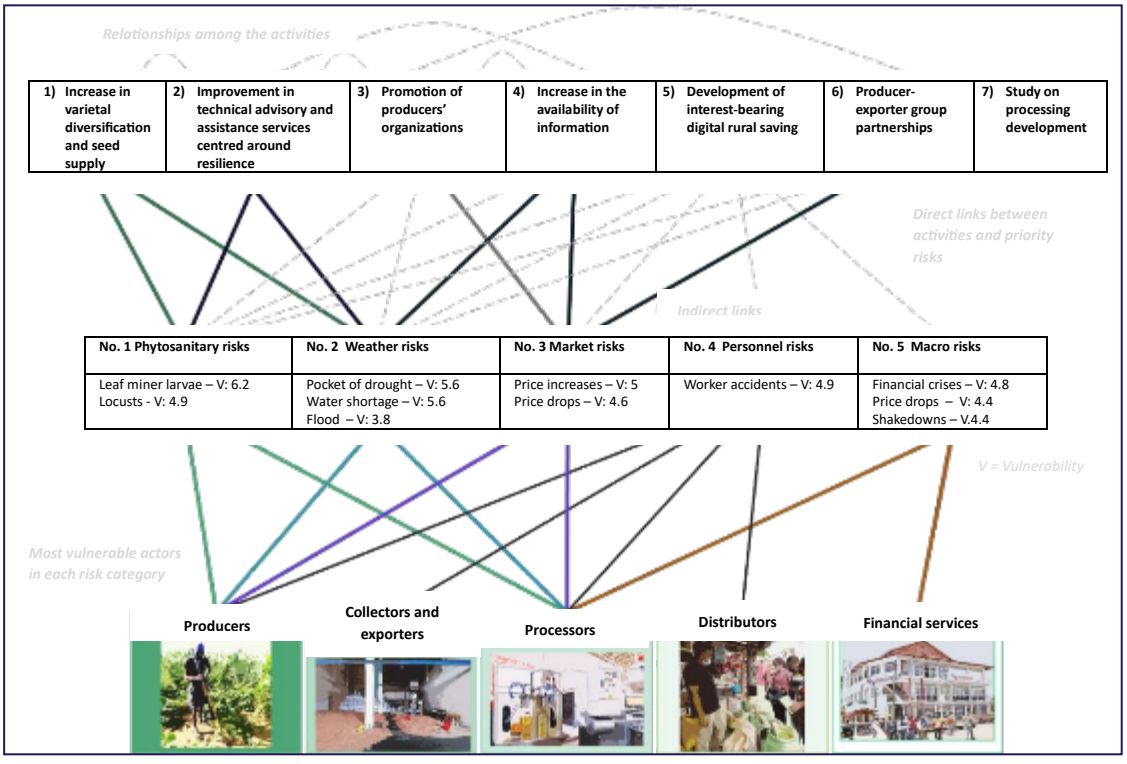
Proposed activities for risk management in the maize and groundnut value chains

The diagrams below summarize the risks with the greatest impact on the two value chains and the proposed activities outlined below to address these priority risks. The activities are then described in the subsequent paragraphs.

Maize value chain



Groundnut value chain



Proposed cross-cutting activities to support risk management in the maize and groundnut value chains

1) Increase varietal diversification and seed supply in the two value chains

As emphasized above, the supply of varietals in the Madagascar maize and groundnut value chains is currently very limited. However, the two crops are benefitting from past diversified research at the international level.

Diversifying the supply of varietals should enable farmers to respond to weather-related risks (with varieties with less need for water, short-cycle varieties, varieties more able to tolerate excessive water in flood-prone areas) and phytosanitary pressure (varieties less appetizing to armyworms or locusts, fast-growing varieties that can be harvested before infestations cause losses that are too high, etc.).

This approach begins with the assumption that greater varietal diversity will enable producers to tailor their risk management to the country's different agro-climatic zones, their farming systems and their parcels. Accustomed to managing climate and phytosanitary risks, Malagasy producers can be expected (gradually, over several crop seasons) to identify the genetic material best suited to their context, as long as they are given access to diverse genetic material and receive support during the experimentation and diversification process (see proposal 2).

The seed supply should be diversified through two complementary channels, namely:

(i) The marketing of varieties selected by the specialized private sector (seed sector) in other countries, which could be done by the networks of input suppliers and buyers (maize processors and groundnut exporters) hired through contracting with producers' groups (proposals 3 and 5).

(ii) The development of a favourable framework for marketing seeds obtained through massal selection by farmers in the private sector or agroecological centres such as the Southern Agro-ecological Technical Center (CTAS).

This activity is essential for increasing farm resilience and the potential for productivity in the two value chains and significantly reducing the risk exposure of the downstream actors directly impacted by poor harvests and lower yields.

When implementing this activity it is essential to ensure women's participation in activities to promote new varieties and especially in the massal selection process and definition of selection criteria. In fact, since certain activities in the agricultural cycle of the two crops are largely the province of women (sowing, weeding, post-harvest treatment, meal preparation for on-farm consumption), it is essential for all varietal innovation processes to rely on the experience and preferences of women (farm managers or companions of farm managers) in the two value chains.

Young farmers should also be targeted, as they are more receptive to opportunities for adaptation and changes in practices.

The design phase that will follow this study should identify the partners that will be involved in the implementation of this activity. However, it already seems essential to strengthen technical capacity at the National Centre for Applied Research and Rural Development (FOFIFA) and the Ministry of Agriculture to simplify and accelerate the marketing of foreign varieties by private actors wishing to do so.

2) Increase technical advisory and assistance services in the two value chains, focusing them on the resilience of crop systems

Tackling the climate and phytosanitary risks that affect maize and groundnut production will require efforts to improve technical advisory and assistance mechanisms in the two value chains.

Technicians from the Ministry of Agriculture should receive support and capacity building to:

- Understand the challenges of holistic agricultural risk management at the farm level and shift their stance from a position historically geared to the dissemination of intensification practices that are sometimes a factor that heightens the risks for producers to technical and experimental support to producers for a more resilient, better performing crop system.
- Be able to understand the constraints, risks and opportunities specific to maize and groundnut cultivation, which up to now the State has hardly addressed and in which technicians have received little training.
- Be knowledgeable about fertilization, soil preparation, intercropping, agroecological crop rotation and protection techniques, as well as the general ecological approach as an agricultural system geared to crop and farm resilience.

Since Ministry of Agriculture technical teams are small and have multiple missions, it will also be necessary to identify other advisory entities (producers' organizations, women's associations, youth associations, local NGOs, buyer enterprises working in partnership with producers' groups, etc.) to participate in the dissemination of new technical advisory and coaching practices focused on agricultural risk management and efforts to increase the resilience and productivity of these two crops.

Like activity 1, all stages of this activity should pay particular attention to the place of women (too often excluded from agricultural advisory services) and youth (who are particularly receptive to innovations and changes in practices).

3) Promote producers' organizations

In order to address commercial risks and, in the medium term, increase the resilience of farms and the value chain to both production and institutional risks, it is essential to strengthen the producers' organizations operating in these two value chains.

However, preference should not be given to producers' organizations focused exclusively on monoculture in these two value chains. Assistance to producers' organizations already focused on input supply or the production, marketing and even processing of other agricultural products but whose members are also maize or groundnut producers could lead to gains in effectiveness. Producers' Organisations (POs) already equipped and sound in terms of their governance, commercial network, logistical know-how and the trust of their members will be much more effective in conducting activities in the two value chains.

By diversifying their value chains, they will also be more resilient to the marketing risks associated with each value chain and achieve economies of scale in their activities.

It will also be necessary to ensure that the organizing is done on a small scale in terms of geographic coverage and the number of members to encourage the most democratic governance possible, easy holding of member meetings, logistical simplicity in the pooling of production and limitation of the risks of poor management in the POs.

The activities targeted by these producers' organizations could initially be access to seed (capitalizing on the supply of new seeds resulting from activity 1 once it has been carried out) and the maintenance of local seed banks (to avoid the consumption of seed as food in poor harvest years and the indebtedness of farms the following year), as well as pooled marketing and access to the advisory services and farmer experimentation of activity 2.

For this activity, it will be necessary once again to guarantee the inclusion of women and young people in mixed producers' organizations, women producers' organizations and young farmers' organizations. This strategy should be spelled out in the concept note.

4) Improve the availability of agricultural, agrometeorological and commercial information through ICT

Information is one of the keys to managing production and market risks.

Thanks to the new information and communication technologies (ICT), information gathering is faster and cheaper. Following rainfall, phytosanitary pressure and price trends no longer requires dozens of interviewers to travel across rural areas but can be done at a lower cost by building networks of village information reporters and groups for discussion and information-sharing among producers.

The example of the *Service n'kalô* in West Africa and the cashew value chain in Madagascar[10] shows that a single market analyst can closely follow price and demand trends throughout a country's main production basins.

As with prices, a small hub of specialized technicians with a good network of actors in the production basins can monitor production constraints, disseminate technical solutions when risk levels are moderate and plan public interventions when the risk level becomes too extreme.

This proposal, therefore, consists of creating a monitoring and information dissemination unit in the Ministry of Agriculture for the two targeted value chains. Initially, this unit could build a network for sharing information in the areas targeted by the programme and the two targeted value chains. Over time, however, it could expand its area for gathering and sharing information to all production zones and actors in the two value chains, and ultimately to other agricultural value chains.

As always, construction of the network(s) for gathering, sharing and disseminating information should include the diverse actors in each link of the value chains (women, youth, migrants, small-scale entrepreneurs and large dealers and industrialists).

The facilitators of this network should be trained in the agricultural risk management approach and prioritize the rapid circulation of information on all topics related to climate, phytosanitary and market risks. Like the Borderless Alliance initiative,[11] they could even envisage sharing information on shakedowns by law enforcement and rural security risks to facilitate efforts to combat parafiscal levies and strengthen security in logistics operations.

5) Develop interest-bearing digital savings

Saving is a cross-cutting risk management tool. Where many projects focus on access to credit in contexts where extreme vulnerability to risks makes repayment difficult, contributing to savings as the foundation of any programme for sustainable financial inclusion appears to be a priority.

Small farms and enterprises in the maize and groundnut value chains currently receive very little financing and primarily raise small livestock as a savings vehicle. However, it is a risky one (the animals could die or easily be stolen) and not very liquid (farmers must often incur costs and wait for market day to sell an animal).

In many developing countries, the growth of mobile money is primarily built around saving. Its advantage lies in its semi-liquidity – that is, people are less tempted to spend it than cash but can rapidly have secure access to it in emergencies (even if theft rings are present, it is easier to thwart them than with cash or livestock).

In recent years, certain technology companies have begun developing interest-bearing digital saving tools in Africa based on mobile money.[12] Their penetration in rural areas is still

[10] https://www.nkalo.com

[11] https://2017-2020.usaid.gov/news-information/fact-sheets/borderless-alliance

[12] https://www.ejara.io/, https://www.scribd.com/document/596516147/IFC-CDI-Inactivity-Study-FRENCH and https://www.telecomreviewafrica.com/articles/operateurs/1943-lancement-d-orange-bank-africa-en-cote-d-ivoire

limited but is rapidly growing and responds to a real need of populations to save without a loss of value.

After a study to identify the banks, mobile operators and digital finance companies in a position to offer the best options in Madagascar (coverage and transfer costs, interest rate, ease of access to deposit and withdrawal sites), this activity would consist of informing producers about the importance of saving, promoting their understanding of its advantages and expanding use of the tools that best meet their needs.

This could be done in parallel by the teams involved in the other activities to ensure a lower cost.

Proposed activities specific to the maize value chain

6) Partnerships between maize producers' groups and maize processors

As noted earlier, producers and processors are the two links in the maize value chain with the greatest risk exposure. The risks to both of them could be mitigated by forging nimble partnerships tailored to the risks.

Given the production and market risks faced by these two types of actors, it is essential to forge contractual relationships around risk anticipation rather than risk transfer. The rigid, definitive Western approaches to contracting are not suited to the context of the two value chains.

Beyond the common objectives of quantity and quality, the purpose of a contract should be to stipulate the methods for measuring and considering environmental and marketing risks. More specifically, it must anticipate loss distribution in the event of insufficient yields for the repayment of input loans, the conditions for price adjustment based on trends in the domestic and/or international market and the conditions for rewarding merit when objectives are exceeded.

That is why the negotiation and drafting of pre-contract documents (charter, agreement) and the segmentation of contracts into subcontracts by stage should serve as the foundation for clear discussions of known and predictable risks. The use of simplified single and unilateral contracts[13] is particularly unsuited to contexts such as that of the two value chains in Madagascar. The numerous failures of agricultural producer-processor contracts in Madagascar and across Africa bear witness to the need for the tropicalization of contracting processes.

7) Introduction of indexed yield insurance in contracting processes

At least two agriculture insurance initiatives have been introduced in Madagascar with very mixed results.

Agriculture insurance is a complicated tool in terms of its promotion among producers and insurers. The selection of areas with the highest agricultural risk exposure and farthest from the end markets is likely much of the reason for the discouraging results of the two pilot initiatives.

In the developing countries as a whole, indexed insurance is a service that has met with success mainly in contract farming with input credit for producers. Insurance premiums are a useful tool for reducing the risk of nonpayment for the buyers who prefinance inputs, while the buyer's promotion and collection of insurance premiums eliminates a major expense for insurers.

It appears to be a priority, therefore, to develop this tool in the contract farming process; it could even be expanded beyond this framework, once insurance products become robust and beneficial to producers and insurers alike.

[13] Where buyers propose them to producers without the possibility of negotiation.

Proposed activities specific to the groundnut value chain

8) Producer-exporter/processor partnerships

Exporters in the groundnut value chain currently play a more significant role than processors and could therefore be more inclined to forge contractual partnerships with producers' organizations to ensure the volumes and quality that suits their needs. However, if industrial groundnut processing projects are implemented (this would only be under activity 8), PO-processor partnerships could likewise be envisioned.

As in the case of maize, these contractual frameworks must be very agile to adapt to the volatility of the international market and exchange rate and maritime logistical risks, but they could enable producers, exporters and processors to reduce their exposure to market risks and work together to reduce production risks.

The idea is to subsidize the design and implementation costs (CAPEX) of partnerships upstream and downstream between producers and major buyers (processors and exporters) through public-private partnerships to support implementation of the Agricultural Aggregation Law.

These subsidies could also support the improvement and dissemination of insurance products to de-risk some of the risks assumed by downstream operators.

Context

1.1 Study objective and framework

1.1.1 Platform for Agricultural Risk Management (PARM)

Launched in 2013, the purpose of the Platform for Agricultural Risk Management (PARM) is to make risk management an integral part of agricultural policy and agricultural investment planning. PARM is G20 initiative, hosted and managed by the International Fund for Agricultural Development (IFAD) and financed by a partnership between the European Commission, the French Development Agency, the Italian Agency for Development Cooperation, IFAD, and the German Development Bank (KfW). This latter has supported the partnership between PARM and the African Union Development Agency, formerly known as the New Partnership for Africa's Development (NEPAD), since phase 1 of PARM.

The platform encourages use of a rigorous overall method for assessing and managing agricultural risks in developing countries, providing factual data on risks and tools for agricultural risk management.

It also facilitates dialogue between public authorities and stakeholders with a view to:

- Integrating agricultural risk management into agricultural policies and practices;
- Stimulating investment in agriculture.

1.1.2. Nitidæ

Nitidæ is a non-governmental organization headquartered in Lyon, France. With a team of 160 professionals (economists, agroeconomists, engineers, agronomists, foresters, geographers, soil carbon specialists and GIS and remote sensing experts) and an annual budget of EUR 6.1 million, this NGO currently has some 60 projects under way, primarily in Madagascar, Mali, Burkina Faso, Mozambique, Senegal and Côte d'Ivoire. Nitidæ also lends its technical expertise to agrifood and cosmetics businesses to improve the performance of agricultural value chains, set up value chains, mitigate their environmental impact, introduce certification (BIO, FFL, FLO, VCS, etc.), ensure the conservation of natural resources, boost the energy efficiency of processing methods, offset carbon emissions and stimulate local economic development in concert with producers' organizations.

In Madagascar, Niditæ has a team of 40 with very diverse profiles ranging from botanists to economists to cartographers. It works with the following value chains in Madagascar: rice, maize, cassava and groundnut, as well as a wide range of cash crop value chains: vanilla, cacao, cashew, mango, pink pepper, cloves, pepper, ylang, ginger, coffee, honey and non-timber forest products.

1.1.3 Study objectives

This assessment should make it possible to identify, quantify and prioritize agricultural risks and identify risk management tools tailored to the risks identified and prioritized at different stages of the two selected value chains. Its analyses will inform the design of an agricultural risk management (ARM) project/programme, whose implementation by the national authorities will benefit from PARM support.

Its development repeats the stages of the PARM methodology detailed in the practitioners toolkit *assessing value chain risks to design agricultural risk management strategies*.[14]

1) This report precedes the report on the start-up phase, which made it possible to target the two value chains based on their place in Madagascar's food and nutrition security, employment and economy, their agricultural risk exposure and their priority in national

[14] https://www.p4arm.org/document/assessing-value-chain-risks-to-design-agricultural-risk-management-strategies/

agricultural policy and programmes implemented by the State and its technical and financial partners;

2) Following the aforementioned report on the start-up phase, a study phase focused on agricultural risks in the two targeted value chains that reflects the present report has led to the scoring of risks in the country and the targeted value chains;

3) The present report at the same time also shows the vulnerability to agricultural risks, listing the agricultural risk management tools, mechanisms and competencies already developed and/or planned in Madagascar in the pre-targeted agricultural value chains;

4) Following the risk and vulnerability assessments, risk mapping was performed, making it possible to prioritize the risks with the widest gap in terms of vulnerability rates. This prioritization was then presented, discussed and adapted with the Malagasy Government to proceed to the final stage;

5) The final stage consists of devising an action plan for implementing the agricultural risk management tools and polices in Madagascar's targeted value chains and addressing the risks with the widest gap in terms of vulnerability rates. This plan will be presented and validated in a workshop.

1.2 National context

With 70.3 per cent of the land devoted to farming (FAO 2020[15]) and 64 per cent of the jobs concentrated there (ILO 2019[16]), agriculture plays an outsize role in Malagasy's society and economy, even though it accounts for just 24.7 per cent of the gross domestic product (World Bank 2024[17]).

The country's bioclimatic diversity, the result of its geographic location and varied topography and elevation, is especially rich, with wide rainfall and temperature variations.

This territorial heterogeneity has led to the development of highly diverse agrarian systems in the country, with crops suited to humid tropical climates, arid tropical climates, high-altitude tropical climates and to a lesser extent, temperate climates.

Madagascar's particular characteristics also guarantee its global leadership in certain niche crops with high value added, such as vanilla, cloves and even ylang ylang and lychee. Essential oils from its highly diverse crops and non-timber forest products (NTFP) also constitute the third largest agricultural export sector after vanilla and cloves and before seafood products and cacao.

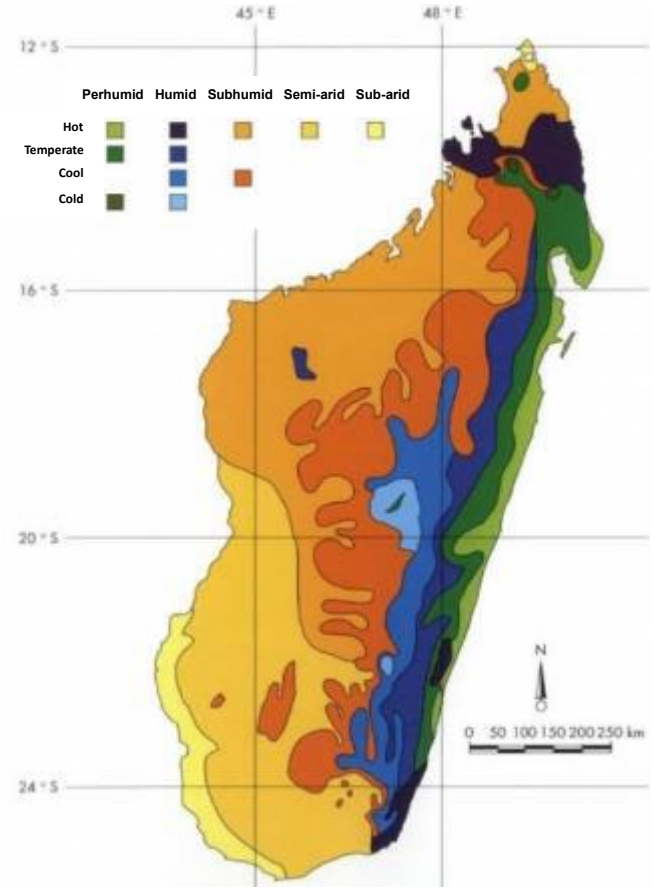


Figure 7: Atlas of plague in Madagascar, IRD 2006, adapted by J. KOECHIN et al., 1997.

[15] www.fao.org/faostat/
[16] https://www.ilo.org/global/statistics-and-databases/lang--en/index.htm
[17] https://data.worldbank.org/

Malagasy agriculture also has an important livestock sector in which more than half its farms participate, enabling the country to import very few products of animal origin (with the exception of dairy products). However, even in the dairy sector, local production (estimated at 50,000 to 100,000 tonnes) is much higher than imports, which stood at around 15,000 tonnes in 2022. The country's largest trade deficit in terms of food is in the edible oil sector. Local production of vegetable oil is, in fact, fairly undeveloped, obliging the country to import some 175,000 tonnes of oil (mainly palm and soybean oil) per annum to cover its shortfall (the estimated domestic consumption of vegetable oil is 225,000 to 250,000 tonnes).

Thanks to the heterogeneity of Madagascar's territory and its relative self-sufficiency in amylaceous (starchy) crops (grains and tubers), which cover more than 80 per cent of the market, the food insecurity rate calculated by FAO in recent years was clearly below that of most of the neighbouring countries and close to that of South Africa.

Note, however, that the prevalence of food insecurity rose after 2018 and intensified after 2020[18] due to the inflationary effects of the COVID-19 crisis, a severe drought that hit the south of the country in 2021 and 2022 and particularly violent cyclone events.

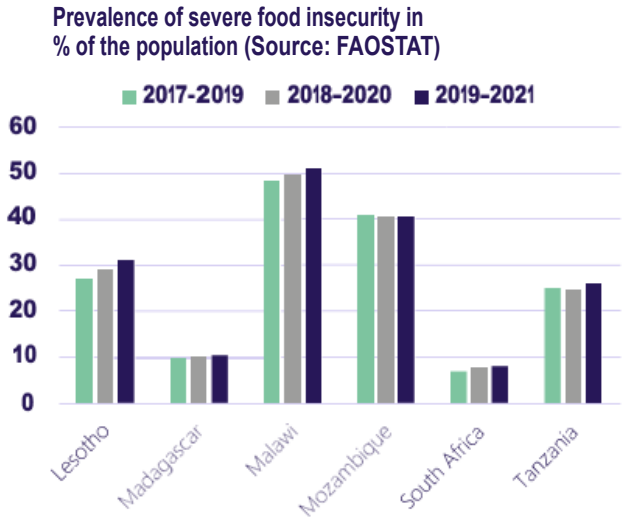


Figure 8: Prevalence of severe food insecurity in Madagascar and some neighbouring countries

Furthermore, while up to now, access to the minimum daily caloric intake has been guaranteed for the vast majority of the population, the malnutrition rate is relatively high, especially among children, pregnant women and nursing mothers.

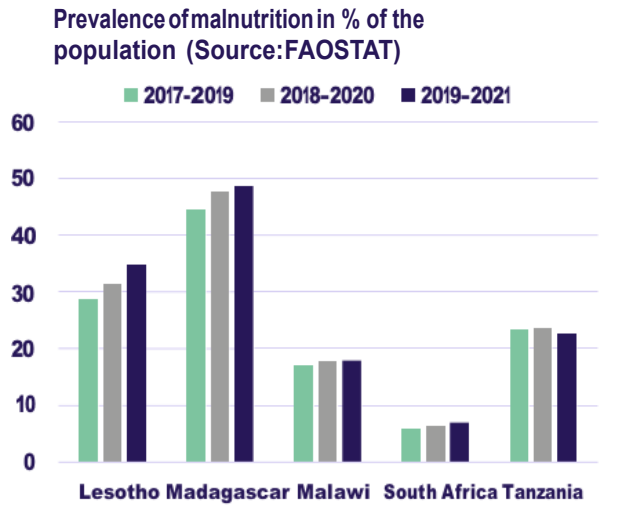


Figure 9: Prevalence of chronic malnutrition in Madagascar and some neighbouring countries

In fact, the available calorie intake and its diversity are either insufficient, especially in the south and certain mountainous regions in the east, or it consists primarily of cassava. Moreover, access by the country's poorest households to vegetable and animal protein is relatively limited, since only half the farms have livestock, and oleo-proteinaceous crops (groundnut, coconut, oil palm), and to a lesser extent, proteinaceous crops (green beans, peas, soybeans), are not sufficiently cultivated and part of the crop is reserved for export.[19]

[18] https://documents1.worldbank.org/curated/en/475961608066887461/pdf/Madagascar-Economic-Update-Setting-a-Course-for-Recovery.pdf

[19] Plan National d'Action pour la Nutrition-III 2017-2021, Republic of Madagascar, published by UNICEF

Paradoxically, therefore, Madagascar is a country that benefits from a rich diversified agriculture, livestock and fishery sector that meets the bulk of domestic demand, but due to vast social inequalities between and within regions, much of the population has access to a diet that is deficient in terms of quantity, quality and diversity.

In its country overview,[20] the World Bank indicates that after the COVID-19 crisis, 81 per cent of the Malagasy population was living below the international poverty line (US$2.15 per capita/day). Madagascar also numbers among the countries with the greatest inequalities in both the world and Africa (GINI Index of 49.2, according to the World Economics website, last measured in 2019[21]).

GDP and GDP growth in Madagascar
(Source: World Bank – Constant 2015 United States dollars)

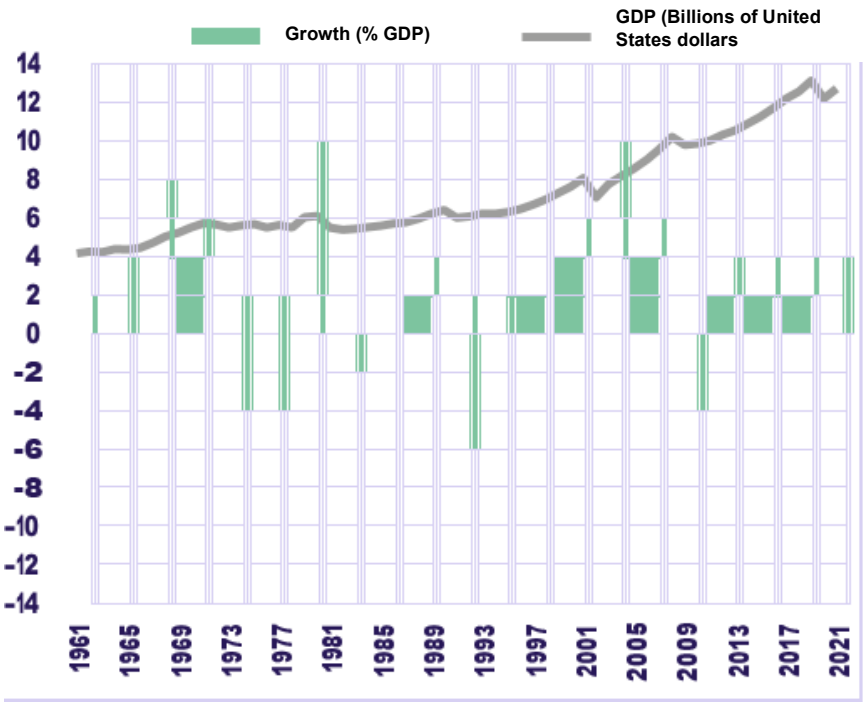


Figure 10: GDP growth in Madagascar 1961-2021

The outlook is even bleaker, as Madagascar's economic growth remains low and erratic, and it is already one of the African countries most affected by climate change.[22]

Within this context, it is especially important to approach Malagasy agriculture through the lens of agricultural risk.

1.3. Risk profile of the country's agriculture sector

Madagascar is particularly exposed to agricultural risks, buffeted by frequent extreme weather events that are more violent than those in most developing countries (cyclones, droughts, floods, sandstorms). Its balance of trade is dependent on a major export value chain (vanilla, which accounted for 25 per cent of exports[23] and 18.6 per cent of agricultural GDP in 2021/2022[24]). Harvest and livestock theft from parcels is becoming increasingly common. Madagascar's very high oilseed production deficit exposes it to price fluctuations and logistical disruptions. Finally, the country has also been hit by serious locust invasions since 2012[25] and the rapid spread of armyworms since 2018.[26]

Faced with these challenges, Malagasy agricultural value chains and households have developed numerous resilience strategies, first among them extensive diversification of their crops (National Agricultural Census [RNA] data) and activities (primarily stock raising, RNA data), which enables them to mitigate climate and market shocks. Stock raising is extensively practiced in non-farming households (rural non-farming households and urban

[20] https://www.banquemondiale.org/fr/country/madagascar/overview
[21] https://www.worldeconomics.com/Inequality/Gini-Coefficient/Madagascar.aspx
[22] https://handicap-international.fr/fr/actualites/madagascar---l-impact-humanitaire-du-changement-climatique
[23] https://www.agenceecofin.com/epices/1511-102971-madagascar-la-campagne-d-exportation-de-la-vanille-s-ouvre-le-15-novembre
[24] https://donnees.banquemondiale.org/indicator/NV.AGR.TOTL.CD?locations=MG
[25] https://un.org/africarenewal/fr/derni%C3%A8re-heure/la-campagne-antiacridienne-porte-ses-fruits-%C3%A0-madagascar
[26] https://agritrop.cirad.fr/598993/1/CV%20mais%20Soja%20Evaluation%20outil%20de%20vulgarisation%20et%20utilisation%202021.pdf

households both have a small area for raising poultry or pigs). There is also significant development of off-season (or second cycle) crops on the east coast and central region of the country, where rainfall and hillside and river-basin reservoirs make two crop cycles possible, especially for rice. More generally, with the exception of oilseeds, Madagascar is relatively self-sufficient, importing less than 12 per cent of its carbohydrate and protein needs.[27] A large portion of Malagasy agriculture is devoted to legumes, which are rotated with grains and tubers in most production zones and provide the country with a wide variety of peas and beans, as well as significant groundnut production and a small soybean value chain. To reduce its logistical risks, the country also has several ports and a star-shaped road network surrounding a relatively central capital city, allowing for diverse supply channels.

However, repeated environmental and market risks, heightened by political crises and growing security risks, keep Malagasy households and value chains in a precarious situation that reduces their capacity and chances of investment success. It is therefore essential to target tools for managing the main agricultural risks to enable farmers, merchants, processors and agro-industrialists to invest in wealth creation and additional value added.

1.4. The selection of two value chains

This study focuses on two value chains, maize and groundnuts, chosen because of the desire to integrate them into the more general national agricultural policy framework (these value chains are among the six priority value chains identified by the Government in the Food and Agriculture Delivery Compact, validated in June 2022[28]) and a selection process based on the value chain dynamic and risk exposure.

The maize value chain is a food and commercial value chain that grew rapidly across the country in the 1980s due to the combined effect of human and livestock consumption and industrial use (notably in the brewing sector).

The groundnut value chain also experienced significant growth for a decade, spurred by export demand from Asia.

The two value chains are present throughout the country but have very high production in the south and southwest, which historically are the regions most vulnerable to climate risks, locust invasions and food price volatility.

[27] 630,000 tonnes of white rice and 130,000 tonnes of wheat, 200,000 tonnes of cane sugar and 15,000 tonnes of dairy products are the main carbohydrate and protein imports, with local production of more than 7.5 million tonnes of grain, tubers, proteinaceous crops and animal and seafood products (Source: customs statistics 2021/2022).

[28] https://www.afdb.org/ar/documents/madagascar-pacte-pour-lalimentation-et-lagriculture

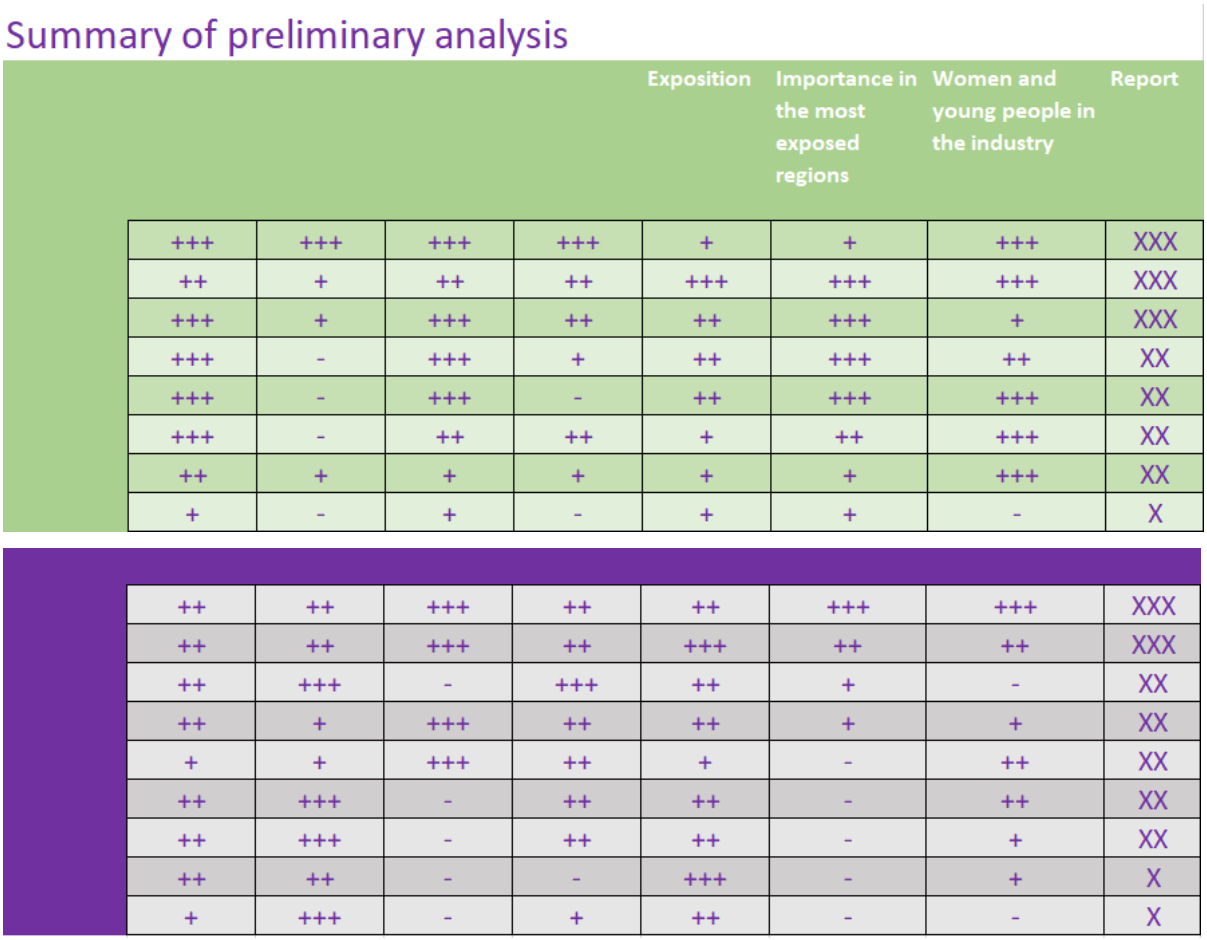


Figure 11: Criteria and classification of value chains done in the start-up phase

2. Description of the maize and groundnut value chains

2.1. The maize value chain in Madagascar

2.1.1. Some reminders about the characteristics of maize

Maize is a tropical grain that originated in Central America and in 2023 is the most cultivated grain in the world before rice and wheat, with global production estimated by the USDA at 1.15 billion tonnes for the 2022/2023 season.[29] Maize performs C4 photosynthesis,[30] making it an extremely high-performing plant from the standpoint of biomass production per unit of area and explaining why its use for grain and forage production has spread across the globe.

Maize is the plant species with the best-known genetic make-up, and varietal selection of maize, chiefly through hybridization, has enabled certain varieties to produce extremely high yields (averaging more than 10 tonnes/ha in Europe and North America[31] and up to 30 tonnes/ha under optimal conditions).

The maize production cycle varies with the variety. Long-cycle varieties are grown for 120 days, while short-cycle varieties can reach maturity 90 days after germination.

Maize does not do well in low temperatures (less than 10° C) but tolerates high temperatures (up to 40° C) well, even if the optimal temperature during its growing cycle is around 25° C. It requires a minimum of 600 mm of rain during its growing cycle (the three weeks before and

[29] https://apps.fas.usda.gov/psdonline/circulars/grain.pdf
[30] https://rnbio.upmc.fr/physio_veg_photosynthese_22_C4_1
[31] https://www.fao.org/faostat

after flowering) and tolerates high levels of rainfall (more than 1,000 mm during its cycle) very well, if planted in well-draining soil.

Maize is very sensitive to soil acidity and salinity, which heavily impact yields. It is also very sensitive to nutrient deficiencies, especially nitrogen, but responds very well to the use of fertilizer; this is because, ideally, it is cultivated in soil rich in organic matter ahead of rotation (first year after the clearing of fallow or virgin land).[32]

Also note that genetic selection has led to significant differentiation between tropical and temperate varieties of maize; thus, in the agro-climatic conditions of most of Madagascar's territory, it is clearly recommended that priority be given to tropical varieties. However, in certain high-altitude or temperate zones, temperate varieties may be more appropriate.

Most maize production in Madagascar involves unselected varieties or varieties chosen through massal selection, which therefore do not take advantage of the potential offered by maize hybridization. In 2017, the catalogue of Madagascar's Official Seed and Plant Control Service (*Service Officiel de Contrôle des Semences et Matériel Végétal – SOC)* listed only six varieties,[33] four of which had been introduced between 1971 and 1983.[34]

The Agroecological Technical Centre of the South (*Centre Technique Agroécologique du Sud* – CTAS) identified and characterized a "local variety" called "amaninagnombe." It is uncertain, however, that it currently meets the three criteria for the definition of a plant variety: distinction (D), homogeneity (H) and stability (S), based on the comments of certain actors and the 2016 assessment of the seed mechanism,[35] which reveals very mixed success with this seed.

Certain operators in the animal feed sector have secured authorization to import selected maize seed produced in other countries for their own crops but are not authorized to market this seed, and the distribution of imported seed among small producers seems to be very limited.

The domestic mineral and organic fertilizer use rate for maize also appears to be extremely low. Madagascar does not produce mineral fertilizer and imports 25,000 and 45,000 tonnes of it per year.[36] According to the 2004 National Agricultural Census and the few available studies on Madagascar's fertilizer sector, a large portion of these imports are used mainly for rice and horticultural production.

With very limited use of selected seeds and fertilizer, average maize yields in Madagascar are rather low (around 1.8 tonnes per hectare according to FAOSTAT), even though, as seen below, FAO estimates that they have substantially increased since 2004.[37]

The sharp rise in domestic production observed in 2003 and the equally spectacular fall from 2003 to 2018 appear to be the result of statistical errors and corrections. As seen below, domestic maize consumption has substantially grown in the past two decades (driven by the monogastric animal feed sector), and the country's imports have not exploded, leading to the conclusion that Madagascar's maize production steadily grew in the 2000s and 2010s.

[32] For more information on the ecology and agronomy of maize, see *Memento de l'Agronome* (CIRAD and GRET, 1st edition, 1968).
[33] https://soc-semences.mg/registre-des-especes-et-varietes/
[34] https://soc-semences.mg/media/cnev/Catalogue-Varietale-edition-2017.pdf
[35] https://docplayer.fr/54896764-Etude-de-la-filiere-semenciere-a madagascar-et-plus particulierement-dans-la-zone-d-intervention-du-projet-asara.html
[36] For comparison purposes, note that a landlocked country like Burkina Faso, with a population close to the size of Madagascar's (22 million), imports 150,000-200,000 tonnes of fertilizer per year; Mali (with a population of 22 million as well) imports more than 300,000 tonnes of mineral fertilizer.
[37] It should be noted that these production and yield statistics, collected by FAOSTAT, appear to come from modeling rather than field surveys.

Madagascar maize production, international trade and yields (Source: FAOSTAT)

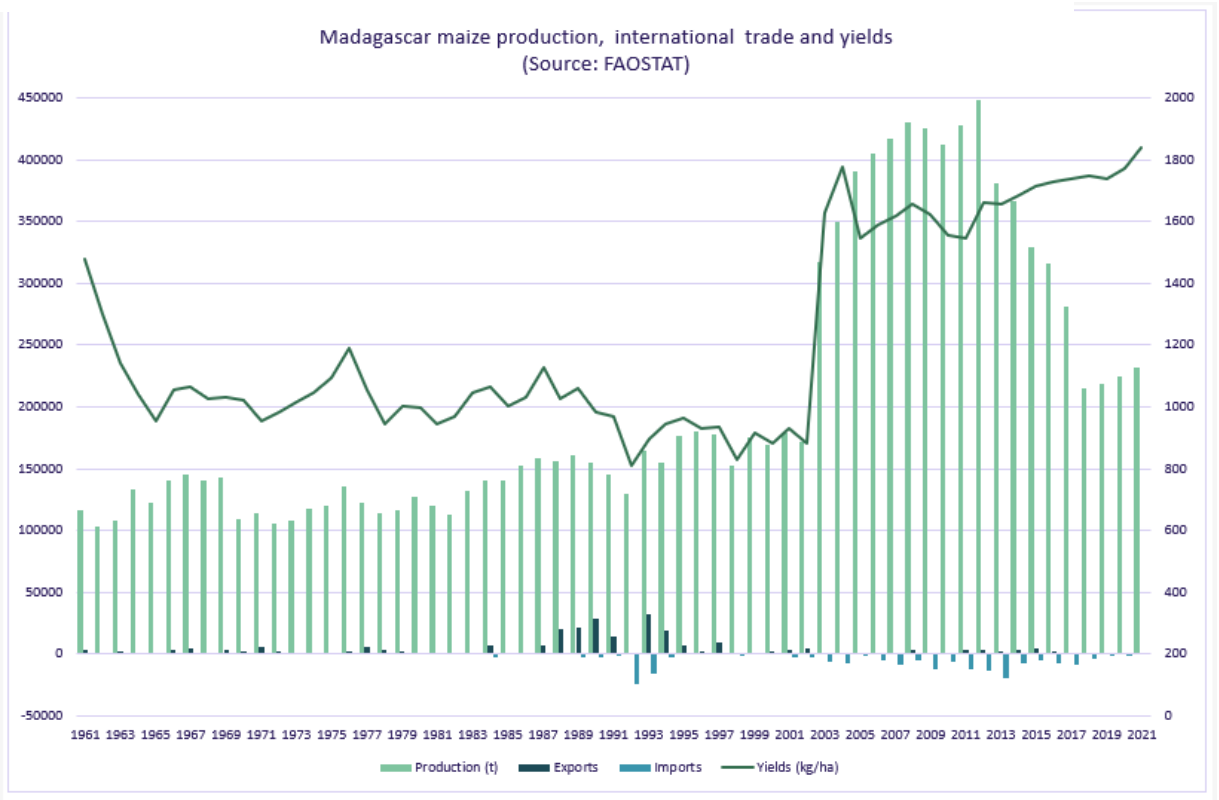


Figure 12: Madagascar maize production, international trade and yields 1961-2021

2.1.2 Maize value chain map

While official statistics based on extrapolations of census data (2004 RGA and 2018 General Census of Population and Housing (RGPH) put domestic production at slightly under 300,000 tonnes, our interviews lead us to believe that this figure is underestimated today.

As seen below, Madagascar's agricultural statistics system has seriously deteriorated in recent decades[38] and does not allow for up-to-date monitoring of agricultural activity that is rapidly changing due to the growing demand for certain products such as maize and groundnuts.

In addition to demographic growth, which leads to growing urban and rural consumer demand, the maize value chain is supported notably by the growing demand of the animal feed sector, which absorbs about 50 per cent of domestic production, and, to a lesser extent, the development of the agro-industrial sector (breweries, baby food production and flour milling), which absorbs around 5 per cent.

On-farm consumption in rural areas absorbs between 25 and 79 per cent of production, depending on the production zone, averaging between 50 and 55 per cent, depending on the year, according to the 2010 Periodic Household Survey[39] and the 2012/2013 National Survey to Monitor the Millennium Goals for the development of Madagascar.[40] The three major actors in the feed sector (LFL, Agrival and Soafiary) all confirm the figure of around 150,000 tonnes/year, which represents 40 to 50 per cent of domestic consumption.

[38] J.N. RANDRIAMORIA, Projet TCP/MAG/3502-Country STAT, Système Statistique Agricole et Alimentaire, FAO 2015.
[39] https://demostaf.web.ined.fr/index.php/catalog/164/study-description
[40] https://demostaf.web.ined.fr/index.php/catalog/157/study-description

Despite the growth observed in feed consumption (companies in the feed sector have witnessed 5 to 20 per cent annual growth in their sales in the past 10 years, and maize accounts for 70 per cent of their ingredients, on average), Madagascar's maize imports are still minimal, ranging from 500 to 5,000 tonnes/year over the past 20 years. This bears witness to the strong production dynamic in response to domestic demand.

According to our surveys, in 2022/2023, domestic farmgate prices appear to have ranged from 750 to 1,500 Ar/kg (US$0.17 to 0.36/kg) based on proximity to the markets with the greatest shortages, with prices from 750 to 850 Ar/kg (US$0.17 to 0.20/kg) in areas with a surplus but far from consumption hubs (Menabe and Atsimo-Andrefana regions) and from 1,000 to 1,500 Ar/kg (US$0.23 to 0.35/kg) in the plateaus in the country's centre near the feed factories.

In the absence of historical price series (the Ministry of Agriculture and the National Statistics Institute do not regularly collect information on maize and groundnut prices), we have been able to obtain only the annual data produced by the Rural Observatory Network (ROR) on a group of farms for the period 2009-2015. These data show that the farmgate price[41] ranged from 300 to 900 MGA/kg during that period, with a median sale price of 500 MGA/kg (but in a context in which the MGA/USD exchange rate ranged from 2,000 to 2,300 MGA per 1 USD). In the Atsimo-Andrefana region, where maize accounted for a significant portion of household income (60 to 80 per cent of the production marketed, with maize producing 10 to 33 per cent of annual income), average annual farmgate prices ranged from a low of 400 MGA/kg (US$0.20/kg) in 2009 to a high of 600 MGA/kg (US$0.27/kg) in 2013.

We can thus note that despite the 2021/2022 drought, which seriously impacted production in the south and southwest of the country, and the sharp devaluation of the Ariary against the United States dollar, maize prices in the country have remained fairly stable in recent years (and their real value has even fallen).

We note that the maize import values indicated by Madagascar customs facilities do not appear to be correlated with international maize prices and are thus rather unreliable (especially since Madagascar is located near a large maize exporting country, South Africa, and has a very good containerized shipping connection with that country).

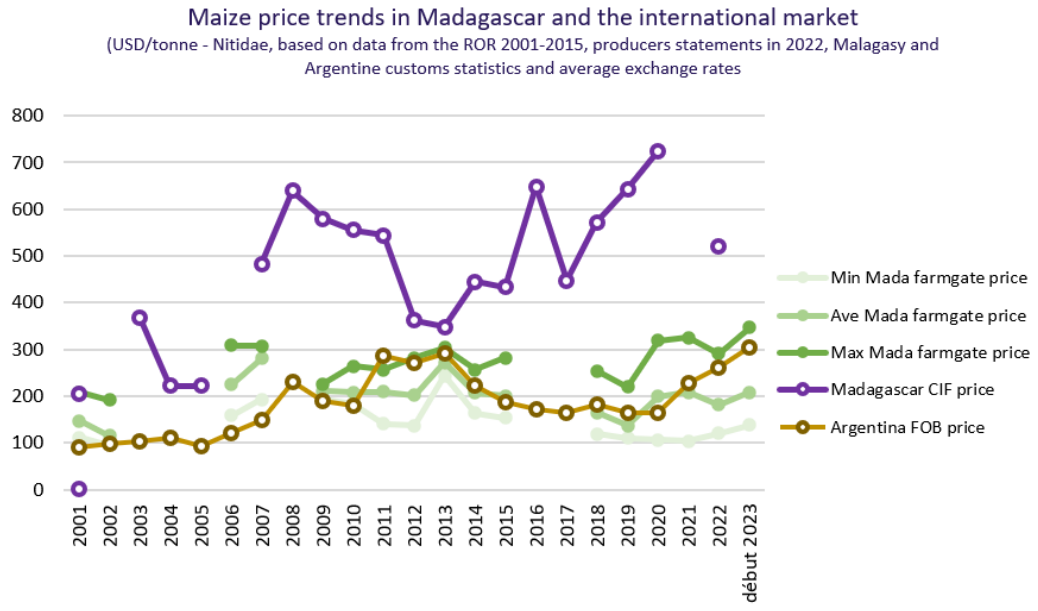


Figure 13: Trends in maize farmgate prices in Madagascar and international prices in USD/tonne

[41] The farmgate price is the producer's sale price without any transport fee other than for relocating the production and transporting it from the cultivated parcels to the producer's home or primary storage facility.

The wholesale resale prices of large “collectors” – that is, wholesalers who transport the maize from production zones to urban centres and feed factories – range from 1,500 to 2,000 Ar/kg (US$0.35 to 0.46/kg).

The retail prices obtained by the World Food Programme (WFP) in the south and east of the country from 2000 to 2022 and the maps produced by Nitidæ, below, bear witness to wide spatial heterogeneity, which we believe indicates limited domestic market integration.

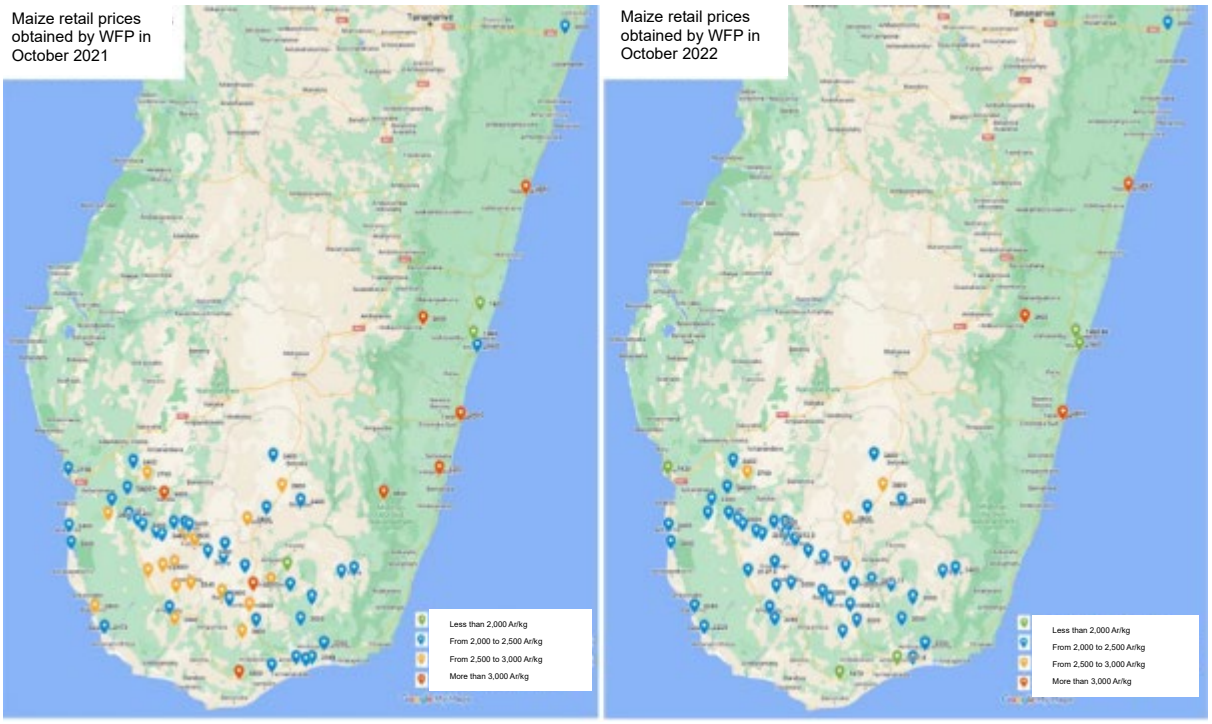


Figure 14: Geographic variability of maize retail prices in the south and east of Madagascar (WFP data)

The figure below shows the retail prices obtained by WFP in the southeast (Manakara, seat of the Vatovavy Fitovinany region), the south (Ambobombe, seat of the Androy region) and the southwest (Toliara, seat of the Atsimo-Andrefana region). It can be seen that retail price volatility has remained relatively low in the three areas, except for a sharp peak in the south of the country during the “hunger season” (January-April) and subsequent months in the south and a sharp drop in prices at the beginning of the 2022 harvests (in April) in the southeast and southwest.

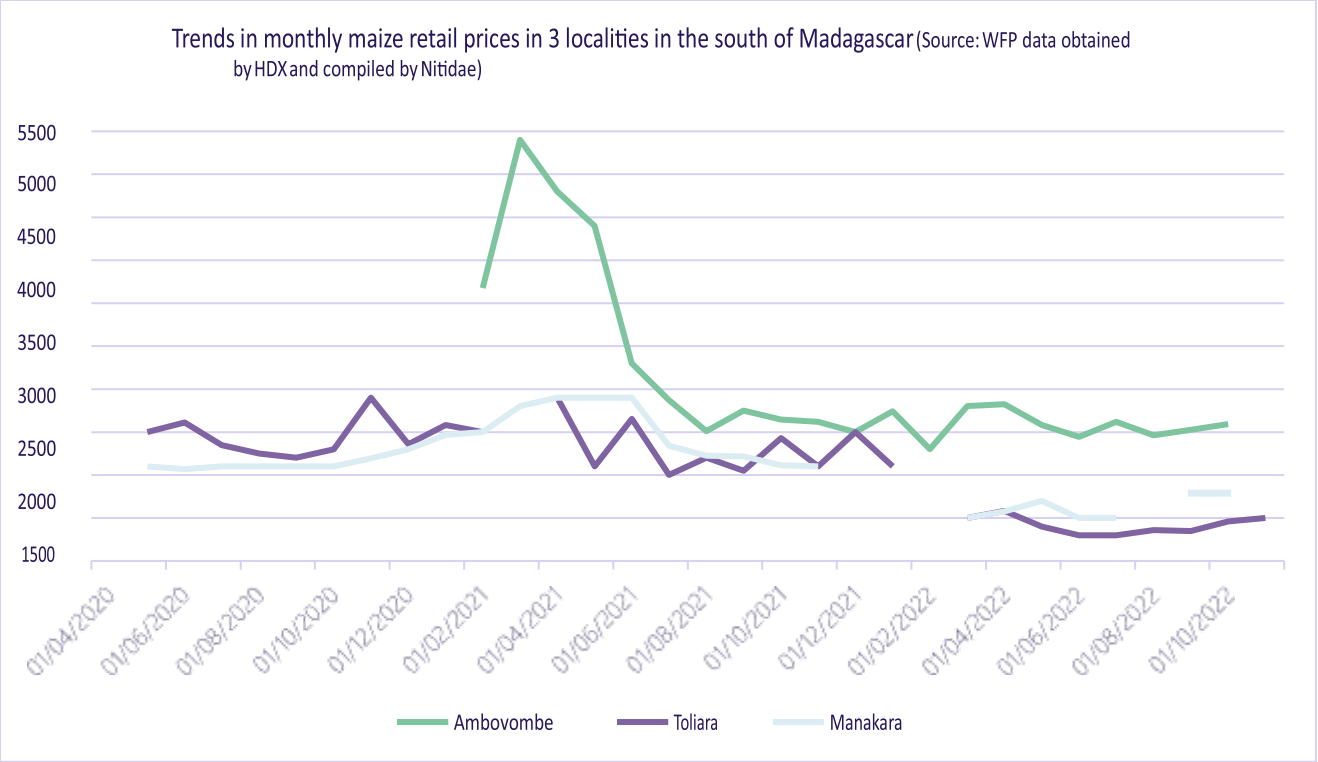


Figure 15: Monthly trend in maize retail prices in the markets of three large cities in the South of Madagascar 2020-2022

The diagram below maps the main stages of maize marketing in Madagascar and estimates volumes by type of market (by geography in purple and end use in dark grey). The values indicated are based on official data, but as previously noted, conversations with actors in the animal feed value chain led to the conclusion that domestic production is more than 300,000 tonnes and the animal feed sector absorbed more than 150,000 tonnes of maize in 2022.

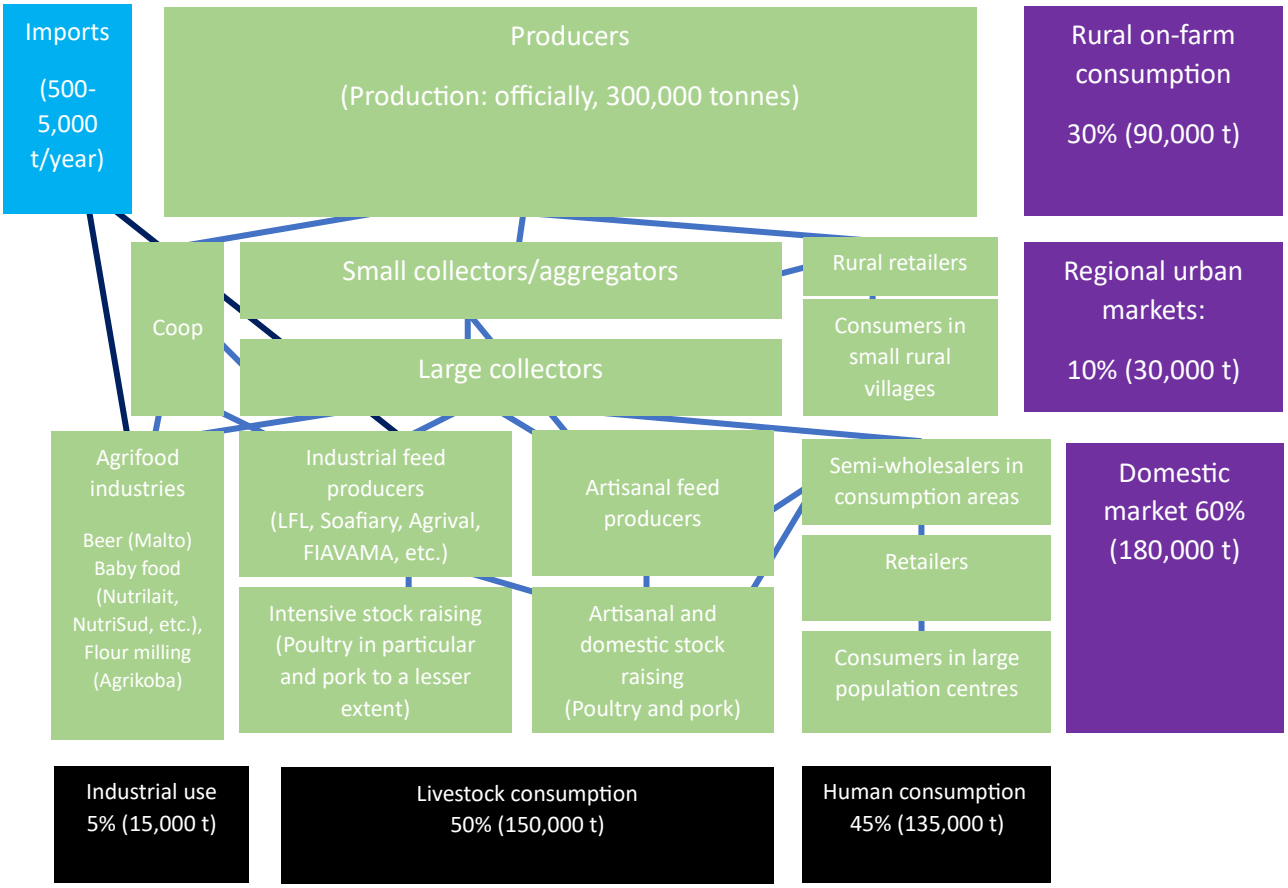


Figure 16: Diagram of actors and flows in Madagascar's maize value chain (Source: Nitidæ)

2.1.3 Analysis of the end market

Animal consumption

The animal feed sector is the largest market for maize production.

It is a very dynamic sector with a dozen large and medium-sized agrifood groups (LFL, Agrival, Sabma, Fiavama, Soafiary, etc.), as well as hundreds of small artisanal processers who are sometimes retailers as well. The burgeoning of semi-modern poultry and pig farming (dozens or hundreds of head) in peri-urban areas and even towns appears to be driving significant growth of the sector.

Artisanal urban and peri-urban poultry raising (several head per household) also absorbs the unprocessed or mixed maize kernels sold by retailers. The kernels are fed directly to the animals. Retailers from the Anosbé market in Antananarivo indicated that some 25 to 40 per cent of their sales were destined for small-scale domestic stock raising.

According to interviews with a number of major actors in the sector, animal feed may have absorbed more than 150,000 tonnes of maize in 2022. One indicator of the growth in demand is the volume of maize sold to the Livestock Feed Limited (LFL) group, which, according to our interviews, grew from a little more than 10,000 tonnes in 2007/2008[42] to more than 45,000 tonnes in 2021/2022. The main regions in which feed producers and stock raisers are supplied are Diego, Tamatave, Vakinankaratra, Boeny and Tulear.[43]

[42] https://agritrop.cirad.fr/555223/1/document_555223.pdf
[43] https://www.business-magazine.mu/entreprendre/autres-entreprendre/alimentation-pour-animauz-lexportation-dans-la-region-en-plein-essor/

The Menabe region, which also boasts a surplus of maize, is under an unofficial embargo of the crop due to maize production in protected areas.[44] It is likely that Menabe maize will continue to be marketed informally and considered to come from other regions.

Human consumption

As shown in the preceding diagram, the second most common use of maize in Madagascar today is human consumption. Maize is often the second most important source of calories for rural and urban households. Urban and rural households in rice-growing areas prefer rice as dietary staple, while rural households in non-rice-growing areas (south, southeast) consider cassava the mainstay of their nutrition. Maize supplements their rice and cassava intake.

Maize is largely consumed as kernels or pureed. These purées are most often eaten at breakfast, with the frequency varying from once a day to several times a week, depending on the household. The maize is also crushed or ground to make liquid slurries for young infants during weaning.

The use of maize-based baby cereal enriched with vegetable protein (soy, groundnut, beans) through industrial (or semi-industrial) processing appears to be confined to middle-class households in large urban centres. The poorest urban households and rural households make their own baby cereal with maize meal purchased in the market and on rare occasions enrich it with vegetable protein. Rural households that own zebu cattle and some urban households sometimes prepare slurries with milk, which increases the protein and lipid content.

This food market appears to be relatively stable. Few Malagasy consumers seem interested in adding more maize to their diet, and the growth of this demand comes primarily from demographic growth.

We noted the very limited presence of maize bread flour, which could be used as a partial or total substitute for imported wheat in the baked goods sector. This market segment appears to be clearly underexploited and has great potential for the development of human consumption.

Industrial use

Apart from the industrial manufacture of animal feed, the main industrial outlet for maize is the brewery sector. In 2019, the Malto company (Groupe Star) was buying more than 13,000 tonnes of maize[45] per year. This sector has also saw a sharp increase in demand, since Groupe Star demand was estimated at just 4,000 tonnes/year in 2009.[46]

In addition to this demand, the companies engaged in the semi-industrial manufacture of baby cereal (TAF, Nutrizaza, Nutrilait, NutriSud, Agrikoba) each absorb several hundred tonnes of maize per year, concentrating a demand assessed at 1,000 to 2,000 tonnes/year. Like TAF and Agrikoba, some of these companies produce both pure maize flour and maize for popcorn, sold in modern facilities (supermarkets, convenience stores), but to date, the sector remains relatively small, absorbing several hundred tonnes per year at most.

To date, the the Factory “Les Minoteries de l'Océan Indien” (LMOI), the country’s main producer of flour, does not appear to have developed flour for bread-making (to mix with or replace soft wheat) or flour for replacing durum wheat (for maize-based pasta).

[44] Surprisingly, the Tulear region is not considered, though much of the deforestation associated with maize growing is located there.
[45] https://afrique.latribune.fr/entreprises/industrie/2019-09-19/madagascar-l-entreprise-francaise-star-s-approvisionne-t-elle- en-mais-cultive-illegalement-828490.html
[46] https://agritrop.cirad.fr/555223/1/document_555223.pdf

2.1.4. Stages in the agricultural value chain and direct actors (unit of analysis)

The following are the links in the maize value chain:

Input providers

The input supply sector is relatively small and concentrated mainly in the high plateaus in the country's centre, where the majority of seeds, phytosanitary products and fertilizers are used for rice production and, to a lesser extent, market gardening.

The Agrivet/Agrival input supply outlets (Groupe SMTP) and Farmershop (Groupe LFL), however, distribute hybrid maize seed (imported but not found in the SOC online catalogue), fertilizers suited to maize (NPK 12-12-17 and 11-22-16, urea), selective herbicides for maize and insecticides to fight the noctuids and armyworms that ravage maize throughout the country.

Figure 17: Screenshot of a publication by the Farmershop network of input supply outlets

The use of fertilizer and phytosanitary treatments for maize growing appears to be negligible, however, input supply outlet networks are confined to major cities. The isolation and limited purchasing power of producers substantially limits the distribution of adapted inputs in rural areas.

Producers

The vast majority of producers are small-scale family farmers who grow less than 1 hectare of maize. The ROR data produced between 2009 and 2015 on a group of more than 2,000 farms monitored by 13-17 observatories depending on the year[47] shows the average yield per farm, which ranges from 50-100 kg/year (Alaotra-Mangoro, Analanjirofo) to 800 kg/year (Atsimo-Andrefana). The average portion marketed during this period ranged from 10 per cent in areas with low yields to 60 per cent in areas with an average yield of 500 kg/farm.

Other sources, such as the National Survey to Monitor the Millennium Development Goals in Madagascar of 2012/2013, also indicate average marketing of 40 per cent of production.

Nonetheless, due to the demand from the major feed groups, the most important farms are flourishing. One feed company that had set up a contracting system with family farms told us, for example, that it had collected 1,500 tonnes of maize from a group of 250 contracted producers, with average marketed production of 6,000 kg per farm. The absence of a statistics system to monitor agricultural dynamics makes it impossible to determine the place of medium-sized and large farms in the value chain, but it is likely that their numbers have steadily grown, especially in areas that are the destination of internal migrant flows or certain immigrant farmers, and benefit from an abundance of labour and a good market to expand the areas planted.[48]

[47] https://agritrop.cirad.fr/558679/1/document_558679.pdf
[48] See paragraph below on internal migration.

There are few large industrial farms. The main one, the Tozigree Group, which farms 6,000 ha of maize in the Lhosy district (Lhorombe region), shifted its operations to sorghum production in 2022-2023 following the very low rainfall of the 2021-2022 crop season (400 mm), which had made intensive rainfed maize farming impossible.

As will be seen in the next paragraph, producers are exposed to many risks.

Small collectors (aggregators)

Aggregators are small local merchants who live in large villages and small towns in rural areas and purchase and resell maize year-round. By speculating on intra-annual price seasonality, they play a role in local storage that is essential for food security. Moreover, they provide collectors with small storage facilities in rural areas during the harvest period.

They sometimes compete with collectors who come to purchase their supplies directly from producers on market days.

They are generally uninformed about price trends in major consumption centres and are therefore relatively exposed to price volatility. In fact, they rarely know what prices collectors will offer them once the harvest begins and regularly incur losses from their initial purchase of early harvests, especially since prices are very high during the hunger season and plummet after a relatively good harvest like that of 2022-2023.

The biggest risk to their activities, however, is the variable size of harvests in their production zone, which seriously impacts the volume of their activities and annual revenue. They generally compensate for this by avoiding specialization in a single type of product and diversifying their activities (sales of all non-perishable agricultural products, sales of agricultural products in cities and of processed goods from cities to the countryside, loans, storage).

In the maize value chain, they provide significant market liquidity by offering producers the opportunity to sell their stocks year-round. Unfortunately, since few producers are in a position to store their surplus production, only large producers profit from the higher prices that they generally offer one to two months after the harvest ends.

Large collectors (wholesalers)

Wholesalers who transport agricultural products from production zones to urban markets and from regions with a surplus to regions with shortages are called “collectors” in Madagascar.[49]

These actors play a role in transporting funds (from urban banks to rural areas) and arranging for the transport of surplus production to cities. Given the variations in yields, which can be very wide depending on the zone, they tend to diversify their supply basins.

Because of the very poor rural roads in Madagascar, they rarely use 35-tonne trucks to collect maize in rural areas and instead use 5 to 10 tonne trucks.

They have high logistical and security risk exposure due to the long distances they travel (or have their employees travel), with numerous accidents, breakdowns, thefts of funds and merchandise thefts or destruction. They are also highly exposed to shakedowns by the police both at the entrance of cities and on rural roads.

Unlike small collectors, they are relatively well-informed about price trends in the main assembly markets in their region and even other regions where they sell the production. Their access to information substantially reduces their exposure to market risks in the case of domestic value chains such as maize. The information also gives them an advantage, enabling them to realize significant margins at harvest time and cover the losses connected with logistical and security risks.

[49] The term used in other countries is “aggregators.”

Their main strength lies in the trusted networks they have built up year after year in rural areas (aggregators, large producers, local authorities) and cities (customers, authorities, bankers). These networks are their main capital and the greatest factor in their success, because they enable them to obtain bank loans and even prefinancing from their customers, which are necessary for collecting the product, avoiding ambushes and quickly solving logistical and security problems.

The long distances that must be travelled to fill a truck, limited access to credit and the oligopolistic situation of these commercial actors, who have learned how to build a reputation as trustworthy people in an extremely risky economic, security and legal environment, is much of the reason for the lack of competition in rural areas and the large price differentials between the farmgate and urban wholesale markets.

Processors

Maize processors are in a value chain dominated by the feed sector. As indicated earlier, this sector includes highly diverse actors, from large industrial factories that process many thousands of tonnes of maize per month, to artisanal processors who produce feed using small mechanical mills, to semi-industrial units and entrepreneurs transitioning from artisanal activity to the industrialization of their process.

Figure 18: Photo of maize-based baby cereal in a supermarket in Antananarivo

Industrially processed feed is distributed by retail outlets specializing in agricultural inputs and animal feed, wholesale urban markets and large weekly rural fairs. Artisanally and semi-industrially processed feed is distributed to wholesale and certain urban retail markets, rural fairs and often directly to stock raisers without going through a retailer.

In addition to feed vendors, this segment includes the brewery and baby cereal sectors. With higher purity and drying requirements than for feed production, these actors have the most demanding quality standards. That is why some of them develop direct supply chains with producers, working with specialized collectors, and even resort to importing foreign maize when they cannot find maize of acceptable quality in the local market.

Processors are moderately exposed to the risk of shortages, as they are largely concentrated in regions in the centre of the country, which enables them to diversify their supply areas. However, they are very sensitive to maize price volatility, which significantly impacts their production costs (maize generally accounts for 70 per cent of feed producers' ingredients) and thus, the competitiveness of their prices.

This is a very competitive sector, where the smallest actors (artisanal), whose fixed costs are lower, can sell at lower prices when maize is abundant. At the same time, however, these small-scale operators have less storage capacity, requiring them to take seasonal jobs or substantially increase their sale prices during the hunger season. Industrial feed manufacturers benefit from greater storage capacity and the gradual decrease in supply after the maize harvest to guarantee stock raisers relatively stable prices year-round.

Wholesalers (semi-wholesalers)

Semi-wholesalers who supply the urban wholesale markets are generally called "wholesalers" in Madagascar. They rarely have direct contact with producers or aggregators

and most often obtain their supplies “when the collectors’ trucks arrive” early in the morning in wholesale market areas.

These actors have only limited risk exposure associated with price volatility. The receive products from several production zones and offset lower volumes of business in periods of shortage by increasing their unit margins, which enables them to keep revenues relatively stable year-round and from year to year.

With the lowest exposure to the risks of this sector, it is a highly competitive segment with dozens of wholesalers in the same market.

They supply neighbourhood retailers, restauranteurs, small artisanal processors, stock raisers and consumers who travel to the wholesale market.

The majority of these actors in the maize value chain are women.

Retailers

The maize value chain is dominated by informal and traditional distribution. Comfortable households consume little maize and what they do consume is processed. Modern distribution is an extremely small niche market in Madagascar’s maize value chain.

In every city in the country, hundreds of retailers (this segment is also dominated by women) sell maize in packets (*Kapok*) of 50 or 100 g. This segment has little risk, because price increases in the wholesale market are immediately reflected in retail prices, and these actors have limited stocks. It is thus an extremely competitive segment with limited margins and sales volumes linked primarily to the location of the business.

Consumers

As indicated earlier, maize is a secondary food in the Malagasy diet. It is generally less expensive than rice (in March 2023, the retail price of maize ranged from 1,800 to 3,500 Ar/kg versus 2,400 to 3,700 Ar/kg for the various types of rice). The impact of maize prices on the purchasing power of Malagasy consumers is therefore moderate.

While maize prices affect the purchasing power of urban consumers, it is more because of their impact on the price of animal products than on the price of maize kernels in retailers’ stalls.

Consumers therefore have little exposure to market risks and agricultural risks in general.

2.1.5 Support services

Figure 19: Photo of a retail sales display of rice, maize kernels and black-eyed peas, with prices, in a small market in Antananarivo (University area)

Unlike the rice value chain, which has benefitted from a significant support mechanism for several decades, the maize value chain has only been a focus of public policy since the late 2010s. For example, the maize sector is not mentioned in the Action Plan for Rural Development drafted between 1999 and 2001,[50] and only the rice and cassava food value chains are considered in the Poverty Reduction Strategy Document (DSRP) drafted between 2003 and 2005.[51,52] The Programme for the Agriculture, Livestock and Fisheries Sectors of the National Agricultural Investment Plan (PNIA), designed in 2015 for implementation in 2016-2020,[53] does not consider the activities targeted in this value chain, either.

In the Atsimo-Andrefana region, considered the country's largest maize production basin in the early 2000s (but later, a secondary production zone), the Regional Director of Agriculture and the technical agriculture staff encountered confirmed that their teams (with very limited means) focus essentially on agricultural monitoring and advisory activities in irrigated rice-growing areas.

The emphasis on rice in Malagasy agricultural policy is also found in the varietal supply (as previously emphasized) and the experimentation with more intensive and/or resilient production systems.

The principal organizations working with the maize value chain are FOFIFA (Multiplication of maize seed[54]) and the CTAS (Support for massal selection and the multiplication of traditional farmers' seed) with, as mentioned earlier, many questions raised about the quality of the seeds obtained and multiplied.

2.1.6. Geographic analysis

The National Agricultural Census of 2004 is the most recent exhaustive national database, allowing for precise mapping of areas planted with maize in the country.

The maps below were based on the regional and district land use data from the RNA 2004.

[50] https://faolex.fao.org/docs/pdf/Mad182121.pdf
[51] https://www.inter-reseaux.org/wp-content/uploads/pdf_DSRP_version_juillet_2003.pdf
[52] https://www.inter-reseaux.org/wp-content/uploads/pdf_dsrp_juin_05.pdf
[53] https://faolex.fao.org/docs/pdf/Mad169997.pdf
[54] https://www.facebook.com/FoodSecSemence/videos/madagascar-un-cycle-de-multiplication-de-semences-de-ma%C3%Afs-au-fofifa-kianjasoa-ra/374930647867646/?locale=ms_MY

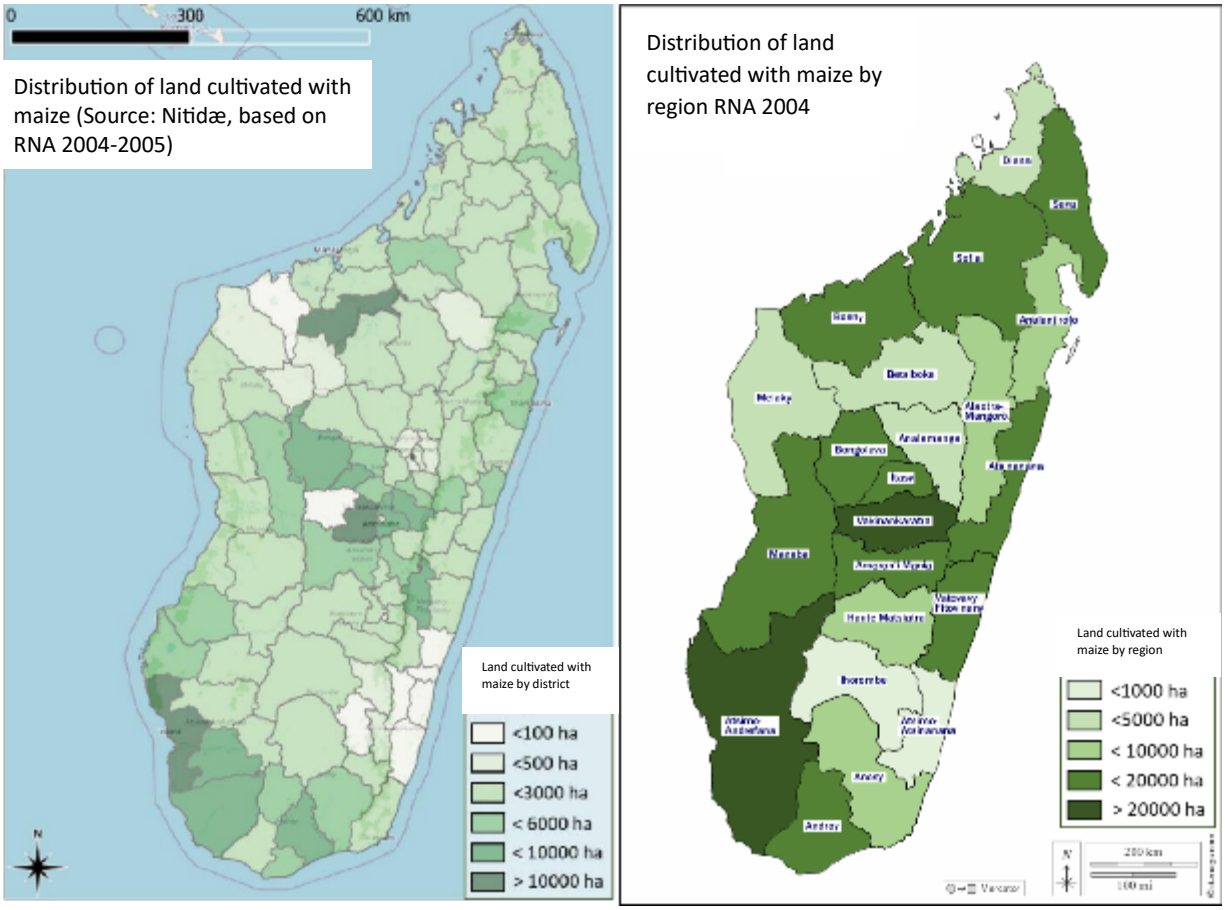


Figure 20: Two maps of land cultivated with maize by region and district in 2004

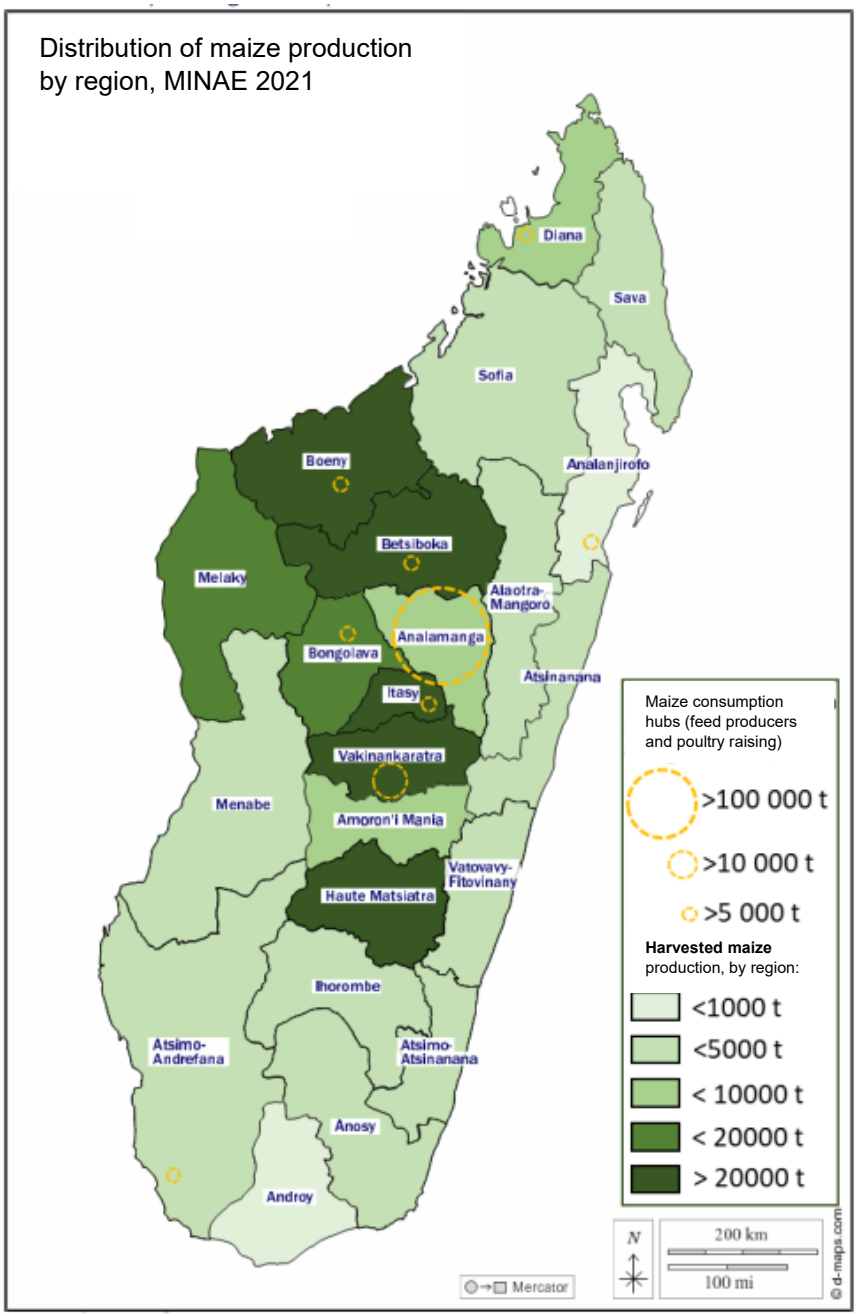


Figure 21: Distribution of corn production by region MINAE 2021

However, the Ministry of Agriculture has updated the data from the RNA 2004, using the data from the agricultural section of the 2018 Population and Housing Survey (RGPG3). These new data, though less specific since their focus was not agriculture, show a fundamental change in the geographic distribution of maize production.

According to these recent data, production in the south of the country has sharply declined but significantly increased in the west and central plateau regions.

These trends are associated with the lower average rainfall in the south of the country, which has driven many producers to reduce the amount of maize grown in their crop rotation, substituting it largely with cassava varieties with a high tolerance to drought and, more recently, millet and sorghum – grains with less need for water that were introduced by FAO and several resilience projects.

2.2. Groundnuts

2.2.1. Product characteristics

The groundnut originated in tropical and subtropical regions of Brazil, Peru and Argentina in South America. It is an annual legume with a taproot that produces a protein-oleaginous seed (like soy) and thus, differs from other annual leguminous plants, which produce proteinaceous seeds (beans and peas).

Figure 22: Photo of groundnut plant and seeds in a field in Befandriana, Atsimo-Andrefana region

Its main feature is that its seeds are produced underground. The nodules on its roots and its underground seeds are highly sensitive to excessive water and organic matter, which favours its cultivation in well-draining soils. Excessive water adversely affects this plant in several ways, causing its roots and seeds to rot, creating water stress from saturation (the plant's inability to absorb water due to the excess) and causing nitrogen loss through the slowdown of rhizobium activity (rhizobia are nitrogen-fixing bacteria that function in symbiosis with leguminous plants), as well as leaching or even fungus attacks, especially brown rot (*Sclerotium rolfsii*) and white rot (*Rhizoctonia solani*). In Madagascar, groundnuts have been afflicted for more than 50 years by the "groundnut rosette," associated with a virus from East Africa,[55] and groundnut rust, a fungal disease from Sri Lanka.[56] More recently, it has been heavily attacked by leaf miner larvae of undetermined species.

Groundnuts are sensitive to frost and require warm temperatures to develop properly. They prefer a hot, humid climate with optimal growing temperatures of around 25° to 30° C. Though primarily grown in dry tropical climates (Asia, the Americas, Africa), they are also grown in humid tropical climates on these same continents and even in Mediterranean climates (Spain, California), cultivated in sandy soil to prevent excessive water. They are grown in most of Madagascar, where the largest production basins are located in the dry tropical climate of the southwest (Andray and Atsimo-Andrefana) and northwest (Boeny).

Groundnuts are a short-cycle crop that tolerates fairly low rainfall (400 mm) but requires very regular rains in the first two months of its cycle.[57] At the end of the cycle, however, once the

[55] https://www.persee.fr/doc/jatba_0370-5412_1946_num_26_289_1958
[56] https://horizon.documentation.ird.fr/exl-doc/pleins_textes/doc34-07/41233.pdf
[57] Agronomist's memo, Ibid.

seeds mature, it needs low levels of rainfall, because excessive water before harvest could cause the seeds to rot or even sprout. Under such conditions groundnuts should be a late-planted crop, but for economic reasons (consumption and early groundnut sales[58] at the end of the hunger season), a large portion of producers seem to prefer semi-early harvests (November-December).

Unlike maize, groundnut cultivation in Madagascar does not appear to benefit from any varietal selection and multiplication mechanism. The SOC catalogue lists only one officially recognized variety of groundnut, the Flower 11 variety, selected in Senegal and introduced in Madagascar by FOFIFA.[59] This variety has the advantage of tolerating very low rainfall in its growing cycle (300 to 500 mm of rain) but the disadvantage of not having a dormancy period, which could seriously harm germination if the rainy season begins late. The CTAS has also identified two traditional varieties produced by massal selection in the Androy region: Boha (prized for its yields) and Kanety (prized for its taste).

However, merchants prefer traditional qualities, notably colour and region of origin. In the Anosobé wholesale market in Antananarivo, merchants prefer groundnuts with large seeds from Mahabe (Menabe region) and highly appreciate the bright red medium-sized seeds from Ambositra (Amoron'i Mania region), which they sell at higher prices than those of other origins or less uniform and/or smaller varieties from Majunga (Boeny region), Mandabe (Menabe region) or Bekily (Androy region).

Limited groundnut availability is an even greater constraint for the value chain, as this crop requires a large amounts of seed per hectare – 50 to 60 kg of shelled seed (versus 15 to 20 kg for maize). At 3,000-4,000 Ar/kg, ordinary seed entails high growing costs (15,000 to 240,000 Ar/ha, or US$38 to US$60/ha).

Logically, the use of mineral and/or organic fertilizer in the Malagasy groundnut value chain is exceedingly rare. As noted earlier, groundnuts do not fare well with the application of organic matter (except in soils very lacking in organic matter, which is likely the case in certain historical production zones but affects few groundnut producers, because most of the production in Madagascar comes from an area where land with long fallow periods is very available). As a legume, groundnuts need little additional nitrogen but react strongly to a high dose of phosphate (in Senegal, there is extensive use of NPK 6-20-10). Furthermore, as with most legumes, groundnut productivity can be powerfully stimulated by inoculation (a dose of additional nitrogen-fixing bacteria to intensify activity in the root nodules), though this practice appears to be non-existent in Madagascar.

2.2.2. Diagram of the value chain

Groundnuts in Madagascar have long been considered an industrial product destined for the development of local trituration and the country's self-sufficiency in edible oils.

The history of this value chain is studded with many industry failures (Union of Groundnut Production Cooperatives – UCOPRA) in the 1960s, Office of the Groundnut Stabilization Fund (BSCA) and Operation Groundnut Relaunch in the 1970s, the opening of industrial oil manufacturing plants such as Huilerie Centrale de Tananarive, the SCIM oil manufacturing plant, SICA Morondave, the Fidahoussen oil manufacturing plant in Isoanala, the Antsohihy oil manufacturing plants, etc.[60] The last three industrial trituration plants walked away from the groundnut value chain in 2000 and 2010. Tiko Oil closed its doors in 2009 after a series of equipment thefts and a tax adjustment it claimed was abusive. The Indosuma company shifted its trituration activity to cotton seed in the early 2010s. The SCIM shifted to the essential oil extraction chiefly for export.

[58] Early groundnuts are groundnuts harvested before reaching full maturity. They can contribute significantly to the income and caloric intake of rural households in March, before the grain, bean and cassava harvests.
[59] https://SOC-semences.mg/registre-des-especes-et-varietes/
[60] https://www.inter-reseaux.org/wp-content/uploads/pdf_109_Filiere_Oleagineux.pdf

The edible oil trituration and refining sector has historically endured political constraints (variable regulations, nationalization) and then, economic constraints (competition from imported oils after liberalization of the sector, competition from raw exports to Asia to supply factories since 2009).

In 2022, exports of groundnut seed dominated the value chain. This is a dynamic outlet that absorbs almost half of domestic production, estimated at 65,000 tonnes, according to official production statistics.

However, as indicated earlier, domestic production statistics for the maize and groundnut value chains are extrapolated from the National Agricultural Census of 2004 and the RGPH of 2018. They appear to be relatively out-of-date for understanding what appear to be rapidly changing production dynamics in the two value chains.

The upsurge in groundnut exports to Asia was accompanied by an upward adjustment in domestic production in 2014, but as seen below, the production estimates appear to be strongly uncorrelated with export growth.

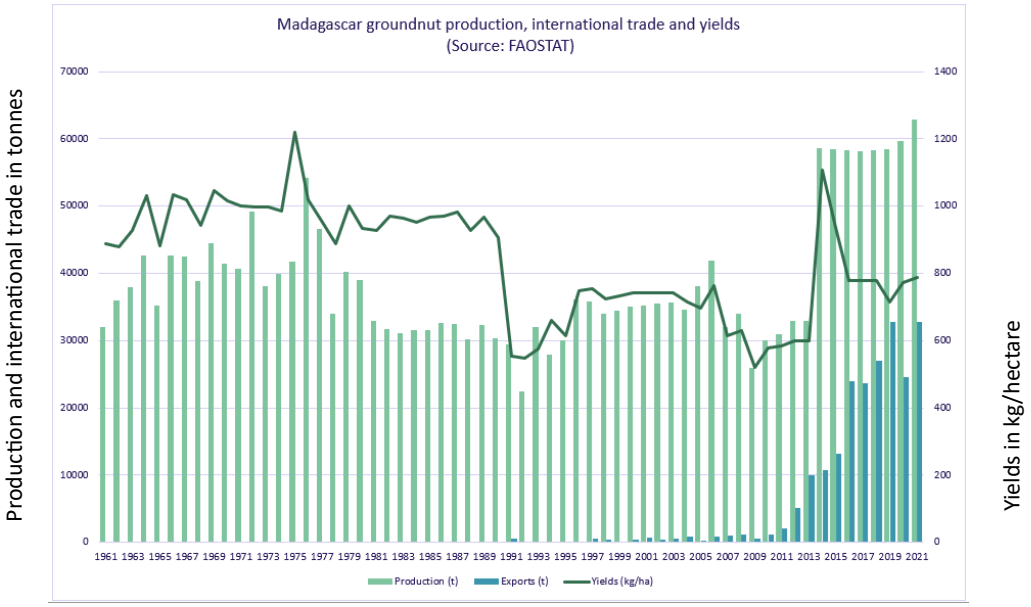


Figure 23: Trends in groundnut production, international trade and yields in Madagascar 1961-2021

After exports, on-farm rural consumption, which, according to the agricultural surveys, increased by 30 and 35 per cent from 2010 to 2012, ranks second. If the official production statistics can be relied on, there is only a small place for urban consumption (artisanal trituration, and especially, Koba Ravina pastry) and semi-industrial and industrial demand (enriched flour and the new semi-industrial oil production facility being launched by Feedmax). Domestic production is likely more than 65,000 tonnes, and these outlets have a slightly more important place in the value chain.

In the absence of regular institutional price records, we have been able to access the annual sale prices obtained by the ROR from 2001 to 2015. These prices ranged from 400 to 750 Ar/kg in 2007 to a higher price of 1,200 to 2,200 Ar/kg in 2015 for unshelled groundnuts (losses of around 35 per cent of the weight on shelling). During our surveys in the Befandriana area (Atsimo-Andrefana region), the producers we encountered stated that the farmgate price of unshelled groundnuts had risen from 1,000 Ar/kg in March 2022 at harvest time to 2,000 Ar/kg in November at the start of the hunger season and the buybacks of groundnuts for seed. The figure below shows the prices found, converted to United States

dollars/tonne, the Free On Board (FOB) export price declared by Malagasy customs (obtained from trademap.org) and the export price of the largest exporter of groundnuts for oil, India.

We can see that with the sharp rise in groundnut oil prices in the international market as of 2011, price ranges in Madagascar appear to have been widening. At the end of the crop season and during the hunger season, buyers appear to have paid prices relatively correlated with those of the international market, but during the harvest period, the prices paid appear to be completely disconnected to the market in the main destination, indicating that a large portion of groundnut producers do not have access to a competitive market and face major losses.

For example, the differential between the average farmgate price and the international price, which in 2022 averaged US$700/tonne in Senegal (Africa's main groundnut exporter) was used to represent the theoretical farmgate price (in grey) that could be paid to producers in a competitive situation with limited information asymmetries.

We also note that the FOB prices provided by Malagasy customs appear to be completely underestimated and disconnected from reality.

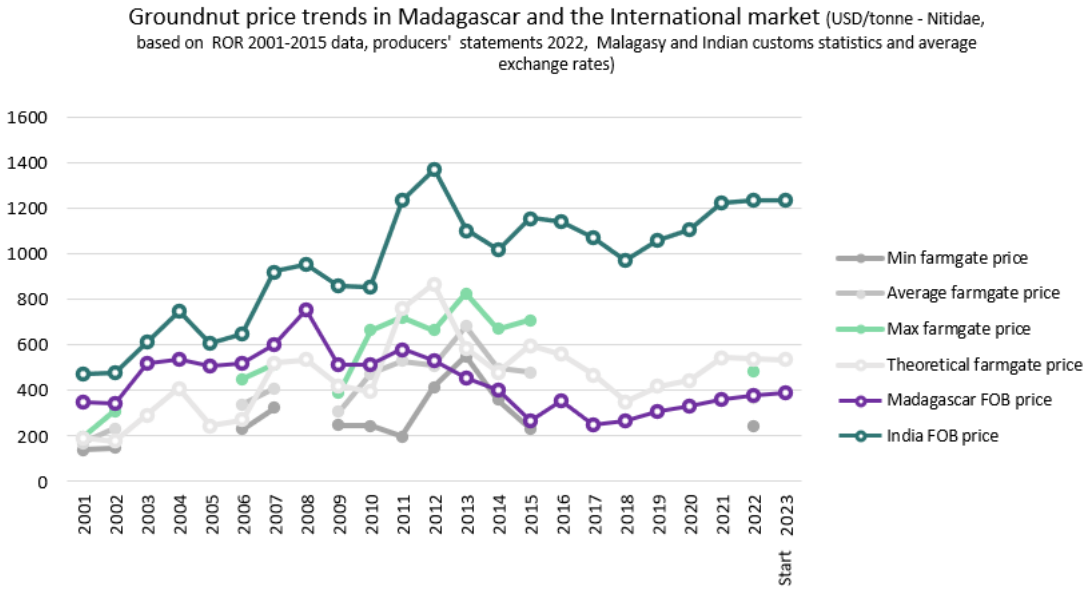


Figure 24: Trends in annual farmgate prices in Madagascar and average annual international prices of groundnuts for oil

The diagram below summarizes the main actors directly involved in this value chain and the opportunities by geography (purple) and type of use (blue and grey).

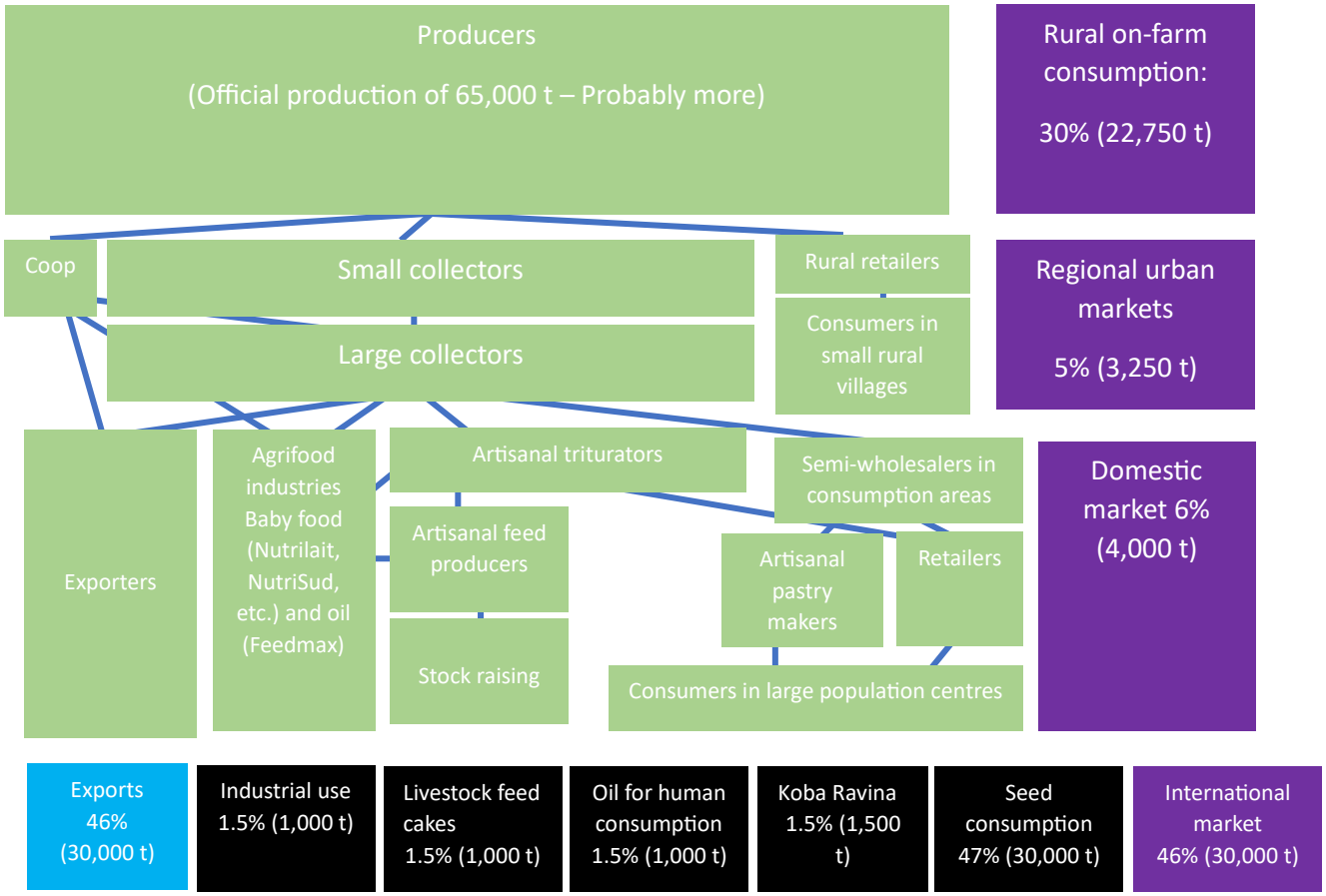


Figure 25: Diagram of actors and flows in the Madagascar groundnut value chain

2.2.3. Analysis of the end market

The Chinese and Southeast Asian markets

The main outlet for commercial groundnut production in Madagascar today is exports of shelled seed to Asia. Viet Nam, which is registered as the main destination of export flows, is, in fact, an intermediary for penetrating the Chinese market, which is the main destination for Malagasy groundnuts. Direct access to the Chinese market requires registration with several Chinese administrative entities – notably, the General Administration of Customs of China (GACC), the State Administration for Market Regulation (SAMR), the National Health Commission of China (NHCC) and China's Certification and Accreditation Administration (CNCA). To circumvent this lengthy process and the controls required by the Chinese Government for delivering food products to these ports, many export companies ship their products through Viet Nam to enable them to enter the China by land (where they are subject to much less stringent controls) or by sea (by altering the product's certificate of origin).

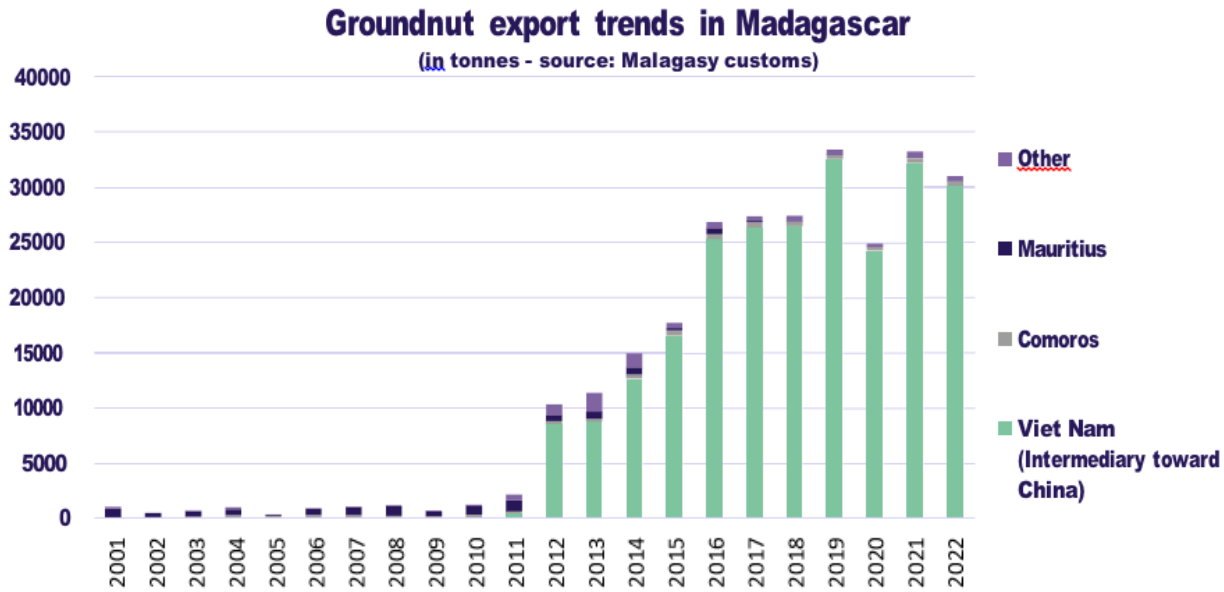


Figure 26: Trend in Madagascar groundnut exports by main destination

In 2007/2008, China shifted from its position as an exporter of groundnuts to that of a net importer. This shift led to soaring groundnut prices in the international market and shortages in Southeast Asia's groundnut oil market. These shortages worsened and resulted in the revitalization and even the development of numerous groundnut export value chains in Africa (Senegal, The Gambia, Sudan, Nigeria, Ethiopia, etc.). The Malagasy groundnut value chain was able to profit from these shortages but is still very much a minority in a Chinese market of around 1.5 million tonnes. By way of comparison, exports from Sudan, the country that has benefitted the most from the growth in Chinese demand, rose from 6,000 tonnes in 2018/2019 to more than 400,000 tonnes in 2020/2021. Exports from Senegal to China rose from 10,000 tonnes in 2012/2013 to 330,000 tonnes in 2020/2021.[61]

Furthermore, India, historically the largest groundnut exporter in Southeast Asia, is increasingly shifting its focus to its domestic market. The demand from China, and more generally, Southeast Asia (Indonesia, the Philippines and Malaysia are also major groundnut importers), has therefore launched on a new growth trajectory, which should continue to draw on the groundnut supply in Africa.

Moreover, unlike Western markets, which are characterized mainly by the consumption of edible groundnuts (seeds) and access to which requires extremely low levels of aflatoxins, Southeast Asian countries use groundnuts primarily for the production of oil, whose trituration and refinement destroys the aflatoxins. The technical barriers to trade (ToT) of these markets are much lower than those of Western markets, making them easily accessible.

The constraints to Malagasy export growth currently appear to be the limited value added captured by producers, on the one hand, and climate and environmental risks that slow production growth on the other. If these constraints were lifted, production of groundnuts for export could see growth comparable to that of other value chains in Africa.

The local market

Local groundnut consumption is mainly their consumption as food – that is, whole groundnuts, fresh or roasted, without pre-grinding or trituration.

[61] These analyses are based on the continuous monitoring of the groundnut market by Nitidæ's n'kalô information and advisory service (www.nkalo.com) since 2010.

Groundnuts are consumed directly or added to dishes (with rice and leafy vegetables, especially *brèdes*). Since they are relatively expensive, 5,000-6,800 Ar/kg in the Anosbé retail market in March 2023 at the height of the harvest season, their consumption is influenced by the purchasing power of populations of modest means. The retailers we encountered told us they see significant variations in the amounts purchased, depending on prices and the economic situation. Since the COVID-19 crisis and its negative impact on the Malagasy economy, they have noted a slight drop in urban consumption.

Groundnuts are also the main ingredient in Koba Ravina, an iconic Malagasy pastry that is regularly enjoyed, especially on weekends and holidays. Certain bakers and street venders are involved in the production and distribution of this pastry, especially in large cities.

2.2.4. Stages in the agricultural value chain and direct actors (unit of analysis)

Input suppliers

Unlike the maize value chain, the sector for the supply of inputs tailored to the groundnut value chain is in the embryonic stage. As indicated earlier, only one variety of groundnut, Flower 11, is officially recognized in Madagascar.[62] Developed in Senegal, its multiplication and distribution are handled by private input distribution networks but only intermittently by development projects and programmes.

Access to fertilizer and phytosanitary treatments for groundnuts appears to be non-existent, as is inoculum.

Access to seed is provided mainly through self-seeding or the buyback of groundnuts intended for consumption from retail markets.

During our field visits to the Befandriana production zone (Atsimo-Andrefana region), the groundnut plants were under massive attack by leaf miner larvae (of undetermined species), and producers were unaware of or did not have access to any treatment or biological control method for this pest.

Producers

As with maize, the vast majority of production comes from small family farms that grow less than 1 hectare of groundnuts. According to the ROR data for 2009-2015, annual production averaged 50-800 kg/farm, depending on the area and year. Unlike maize, most of the production is destined for the market.

On the farms monitored by the ROR, the proportion of production marketed ranged from 30 per cent for the smallest producers who harvested less than 100 kg to 80 or even 90 per cent for the majority of producers who harvested 200-800 kg. The data from the 2012/2013 National Survey to Monitor the Millennium Development Goals in Madagascar also show average marketing of 70 per cent of production.

Groundnuts are therefore primarily a cash crop, even if they play a nutritional role (fat and protein intake) in rural households. According to the ROR data, groundnuts account for 5 to 60 per cent the annual financial revenue (from sales) of producer households. The median weight of groundnuts in their financial revenues is 17 per cent.

Aggregators

The aggregators in the groundnut value chain are the same ones that operate in the maize value chain. Their characteristics, constraints and risk exposure, notably price volatility, are the same as those of the maize value chain.

[62] https://soc-semences.mg/registre-des-especes

Collectors (wholesalers)

The collectors in the groundnut value chain are likewise the same ones that operate in the maize value chain.

However, since the groundnut value chain is in part an export value chain, certain collectors receive financial support of an exporter that prefinances them, while others operate with their own funds and deliver to both exporters (payment on delivery) and wholesalers in urban markets.

In contrast to the maize value chain, where price trends are primarily determined by domestic supply and demand, the groundnut value chain is strongly influenced by price trends in the international market. In this context, collectors have very little information on the state of the international market and are therefore highly dependent on the information provided by exporters. Thus, they are more exposed to market risks in this value chain, where prices evolve as a function of factors they are unaware of and cannot control. They are periodically subject to losses when prices fall below those of the international market at the end of one crop season and the beginning of the next, because they must make purchases with their own funds at the start of the year based on the previous year's prices and must then sell to customers at a loss.

Thus, in this value chain, they are also exposed to logistical and security risks, leading to significant market risks.

Furthermore, most collectors handle the shelling of groundnuts. After purchasing the unshelled groundnuts from aggregators and transporting them to their warehouses in the city, they pay dozens of women to manually shell the groundnuts before repackaging them for sale in the urban wholesale market and to exporters.

Exporters

Groundnut exporters operate primarily in the ports of Tamatave and Tulear.

Some of them are export companies that built their business on exports of vanilla, cloves and cacao and then diversified to exporting groundnuts with the emergence of the demand from China in 2008. These companies work with different importers and generally have their own warehouses and groundnut cleaning and packaging lines before exporting the product.

Others are collectors who have forged ties with Chinese and/or Indian exporters' representatives, who come to set up a groundnut and/or bean supply chain (mainly black-eyed peas and Cape sweet peas). These collectors/exporters work as contractors for their customers, who each crop season send a representative to oversee their work, set the purchase price and exercise quality control. They delegate all export procedures and formalities to independent contractors and play a role that could be called "subcontractors" for their foreign customers. The majority of them are even equipped with a groundnut cleaning and packaging line for export directly to their customers. These collectors/exporters have relatively low risk exposure because it is their foreign "partner" that sets the prices based on the international market and the quality of the groundnuts received.

Processors

Since the closure of the industrial trituration factories in 2000 and 2010, groundnut processing in Madagascar has primarily been artisanal. There are some artisanal triturators in the central plateau regions, especially in Fianarantsoa and its surrounding areas. They triturate groundnuts (and sometimes soybeans) mainly for the production of animal feed cake (which they sometimes produce for themselves). Artisanal groundnut oil is therefore a by-product of groundnut cake production.

Figure 27: Photo of a groundnut exporter's storage warehouse with a cleaning and packaging chain and a stock of groundnuts in Toliara (Atsimo-Andrefana)

In March 2023, artisanal groundnut oil sold for around 6,000Ar/litre wholesale and 8,000 Ar/litre retail. We were unable to find the sale price of groundnut cake.

An interesting indicator of the connection between trituration and the production of animal feed is that we only found groundnut oil in the Anosbé wholesale market among semi-wholesalers specializing in feed.

Paradoxically, while it is more expensive in the international market than palm, soybean, or copra oil, the local sale price of artisanal groundnut oil is lower than the sale price of imported oils, which at the time of our surveys was between 9,000 and 12,000 Ar/litre. The increase in the price of imported oils in the international market in 2022 and the depreciation of the Ariary appear to have made local groundnut processing highly competitive.

Beyond artisanal trituration, there are numerous small artisanal processors who roast groundnuts and package them in small bags, and sometimes caramelize them. These small-scale roasters also sell of groundnut bags retail or give them to members of their family.

Figure 28: Photos of roasted groundnuts, covered groundnuts and groundnut butter sold

There are also semi-industrial processing entities that sell roasted and caramelized groundnuts and groundnut butter to modern distributors (supermarkets, convenience stores, service stations). However, this is a niche market that targets the wealthier classes mainly in the country's capital and large cities.

Figure 29: Photo of Koba Ravina in an artisanal processor's display in Antananarivo

Finally, an important processing sector is the pastry sector – especially production of the iconic Koba Ravina, a traditional Malagasy pastry sold in every city in the country. This sector employs hundreds of small artisanal processors who produce this confection made of rice flour, groundnuts, bananas and sugar in their home, with groundnuts accounting for 15 to 30 per cent of the ingredients.

Wholesalers (semi-wholesalers)

The semi-wholesalers who sell groundnuts in urban wholesale markets are generally the same ones that market maize. As with maize, they have little risk exposure, because they quickly pass price increases on to their resale prices.

Retailers

As with maize, the groundnut value chain is dominated by informal and traditional distribution. The exposure of retailers, who are largely women, to agricultural risks is also limited, but this segment is very competitive.

Consumers

Groundnuts are most often eaten as snacks but are also used as an ingredient in certain dishes. They can be boiled, ground or simply pan-roasted before mixing them with rice and/or *brèdes.*

They are a minor ingredient in comparison with rice, meat, or beans but nonetheless are regularly eaten in both urban and rural households.

The main risk at the consumer level is related to higher prices but, given the limited quantities consumed by the family, the impact on household purchasing power is minimal.

2.2.5 Support services

As previously indicated, there has been virtually no specialized support mechanism for the groundnut value chain since the 2000s.

The Ministry of Agriculture and the Government, however, designated oleaginous value chains (groundnut and soy) as strategic value chains in the Food and Agriculture Delivery Compact of 2022. An investment target of US$21 million was set for the sector's development, and certain Technical and Financial Partners (TFPs) have already stated that US$14.1 million has been received.

The value chain support activities are defined only in broad strokes but include support for seed production and multiplication (already begun by the Emergency Food Production Enhancement Project [PURPA] financed by the African Development Bank), the development of local processing and the upgrading of its by-products. It should be noted, however, that while the groundnut value chain is explicitly mentioned in the Compact, activities in the oleo-proteinaceous sector appear to target only soy, an important value chain but one that is clearly smaller and less dynamic.

6. Geographic analysis

As seen in the maps below, groundnuts are grown throughout Madagascar, but the country has three historic production hubs: in the south, the districts of Ampaniny in the Atsimo-Andrefana region and Bekily and Ambovombe in the Androy region; in the northwest, Soalala in the Boeney region; and in the centre, Betafo in the Vakinankatra region.

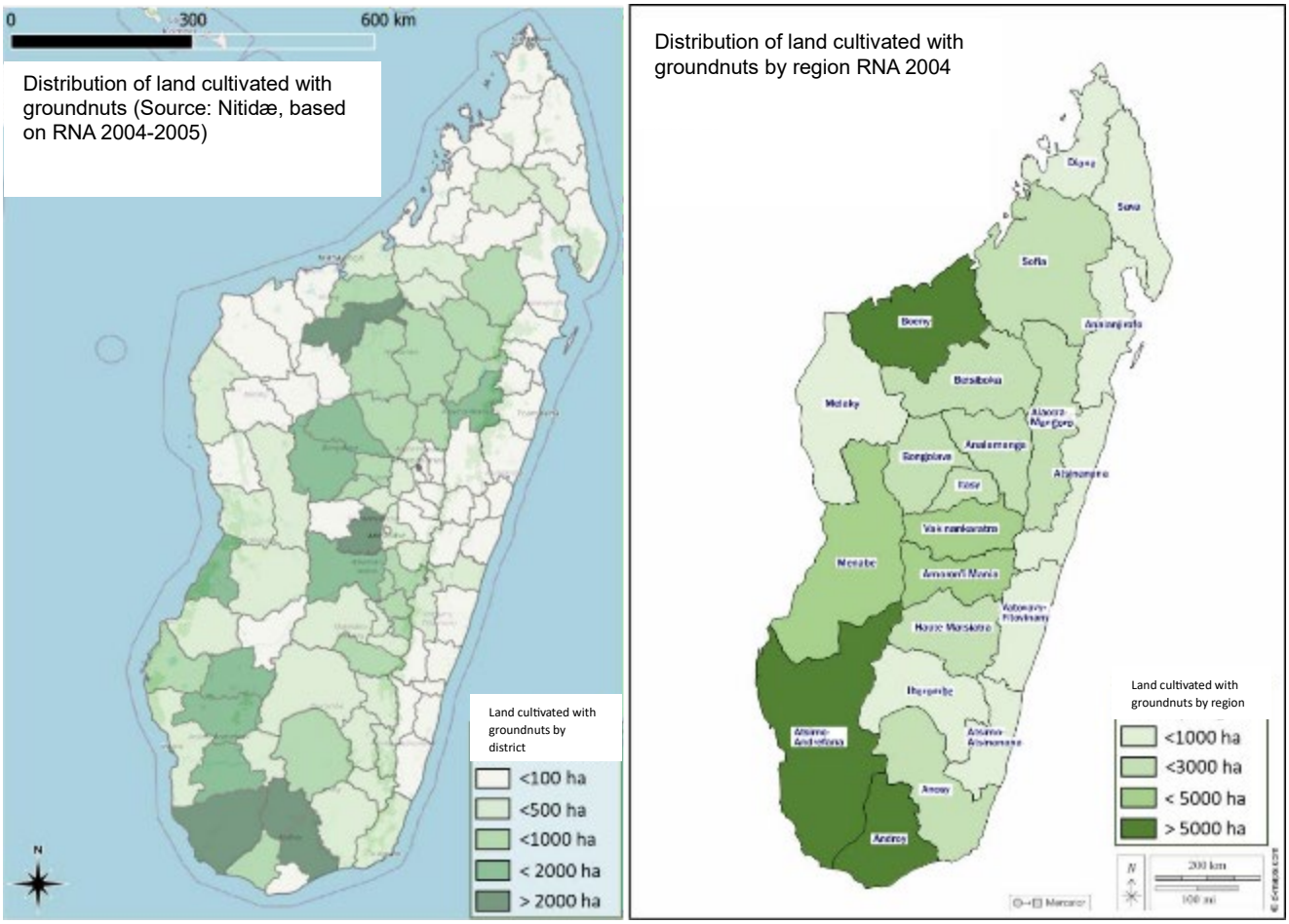


Figure 30: Maps of the distribution of land devoted to groundnut production in Madagascar in 2004 by region and district

MINAE's updating of these data based on the data collected in the 2013 RGPH3 show that the distribution is still the same but that production in the northwest is increasing first and foremost in the Boeny and Sofia regions and in the centre, in the Alaotra-Mangoro region but more moderately in the Amroni'I Mania and Haute Matsiatra regions.

In the regions in the south of the country, production appears to have fallen slightly in terms of planting, due to producers' interest in proteinaceous crops (especially black-eyed peas, Cape sweet peas, and pigeon peas), which, like groundnuts, are experiencing growing export demand and appear to be less prone to attacks by pests (according to producers in the field). Black-eyed peas and pigeon peas have also benefitted from significant promotion by several NGOs in recent years. Pigeon peas are promoted as windscreens and water-retaining plants and grown on a semi-perennial basis (2 to 3 year cultivation). Note, however, the groundnuts are often grown in parallel or association with other leguminous crops, maize, cassava and more recently, sorghum and millet, which were introduced by FAO and NGOs.

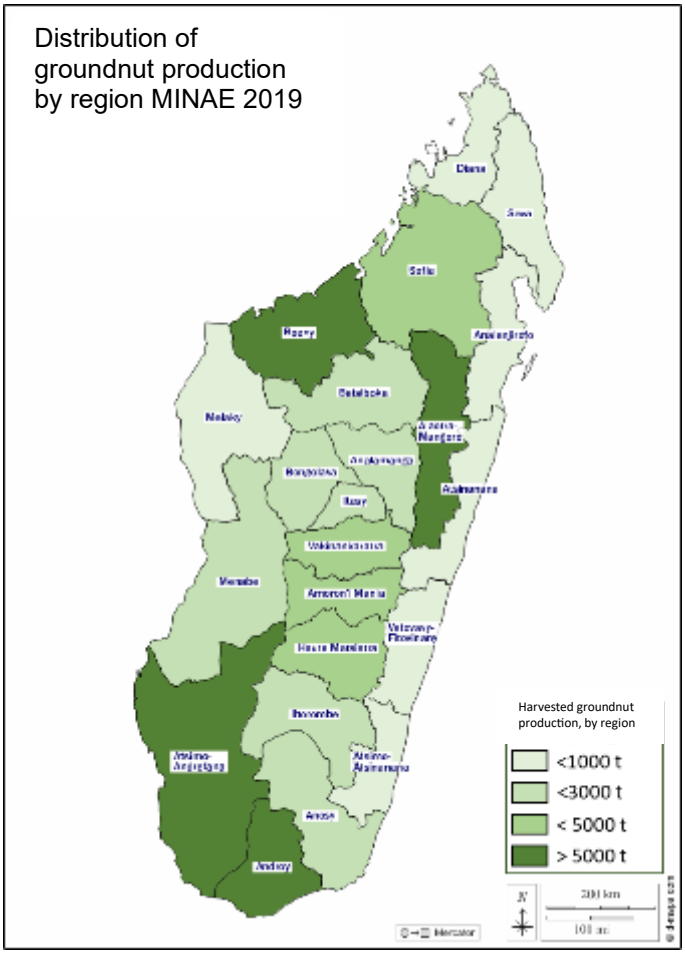


Figure 31: Map of the distribution of groundnut production in 2019, based on RGPH 3 data from 2018

2.3. Cross-cutting social and gender issues

2.3.1. Migration

With the increasingly frequent droughts in the south of the country in recent years. The past decade has witnessed major flows of migrants from the south and southwest to the centre, west, and north of the island.[63] As seen in the map to the right, these flows are relatively diverse.

Nationally, along with high population growth (averaging 2.71 per cent/year in the period 2004-2021 according to the World Bank[64]) and a significant rural exodus (the rural population fell from 72 per cent in 2004 to 61 per cent in 2021, according to World Bank figures[65]), variations in the farming population seen when comparing the data from the National Agricultural Census of 2003 and the General Population and Habitat Census (RGPH 3) of 2018 bear witness to the significant migration from the south and west to the north and east.

These variations are seen in the map and table below.

The phenomenon of internal migration therefore appears to be a major adaptation to the growing agricultural risk in the south and west of the country. Given the relatively low population density of rural Madagascar, migrants rarely have difficulty gaining access to land, except in the high-altitude plateaus in the centre of the country, where the pressure on the land is becoming very heavy.

South-to-North migration flows in Madagascar

(Source: Research Consortium (Reference MEEF-ONE-WCS-Etc terra, 2015 completed by ONE, DGF, MNP, WCS, Etc Terra, 2015)

Figure 32: Map of main internal rural migration flows in Madagascar

However, most of the migrants who settle in rural areas face high settlement costs (housing construction, clearing of virgin land, terracing of hillsides) and often have difficulty financing the purchase of inputs to ensure the success of their initial crop seasons.

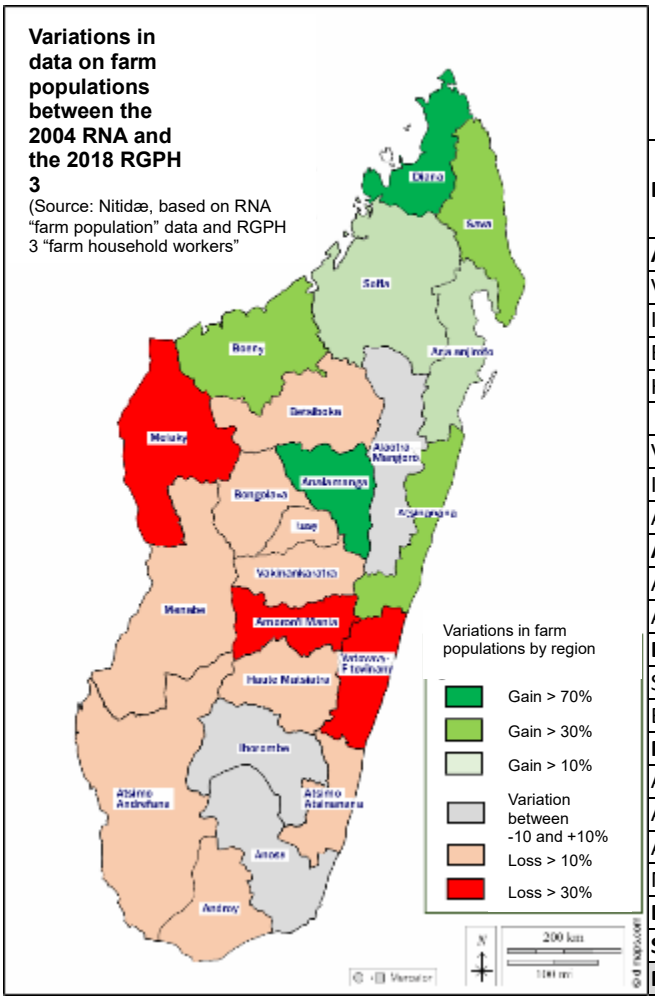
Many of them are obliged to work as farm labour for native-born populations to finance the purchase of inputs so that they can cultivate their own land. This results in late sowing, which results in low yields, especially when the rainy season ends early.

More generally, the significant internal migration leaves many farm households with very little capital and thus, very little ability to invest in agriculture.

[63] https://www.researchgate.net/profile/Heriniaina-Ramanankierana/publication/337137685_Defis_enjeux_et_politiques_migration_environnement_et_changement_climatiques_a_Madagascar/links/5dcbbcc992851c818049fe3b/Defis_enjeux-et-politiques-migration-environnement-et-changements-climatiques-a-Madagascar.pdf?origin=publication_detail

[64] https://donnees.banquemondiale.org/indicateur/sp.pop.grow?locations=MG

[65] https://donnees.banquemondiale.org/indicateur/SP.RUR.TOTL.ZS?locations=MG



Region	Farm population (2004)	Household workers (2018)	Variations 2004/2018
Analamanga	**519 963**	**896 823**	**72%**
Vakinankaratra	589 055	464 530	-21%
Itasy	288 400	204 827	-29%
Bongolava	190 497	150 596	-21%
Haute Matsiatra	390 062	296 552	-24%
'	**287 392**	**173 320**	**-40%**
Vatovavy Fitovinany	447 055	312 888	-30%
Ihorombe	100 394	91 602	-9%
Atsimo Atsinanana	254 652	198 145	-22%
Atsinanana	**259 931**	**375 471**	**44%**
Analanjirofo	286 451	322 758	13%
Alaotra Mangoro	271 639	297 267	9%
Boeny	**175 265**	**229 731**	**31%**
Sofia	320 736	375 861	17%
Betsiboka	102 705	88 606	-14%
Melaky	**107 796**	**69 569**	**-35%**
Atsimo Andrefana	494 091	416 441	-16%
Androy	270 064	200 268	-26%
Anosy	200 412	189 986	-5%
Menabe	206 802	161 822	-22%
Diana	**147 447**	**253 261**	**72%**
Sava	**231 459**	**309 552**	**34%**
MADAGASCAR	**6 149 271**	**6 079 876**	-1%

Figure 33: Map and table showing variations in farm populations in Madagascar by region between the 2004 RNA and the 2018 RGPH 3

2.3.2 Gender

Most girls and women live in a society under very precarious conditions, marked by inequalities in many areas, such as education, health, violence, the right to their own land, housing and political and economic rights. Women are more likely to be living in poverty with less protection of their rights and are disproportionately impacted by extreme climate phenomena (droughts, floods, cyclones, etc.). In rural areas, whether living in a household or abandoned, it is women who are responsible for chores such as fetching water, gathering and chopping firewood, cooking, farming and caring for small livestock, as well as time-consuming, repetitive manual labour. Agricultural work requiring heavy physical labour (tilling the soil, mechanical weeding using a weeder) is generally done by men. The same holds true for activities requiring the use of equipment such as sprayers. Other activities, such as planting, watering, manual weeding and harvesting are shared by men and women, depending on the crop – even, however, if certain crops, such as market gardening, are more or less reserved for women.

Figure 34: Trend in female employment in agriculture in Madagascar (Source: World Bank 2022)

Women contribute to food security and environmental protection, but many of their activities are not counted as economic activities. Women are more likely to encounter financial and practical difficulties when it comes to their personal development and empowerment. For example:

- The majority of rural women are unable to obtain credit because they have no capital and must ask their husband to apply for microcredit;
- Few of them own land, because under inheritance law, a women is the seventh in line to inherit her husband's possessions (after his children, parents, brothers and sisters and other members of the family);
- 80 per cent of women are illiterate, having left school very early, which keeps them from filling out forms (for example, to apply for a loan), keeping records and fulfilling requirements;
- Juggling domestic and farming chores, women have no time and lack access to the tools and machinery that would save them time; the fact that they have no one to replace them in the fields keeps them from getting an education;
- Many women farmers are single mothers who work while pregnant or nursing, and many of them are undernourished;
- Domestic violence can keep women from engaging in economic activities, especially if a man feels threatened by his wife or partner's greater economic independence.

Decision-making

Rural women have even less influence and power in household decision-making. It also appears that rural production is often destined for on-farm consumption. This creates relative food security for rural women but their inability to have a cash income if there is no food surplus or the produce cannot be sold in the markets. Hence, the absence of financial independence/emancipation that would enable women to participate in household economic activities. The lower the household income, the more men exercise exclusive control over its management.

In terms of control, it appears that in mixed households, land use decisions – the type of crop to plant, the techniques to employ, the location, etc. – generally fall to men. Some women make suggestions, while others await their husband's decisions, but in most cases, the final decision rests with the husband.

However, thanks to the influence of NGOs, for some years, rural women have been able to take on more responsibility in village communities and village development committees. Current projects include outcome indicators for the percentage of women's involvement in activities; however, this is not enough considering the challenges of women's situation.

Land resources

The available literature indicates that households headed by women have less land than two-parent households or households headed by men (EPM 2010, BAD 2017). Moreover, in certain ethnic groups (Antanosy, Antandory, Bara, Antesaka), women have the right to inherit, and if on rare occasions they do, their share will always be minimal compared to that of their brother(s) (among the Bara and Antanosy). Throughout the country, women have less access to secure land rights. According to the Land Observatory, in 2017, 535 land offices were opened and 142,000 land certificates (CF) were issued, 32,800 of them in the name of women, or 23 per cent.

Inputs and equipment

The available literature mentions inequalities in terms of access to knowledge, capital and production tools that keep rural women from fully taking on responsibilities (FVTM, 2014). According to the Madagascar Country Gender Profile prepared by the African Development Bank, "the acquisition and utilization of equipment more complex than the spade remains the prerogative of men. Four out of six households headed by a woman lack farm equipment compared to three out of ten households headed by a man."

3. Analysis of risks in the value chain

3.1. Analysis of risks in the maize value chain

3.1.1. Description of risks

A total of 18 risks were identified as impacting the maize value chain in Madagascar.

The diagram to the right lists these risks and the actors directly impacted.

Weather and phytosanitary risks primarily impact producers, causing a drop in production, and processors, whose principal raw material is maize, making them particularly sensitive to variations in production.

Market risks impact virtually all actors but to varying degrees.

While lower prices mainly penalize producers and, to a lesser extent, input suppliers, by reducing the purchasing power of producers and the collectors and processors who store the

product and watch its value diminish, higher prices have a greater impact downstream in the value chain – that is, among processors and distributors, who must increase their access to working capital and raise their resale prices, potentially experiencing a drop in sales due to the higher costs to the end consumer (households and stock raisers).

Logistical risks mainly affect input suppliers, collectors and processors, because they are the ones who transport funds, inputs and maize across the country.

Storage risks mainly affect actors who store product for lengthy periods – that is, merchants, processors, and, to a lesser extent, producers and distributors.

Political and macroeconomic risks potentially affect all actors but have a heavier impact on input suppliers and actors downstream in the value chain, processors, distributors and financial services, whose activity is seriously affected by urban and peri-urban tensions and who are more exposed to the discretionary action of public officials and law enforcement.

Finally, personnel risks primarily affect small economic units (producers, aggregators, small processors), who are highly sensitive to their employees' ability to work, and major processors, when they involve a highly skilled technician or manager or one with great responsibilities.

Using the PARM methodology, the risks

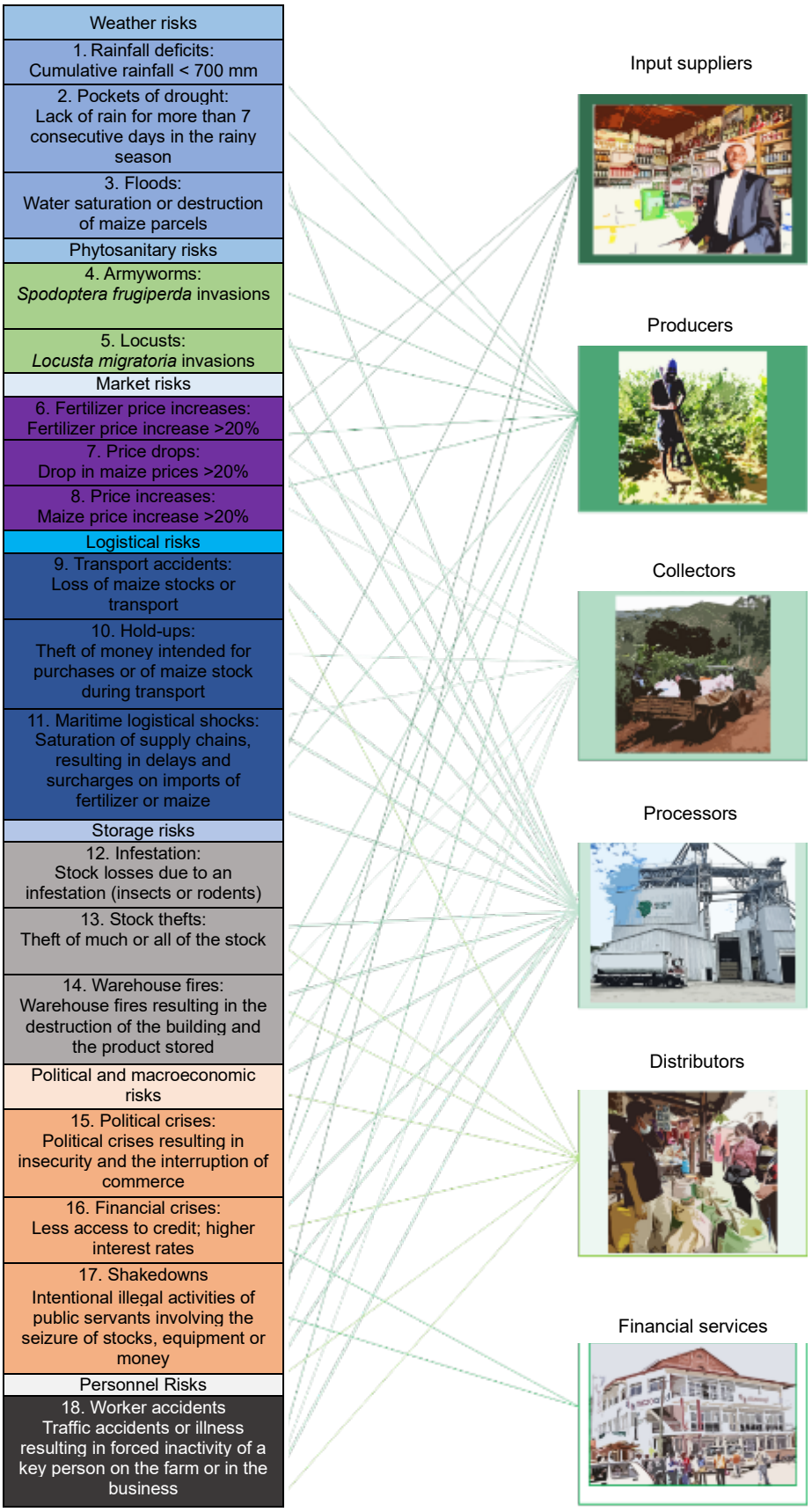


Figure 35: List of risks identified and their direct impacts on actors in the maize value chain.

identified were then analysed in terms of frequency (probability score), average intensity for each of the affected actors (average impact score) and extreme impact, when their intensity reaches its peak level (maximum impact score).

Frequency of risk			Intensity of risk		
Category	**Criteria**	**Score**	**Category**	**Criteria**	**Score**
High probability	Once every 7 years or more	3	Catastrophic	Drop in revenues> than 50% Impact on more than 50% of actors in the value chain. Higher impact on women and youth	5
			Critical	Drop in revenues of between 30 and 50% Impact on more than 30% of actors in the value chain Higher impact on women and youth	4
Moderate probability	Once every 15 years or more	2	Substantial	Drop in revenues of between 15 and 30% Impact on more than 20% of actors in the value chain Higher impact on certain women and youth	3
			Moderate	Drop in revenues of between 5 and 15% Impact on more than 10% of actors in the value chain Higher impact on certain women and youth	2
Low Probability	Less than once every 15 years	1	Negligeable	Drop in revenues of less than 5% Impact on less than 10% of actors Little impact on women and youth	1

Figure 36: PARM method for quantifying the importance of risks

In the paragraphs below, the risks are analysed by actor category and then for the entire maize value chain.

3.1.2. Main risks for input suppliers in the maize value chain

The table below classifies the main risks to which input suppliers in the maize value chain are exposed.

Input suppliers		Frequency	Intensity		Risk ranking	
No	Risks	Frequency Score (F)	Average impact score (Iave)	Maximum impact score (Imax)	Final score: ((F*Iave)*.75) + (Imax*0.25)	Comments
8	**Fertilizer price increases**	2	3	4	5.5	Following the COVID-19 crisis, the price of fertilizer in the international market virtually doubled with the devaluation of the Ariary against the dollar. The increase in retail sale prices in 2021 and 2022 is estimated at +150% and led to a 45% drop in fertilizer use and a 12% drop in the use of phytosanitary products in Madagascar.
11	**Maritime logistical shocks**	2	3	4	5.5	As fertiizer importation and distribution are highly seasonal activities, logistical shocks can lead to stock shortages and added costs, resulting in a significant drop in the revenues of input suppliers.
14	**Warehouse fires**	1	4	5	4.25	Fertilizer and phytosanitary products are highly flammable, and a fire could result in the total loss of the stock and storage facility and even the sales locale.
9	**Transport accidents**	2	2	3	3.75	The transfer of inputs from port to storage site and from storage site to warehouse entails the risk of accidents
16	**Financial crises**	2	2	3	3.75	Maize is an important commodity for only a minority of input suppliers; however, a sharp drop in maize prices leads to lower producer investments, and thus, a 5-15% drop in their volume of business.
18	**Worker accidents**	1	2	3	2.25	Small input venders are often family businesses with few employees, so an accident involving a worker can result in the temporary closure of the warehouse.
13	**Stock thefts**	1	3	4	3.25	Stock thefts can put input suppliers in serious financial difficulties.
16	**Political crises**	1	3	4	3.25	Before the inputs are transferred from the port to the country's interior and then from storage facilities to rural areas, input suppliers are particularly sensitive to political crises.

6	**Price drops**	3	1	2	2.75	A drop in the sales price of maize can substantially reduce the purchasing power of maize producers and maize sales; however, since most inputs are for the horticulture and rice value chains, the impact on input venders is moderate.
17	**Shakedowns**	3	1	2	2.75	Shakedowns during transport or a sales locale can result in moderate losses for input venders
10	**Hold-ups during transport**	1	2	3	2.25	Transport to rural areas is exposed to the risk of hold-ups.
7	**Price increases**	Input suppliers are not directly affected by the other risks affecting the sector, and some even benefit from them, as they help to boost their sales of agricultural inputs and equipment.				
12	**Stock infestations**					
1	**Rainfall deficits**					
2	**Floods**					
3	**Inondations**					
4	**Armyworms**					
5	**Locusts**					

Figure 37: Ranking of the risk exposure of input suppliers in the maize value chain

Input suppliers are exposed to three main risks: variations in the price of the raw materials used in fertilizer production in the international market, logistical shocks that could slow the importation of fertilizer and increase its cost and variations in producer purchasing power.

Up to now, the use of mineral and organic fertilizers in the maize value chain has been relatively limited. As analysed in the national strategy for fertilizer development and utilization of 2006, the mineral fertilizer sector, which is based exclusively on imports, has seen successive phases of growth and decline based on subsidy policies and programmes to support conventional intensification, but fertilizer has historically been used in rice growing and horticulture.[66]

A 2001 study by FOFIFA, INSTAT and Cornell University[67] confirms, moreover, that, historically, the availability of chemical fertilizer in rural areas is extremely limited, except in the central plateau regions.

The ROR data analysed in the annual bulletin, *Cahier du ROR,* of 2006[68] also shows a concentration of fertilizer use in plateau rice-growing areas.

Recently, OCP, the giant Moroccan fertilizer company, announced the construction of a fertilizer blending factory in Madagascar, which will be the first in the country.[69] However, the ingredients used will continue to be imported.

Phytosanitary treatment prices, in contrast, are less volatile, because the cost of the raw materials needed to manufacture the treatments is less than the amortization costs of the research and development necessary for their manufacture.

According to distributors, the rise in chemical prices and lack of availability in recent years have led to a surge in small local organic fertilizer companies. However, these inputs (compost, guano, biostimulants) are used mainly in horticulture and their use in the maize value chain is highly anecdotal.

3.1.3 Main risks to maize producers

The table below classifies the main risks to which maize-growing farms in Madagascar are exposed. Due to significant geographic differences between farms in the south and west of the country, on the one hand, and farms in the centre, east and north of the country, on the other, the farms have been divided into two large groups.

[66] https://faolex.fao.org/docs/pdf/mad147395.pdf

[67] https://www.ilo.cornell.edu/polbrief/03conv/pb1-1.pdf

[68] Table available in annex.

[69] https://www.agenceecofin.com/intrants/0201-104176-madagascar-espere-un-investissement-de-l-ocp-dans-son-secteur-des-engrais

Producers		Frequency	Intensity South and West			Intensity Centre, North and East			Risk ranking	
No	Risks	Frequency score (F)	Average impact score (Iave)	Maximum impact score (Imax)	Final score: ((F*Iave)*.75) + (Imax*0.25)	Average impact score (Iave)	Maximum impact score (Imax)	Final score: ((F*Iave)*.75) + (Imax*0.25)	Final score: average of the two zones	Comments
2	**Interrupted rains**	3	3	4	7.75	3	4	7.75	7.75	Rain interruptions rains during the maize germination and flowering periods can affect all production zones and result in substantial yield losses.
4	**Armyworms**	3	3	4	7.75	3	4	7.75	7.75	Depending on the year, armyworms can attack virtually all production zones and cause very heavy yield losses.
18	**Worker accidents**	2	3	5	5.75	3	5	5.75	5.75	All farms are regularly affected by accidents that substantially reduce workers' ability to work. Women and young farm owners, who often have fewer workers, are extremely sensitive to such accidents and serious illnesses, which heavily impact their farm revenues.
1	**Rainfall deficits**	3	3	5	8	1	1	2.5	5.25	Rainfall deficits, which are increasingly frequent in the south and west of the country, can result in major losses but virtually do not occur in the production zones of the centre, north and east.
3	**Floods**	3	1	2	2.75	3	4	7.75	5.25	Floods rarely occur in production zones in the south and west but regularly destroy parcels in the centre, east and north of the country.
6	**Price drops**	3	2	3	5.25	2	3	5.25	5.25	Price drops, particularly at harvest time, are common and regularly impact farm revenues. They more heavily impact farms managed by women and young people, who often have small parcels and less-diversified crops.
5	**Locusts**	3	2	3	5.25	1	3	3	4.125	Locusts regularly plague maize production zones throughout the country, but with greater intensity in the south and west. They cause substantial losses at germination or sprouting.
12	**Stock infestations**	2	2	3	3.75	2	3	3.75	3.75	While producers rarely store large stocks of maize for long periods and have storage methods that limit infestations, significant storage losses are regularly seen on farms.
13	**Stock thefts**	1	3	5	3.5	3	5	3.5	3.5	Though infrequent, thefts of stock from producers can result in very heavy losses on farms.

14	**Warehouse fires**	1	3	5	3.5	3	5	3.5	3.5	While infrequent and often contained, fires in storage areas (often in dwellings) can result in extremely high losses for farms, especial for the most financially precarious ones managed by women, young people and migrants.
8	**Fertilizer price increases**	2	1	2	2	2	3	3.75	2.875	While fertilizer is used by only a limited proportion of farms in the maize value chain, sharp increases in fertilizer prices entail extra costs or result in non-use of this input, leading to sharp drops in production where fertilizers are not used.
15	**Political crises**	1	2	3	2.25	2	3	2.25	2.25	While political crises rarely lead to violence in rural areas, they cause significant slowdowns in value chain operations and can lead to problems with maize sales that affect producers' revenues.
11	**Maritime logistical shocks**	2	1	2	2	1	2	2	2	For farms that use inputs, maritime logistical issues can lead to the unavailability of inputs when they are needed.
16	**Financial crises**	2	1	2	2	1	2	2	2	While farms rarely have access to credit, they are indirectly impacted by financial crises (lower demand, higher input prices, bankruptcy of partners/buyers).
7	**Price increases**									
9	**Transport accidents**									
10	**Hold-ups during transport**									
17	**Shakedowns**									

Farms are hardly ever subject to shakedowns and logistical problems, because they rarely handle maize transport over long distances. The increase in maize prices actually benefits them.

Figure 38: Ranking of the risk exposure of maize producers

The analysis of 42 years of meteorological data in the principal maize production zones shows that interruptions in rain during the heart of the rainy season (the maize maturation and blossoming phase, when the plant is particularly sensitive to water stress) affect all production zones and are frequent. Floods are primarily a problem in the east, north, and centre of the country, and rainfall deficits throughout the rainy season mainly affect the south and west; however, the two phenomena are also frequent and sometimes have a significant impact on maize yields and producer revenues. Detailed analyses of these risks are available in an annex.

Phytosanitary risks in Madagascar are also high. While locusts are an ancient risk that results in significant losses when raising seedlings, they rarely result in catastrophic losses due to the staggering of planting and the possibility of replanting once they disappear. However, the emergence of armyworms in virtually every region in the country is the most common and intense risk because it can easily cause losses of more than 50 per cent among affected producers and could affect producers practically one out of every two years. The analyses from a 2022 SFI study and a 2023 FAO study are presented in an annex.

Price drops at harvest time are a frequent risk whose impact is relatively limited due the low cost of maize production in most areas (few inputs, family labour) and farm diversification.

Storage, infestation, theft and fire risks can also be a major source of lost revenue; fortunately, however, they are rare.

The fact that fertilizer is used by only a minority of farms also reduces exposure to price variations in the international fertilizer market and maritime logistical shocks.

Finally, farms that handle the transport for their production (beyond the transfers from field to dwelling, which involve short distances and entail little exposure to risks) are rare, which reduces their exposure to transport risks.

Increased risks to women and young farm managers

Note that several risks are greater for farms managed by women (the majority of whom are widows) and young people (the majority of whom are couples with children and only two workers).

These farms generally have smaller parcels, less diversification and fewer workers, which exposes them both to higher personnel risks (the loss of a worker, even temporarily, during the production season drastically reduces their workforce and thus, their capacity to manage the different stages of the crop cycle) and the heavier impact of production and marketing risks.

3.1.4. Risks to aggregators (collectors)

The table below classifies the main risks to aggregators (called collectors) in the maize value chain.

Aggregators		Frequency	Intensity			Risk ranking
No	Risks	Probability Score (1-3)	Average Impact Score (1-5)	Maximum Impact Score (1-5)	Score final: ((F*Iave)*.75) + (Imax*0.25)	Comments
18	Worker accidents	2	3	5	5.75	Aggregators often operate as one-person ventures. They rarely have salaried employees, and the essential knowledge is concentrated in themselves (knowledge of the commodity, input supplier network, customer network). As a result, they are highly exposed to personnel risks.
9	Transport accidents	2	3	4	5.5	Transport accidents are common in rural areas and result in significant losses for aggregators.
10	Hold-ups during transport	2	3	4	5.5	Hold-ups during the transport of funds to pay producers and, more rarely, the transport of maize, are common and the source of major losses for aggregators.
13	Stock thefts	1	3	5	3.5	While infrequent, stock thefts can result in enormous losses to merchants.
14	Warehouse fires	1	3	5	3.5	While infrequent, storage warehouse can result in enormous losses to merchants.
1	Rainfall deficit	3	1	2	2.75	Events that affect maize production significantly reduce the volume of aggregator activity and often impact not only maize but other crops marketed by the latter. However, merchants can limit the impact on their revenues by profiting from the price increases that generally follow drops in production.
2	Interrupted rains	3	1	2	2.75	
3	Floods	3	1	2	2.75	
4	Armyworms	3	1	2	2.75	
5	Locusts	3	1	2	2.75	
17	Shakedowns	3	1	2	2.75	Aggregators are particularly exposed to shakedowns in the rural areas they traverse and even sometimes in their storage facilities. They tend, however, to pass this risk on in their marketing fees and thus limit their intensity.
6	Price drops	3	1	1	2.5	Price variations can negatively impact aggregations. This is true for both price drops (devaluation of stocks already obtained) and price increases (difficulty meeting contracts already signed with customers). However, merchants benefit from information networks and market experience, which generally enable them to limit the impact of volatility on their revenues.
7	Price increases	3	1	1	2.5	
15	Political crises	1	2	3	2.25	Aggregators are regularly targeted during political crises, which can lead to considerable losses for some of them.
12	Stock infestations	2	1	2	2	Aggregators often hold stocks for long periods and are thus at high risk of stock infestations. However, they generally have the facilities and treatments needed to limit losses.
16	Financial crises	2	1	2	2	Financial crises can mildly affect aggregators' access to credit. However, since they operate partly with their own funds and their cash flow cycles are relatively short (2-9

						months), the impact on their activities is generally moderate.
11	Maritime logistical shocks	2	1	2	2	Logistical shocks and fertilizer price increases can mildly and indirectly affect aggregators by causing lower production in their supply basins.
8	Fertilizer price increases	2	1	1	1.75	

Figure 39: Ranking of the risk exposure of aggregators in the maize value chain

As seen in the table, aggregators' main risks are logistical, storage and personnel risks. Their diversification and the flexibility of their margins enables them to adapt relatively easily to the other risks.

3.1.5 Risks to processors

The table below classifies the main risks to processors in the maize value chain.

Processors		Frequency	Intensity		Risk ranking	
No	Risks	Probability Score (1-3)	Average Impact Score (1-5)	Maximum Impact Score (1-5)	Score final: ((F*Iave)*.75) + (Imax*0.25)	Comments
4	Armyworms	3	4	5	10.25	Army worms are currently the greatest risk to domestic maize production. Thus, they heavily impact the supply to maize processors.
7	Price increases	3	4	5	10.25	Maize price increases, whatever their origin, heavily impact processors. Because, on the one hand, they increase their need for working capital and on the other, they influence the sale price of their end product, lowering their sales. In periods of rising prices, processors must generally reduce their margins to keep their sales from slowing too much.
1	Rainfall deficits	3	3	4	7.75	Rainfall deficits, especially in extreme cases where they are prolonged in the production zones involved, significantly affect the domestic supply of maize and thus, the ability to supply processors.
16	Financial crises	2	3	5	5.75	Processors have very great working capital needs and are therefore very sensitive to financing conditions. Financial crises have a greater impact on them than on all the other actors.
17	Shakedowns	3	2	5	5.75	Processors are the preferred target for shakedowns during provisioning at their worksite and during the marketing of their products. The example of the bankruptcy of the Tiko agribusiness in the maize value chain is illustrative
18	Worker accidents	2	3	5	5.75	Processors are very sensitive to accidents involving technical, managerial and financial personnel, who are few in number, take a long time to train and are hard to replace.
2	Interrupted rains	3	2	3	5.25	All the risks that affect production indirectly affect processors by reducing the volume of raw material available. Producers limit their risk
3	Floods	3	2	3	5.25	

5	Locusts	3	2	3	5.25	exposure by diversifying their supply areas.
8	Fertilizer price increases	2	2	3	3.75	
9	Transport accidents	2	2	3	3.75	Logistical risks can affect the processors' revenues, even if they generally limit their involvement in transport operations (delegating them to collectors or independent transport companies).
10	Hold-ups during transport	2	2	3	3.75	
13	Stock thefts	1	3	5	3.5	Since processors accumulate significant stocks each crop season, they are particularly exposed to storage risks, which, fortunately, are relatively rare.
14	Warehouse fires	1	3	5	3.5	
6	Price drops	3	1	2	2.75	Price drops can affect processors when they have already built up their stocks and witness their devaluation.
15	Political crises	1	2	3	2.25	Political crises can affect the activities of processors, who are often located on the outskirts of cities. They can interfere with their supply, their employees' and subcontractors' availability and their sales.
11	Maritime logistical shocks	2	1	2	2	Maritime logistical shocks affect processors because of their impact not only on maize production but on spare parts (often imported) and their occasional supplementary supply of imported maize.
12	Stock infestations	2	1	2	2	Processors generally have good control over their stocks (humidity, phytosanitary protection, etc.).

Figure 40: Ranking of the risk exposure of maize processors

Processors are the actors with the most risk exposure. Because of their specialization (much greater than that of the other actors), feed factories, 70 per cent of whose raw material is maize, are very sensitive to any event that affects maize production and prices.

Furthermore, these risks related to supply entail particularly high risks for their most qualified salaried workers (who are hard to replace), risks related to difficulty financing their substantial need for working capital, higher storage risks than those of other actors because of the need to store very large quantities of maize and risks related to storing spare parts and other inputs for lengthy periods.

3.1.6 Risks to distributors

The table below classifies the main risks to distributors in the maize value chain. Like small-scale actors with relatively low revenues, distributors are subject to clearly lower risks than actors upstream in the value chain because of their diversification and the flexibility of their margins. Consisting largely of single-person enterprises, this link, however, is highly exposed to personnel risks. Largely women, these actors are also highly exposed to urban security risks (theft, shakedowns, looting of their shops during political troubles).

Distributors		Frequency	Intensity		Risk ranking	
No	Risks	Probability Score (1-3)	Average Impact Score (1-5)	Maximum Impact Score (1-5)	Final score ((F*Iave)*.75) + (Imax*0.25)	Comments
18	Worker accidents	2	2	5	4.25	The vast majority of distributors (outside of modern distribution) are one-person ventures. Worker accidents, therefore, directly impact their economic activity.
13	Stock thefts	1	3	5	3.5	Although distributors maintain only small stocks, they also have little funds of their own. Largely women, they rarely have access to security services or insurance and are very sensitive to theft and hold-ups at their sales location.
14	Warehouse fires	1	3	5	3.5	As with theft, distributors have limited means and are rarely insured, which can lead to bankruptcy in the event of fires.
7	Price increases	3	1	3	3	While accustomed to managing price volatility and capable of mitigating its impact on their activities thanks to the diverse products they sell and margins that vary with price levels, distributors can suffer losses when the variations are extreme, either through the devaluation of their stock or a reduction in their sales volumes during peak price periods.
6	Price drops	3	1	2	2.75	
17	Shakedowns	3	1	2	2.75	As small entrepreneurs, largely women, distributors are highly exposed to shakedowns by government agents; even if they generally pass this cost on to their customers, they can experience substantial losses in revenue when the shakedowns are extreme.
1	Rainfall deficits	3	1	1	2.5	All the risks that affect production impact distributors indirectly by reducing the volumes of maize that they can sell. Distributors limit their risk exposure by diversifying their supply areas and the commodities marketed.
2	Interrupted rains	3	1	1	2.5	
3	Floods	3	1	1	2.5	
4	Armyworms	3	1	1	2.5	
5	Locusts	3	1	1	2.5	
15	Political crises	1	2	4	2.5	Distributors are affected by political crises, because most of them are located in cities. Their warehouses and stands are sometimes looted or vandalized during political crises, and they are rarely covered by vandalism insurance.
12	Stock infestations	2	1	2	2	Distributors hold small stocks of maize (from hundreds of kilograms to several tonnes). Although they sometimes suffer losses from infestations, the latter have little impact due to high stock turnover and the distributors' easy access to stock treatments.
16	Financial crises	2	1	2	2	Most distributors operate with their own funds or borrow from microfinance institutions. Financial crises can reduce the volume of their activities without threatening them.
11	Maritime logistical shocks	2	1	2	2	Distributors rarely handle product transport. Logistical problems can

9	Transport accidents	2	1	2	2	sometimes mildly impact their activities by forcing them to look for new suppliers or by causing small stock disruptions.
10	Hold-ups during transport	2	1	2	2	
8	Fertilizer price increases	2	1	1	1.75	Fertilizer price increases affect distributors only very indirectly by reducing production and increasing maize prices.

Figure 41: Ranking of the risk exposure of distributors in the maize value chain

Distributors (semi-wholesalers and retailers) are exposed primarily to personnel risks (an illness or an accident often forces them to close their warehouse or shop and substantially reduces their revenues).

Largely women and urban dwellers, distributors are also particularly exposed to security risks (theft, arson or accidental fires, shakedowns, looting and vandalism during political crises).

Diversified and easily able to adapt their margins, weights and resale prices, they are also capable of adapting relatively effectively to market risks and lower availability.

3.1.7. Risks to financial services

Financial services		Frequency	Intensity		Risk ranking	
No	Risks	Probability Score (1-3)	Average Impact Score (1-5)	Maximum Impact Score (1-5)	Score final: ((F*Iave)*.75) + (Imax*0.25)	Comments
16	Financial crises	2	3	5	5.75	Financial crises are the shocks with the most negative impact on the activity of financial services, reducing their flexibility and revenues and forcing them to disinvest in sectors considered risky, such as the maize value chain and the agriculture sector in general.
17	Shakedowns	3	1	2	2.75	
1	Rainfall deficits	3	1	1	2.5	
2	Interrupted rains	3	1	1	2.5	For most of the other risks, the financial sector's exposure is minimal – on the one hand, because financing for the agriculture and agrifood sector is extremely limited (less than 15%, according to Central Bank of Madagascar reports analysing the banking sector), and on the other, because in the Malagasy agriculture and agrifood sector, the maize value chain is far behind the export value chains (vanilla, cacao, cloves, essential oils), which receive most of the sector financing, especially via exporter financing through export contracts and letters of credit). The risks to the value chain ultimately impact its attractiveness to the traditional financing sector (banks, microfinance institutions), which is particularly risk-averse.
3	Floods	3	1	1	2.5	
4	Armyworms	3	1	1	2.5	
5	Locusts	3	1	1	2.5	
6	Price drops	3	1	1	2.5	
7	Price increases	3	1	1	2.5	
15	Political crises	1	2	3	2.25	
8	Fertilizer price increases	2	1	1	1.75	
9	Transport accidents	2	1	1	1.75	
10	Hold-ups during transport	2	1	1	1.75	
11	Maritime logistical shocks	2	1	1	1.75	
12	Stock infestations	2	1	1	1.75	

18	Worker accidents	2	1	1	1.75
13	Stock thefts	1	1	1	1
14	Warehouse fires	1	1	1	1

Figure 42: Ranking of the risk exposure of financial services in the maize value chain

Providing little credit to the agriculture sector, financial actors today have little exposure to the risks in this value chain. Reducing other actors' risk exposure, however, is necessary to enable them to increase investment in the sector.

3.1.8. Risks to the entire value chain

Risks to the entire value chain are ranked by averaging the actors' risk score for each of the risks identified.

From this value chain ranking, we find that the main risks affecting the development of the maize value chain are (i) armyworms; (ii) worker accidents; (iii) all weather risks.

The value chain actors most exposed to risks are: (i) processors; (ii) producers in the south and west of the country; (iii) producers in the centre, north and east.

Category	Risk	Input suppliers	Producers (South and West)	Producers (Centre East North)	Aggregators	Processors	Distributors	Financial services	Value chain
Phyto	Armyworms		7.75	7.75	2.75	10.25	2.5	2.5	**4.79**
Personal	Worker accidents	3.75	5.75	5.75	5.75	5.75	4.25	1.75	**4.68**
Weather	Interrupted rains		7.75	7.75	2.75	5.25	2.5	2.5	**4.07**
Weather	Rainfall deficits		8	2.5	2.75	7.75	2.5	2.5	**3.71**
Market	Price drops	2.75	5.25	5.25	2.5	2.75	2.75	2.5	**3.39**
Weather	Floods		2.75	7.75	2.75	5.25	2.5	2.5	**3.36**
Macro	Financial crises	3.75	2	2	2	5.75	2	5.75	**3.32**
Stock	Warehouse fires	4.25	3.5	3.5	3.5	3.5	3.5	1	**3.25**
Stock	Stock thefts	3.25	3.5	3.5	3.5	3.5	3.5	1	**3.11**
Phyto	Locusts		5.25	3	2.75	5.25	2.5	2.5	**3.04**
Market	Fertilizer price increases	5.5	2	3.75	1.75	3.75	1.75	1.75	**2.89**
Market	Price increases				2.5	10.25	3	2.5	**2.61**
Logistics	Maritime logistical shocks	5.5	2	2	2	2	2	1.75	**2.46**
Macro	Political crises	3.25	2.25	2.25	2.25	2.25	2.5	2.25	**2.43**
Macro	Shakedowns	2.75			2.75	5.75	2.75	2.75	**2.39**
Logistics	Transport accidents	3.75			5.5	3.75	1.75	1.75	**2.36**
Logistics	Hold-ups during transport	3.75			5.5	3.75	1.75	1.75	**2.36**
Stock	Stock infestations		3.75	3.75	2	2	2	1.75	**2.18**
Average per actor		**3.84**	**4.39**	**4.32**	**3.07**	**4.92**	**2.56**	**2.26**	

Figure 43: Ranking of risks to actors and the entire maize value chain

3.2. Analysis of risks in the groundnut value chain

3.2.1. Description of risks

At present, there is practically no role for input suppliers in the groundnut value chain, because virtually none of them offer groundnut seed, fertilizer use is non-existent and so too is the sale of inoculum.

The value chain therefore begins directly with producers. A total of 17 risks have been identified for this valu chain.

At the meteorological level, groundnut are less sensitive to rainfall deficits than maize but clearly more sensitive to excessive water, especially during the seed formation and maturation phase. They have little exposure to attacks by armyworms but were seriously attacked in 2023 by leaf miner larvae, whose particular species we were unable to determine; this pes caused losses of up to 80 per cent on parcels in the Atsimo-Andrefana and apparently other regions as well. As with maize, the risks that affect production affect the entire value chain.

Groundnuts are subject to potentially higher price volatility than the maize value chain due to their link with the international market. Since around hal of domestic production is exported, domestic market prices are linked to international prices, as well as the exchange rate and sea freight costs and disruptions.

The other risks (storage, logistical, personnel, political and macroeconomic) are comparable to those of the maize value chain.

As with maize, the risks are analysed in terms of their frequency, average intensity and extreme intensity.

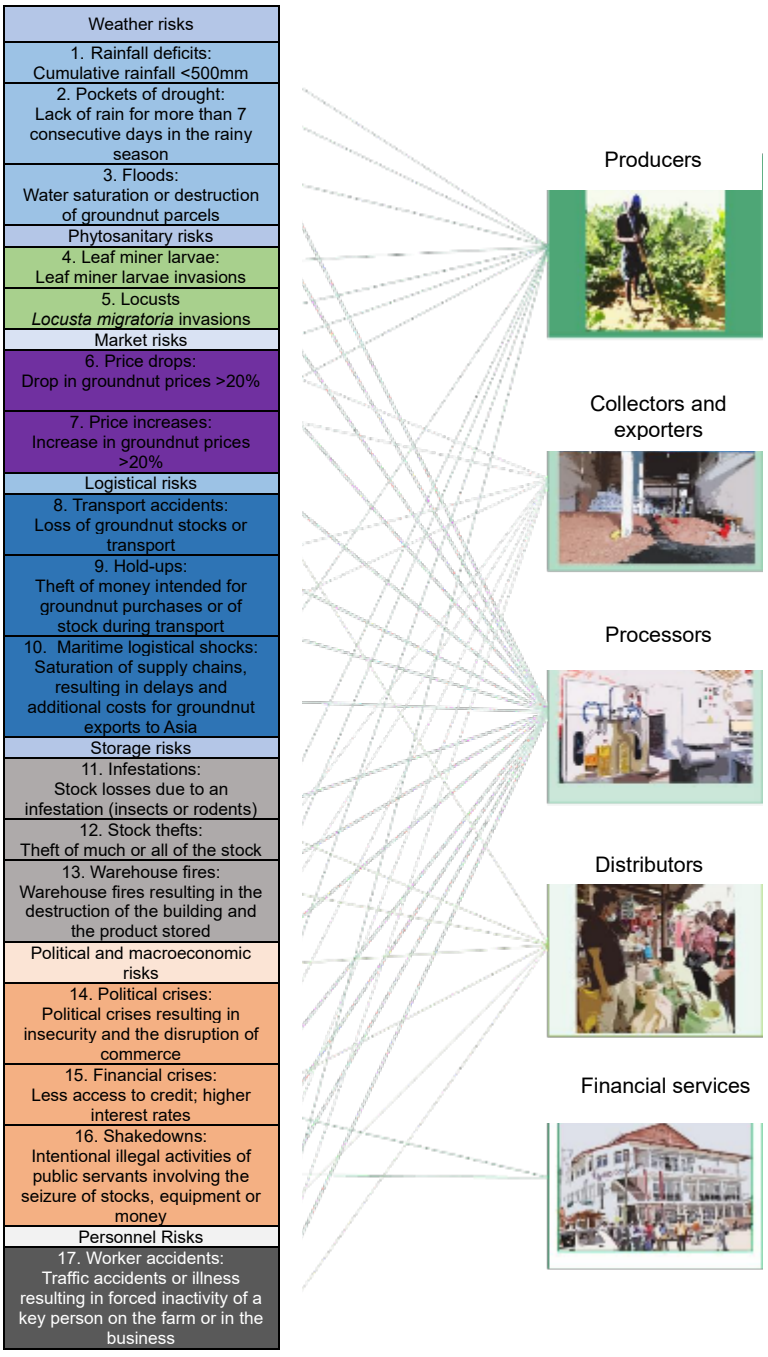


Figure 44: List of risks and their direct link to actors in the groundnut value chain

3.2.2. Main risks to groundnut producers

Producers		Frequency	Intensity South and West			Intensity Centre, North and East			Risk ranking	
No.	Risks	Frequency score (F)	Average impact score (lave)	Maximum impact score (Imax)	Final score ((F*lave)*.75) + Imax*0.25)	Average impact score (lave)	Maximum impact score (Imax)	Final score ((F*lave)*.75) + Imax*0.25)	Final score: average of the two zones	Comments
2	**Interrupted rains**	3	3	4	7.75	3	4	7.75	7.75	Unlike maize, groundnuts tolerate very low rainfall (they can even produce with 400mm of annual rainfall), as long as it is well-distributed throughout its production cycle. Lack of water during the production cycle is a regular source of yield losses
4	**Leaf miner larvae**	3	3	4	7.75	3	4	7.75	7.75	While no documentation has been found on phytosanitary pressure on groundnuts in Madagascar, we observed enormous losses associated with leaf miner larvae in the Atsimo-Addrefana region. Ministry of Agriculture staff told us that the bioagressor was ravaging other regions of the country.
3	**Floods**	3	1	2	2.75	4	5	10.25	6.5	Groundnuts are extremely sensitive to excessive water, especially at the end of their production cycle. In the regions of the centre, north and east, excessive water appears to cause tremendous drops in yield.
17	**Worker accidents**	2	3	5	5.75	3	5	5.75	5.75	All farms are regularly subject to workplace accidents, significantly reducing workers' ability to work. Women and young farm owners, who often have fewer workers, are extremely sensitive to such accidents and serious illnesses, which heavily impact their revenues.

6	**Price drops**	3	2	4	5.5	2	4		5.5	5.5	In addition to price drops at harvest time, groundnuts are subject to the volatility of the international market and the crop export cycle. While price drops have been limited in the past few years due to high Asian demand, the risk of fluctuations and losses in this commodity, which is impacted by local demand, the international market and the periods when the seasonal exporters who dominate export production arrive and depart, is high.
5	**Locusts**	3	2	3	5.25	**1**	3		3	4.125	Locusts regularly attack groundnut production zones throughout the country, but with greater intensity in the south and west. They cause significant losses during germination and sprouting.
10	**Maritime logistical shocks**	2	2	3	3.75	2	3		3.75	3.75	Groundnut exports can be disrupted or increased by maritime logistical shocks. In recent years, several shocks have hit this market, the last one in 2021, due to the container crisis and the blockage of the Suez Canal by the Evergreen vessel.
11	**Stock infestations**	2	2	3	3.75	2	3		3.75	3.75	When stored in their shell and very dry, it is relatively easy to preserve groundnuts; however, if they are not thoroughly dry or are stored as seed, they are subject to fungus, insect and rodent attacks.
12	**Stock thefts**	**1**	3	**5**	3.5	3	**5**		3.5	3.5	While infrequent, stock thefts result in very high farm losses.
13	**Warehouse fires**	**1**	3	**5**	3.5	3	**5**		3.5	3.5	While infrequent and often well-contained, fires in storage facilities (and often in dwellings) can cause extremely high losses for farms, especially the most financially precarious ones run by women, young people and migrants.

14	**Political crises**	**1**	2	3	2.25	2	3	2.25	2.25	While political crises rarely lead to violence in rural areas, they significantly slow value chain operations and can lead to problems with groundnut sales, impacting producers' revenues.
15	**Financial crises**	2	**1**	2	2	**1**	2	2	2	While farms rarely have access to credit, they are indirectly impacted by financial crises (lower demand or competitiveness, the failure of exporters to arrive, the bankruptcy of partners/buyers).
1	**Rainfall deficits**	1	**1**	3	1.5	**1**	**1**	1	1.25	As indicated earlier, groundnuts can be grown with extremely low rainfall (400 mm), as long as the rains are regular enough. This risk is therefore relatively low, and they can be grown in the south and west of the country even in years with less than 400 mm of rainfall.
7	**Price increases**	**Farms are very rarely affected by shakedowns and logistical problems, as they rarely handle the long-distance transport of groundnuts. In fact, they benefit from the higher groundnut prices**								
8	**Transport accidents**									
9	**Hold-ups during transport**									
16	**Shakedowns**									

Figure 45: Ranking of the risk exposure of groundnut producers

As indicated in the table, groundnut production is highly sensitive to more than one week of interrupted rains in the 90 days after germination. Interruptions in rain are common in every production zone. The other major weather risk is excessive water at the end of the production cycle (late February, March and even April, depending on the planting date); this risk is particularly evident in the regions in the centre, east and north of the country, which are regularly subject to heavy late rains.

Leaf miner larvae appear to be the main source of phytosanitary pressure, but the absence of accurate monitoring kept us from identifying the diversity of past and present pressures in the value chain. According to statements from producers, merchants and technical personnel, the level of pressure varies significantly from year to year but could have a significant impact on production.

Over the past 20 years, groundnut prices have experienced wide variations, rising from around 200 Ar/kg at the farmgate for unshelled seeds in 2001 and 2002, to a peak of 600-800 Ar/kg around 2012, with the historic peak in the international market (the period in which China shifted from being a net exporter of groundnuts to an importer). In recent years, Madagascar's producers have benefitted from relatively attractive prices (400-500 Ar/kg at the farmgate) due to the steady growth in the demand from Asia (especially China); however, a downturn in the international market could occur in the coming years, and producers of this cash crop are therefore particularly exposed to the risk of falling prices.

Logistical shocks can heighten these international market volatility risks by potentially raising export fees, directly increasing the cost to producers.

Storage, infestation, theft and fire risks can also be a major source of lost revenue, but their frequency is clearly lower.

Increased risks to women and young farm managers

As in the maize value chain, farms managed by women (the majority of them widows) and young people are smaller, less capitalized and have fewer workers on average.

Their exposure to various risks is especially high. Their sensitivity to personnel risks in particular is extreme, depending on the extent to which their few workers can replace one who is sick or injured.

3.2.3. Risks to aggregators (collectors) and exporters

As explained earlier, the majority of collectors in the groundnut value chain work as direct subcontractors for exporters. The risks are therefore shared between them, which is why we analyse them as a single link in the value chain.

As in the maize value chain, these actors are primarily exposed to personnel, logistical and storage risks.

In this value chain, revitalized a little over 10 years ago by exports, market risks are relatively well-controlled by dealers, who are generally subcontracted by Asian importers. However, the risk associated with maritime logistics is high, because it can lead to the breaking or renegotiation of contracts. It is essential for exporters to adhere the delivery schedule stipulated in contracts to avoid losses.

Aggregators and exporters		Frequency	Intensity		Risk ranking	
No	Risks	Probability Score (1-3)	Average Impact Score (1-5)	Maximum Impact Score (1-5)	Final score: ((F*Iave)*.75) + (Imax*0.25)	Comments
17	Worker accidents	2	3	5	5.75	Aggregators often operate as one-person ventures. Rarely having salaried employees and concentrating the essential know-how in themselves (knowledge of the commodity, input supplier network, customer network), they are highly exposed to personnel risks.
8	Transport accidents	2	3	4	5.5	Transport accidents are common in rural areas and entail major losses for aggregators and exporters.
9	Hold-ups during transport	2	3	4	5.5	Hold-ups during the transport of funds to pay producers and, more rarely, during the transport of maize, regularly occur and result in major losses for aggregators and exporters.
10	Maritime logistical shocks	2	2	3	3.75	Logistical shocks that increase export costs or interrupt maritime shipping between Madagascar and Asia are a significant risk, because in addition to the direct loss of revenue that they can entail, delayed deliveries can also lead to broken export contracts and thus, greater exposure to price risks.
12	Stock thefts	1	3	5	3.5	While infrequent, stock thefts can cause merchants enormous losses.
13	Warehouse fires	1	3	5	3.5	While infrequent, storage warehouse fires can cause merchants enormous losses.
6	Price drops	3	1	2	2.75	Aggregators and exporters generally work under export contracts that protect them from price drops during the provisioning and export process. They may be especially exposed to price volatility when their contracts are violated (logistical shocks, importer default).
7	Price increases	3	1	2	2.75	
2	Interrupted rains	3	1	2	2.75	Events that affect groundnut production markedly reduce aggregators' and exporters' volume of activity and often impact not only the groundnut value chain but other crops they market. Exporters may not be able to meet their export targets in low-production years (a recent example is 2022). However, since they have revolving export contracts, it is mostly a matter of a lack of earnings.
3	Floods	3	1	2	2.75	
4	Leaf miner larvae	3	1	2	2.75	
5	Locusts	3	1	2	2.75	
16	Shakedowns	3	1	2	2.75	Aggregators are particularly exposed to shakedowns in the rural areas they traverse and sometimes in their storage locations. However, they tend to pass this risk on in their marketing fees and thus limit their intensity.
14	Political crises	1	2	3	2.25	Foreign (Asian) aggregators and exporters are regularly targeted during political crises, which can lead to significant losses for some of them.
1	Rainfall deficits	2	1	2	2	Rainfall deficits rarely affect groundnut production.

11	Stock infestations	2	1	2	2	Groundnuts are rather immune to infections other than aflatoxins. The Asian importers who purchase groundnuts for the production of edible oil are unconcerned about the level of aflatoxins because the trituration process destroys them.
15	Financial crises	2	1	2	2	Financial crises can mildly affect aggregators' and exporters' access to credit. However, since they operate under export contracts or with their own funds, the problems and losses in financial crises are limited.

Figure 46: Ranking of the risk exposure of aggregators and exporters in the groundnut value chain

3.2.4. Risks to processors

Unlike the maize value chain, where processing is dominated by industrial actors, groundnuts are processed mainly by artisanal processors.

Thus, they are less exposed to logistical and storage risks than industrial processors, because only rarely do they handle the transport from production basins, and they maintain only small stocks.

However, they are highly exposed to market risks, especially unanticipated price increases or decreases deriving from exogenous factors (the international market, exchange rate variations) and to decreases in domestic production, which could make groundnuts scarce and expensive after the harvest period if export demand has absorbed the bulk of production as it did in 2022.

Furthermore, since these actors are largely women, they are particularly exposed to security risks (theft, shakedowns).

Processors		Frequency	Intensity		Risk ranking	
No	Risks	Probability Score (1-3)	Average Impact Score (1-5)	Maximum Impact Score (1-5)	Score final: ((F*Iave)*.75) + (Imax*0.25)	Comments
7	Price increases	3	4	5	10.25	The main risk to small groundnut processors is price increases caused by trends in the international market, poor domestic production or the devaluation of the Ariary against the US dollar, which could significantly increase their production costs and entail heavy financial losses. Exogenous increases that are unanticipated by these actors, who are ill-informed about the international market, are especially problematic.
4	Leaf miner larvae	3	4	5	10.25	The two factors that affect domestic production also heavily impact processors, who are totally dependent on domestic production for their supply and sometimes even on regional production, as their small size prevents them from diversifying their sources of supply to other production basins, except at a high cost.
3	Floods	3	3	4	7.75	
17	Worker accidents	2	3	5	5.75	The majority of processors in the groundnut value chain are small, one-person ventures. Thus, they are particularly vulnerable to personnel risks, which can force them to halt

						their entire operation and thus lead to very high revenue losses.
16	Shakedowns	3	2	3	5.25	Processors are the preferred target for shakedowns during provisioning at their worksites and the marketing of their production. Since the majority of them are women, they are highly exposed to pressure from government agents and law enforcement, who use any pretext to charge them illegal fees.
2	Interrupted rains	3	2	3	5.25	The other factors that affect production also have a significant impact on processors' revenue.
5	Locusts	3	2	3	5.25	
15	Financial crises	2	2	4	4	Groundnut processors generally operate with their own funds, but some obtain microfinancing for their activities. These latter are particularly sensitive to interest rate hikes and the tightening of credit during financial crises.
8	Transport accidents	2	2	3	3.75	Processors rarely handle the transport of groundnuts from production zones. The primarily obtain their supplies from aggregators or semi-wholesale distributors.
9	Hold-ups during transport	2	2	3	3.75	
12	Stock thefts	1	3	5	3.5	Groundnut processors rarely amass significant stocks because they have limited working capital and small storage facilities.
13	Warehouse fires	1	3	5	3.5	
6	Price drops	3	1	2	2.75	Price drops can affect processors who have purchased stocks at a high price, causing the devaluation of this stock and making them less competitive than their competitors. However, groundnut processers generally maintain small stocks.
14	Political crises	1	2	3	2.25	Political crises can affect processors' revenues, but their processing facilities are rarely exposed because they are located in their home or residential neighbourhoods.
1	Rainfall deficits	2	1	2	2	Rainfall deficits have little impact on domestic groundnut production.
11	Stock infestations	2	1	2	2	Small processors generally manage their storage conditions well.
10	Maritime logistical shocks	2	1	1	1.75	The logistical shocks that handicap exporters are actually an advantage for domestic processors, who benefit from easier provisioning at a lower cost.

Figure 47: Ranking of the risk exposure of groundnut processors

3.2.5. Risks to distributors

As in the maize value chain, distributors limit their exposure to risks in the value chain through highly diversified activities (the sale of dried seeds and even food products in general). Nonetheless, they are highly exposed to personnel risk (small one-person enterprises) and security risks (theft and shakedowns in this largely female category of actors).

Distributors		Frequency	Intensity		Risk ranking	
No	Risks	Probability Score (1-3)	Average Impact Score (1-5)	Maximum Impact Score (1-5)	Score final: ((F*Iave)*.75) + (Imax*0.25)	Comments
17	Worker accident	2	2	5	4.25	The vast majority of distributors (outside of modern distribution) are one-person ventures. Thus, worker accidents directly affect their economic activities.
12	Stock thefts	1	3	5	3.5	While distributors maintain only small stocks, they also have little funds of their own. Largely women, they rarely have access to security services or insurance and are very sensitive to theft and hold-ups at their sales locale.
13	Warehouse fires	1	3	5	3.5	As with theft, distributors have limited means and are rarely insured, which can force them into bankruptcy in the event of a fire.
7	Price increases	3	1	3	3	While accustomed to managing price volatility and capable of mitigating the impact on their activities thanks to the diversity of products they sell and variable margins that are dependent on price levels, distributors can suffer losses from extreme variations, either through the devaluation of their stocks or the reduction of their sales volume in peak price periods.
6	Price drops	3	1	2	2.75	
16	Shakedowns	3	1	2	2.75	Small entrepreneurs, the majority of whom are women, distributors are highly subject to shakedowns by government agents. Even though they generally pass the cost on to their customers by raising their prices, they can experience substantial losses in revenue in extreme cases.
2	Interrupted rains	3	1	1	2.5	All the risks that affect production affect distributors indirectly by reducing the volume of groundnuts they can sell. They limit their exposure by diversifying their supply zones and the products sold.
3	Floods	3	1	1	2.5	
4	Leaf miner larvae	3	1	1	2.5	
5	Locusts	3	1	1	2.5	
14	Political crises	1	2	4	2.5	Distributors are affected by political crises, because most of them are located in cities. Their warehouses and stands are sometimes looted and vandalized during political crises. They are rarely covered by vandalism insurance.
11	Stock infestations	2	1	2	2	Distributors maintain small groundnut stocks (hundreds of kilograms to several tonnes). While they sometimes suffer losses from infestations, the losses are limited by the high turnover of their stock and their easy access to stock treatments.
15	Financial crises	2	1	2	2	Most distributors operate with their own funds or borrow from microfinance institutions. Financial crises can reduce the volume of their activities without threatening them.
1	Rainfall deficit	2	1	1	1.75	Rainfall deficits have little impact on groundnut production and thus, very little impact on distributors who are diversified in dried seeds.
8	Transport accidents	2	1	1	1.75	Distributors rarely handle product transport. However, logistical problems

9	**Hold-ups during transport**	2	1	1	1.75	can sometimes mildly impact their activities, forcing them to look for new suppliers or causing small disruptions in stock supply.
10	**Maritime logistical shocks**	2	1	1	1.75	

Figure 48: Ranking of the risk exposure of distributors in the groundnut value chain

3.2.6. Risks to financial service providers

Financial actors are relatively uninvolved in the groundnut value chain, as their main risk exposure is financial crises.

Financial services		Frequency	Intensity			Risk ranking
No	Risks	Probability Score (1-3)	Average Impact Score (1-5)	Maximum Impact Score (1-5)	Score final: ((F*lave)*.75) + (Imax*0.25)	Comments
15	Financial crises	2	3	5	5.75	Financial crises are the shocks with the most negative impact on the activities of financial services, reducing their flexibility and revenues and forcing them to disinvest in sectors considered risky, such as the groundnut value chain and agriculture in general.
16	Shakedowns	3	1	2	2.75	
2	Interrupted rains	3	1	1	2.5	
3	Floods	3	1	1	2.5	
4	Leaf miner larvae	3	1	1	2.5	
5	Locusts	3	1	1	2.5	The financial sector's exposure to most of the other risks is extremely low -- on the one hand, because the agrifood sector is extremely small (less than 15%, according to Central Bank of Madagascar reports analysing the banking sector), and on the other, because in the Malagasy agriculture and agrifood sector, groundnuts hold a position behind that of other export value chains (vanilla, cacao, cloves, essential oils), which benefit from most of the sector's financing due to the high volumes of finance involved.
6	Price drops	3	1	1	2.5	
7	Price increases	3	1	1	2.5	
14	Political crises	1	2	3	2.25	
1	Rainfall deficits	2	1	1	1.75	Ultimately, the sector's risks largely impact its attractiveness to the traditional financial sector (banks, microfinance institutions), which is particularly risk-averse.
8	Transport accidents	2	1	1	1.75	
9	Hold-ups during transport	2	1	1	1.75	
10	Maritime logistical shocks	2	1	1	1.75	
11	Stock infestations	2	1	1	1.75	
17	Worker accidents	2	1	1	1.75	
12	Stock thefts	1	1	1	1	
13	Warehouse fires	1	1	1	1	
14	Warehouse fires	1	1	1	1	

Figure 49: Ranking of the risk exposure of financial services in the groundnut value chain

3.2.7. Risks to the entire value chain

In the entire value chain, the risks that affect the greatest number of actors and have the most negative impact are those that impact production (phytosanitary pressure, interrupted rainfall and floods in particular), followed by market risks, which are clearly more serious than in the maize value chain due to exogenous volatility factors linked to the international market, and personnel risks, because many actors in the groundnut value chain are individual entrepreneurs or microenterprises that are highly dependent on their creator.

Processors, who are largely women and artisanal, are the actors with the highest risk exposure, because they are significantly impacted by production and price variations and at the same time by security risks (shakedowns and theft in particular). Next come producers, but in contrast to the maize value chain, it is producers in the most humid areas who are subject to the highest risks due to the groundnut's sensitivity to excessive rainfall.

Aggregators and exporters likewise have greater risk exposure than those in the maize value chain because of the greater unpredictability of price variations and the logistical risks in the export chain.

Category	Risk	Producers (South and West)	Producers (Centre, East and North)	Aggregators and exporters	Processors	Distributors	Financial services	Value chain
Phyto	Leaf miner larvae	7.75	7.75	2.75	10.25	2.5	2.5	**5.58**
Personnel	Worker accidents	5.75	5.75	5.75	5.75	4.25	1.75	**4.83**
Weather	Interrupted rains	7.75	7.75	2.75	5.25	2.5	2.5	**4.75**
Weather	Floods	2.75	10.25	2.75	7.75	2.5	2.5	**4.75**
Market	Price drops	5.5	5.5	2.75	2.75	2.75	2.5	**3.63**
Phyto	Locusts	5.25	3	2.75	5.25	2.5	2.5	**3.54**
Macro	Financial crises	2	2	2	5.5	2	5.75	**3.21**
Market	Price increases	0	0	2.75	10.25	3	2.5	**3.08**
Storage	Stock thefts	3.5	3.5	3.5	3.5	3.5	1	**3.08**
Storage	Warehouse fires	3.5	3.5	3.5	3.5	3.5	1	**3.08**
Logistical	Maritime logistical shocks	3.75	3.75	3.75	1.75	1.75	1.75	**2.75**
Storage	Stock infestations	3.75	3.75	2	2	2	1.75	**2.54**
Macro	Political crises	2.25	2.25	2.25	2.25	2.5	2.25	**2.29**
Macro	Shakedowns	0	0	2.75	5.25	2.75	2.75	**2.25**
Logistical	Transport accidents	0	0	5.5	3.75	1.75	1.75	**2.13**
Logistical	Hold-ups during transport	0	0	5.5	3.75	1.75	1.75	**2.13**
Weather	Rainfall deficits	2.25	1.75	2	2	1.75	1.75	**1.92**
Average per actor		**3.28**	**3.56**	**3.24**	**4.74**	**2.54**	**2.25**	

Figure 50: Ranking of the risk exposure of actors and the entire groundnut value chain

3.2.8. Other comments about the relationship among risks

In the Madagascar context, it is rare for a risk to emerge by itself. In fact, each cataclysm occurs in a context of constraints and most often, at the same time as another risk. Moreover, it is not rare for different types of risk to occur in successive years. Actors barely emerge from the impact of one risk when another type arrives – all within a context of production with multiple constraints.

Thus, risk management must involve an integrated approach developed with inclusive grassroots organizations, at least if it is to be holistic. This means that each risk is as important as the relationship between risks on the one hand and between the risks and other constraints on the other, as well as their relationship or impact with each link in the value chain. Another no less important element is integration of the negative externalities of a risk,

depending on whether they affect all or part of the population through an effect involving the other economic sectors, in particular the connected domains.

Furthermore, the risks and their consequences should enable direct and indirect actors, governments and TFPs to adopt proactive, coordinated approaches to mitigate the risks as a whole. Currently, however, poor coordination of interventions currently makes it impossible to efficiently estimate the impact of the various tools and mechanisms mobilized to mitigate risks and disasters.

3.3. Menu of existing agricultural risk management solutions

3.3.1 Main mechanisms

Risk management is a Malagasy Government priority, for which it created the National Office for Risk and Disaster Management (BNGRC). The role of the BNGRC is to manage all risks and disasters (prevention and mitigation). However, its activities consist much more of emergency interventions and to a lesser extent, alerts, especially about the food security of disaster-stricken populations. This translates into the coordination of food distribution through the support of international partners such as WFP. However, the BNGRC does not manage agricultural risks.

Ivontoerana famonoasa Valala eto madagaskary (IFVM) is the country's locust control centre. Its main role is locust prevention and control, but it intervenes largely in locust attacks. It is limited in terms of prevention, even though it collects information to prevent locust plagues.

Ministry of Agriculture and Livestock (MINAE):

Department of Plant Protection (DPV): This department is charged with coordination and support for technical activities during implementation of the Ministry's plant and phytosanitary protection policy.

Weather Service: As a result of its break-up, it is limited in terms of providing information on agricultural production, especially for producers, to manage hydrometeorological risk in a proactive, coordinated manner.

Added to this are national and/or regional agroecological projects, as well as research institutes such as FOFIFA, notably for seed research and development and assistance to producers on specific techniques for crops and regions. There is limited scale-up of research findings in rural areas, except in the case of wholly milled rice, where advances have been considerable.

Agricultural aggregation: Through its Agricultural Aggregation Law, the Malagasy Government promotes the development of contract farming among all producers and value chains (Office of the President of the Republic, 2019). This law defines the nature of assistance and technical support for aggregators to the benefit of producers – establishing in particular:

- The minimum yield in terms of the agreed technical management of production
- The obligation of producers to deliver quality products
- The agreed prices for the delivery of production and the ways in which they were set

Aggregation in the value chains of the crops in question is more tailored to the contract farming already practiced in export value chains and niche crops, such as green beans, cotton and vanilla.

There is no specific management tool or mechanism for groundnuts and maize beyond pilot agriculture insurance initiatives by the German Agency for International Cooperation (GIZ) through its Adapting agricultural value chains to climate change (PrAda) project and WFP in its activities in the south of the country.

3.3.2. Climate risks

The State and its partners

The Government is conducting research and development (especially on improved seeds); providing monitoring, support and advisory services for producers and capacity building for actors; implementing hydro-agricultural development projects; and providing emergency assistance. This, however, does not allow for sustainable risk mitigation. Thus, emergency interventions prevail over preventive agricultural risk management.

Agroecological production techniques supported by NGOs, such as GRET, AVSF and CTAS (Centre Technique Agro-écologique du Sud), include intercropping, agroforestry and the reclaiming of degraded land. Added to this is the new Emergency Food Production Project (PURPA), financed by the African Development Bank, launched on 15 April 2023. This project covers the rice, maize and groundnut value chains.

Agriculture insurance is just emerging in the maize and groundnut value chains with support from WFP (for some 5,000 producers) and GIZ (for some 200 producers) through Omnibranch Reinsurance Insurance (ARO). However, this indexed insurance approach is struggling to attract producers. In fact, tailoring the proposed insurance products to the real needs of producers and their production level, as well as their sustainability, is still a pending issue.

Grassroots actors

At the producer level: diversifying production and activities is still the primary means of mitigating risks to producers. Added to this is the choice of varieties tailored to pedoclimatic conditions, notably drought-resistant varieties; the choice of crops for on-farm consumption and the land; planting and replanting, based on variations in rainfall and planting; seed exchanges; the combination of crop farming and stock raising; migration; the sale of assets such as land and livestock; and the construction of warehouses by farmers' organizations so that buyers can store their purchases before transferring them. Producers also invest in stock raising, which for centuries has been a method for saving (reproduction, sellable at any time, a wealth factor, etc.).

Certain companies (SOAFIARY, LFL) offer contract farming for maize production. For the 2022-2023 crop season, LFL initially issued eight contracts, two of them with one-person enterprises and six with producers' organizations. SOAFIARY employs an advisory approach and supplies inputs through a tripartite contract: PO-NGO-SOAFIARY interface. These latter enterprises use production costs as the price reference. Contract compliance is a matter that is still pending due to lack of a well-defined framework (there is no legal and regulatory framework).

3.3.3. Biological and environmental risks

The State and its partners

Madagascar has domestic regulations governing standardization, sales (licensing) and the use of synthetic chemicals. Phytosanitary control of agricultural products for import/export is exercised when they enter or exit the country. There is no streamlined monitoring or statistics on the impact of pesticide use, despite the existence of services devoted to it.

Grassroots actors: Limited use of synthetic products is closely linked to producers' limited access to inputs. The producers who use these products are often ill-equipped to do so efficiently. Thus, they are exposed to inputs that are frequently used without following the safety instructions (personnel and environmental risks).

3.3.4. Market risks

Farmer strategies: Producers' approach is mainly to defer the sale of their crops, staggering sales to take advantage of opportunities and gradually, the harvests. However, the generally urgent need for liquidity at the end of the crop season (household expenses, loans), coupled with storage problems, prevents producers from holding on to their production long enough to receive the higher prices.

3.3.5. Health risks

The State and its partners

The State and its partners conduct public awareness and vaccination campaigns and work to improve access to basic health services.

Farmer strategies

In the absence of a universal health system, producers combine modern and traditional medicine to soothe their ills. In this context, prevention is generally non-existent except in epidemics of contagious diseases, when vaccination campaigns are conducted by the State and its partners.

3.3.6. Infrastructure risks

Farmer strategies

Crop storage is generally an individual and empirical undertaking, as is drying. To prevent production losses and meet financial needs, farmgate sales that follow the harvest rhythm and drying are the most developed strategies. However, some seed is conserved for a short time in sacks and barrels.

3.3.7. Financial risks

The classical structured bank credit system in Madagascar is geared primarily to crops such as cotton, vanilla and rice, for which seasonal loans are granted by the Bank of Africa. However, certain producers resort to informal credit or prefinancing by buyers and merchants (input suppliers and product buyers). The problem of contract compliance (adherence to agreements between the parties) has significantly reduced these types of financing.

3.3.8. Comments on risk management and the mobilization of tools

In an agricultural development context dominated by uncontrolled factors, an isolated tool for all types of production throughout the country is unlikely to sustainably emerge. The more connected the risks are to each other and the existing constraints, the more their management will require a holistic, tailored, gradual and coherent approach in space and time, bearing in mind the overall production priorities but making it specific to the different value chains and regions. What is needed is an overall strategic approach, but with local pools of talent specific to the value chains.

The approaches to recommend should consider the present and future cost to producers, as well as their individual and collective ownership capacity. In the Malagasy context, particularly for producers in the south, any initiative will engender a supplementary farming expense, such as insurance, classical bank loans and the risk that producers will not sign on to it. Yet incentives through subsidies to producers are not necessarily embraced without fostering revenue growth among them, linking productivity with guarantees.

The priorities for producers would be access to means of production tailored to their conditions, such as quality seed, inputs, sustainable good practices, adapted equipment and materials. Thus, the creation of seed banks and supply outlets with assisted mutualist management (tailored technical assistance) and groups for managing agricultural equipment and materials with shared costs would make it possible to sustain production. To add value

to production, a pooled/organized sales system, whether or not supported by a financial mechanism (based on credit, marketing and/or the crop season), would be advisable. To this should be added an effective mechanism for disseminating accurate information in real time – one that is simple, inexpensive and sustainable.

3.4. Capacity and vulnerability

A targeted management option is analysed for each of the risks identified in the maize and groundnut value chains. In addition, the targeted options among the cross-cutting options for multi-risk management are also analysed. The option analysis is based on two estimates:

Effectiveness is the analysis of the option's impact in terms of reducing the impact of risk when implemented. It is scored from 1 to 3 under the methodology presented below.

Applicability is the analysis of the conditions of access to this option. If access is extremely limited due to cost, technical difficulty of implementation or availability along the value chain, the score is low. If, on the contrary, access to this option is simple and common along the value chain, the score is high. This score ranges from 1 to 4 under the methodology presented below.

Effectiveness of risk management options			Applicability of risk management options		
Category	**Criteria**	**Score**	**Category**	**Criteria**	**Score**
Significant effect	**Reduction of or compensation for at least 50% of the losses**	**3**	**Applicable**	**Widespread or common access to this option**	**4**
Moderate effect	**Reduction of or compensation for at least 25% of the losses**	**2**	**Sometimes applicable**	**Access by more than half the group of actors to this option**	**3**
			Hard or expensive to apply	**Access limited to some actors due to its high cost or highly technical nature**	**2**
Minor effect	**Reduction of or compensation for at least 25% of the losses**	**1**	**Inapplicable or very hard to apply**	**Unavailability of the option in the value chain or prohibitive cost**	**1**

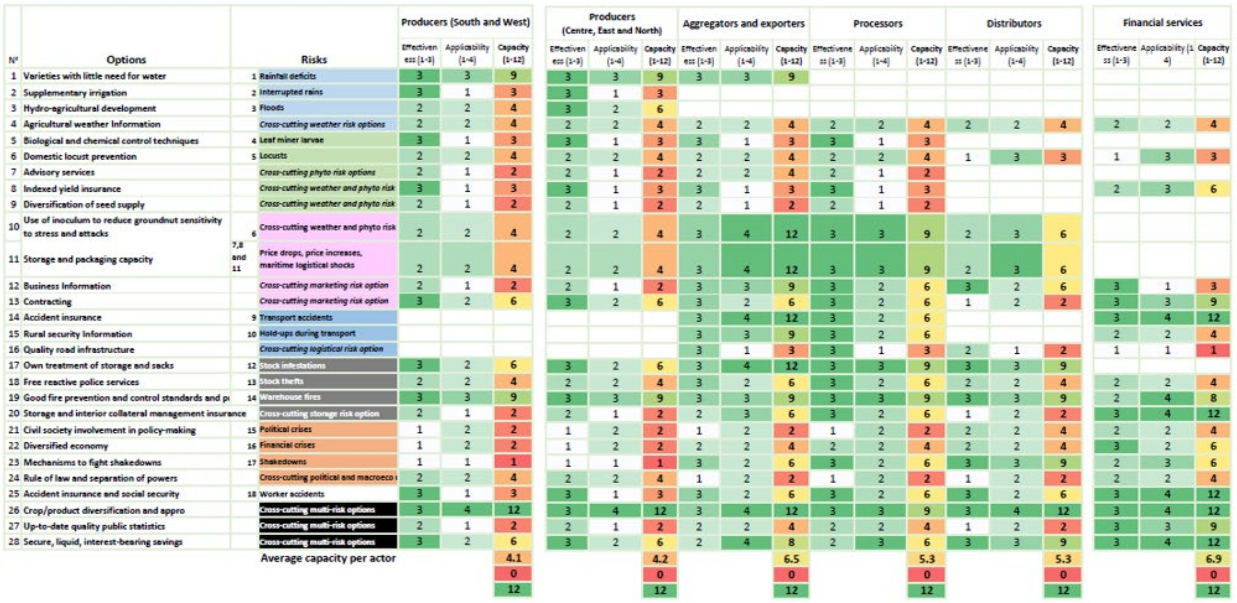
Figure 51: PARM methodology for quantifying risk management capacity

Note that the risk management capacity in each value chain is analysed. In each category of actor, certain more vulnerable populations, such as women, youth, internal migrants or newly created enterprises, may have clearly less risk management capacity than the majority of actors in each link in the value chain.

We will return in the action plan to the need for specific approaches for these more vulnerable actors in each value chain.

3.4.1. Risk management capacity in the maize value chain

The table below assesses the capacity of actors in the maize value chain to manage the risks that affect them through the 29 risk management options identified. Certain risk management options cut across several risks, while others target a single risk.



N°	Options		Risks	Producers (South and West)			Producers (Centre, East and North)			Aggregators and exporters			Processors			Distributors			Financial services		
				Effectiveness (1-3)	Applicability (1-4)	Capacity (1-12)	Effectiveness (1-3)	Applicability (1-4)	Capacity (1-12)	Effectiveness (1-3)	Applicability (1-4)	Capacity (1-12)	Effectiveness (1-3)	Applicability (1-4)	Capacity (1-12)	Effectiveness (1-3)	Applicability (1-4)	Capacity (1-12)	Effectiveness (1-3)	Applicability (1-4)	Capacity (1-12)
1	Varieties with little need for water	1	Rainfall deficits	3	3	9	3	3	9	3	3	9									
2	Supplementary irrigation	2	Interrupted rains	3	1	3	3	1	3												
3	Hydro-agricultural development	3	Floods	2	2	4	3	2	6												
4	Agricultural weather information		*Cross-cutting weather risk options*	2	2	4	2	2	4	2	2	4	2	2	4	2	2	4	2	2	4
5	Biological and chemical control techniques	4	Leaf miner larvae	3	1	3	3	1	3	3	1	3	3	1	3						
6	Domestic locust prevention	5	Locusts	2	2	4	2	2	4	2	2	4	2	2	4	1	3	3	1	3	3
7	Advisory services		*Cross-cutting phyto risk options*	2	1	2	2	1	2	2	2	4	2	1	2						
8	Indexed yield insurance		*Cross-cutting weather and phyto risk*	3	1	3	3	1	3	3	1	3	3	1	3				2	3	6
9	Diversification of seed supply		*Cross-cutting weather and phyto risk*	2	1	2	2	1	2	2	1	2	2	1	2						
10	Use of inoculum to reduce groundnut sensitivity to stress and attacks	6	Cross-cutting weather and phyto risk	2	2	4	2	2	4	3	4	12	3	3	9	2	3	6			
11	Storage and packaging capacity	7,8 and 11	Price drops, price increases, maritime logistical shocks	2	2	4	2	2	4	3	4	12	3	3	9	2	3	6			
12	Business Information		*Cross-cutting marketing risk option*	2	1	2	2	1	2	3	3	9	3	2	6	3	2	6	3	1	3
13	Contracting		*Cross-cutting marketing risk option*	3	2	6	3	2	6	3	2	6	3	2	6	1	2	2	3	3	9
14	Accident insurance	9	Transport accidents							3	4	12	3	2	6				3	4	12
15	Rural security information	10	Hold-ups during transport							3	3	9	3	2	6				2	2	4
16	Quality road infrastructure		*Cross-cutting logistical risk option*							3	1	3	3	1	3	2	1	2	1	1	1
17	Own treatment of storage and sacks	12	Stock infestations	3	2	6	3	2	6	3	4	12	3	3	9	3	3	9			
18	Free reactive police services	13	Stock thefts	2	2	4	2	2	4	3	2	6	3	2	6	2	2	4	2	2	4
19	Good fire prevention and control standards and pr	14	Warehouse fires	3	3	9	3	3	9	3	3	9	3	3	9	3	3	9	2	4	8
20	Storage and interior collateral management insurance		*Cross-cutting storage risk option*	2	1	2	2	1	2	2	3	6	3	2	6	1	2	2	3	4	12
21	Civil society involvement in policy-making	15	Political crises	1	2	2	1	2	2	1	2	2	1	2	2	2	2	4	2	2	4
22	Diversified economy	16	Financial crises	1	2	2	1	2	2	2	2	4	2	2	4	2	2	4	3	2	6
23	Mechanisms to fight shakedowns	17	Shakedowns	1	1	1	1	1	1	3	2	6	3	2	6	3	3	9	2	3	6
24	Rule of law and separation of powers		Cross-cutting political and macroeco	2	2	4	2	2	4	1	2	2	1	2	2	1	2	2	2	2	4
25	Accident insurance and social security	18	Worker accidents	3	1	3	3	1	3	3	2	6	3	2	6	3	2	6	3	4	12
26	Crop/product diversification and appro		Cross-cutting multi-risk options	3	4	12	3	4	12	3	4	12	3	3	9	3	4	12	3	4	12
27	Up-to-date quality public statistics		Cross-cutting multi-risk options	2	1	2	2	1	2	2	2	4	2	2	4	1	2	2	3	3	9
28	Secure, liquid, interest-bearing savings		Cross-cutting multi-risk options	3	2	6	3	2	6	2	4	8	2	3	6	3	3	9	3	4	12
			Average capacity per actor			4.1			4.2			6.5			5.3			5.3			6.9
						0			0			0			0			0			0
						12			12			12			12			12			12

Figure 52: Risk management options and risk management capacity by option and link in the maize value chain

Producers are clearly the actors with the least risk management capacity, especially in the south and west. Up to now, their main option for mitigating the various risks has been to diversify their crops, varieties and production schedules.

In contrast, processors, who are the actors exposed to the highest risks, are also those who have access to and take advantage of the most risk management options to pursue their activities.

3.4.2. Analysis of vulnerability in the maize value chain

Under the PARM methodology, vulnerability is calculated based on the differential between the risk exposure scores (frequency, average intensity and extreme intensity) and the risk management capacity scores.

Since several risk management options can be utilized for the same risk, the capacity to adapt to these specific risks is the average of the score of each of the options for managing it. The tables below present the following for each actor:

1) The previously calculated risk exposure scores

2) The risk management capacity scores for each of the 18 risks identified

3) Vulnerability, calculated by weighting risk exposure by 60 per cent and risk management capacity by 40 per cent. Thus, the higher the risk and the lower the adaptation capacity, the greater the vulnerability. In contrast, if the impact of the risk is low and/or the adaptation capacity is high, the vulnerability will be moderate.

Risk exposure scores		Input suppliers	Producers (South and West)	Producers (Centre, East North)	Aggregators	Processors	Distributors	Financial services
Weather	Rainfall deficits		8.0	2.5	2.8	7.8	2.5	2.5
	Interrupted rains		7.8	7.8	2.8	5.3	2.5	2.5
	Floods		2.8	7.8	2.8	5.3	2.5	2.5
Phyto	Armyworms		7.8	7.8	2.8	10.3	2.5	2.5
	Locusts		5.3	3.0	2.8	5.3	2.5	2.5
Market	Price drops	2.8	5.3	5.3	2.5	2.8	2.8	2.5
	Price increases				2.5	10.3	3.0	2.5
	Fertilizer price increases	5.5	2.0	3.8	1.8	3.8	1.8	1.8
Logistical	Transport accidents	3.8			5.5	3.8	1.8	1.8
	Hold-ups during transport	3.8			5.5	3.8	1.8	1.8
	Maritime logistical shocks	5.5	2.0	2.0	2.0	2.0	2.0	1.8
Storage	Stock infestations		3.8	3.8	2.0	2.0	2.0	1.8
	Stock thefts	3.3	3.5	3.5	3.5	3.5	3.5	1.0
	Warehouse fires	4.3	3.5	3.5	3.5	3.5	3.5	1.0
Macro	Political crises	3.3	2.3	2.3	2.3	2.3	2.5	2.3
	Financial crises	3.8	2.0	2.0	2.0	5.8	2.0	5.8
	Shakedowns	2.8			2.8	5.8	2.8	2.8
Personnel	Worker accidents	3.8	5.8	5.8	5.8	5.8	4.3	1.8

Figure 53: Risk exposure scores in the maize value chain

Risk management capacity scores		Input suppliers	Producers (South and West)	Producers (Centre, East and North)	Aggregators	Processors	Distributors	Financial services
Weather	Rainfall deficits		5.3	5.3	7.3	8.0	5.2	5.4
	Interrupted rains		5.1	5.1	7.3	7.3	5.2	5.4
	Floods		5.3	5.9	7.3	8.0	5.2	5.4
Phyto	Armyworms		5.5	5.5	7.3	8.6	4.8	4.9
	Locusts		5.5	5.5	8.3	8.3	5.3	5.3
Market	Price drops	5.2	4.9	4.9	8.7	8.6	6.4	7.0
	Price increases	5.2			8.7	8.6	6.4	7.0
	Fertilizer price increases	6.0	5.0	5.0	7.2	7.5	6.2	6.7
Logistical	Transport accidents	7.7			9.0	7.7	3.7	8.3
	Hold-ups during transport	6.7			8.0	6.7	3.7	5.7

	Maritime logistical shocks	6.7	2.7	2.7	5.7	5.0	3.7	5.7
Storage	Stock infestations		5.2	5.2	8.5	9.0	6.3	9.0
	Stock thefts	7.7	4.0	4.0	8.0	8.7	5.0	9.3
	Warehouse fires	8.7	5.7	5.7	9.0	10.7	6.7	10.7
Macro	Political crises	4.0	4.0	4.0	5.3	4.0	5.0	6.7
	Financial crises	4.7	4.0	4.0	6.0	4.7	5.0	7.3
	Shakedowns	5.3			7.7	5.3	6.7	7.3
Personnel	Worker accidents	7.0	4.5	4.5	9.0	8.5	7.5	12.0

Figure 54: Risk management capacity scores in the maize value chain

As seen below, from the standpoint of risk exposure and risk management capacity, maize producers are the most vulnerable actors, since they have very high risk exposure and very limited management capacity beyond diversification.

As for maize processors, while they have and employ numerous risk management strategies and tools, they are also very vulnerable, due to the specialization of their activities around a raw material (maize) and their sensitivity to production risks and the macroeconomic and political risks that influence the sustainability and profitability of their activities.

Input suppliers are likewise vulnerable because, while less dependent on the maize value chain, they are subject to numerous risks due to their business activity's focus on rural areas, their dependency on a volatile fertilizer market and logistics subject to regular shocks.

Vulnerability scores		Input suppliers	Producers (South and West)	Producers (Centre East North)	Aggregators	Processors	Distributors	Financial services	Value chain
Weather	Rainfall deficits		7.5	4.2	3.5	6.3	4.2	4.2	**5.0**
	Interrupted rains		7.4	7.4	3.5	5.1	4.2	4.2	**5.3**
	Floods		4.4	7.1	3.5	4.8	4.2	4.2	**4.7**
Phyto	Armyworms		7.3	7.3	3.5	7.5	4.4	4.4	**5.7**
	Locusts		5.8	4.4	3.1	4.7	4.2	4.2	**4.4**
Market	Price drops	4.4	6.0	6.0	2.8	3.0	3.9	3.5	**4.2**
	Price increases				2.8	7.5	4.0	3.5	**4.5**
	Fertilizer price increases	5.7	4.0	5.1	3.0	4.1	3.4	3.2	**4.1**
Logistical	Transport accidents	4.0			4.5	4.0	4.4	2.5	**3.9**
	Hold-ups during transport	4.4			4.9	4.4	4.4	3.6	**4.3**
	Maritime logistical shocks	5.4	4.9	4.9	3.7	4.0	4.5	3.6	**4.5**
Storage	Stock infestations		5.0	5.0	2.6	2.4	3.5	2.3	**3.4**
	Stock thefts	3.7	5.3	5.3	3.7	3.4	4.9	1.7	**4.0**
	Warehouse fires	3.9	4.6	4.6	3.3	2.6	4.2	1.1	**3.5**
Macro	Political crises	5.2	4.6	4.6	4.0	4.6	4.3	3.5	**4.4**
	Financial crises	5.2	4.4	4.4	3.6	6.4	4.0	5.3	**4.8**
	Shakedowns	4.3			3.4	6.1	3.8	3.5	**4.2**
Personnel	Worker accidents	4.3	6.5	6.5	4.7	4.9	4.4	1.1	**4.6**
Average per actor		**4.6**	**5.5**	**5.5**	**3.6**	**4.8**	**4.2**	**3.3**	

Figure 55: Vulnerability by risk and actor in the maize value chain

Finally, it can be seen from this analysis that the risks that pose the greatest challenges for the maize value chain in Madagascar and affect production (and thus, the activity and revenues of all links in the chain) are related to weather and phytosanitary pressure.

Macroeconomic and political risks (which affect the entire economy, including the maize value chain) can also generate very substantial losses for all actors. Their impact is even greater, since, affecting the financing capacity and purchasing power downstream in the value chain, they can lead to particularly violent disruptions all across the marketing chain.

Finally, the maize value chain is especially vulnerable to personnel risks, which many actors, especially in rural areas, have limited capacity to manage. These risks can result in enormous losses for farms and other actors in the value chain.

3.4.3. Risk management capacity in the groundnut value chain

Unlike the situation in the maize value chain, where industrial processors have ample risk management options, the largely artisanal processors in the groundnut value chain have a panoply of accessible but less important options, which explains their clearly lower risk management capacity scores.

The risk management capacity of producers is also lower than that in the maize value chain, because very few of them benefit from technical assistance, a selected-seed supplier or a contracting system with processers in this value chain. Although some cases of producer-exporter contracting with processors were reported by the actors, especially in the Atsimo-Andrefana and Boeny regions, they appeared to involve only one crop season and were limited to supplying seed under a crop production purchasing contract. Government services are also less involved in the groundnut value chain, and technical assistance, information and advisory services and agronomy and marketing services are therefore very limited.

Aggregators and exporters, distributors and financial services, in contrast, have management capacity comparable to that of the maize value chain.

N°	Options		Risks	Producers (South and West)			Producers (Centre, East and North)			Aggregators and exporters			Processors			Distributors			Financial services		
				Effectiveness (1-3)	Applicability (1-4)	**Capacity (1-12)**	Effectiveness (1-3)	Applicability (1-4)	**Capacity (1-12)**	Effectiveness (1-3)	Applicability (1-4)	**Capacity (1-12)**	Effectiveness (1-3)	Applicability (1-4)	**Capacity (1-12)**	Effectiveness (1-3)	Applicability (1-4)	**Capacity (1-12)**	Effectiveness (1-3)	Applicability (1-4)	**Capacity (1-12)**
1	**Varieties with little need for water**	**1**	**Rainfall deficits**	3	3	**9**	3	3	**9**	3	3	**9**									
2	**Supplementary irrigation**	**2**	**Interrupted rains**	3	1	**3**	3	1	**3**												
3	**Hydro-agricultural development**	**3**	**Floods**	2	2	**4**	3	2	**6**												
4	**Agricultural weather Information**		***Cross-cutting weather risk options***	2	2	**4**	2	2	**4**	2	2	**4**	2	2	**4**	2	2	**4**	2	2	**4**
5	**Biological and chemical control techniques**	**4**	**Leaf miner larvae**	3	1	**3**	3	1	**3**	3	1	**3**	3	1	**3**						
6	**Domestic locust prevention**	**5**	**Locusts**	2	2	**4**	2	2	**4**	2	2	**4**	2	2	**4**	1	3	**3**	1	3	**3**
7	**Advisory services**		***Cross-cutting phyto risk options***	2	1	**2**	2	1	**2**	2	2	**4**	2	1	**2**						
8	**Indexed yield insurance**		***Cross-cutting weather and phyto risk option***	3	1	**3**	3	1	**3**	3	1	**3**	3	1	**3**				2	3	**6**
9	**Diversification of seed supply**		***Cross-cutting weather and phyto risk option***	2	1	**2**	2	1	**2**	2	1	**2**	2	1	**2**						
10	**Use of inoculum to reduce groundnut sensitivity to stress and attacks**	**6**	**Cross-cutting weather and phyto risk option**	2	2	**4**	2	2	**4**	3	4	**12**	3	3	**9**	2	3	**6**			
11	**Storage and packaging capacity**	**7, 8 and 11**	**Price drops, price increases, maritime logistical shocks**	2	2	**4**	2	2	**4**	3	4	**12**	3	3	**9**	2	3	**6**			
12	**Business Information**		***Cross-cutting marketing risk option***	2	1	**2**	2	1	**2**	3	3	**9**	3	2	**6**	3	2	**6**	3	1	**3**
13	**Contracting**		***Cross-cutting marketing risk option***	3	2	**6**	3	2	**6**	3	2	**6**	3	2	**6**	1	2	**2**	3	3	**9**
14	**Accident insurance**	**9**	**Transport accidents**							3	4	**12**	3	2	**6**				3	4	**12**
15	**Rural security Information**	**10**	**Hold-ups during transport**							3	3	**9**	3	2	**6**				2	2	**4**
16	**Quality road infrastructure**		***Cross-cutting logistical risk option***							3	1	**3**	3	1	**3**	2	1	**2**	1	1	**1**
17	**Own treatment of storage and sacks**	**12**	**Stock infestations**	3	2	**6**	3	2	**6**	3	4	**12**	3	3	**9**	3	3	**9**			
18	**Free reactive police services**	**13**	**Stock thefts**	2	2	**4**	2	2	**4**	3	2	**6**	3	2	**6**	2	2	**4**	2	2	**4**
19	**Good fire prevention and control standards and practices**	**14**	**Warehouse fires**	3	3	**9**	3	3	**9**	3	3	**9**	3	3	**9**	3	3	**9**	2	4	**8**

20	Storage and interior collateral management insurance		Cross-cutting storage risk option	2	1	**2**	2	1	**2**	2	3	**6**	3	2	**6**	1	2	**2**	3	4	**12**
21	Civil society involvement in policy-making	15	Political crises	1	2	**2**	1	2	**2**	1	2	**2**	1	2	**2**	2	2	**4**	2	2	**4**
22	Diversified economy	16	Financial crises	1	2	**2**	1	2	**2**	2	2	**4**	2	2	**4**	2	2	**4**	3	2	**6**
23	Mechanisms to fight shakedowns	17	Shakedowns	1	1	**1**	1	1	**1**	3	2	**6**	3	2	**6**	3	3	**9**	2	3	**6**
24	Rule of law and separation of powers		Cross-cutting political and macroeco risk option	2	2	**4**	2	2	**4**	1	2	**2**	1	2	**2**	1	2	**2**	2	2	**4**
25	Accident insurance and social security	18	Worker accidents	3	1	**3**	3	1	**3**	3	2	**6**	3	2	**6**	3	2	**6**	3	4	**12**
26	Crop/product diversification and appro		Cross-cutting multi-risk options	3	4	**12**	3	4	**12**	3	4	**12**	3	3	**9**	3	4	**12**	3	4	**12**
27	Up-to-date quality public statistics		Cross-cutting multi-risk options	2	1	**2**	2	1	**2**	2	2	**4**	2	2	**4**	1	2	**2**	3	3	**9**
28	Secure, liquid, interest-bearing savings		Cross-cutting multi-risk options	3	2	**6**	3	2	**6**	2	4	**8**	2	3	**6**	3	3	**9**	3	4	**12**
			Average capacity per actor			**4.1**			**4.2**			**6.5**			**5.3**			**5.3**			**6.9**

Figure 56: Risk management options and capacity in the groundnut value chain

3.4.4. Analysis of vulnerability in the groundnut value chain

As with maize, the vulnerability analysis below is based on a comparison of the level of risk exposure (risk score) and risk management capacity (management capacity score) for each risk. As in the maize value chain, since several risk management options are available for a single risk, the management capacity score is the average of the different scores.

Risk exposure scores		Producers (South and West)	Producers (Centre, East and	Aggregators	Processors	Distributors	Financial services
Weather	Rainfall deficits	2.25	1.75	2	2	1.75	1.75
	Interrupted rains	7.75	7.75	2.75	5.25	2.5	2.5
	Floods	2.75	10.25	2.75	7.75	2.5	2.5
Phyto	Leaf miner larvae	7.75	7.75	2.75	10.25	2.5	2.5
	Locusts	5.25	3	2.75	5.25	2.5	2.5
Market	Price drops	5.5	5.5	2.75	2.75	2.75	2.5
	Price increases	0	0	2.75	10.25	3	2.5
Logistical	Transport accidents	0	0	5.5	3.75	1.75	1.75
	Hold-ups during transport	0	0	5.5	3.75	1.75	1.75
	Maritime logistical shocks	3.75	3.75	3.75	1.75	1.75	1.75
Storage	Stock infestations	3.75	3.75	2	2	2	1.75
	Stock thefts	3.5	3.5	3.5	3.5	3.5	1
	Warehouse fires	3.5	3.5	3.5	3.5	3.5	1
Macro	Political crises	2.25	2.25	2.25	2.25	2.5	2.25
	Financial crises	2	2	2	5.5	2	5.75
	Shakedowns	0	0	2.75	5.25	2.75	2.75
Personnel	Worker accidents	5.75	5.75	5.75	5.75	4.25	1.75

Figure 57: Risk scores by link and risk in the groundnut value chain

Risk management capacity scores		Producers (South and West)	Producers (Centre, East and North)	Aggregators	Processors	Distributors	Financial services
Weather	Rainfall deficits	5.3	5.3	6.8	4.6	5.5	5.4
	Interrupted rains	4.5	4.5	5.6	4.6	5.5	5.4
	Floods	4.6	4.9	5.6	4.6	5.5	5.4
Phyto	Leaf miner larvae	4.3	4.3	6.0	4.8	4.8	4.9
	Locusts	4.4	4.4	6.1	4.9	5.3	5.3
Market	Price drops	4.6	4.6	7.7	6.1	5.6	6.6
	Price increases			7.7	6.1	5.6	6.6
Logistical	Transport accidents			7.7	5.0	3.7	8.3
	Hold-ups during transport			6.7	5.0	3.7	5.7
	Maritime logistical shocks	2.8	2.8	7.6	6.0	5.0	5.6
Storage	Stock infestations	4.8	4.8	6.4	5.4	6.3	9.0
	Stock thefts	4.0	4.0	6.7	6.0	5.0	9.3
	Warehouse fires	5.7	5.7	7.7	7.0	6.7	10.7
Macro	Political crises	4.0	4.0	4.0	3.3	5.0	6.7
	Financial crises	4.0	4.0	4.7	4.0	5.0	7.3
	Shakedowns	3.7	3.7	5.3	4.7	6.7	7.3
Personnel	Worker accidents	4.5	4.5	7.0	6.0	7.5	12.0

Figure 58: Risk management capacity scores by risk and link in the groundnut value chain

As in the maize value chain, producers in the groundnut value chain are the most vulnerable actors, due to their extremely high risk exposure and very low risk management capacity beyond crop diversification.

We should also recall that, on average, farms managed by women and young people, as well as those newly established by migrants, have vulnerability levels that are even higher than the average for farms in the value chain.

Processors are also vulnerable actors, due to their very high level of risk exposure and, in the groundnut value chain, their relatively limited risk management capacity.

The risks to which the value chain is most vulnerable are those that affect production (phytosanitary shocks and weather events) and market risks (rapid exogenous price increases), which could lead to significant cross-cutting losses for numerous actors.

The different links in the value chain are also very vulnerable to the risk of worker accidents, as the majority are small farms with few workers and enterprises operated by one person or a very few salaried employees.

Vulnerability scores		Producers (South and West)	Producers (Centre, East and North)	Aggregators	Processors	Distributors	Financial services	Value chain
Weather	Rainfall deficits	4.1	3.8	3.3	4.2	3.7	3.7	**3.8**
	Interrupted rains	7.7	7.7	4.2	6.1	4.1	4.2	**5.6**
	Floods	4.6	9.0	4.2	7.6	4.1	4.2	**5.6**
Phyto	Leaf miner larvae	7.8	7.8	4.1	9.1	4.4	4.4	**6.2**
	Locusts	6.2	4.9	4.0	6.0	4.2	4.2	**4.9**
Market	Price drops	6.3	6.3	3.4	4.0	4.2	3.7	**4.6**
	Price increases			3.4	8.5	4.4	3.7	**5.0**
Logistical	Transport accidents			5.0	5.1	4.4	2.5	**4.2**
	Hold-ups during transport			5.4	5.1	4.4	3.6	**4.6**
	Maritime logistical shocks	5.9	5.9	4.0	3.5	3.9	3.6	**4.5**
Storage	Stock infestations	5.1	5.1	3.4	3.8	3.5	2.3	**3.9**
	Stock thefts	5.3	5.3	4.2	4.5	4.9	1.7	**4.3**
	Warehouse fires	4.6	4.6	3.8	4.1	4.2	1.1	**3.8**
Macro	Political crises	4.6	4.6	4.6	4.8	4.3	3.5	**4.4**
	Financial crises	4.4	4.4	4.1	6.5	4.0	5.3	**4.8**
	Shakedowns			4.3	6.1	3.8	3.5	**4.4**
Personnel	Worker accidents	6.5	6.5	5.5	5.9	4.4	1.1	**4.9**
Average per actor		**5.5**	**5.5**	**3.6**	**4.8**	**4.2**	**3.3**	

Figure 59: Vulnerability by link and risk in the groundnut value chain

4. Agricultural risk management strategies

4.1. Gap analysis

The maize and groundnut value chains have massive risk exposure.

Value chains historically developed in the peripheral regions of Madagascar, the intensity of their environmental (weather and phytosanitary), logistical, health and security risks has led to the relocation of production, marketing and processing to plateau areas in the centre of the country, which have lower risk exposure and benefit from greater market access.

The main risk mitigation strategy employed by maize and groundnut producers over the past two decades appears to have been internal migration. The next has been to abandon these two crops and shift to more resilient ones (cassava, black-eyed peas, sorghum and millet).

It would seem essential to develop a risk mitigation approach in production zones in the west and south of the country, where the risks are the most numerous, most intense and most

frequent, but at the same time to support risk management in the intensification zones in the centre and north of the country, which receive many migrant farmers.

This is an enormous task, and the means of the Malagasy State and value chain and agricultural development actors will clearly be insufficient to manage all the risks. It therefore seems critical to address several gaps to strengthen actors' capacity to manage the risks.

4.2. Strategic vision for risk management in the two value chains in Madagascar

This study on risks and vulnerabilities in the maize and groundnut value chains in Madagascar, confirmed by the conclusions of the KM1 workshop, highlights three main categories of risk to which the two value chains are especially vulnerable:

1) Production risks, which consist of extreme weather events and regular shocks from phytosanitary pressure in Madagascar, against which actors in the two value chains have few options for adaptation;

2) Market risks, which consist of price volatility in production zones and the domestic market and the impact of the international markets via fertilizer imports in the maize value chain and groundnut seed exports in the groundnut value chain;

3) Structural risks, which are the result of the limited capacity of the State to invest in its infrastructure (roads, ports) and institutions (police, courts, rule of law, social security) on the one hand, and low levels of diversification in the Malagasy economy on the other, which subject actors in the two value chains and all actors in agricultural value chains to high levels of insecurity and disruption that seriously impact their revenues and medium- and long-term forecasting and investment capacity.

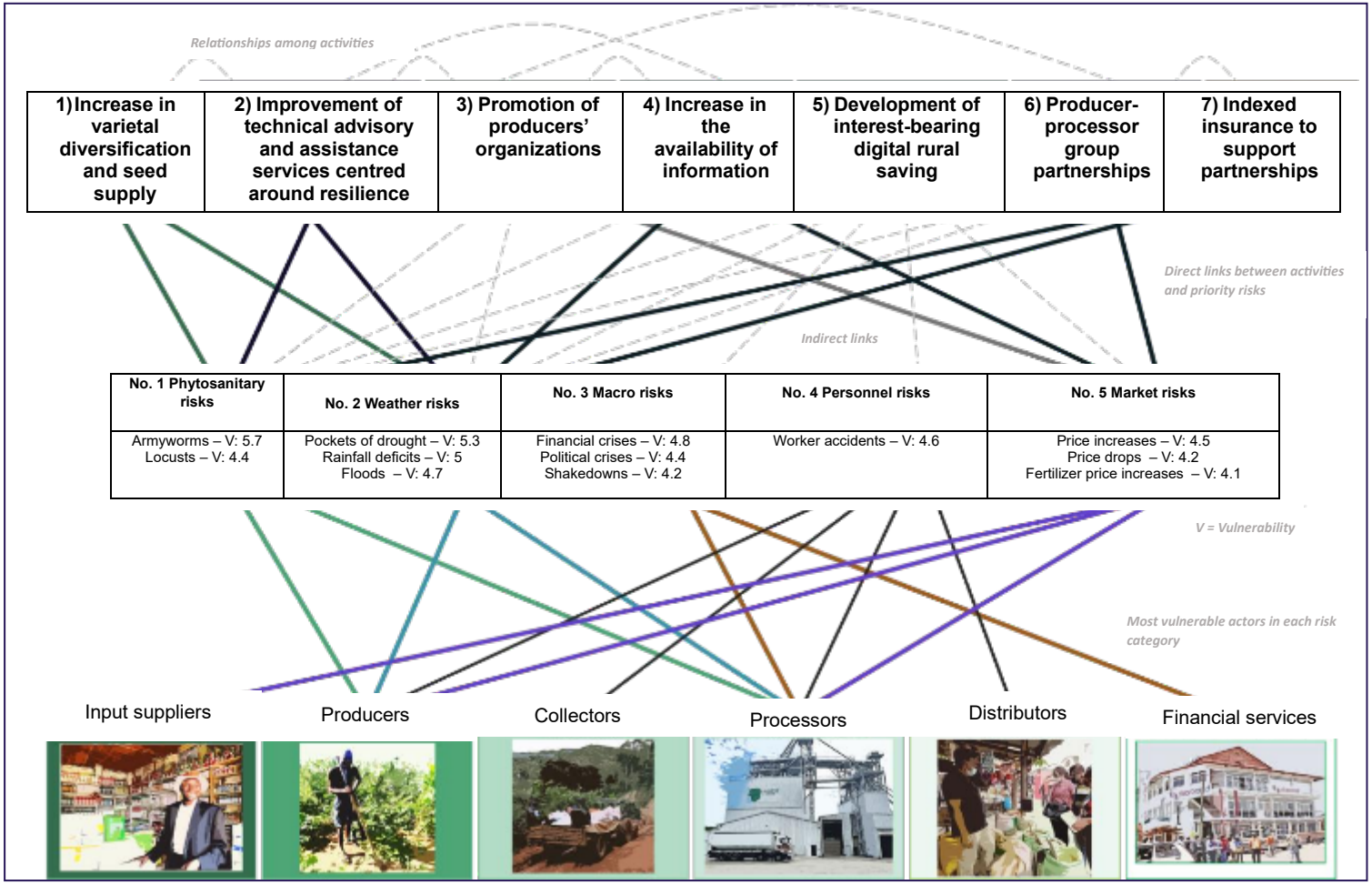
It is hard to address this third risk category through an agricultural risk management (ARM) programme, which is why the essential aspects of the proposals that follow focus on the first two categories.

Note, however, that, several actions, especially those involving the strengthening of producers' organizations, the improvement of production and the dissemination of independent, useful information to the actors, indirectly contribute to strengthening the structure of the Malagasy economy and thus, marginally reduce these structural risks.

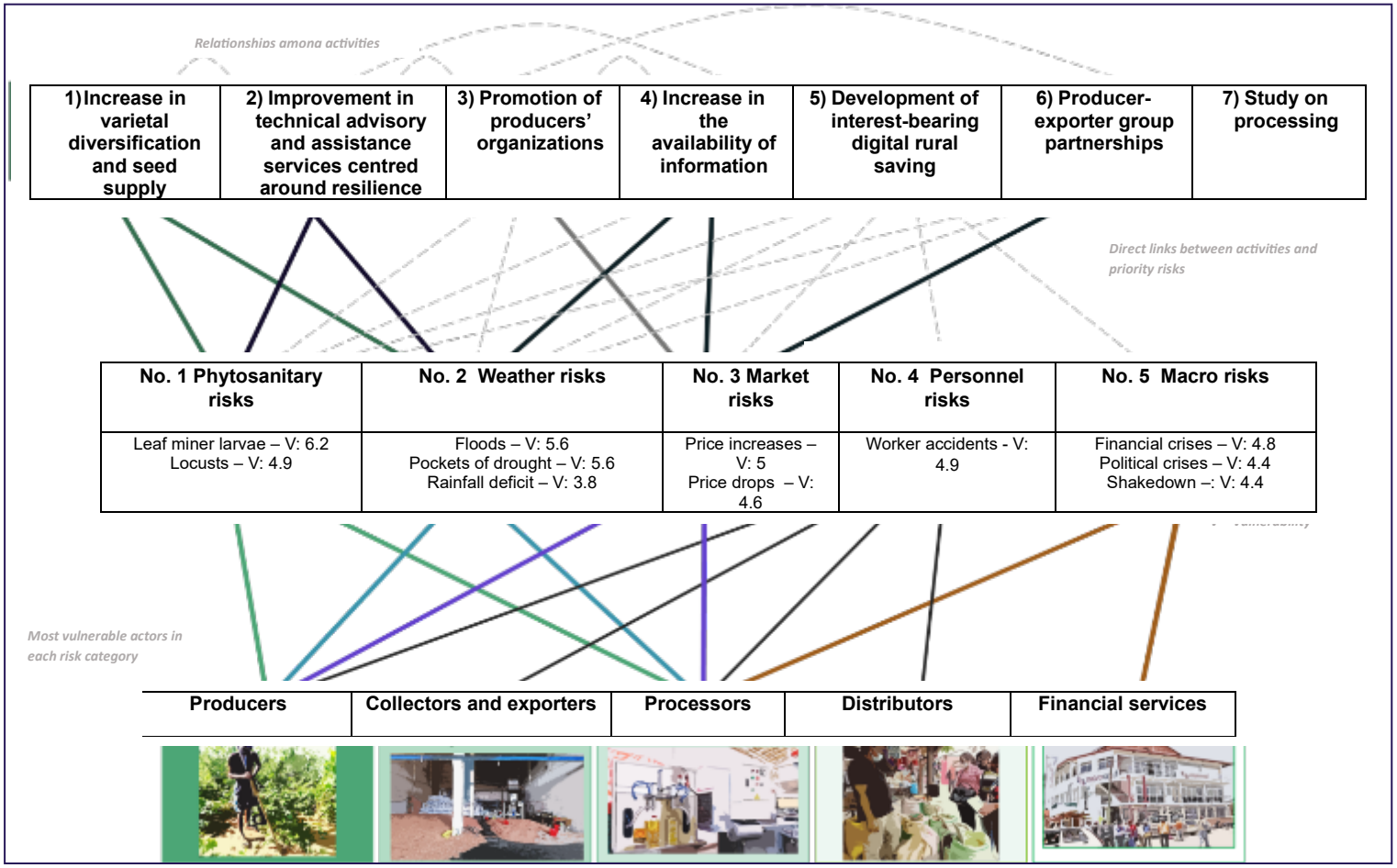
Note also that thanks to an agricultural risk management programme, development of the maize and groundnut value chains will contribute to the diversification of the agricultural economy and the Madagascar economy in general.

The diagram below summarizes the risks with the greatest impact on the two value chains and the actions proposed to address these priority risks. The actions are then described in the subsequent paragraphs.

For the maize value chain



For the groundnut value chain



4.2.1. Proposed cross-cutting actions to support risk management in the maize and groundnut value chains

1) Increase varietal diversification and seed supply in the two value chains

As underscored above, varietal supply in Madagascar's maize and groundnut value chains is very limited. However, the two crops can benefit from earlier diversified international research.

Diversifying the varietal supply should make it possible to respond to weather-related risks (varieties with less need for water, short-cycle varieties, varieties more tolerant of excessive water in areas at risk of floods) and to certain phytosanitary risks (varieties less appetizing to armyworms or locusts, early harvesting varieties harvested before infestations cause losses that are too high, etc.).

This approach is also based on the hypothesis that wider varietal diversity will enable producers to tailor their risk management to the country's different agro-climatic zones, their farming systems and their parcels. Since Malagasy producers are accustomed to weathering climate and phytosanitary risks, they can be trusted to identify (gradually over several crop seasons) the genetic material that will be best suited to their context if they are given access to a variety of genetic material and receive support during the experimentation and diversification process (see proposal 2).

The seed supply should be diversified through two complementary channels, namely:

(i) The marketing of varieties selected by the specialized private (seed) sector in other countries, which could be done by the networks of input suppliers and buyers (maize producers and groundnut exporters) hired by producers' groups through contracting procedures (proposals 3 and 5).

(ii) The development of a favourable framework for marketing seed obtained through private massal selection by farmers or agroecological centres such as the CTAS.

This activity is essential for boosting farm resilience, increasing productivity potential in the two value chains and substantially reducing the risk exposure of the downstream actors directly impacted by poor harvests and low yields.

Implementing this activity will require ensuring women's inclusion in activities to promote new varieties, especially in the implementation of massal selection processes and the definition of selection criteria. In fact, since certain work in the two crops' growing cycle is relegated to women (planting, weeding, post-harvest treatment, preparation of food for on-farm consumption), it is essential for all varietal innovation processes to rely on the experience and preferences of women (farm managers or companions of farm managers) in the two value chains.

Young farmers should also be targeted, since they are more receptive to opportunities for adaptation and changes in practice.

The design phase that follows this study should indicate the partners that will be involved in this activity, but it already seems essential to strengthen the technical capacity of FOFIFA and the Ministry of Agriculture to simplify and accelerate the introduction of foreign varieties by private actors wishing to do so.

2) Strengthen advisory and technical assistance services in the two value chains, focusing on the resilience of crop systems

To respond to the climate and phytosanitary risks that affect maize and groundnut production, it is also essential to work on strengthening advisory and technical assistance mechanisms in the two value chains.

Ministry of Agriculture technical staff should receive support and capacity building to:

- Understand the challenges of holistic agricultural risk management on farms and help these staff shift from a position historically geared to the dissemination of intensification practices that sometimes increase the risks to producers to one of technical assistance and support for experimentation among producers to develop more resilient and performing crop systems.
- Be able to understand the constraints, risks and opportunities specific to the cultivation of maize and groundnuts – crops that up to now, the State has shown little interest in and for which its technical staff have little training.
- Know the techniques in fertilization, tillage, intercropping and the rotation and protection of agroecological crops, as well as the holistic agroecological approach as a crop system focused on crop and farm resilience.

Since the Ministry of Agriculture's technical teams are small and have numerous missions, it will also be necessary to identify other advisory groups (producers' organizations, women's associations, youth associations, local NGOs, procurement companies working in partnership with producers' groups, etc.) to participate in the dissemination of novel technical advisory and support practices revolving around agricultural risk management and efforts to boost the resilience and productivity of these two crops.

As in activity 1, particular attention should be paid at all stages of this activity to the place of women (who are too often excluded from agricultural advisory services) and young people (who are particularly receptive to innovation and changes in practices).

3) Promote the organizing of producers

To respond to marketing risks but in the medium term, increase the resilience of farms and the value chain to production and institutional risks, it is essential to strengthen the producers' organizations involved in these two value chains.

However, producers' organizations devoted to a single activity and focused exclusively on these two value chains should not be given preference. Assistance to such organizations already structured around input supply, production, marketing and even the processing of other agricultural products but whose members are also maize or groundnut producers could facilitate efficiency gains. POs that are already equipped and have sound governance, a commercial network, logistical know-how and the trust of their members will be much more effective in carrying out activities in the two value chains.

By diversifying the value chains in which they operate, they will also be more resilient to the marketing risks in each value chain, and their activities will benefit from economies of scale.

Efforts should also be made to ensure that the scale of the organizational activities is small in terms of geography and the number of members in order to promote the most democratic governance possible, ease in holding member meetings, simplicity in the logistics of relocating production and in limiting the risk of poor PO management.

The activities targeted for producers' organizations can initially be access to seed (capitalizing on the supply of novel seeds emerging from activity 1, once they are available) and the maintenance of local seed banks (to prevent both the consumption of seed as food during poor harvest years and the indebtedness of farms the following year), as well as pooled marketing and access to farmer advisory services and experimentation in activity 2.

For this activity, it will be necessary once again to guarantee the inclusion of women and young people, whether in mixed producers' organizations, women producers' organizations and young farmers' organizations. This strategy will be spelled out in the design project report.

4) *Improve the supply of agricultural, agricultural weather and marketing information using information and communication technologies (ICT)*

Information is one of the keys to managing production risks like market risks.

Thanks to new information and communication technologies, information gathering is faster and cheaper. Following trends in precipitation, phytosanitary pressure or prices no longer requires dozens of interviewers to travel to rural areas but can be done less expensively by building networks of village reporters and groups for discussion and information-sharing among producers

The example of the *Service n'kalo* in West Africa and the cashew nut value chain in Madagascar[70] shows, in fact, that a single market analyst can follow price and demand trends in all production basins in a country.

As with prices, a small hub of specialized technical staff with a good network of actors in the production basins can monitor production constraints, disseminate technical solutions when risk levels are moderate and plan public interventions when risk levels become too extreme.

This proposal therefore consists of creating a monitoring and information dissemination unit in the Ministry of Agriculture for the two targeted value chains. Initially, this unit could develop its network for sharing information in the areas and value chains targeted by the programme but could eventually expand its geographical scope for information gathering and sharing to all production zones and actors in the two value chains and then to other agricultural value chains.

As always, the information-sharing and dissemination network(s) should include the diverse actors in each link of the value chains (women, youth, migrants, small-scale entrepreneurs and major merchants and industrialists).

The facilitators of this network should be trained in the agricultural risk management approach and encourage the rapid circulation of information on all matters related to climate, phytosanitary and market risks. They could even, like the Borderless Alliance initiative[71] in West Africa, envisage sharing information on shakedowns by law enforcement and security risks in rural areas to facilitate the fight against parafiscal levies and improve security in logistical operations.

5) Develop interest-bearing, digital rural savings

Saving is a cross-cutting risk management tool. Where many projects focus on access to credit in contexts where extreme vulnerability to risks makes reimbursement difficult, building savings as the basis for any sustainable financial inclusion programme appears to be a priority.

Small farms and enterprises in the maize and groundnut value chains currently receive very little financing and primarily use small stock raising as a saving tool. It is a risky tool, however (the animals can die or easily be stolen) that is not liquid (it often involves hiring transport and waiting for market day to sell an animal).

In many developing countries, the growth of mobile money is built mainly around savings. Its advantage lies in its semi-liquidity – that is, people are less tempted to spend it than cash but quickly have secure access to it in emergencies (even if theft rings are present, it is easier to thwart them than with cash or livestock).

In recent years, certain technology companies have begun developing interest-bearing digital saving tools in Africa based on mobile money.[72] Their penetration in rural areas is still

[70] https://www.nkalo.com/

[71] https://2017-2020.usaid.gov/news-information/fact-sheets/borderless-alliance

[72] https://www.ejara.io/, https://www.ifc.org/wps/wcm/connect/97a8f8f3-cd19-403c-80f0-7b08aa4669df/IFC+CDI+Inactivity+Study+-+FRENCH.pdf?MOD=AJPERES&CVID=l5nmYF1 and https://www.telecomreviewafrica.com/articles/operateurs/1943-lancement-d-orange-bank-africa- en-cote-d-ivoire

limited but they are rapidly growing and meet the important need of populations to save without losing value.

After a study to identify the banks, mobile operators and digital finance companies in a position to make the best offers in Madagascar (opening and transfer fees, interest rate, ease of access to deposit and withdrawal sites), this activity would consist of raising public awareness about the importance of saving, promote an understanding of its advantages and disseminating the use of tools that best meet producers' needs.

The teams involved could do this alongside other activities to ensure a lower cost.

4.2.2. Proposed action specific to the maize value chain

6) Partnerships between maize producers' groups and maize processors

A previously discussed, producers and processors are the two links in the maize value chain with the highest risk exposure. Mitigating the risks for these groups could be accomplished by creating flexible partnerships tailored to the risks.

Given the production and market risks facing the two categories of actors, it is essential to build contractual relationships around risk anticipation rather than risk transfer. Rigid, definitive Western approaches to contracting are unsuited to the two value chains.

Beyond the usual objectives of stipulating quantities and quality, the objective of contracting should be to establish ways of measuring and considering environmental and market risks. More specifically, they should provide for the distribution of losses in the event of poor yields for the repayment of input credit, the conditions for price adjustment in line with trends in the domestic and/or international market and the conditions for rewards when targets are exceeded.

In this regard, the negotiation and drafting of precontractual documents (charter, agreement) and the segmentation of contracts into subcontracts by stage should serve as the basis for clear discussions of known and predictable risks. The use of single, simplified, unilateral contracts[73] is particularly unsuited to contexts like that of the two value chains in Madagascar. Many failed producer-processor contracts in Madagascar and across Africa reveal the need for tropicalization of the contracting process.

7) Introduction of indexed yield insurance in contracting processes

At least two agriculture insurance initiatives have been introduced in Madagascar, with very mixed results.

Agriculture insurance is a complicated tool when it comes to promoting it among producers and insurers.

The choice of the areas with the highest agricultural risk exposure and farthest from the end markets is likely much of the reason for the disappointing results of the two pilot projects.

In all developing countries, indexed insurance is a service that has been successful primarily in the area of contract farming with input credit for producers. Insurance premiums are a useful tool for lowering the risk of buyers who prefinance the inputs. At the same time, the buyers' promotion and collection of insurance premiums relieves insurance of a significant burden.

It thus appears to be a priority to develop this tool in contract farming, even expanding it beyond this area once the insurance product becomes robust and beneficial to both producers and insurers.

[73] In the sense that buyers offer them to producers without the opportunity to negotiate.

4.2.3. Proposed action specific to the groundnut value chain.

8) Producer-exporter/processor partnerships

Up to now, exporters in the groundnut value chain have played a more important role than producers and might therefore be more inclined to enter into contractual partnerships with producers' organizations to ensure the volumes and product quality that meets their needs. However, if industrially processed groundnut products are developed (this would only be under activity 8), PO-processor partnerships could also be maintained.

As in the case of maize, contractual agreements must have great flexibility to adapt to the volatility of the international market and exchange rate and maritime logistical risks. However, they could enable producers, exporters and processors to reduce their exposure to market risks and work together to reduce production risks.

This would involve subsidizing the design and implementation costs (CAPEX) of upstream and downstream partnerships between producers and major buyers (processors and exporters) through public-private partnerships to support the Agricultural Aggregation Law.

These subsidies can also support the improvement and dissemination of insurance products to de-risk some of the risks assumed by downstream operators.

9) Study on support and de-risking needs for the development of domestic processing

As seen earlier, groundnut processing in Madagascar is fairly undeveloped and exposed to numerous risks.

Industrial groundnut processing, like the transition from artisanal processing to semi-industrial processing with less risk exposure, is a complex enterprise.

In fact, both involve: (i) financial issues (high investment in building construction and the procurement of imported processing equipment, significant working capital needs); (ii) political, marketing and industrial challenges (investment incentives and facilitation); (iii) the challenges of compensating for the lack of competitiveness and the assumption of high risks (of new local processing, given the strong international competition; and of benefitting from economies of scale, amortization, and technical competencies and past experience).

The purpose of this study is not to analyse the success factors of an industrial development policy in the groundnut value chain. The example of Sudan, which in recent years has become a major exporter of groundnut seed and more recently, groundnut oil, shows that these factors exist. Nonetheless, the example of Senegal, the premier African groundnut exporter, where trituration is stagnating despite public and private investment, shows that the issue is complicated.

We therefore recommend starting out with a specific study on the policy support and risk reduction measures necessary for developing local groundnut processing before commencing activities to support this link in the value chain.

This study could then be followed by a specific programme to support this value chain (which could even cover the entire oleaginous sector, given the enormous challenges facing the balance of trade and food security in Madagascar).

4.3. Action plan

The proposed action plan envisages the design of a 5-year agricultural risk management programme in Madagascar's maize and groundnut value chains. This programme would be described in detail in the design phase following the approval of this report.

The general objective of the agricultural risk management programme could be the following:

To release the growth potential of the maize and groundnut value chains in Madagascar by improving agricultural risk management and strengthening partnerships upstream and downstream among all actors.

Two specific programme objectives (SOs) can be distinguished:

SO1: Increase the resilience and risk management capacity of actors in the maize and groundnut value chains by developing a supply of services and inputs designed to reduce their vulnerability to agricultural risks and boost their productivity.

SO2: Improve the organization and governance of the maize and groundnut value chains by supporting upstream and downstream partnerships aimed at pooling and reducing risks.

SO	Strategic lines	Actions	Expected outcomes
	Increase varietal diversification and seed supply in the two value chains	- Strengthening of the technical and physical capacity of FOFIFA's mechanism for validating the marketing of new varieties - Assessment of needs for modernizing the legal framework to facilitate the marketing of new varieties and the coexistence of varieties chosen by modern selection techniques with varieties chosen by farmer selection practices - Technical assistance to private organizations and producers' organizations wishing to introduce, promote and/or market new maize or groundnut varieties in Madagascar	- At least 3 new varieties of maize and 3 new varieties of groundnut are authorized and available in Madagascar. - A reform of the framework for seed monitoring and marketing is voted on and provides an equitable and competitive framework for the marketing of both seeds developed through modern selection and those developed through traditional selection - Madagascar's average score in the "Supplying seed" component of the World Bank's Enabling the Business of Agriculture project increases by at least 10 points - At least 10% of producers benefitting from the programme will have used a new variety of maize or groundnut on their farm at the end of the programme.
	Improve technical advisory and assistance services in the two value chains, centering them around the resilience of farming systems	- Identification of 200 agriculture technical advisors active in the principal and groundnut production basins - Strengthen the capacity of the 200 agriculture technical advisors in the agricultural risk management approach and on the positions of producers on advice and assistance in the adoption of new practices - Improve the technical know-how of the 200 agriculture technical advisors in growing methods, crop protection and intensification, chemical and agroecological maize and groundnut production techniques. - Improvement of the means for the 200 agriculture technical advisors to operate (vehicles, communication equipment) - Technical assistance and advisory support from the 200 technical advisors to 8,000 maize and groundnut producers	- 200 technical advisors identified, trained and equipped - 8,000 maize and groundnut producers have benefitted from at least 10 hours of personal advice/year - 20% of the producers supported are women, 20% of the producers supported are under 35 years of age - 50% of the producers supported confirm a reduction in revenues lost due to climate and phytosanitary risks
	Increase the supply of agricultural, agricultural weather and business information using ICT	- An agricultural weather information unit is created in the Ministry of Agriculture - An information and advisory unit for maize and groundnut marketing is created in the Ministry of Agriculture - The two units are trained in agricultural risk management and the facilitation of digital networks for the collection, discussion, sharing and dissemination of information - The two units create and facilitate digital networks for the collection, discussion, sharing and dissemination of agro-climatic and business information	- The units are created, and their members are trained and provided with work equipment (computer and smartphone) - A network for the collection, discussion, sharing and dissemination of information is created that has more than 1,000 member producers and more than 100 member merchants and processors - More than 250 oral and written agricultural weather information and advisory messages are produced and disseminated to digital network members

	Develop interest-bearing, digital rural saving	- A study is conducted to determine the expectations, need for capacity building and conditions of access of actors to digital saving tools in the maize and groundnut value chains in the targeted production basins and the digital finance operators most likely to satisfy them - Producers benefitting from the project are informed about saving as an agricultural risk management tool and about digital saving - Agriculture technical advisors promote and disseminate the saving and digital finance tool considered most likely to meet producers' needs is promoted and disseminated among producer beneficiaries of the programme	- At least one digital saving product tailored to the needs and abilities of maize and groundnut producers is identified and, if necessary, adapted. - 8,000 producers (at least 20% of whom are women and 20% young people under the age of 35) are informed about saving and digital saving - At least 1,000 targeted producers embrace the saving tool identified (and adapted)
	Promote the organization of producers	- A diagnostic study identifies the organization strategies most tailored to the specific features of the targeted maize and groundnut production basins, allowing for identification of the producers' organizations active in the two value chains, the POs active in other value chains but with maize and groundnut producers as members and informal producers who can receive support to organize. - 20 POs with 600 producers in the maize value chain and 20 POs with 600 producers in the groundnut value chain are identified and supported -20 informal groups with 600 producers in the maize value chain and 20 informal groups with 600 producers in the groundnut value chain are identified and supported -The members of the POs and informal groups identified are trained and receive support in democratic governance (sovereign General Assembly for all important decision-making), group supply and conservation of seed, collective marketing, the value chain approach/constraints of downstream actors and the negotiation/forging of partnerships with operators downstream in the value chain	- 20 POs with at least 600 producers and 20 informal groups with at least 600 producers are identified in the two value chains - 20% of producers who are members of groups and POs are women, 20% are under the age of 35 -1,200 members of groups and POs are trained in democratic governance, seed supply and conservation, the value chain approach and partnership building with downstream actors - For the duration of the project, the supported groups and POs make group purchases of at least 10 tonnes of seed and store at least 20 tonnes of seed collectively - For the duration of the project, the supported groups and POs make group purchases of at least 1,000 tonnes of maize and 500 tonnes of groundnuts
	Partnerships between maize producers' groups and maize processors	- 5 maize processors interested in expanding or creating a partnership arrangement with informal groups and producers' organizations are selected - Matching grants are signed with the 5 processors identified for cofinancing of 50% of their investments in support of the PO groups and implementation of the contractual framework - Technical assistance is provided to processors for monitoring and evaluation of the implementation of their partnerships with producers' organizations - A capitalization study is conducted to emphasize the advantages and success factors of contractual partnerships in the maize value chain	- 5 partnership arrangements are designed and implemented - For the duration of the project, they permit the direct marketing of at least 500 tonnes of maize - The sales price of the maize marketed under these partnerships is more than 10% higher at the time of sale on average than the farmgate price in the targeted production zones - A capitalization study is conducted and distributed to all actors in the maize value chain to promote partnership approaches and highlight success factors, especially in terms of agricultural risk reduction

	Creation of indexed yield insurance in contracting	- A capitalization study is conducted on insurance tools already present in Madagascar and the maize value chain in Africa that makes it possible to design an insurance product tailored to the needs of producers, insurers and processors. - The insurance product is proposed and promoted under PO-processor partnerships - A capitalization study emphasizes the advantages and success factors of indexed insurance in the maize value chain.	- An insurance product is designed or improved (if re-using an existing product) - More than 3,000 such products are sold during the life of the project (1 product = 1 producer*1 crop season) - A capitalization study is produced and distributed to promote the use of indexed insurance in the maize value chain
	Producer-exporter/processor partnerships	- 5 groundnut exporters and/or processors interested in expanding or creating partnership arrangements with informal groups and producers' organizations are selected - Matching grants are signed with the 5 exporters and/or processors identified for the cofinancing of 50% of their investments in support of groups and POs and implementation of the contractual framework - Technical assistance is provided to the exporters and/or processors to monitor and evaluate the implementation of their partnerships with producers' organizations - A capitalization study is conducted to emphasize the advantages and success factors of contractual partnerships in the groundnut value chain	- 5 partnership arrangements are designed and implemented - For the duration of the project, they allow for the direct marketing of at least 500 tonnes of groundnut - The sales price of the groundnuts marketed under these partnerships is 10% higher at the time of sale on average than the farmgate price in the targeted production zones - A capitalization study is produced and distributed to all actors in the groundnut value chain to promote partnership approaches and highlight success factors, especially in terms of agricultural risk reduction
	Study on the need for support and de-risking for the development of domestic processing	- A study on support and de-risking needs for the development of domestic groundnut processing in Madagascar is conducted, validated by the Ministry of Agriculture and the Ministry of Industry and the Ministry of Economy and published - A score and support for the promotion of foreign and domestic investment in groundnut processing are produced, published and disseminated, particularly for the attention of domestic and Asian investors (Chinese, Indian, Vietnamese)	- A study, and investment score and 5 investment promotion messages on domestic groundnut processing are produced and disseminated in French, English and Chinese

5. Methodology and sources

This study is part of PARM's fine-tuned procedure for evaluating agricultural risk, using a value chain approach based on secondary information.

However, the limited availability of data and their analysis in Madagascar did not allow for a faithful adaptation of this methodology in the time allotted. In fact, the available data did not permit quantification of the various risks identified (climate, market, armyworms, locusts, natural disasters, financial, biological and environmental) using the PARM value chain approach. It was thus a matter of analysing the existing data (disconnected from the current reality) and undertaking a supplementary effort to collect primary data to draw useful information for an efficient evaluation. In the case of Madagascar, the PARM methodology would be more applicable to an evaluation of agricultural risks in general. This analysis would make it possible to determine the strategic and/or priority value chains of the Government and the partners to identify the risk management tools and mechanisms in these selected value chains. In addition, the identification of harm in a value chain to the revenue of households highly diversified in terms of their production was also a constraint for this study – all the more so because the harm to household revenues from the different risks is not assessed. Beyond the problem of adapting the methodology to a value chain approach, the Government's selection of the two value chains from among a large number of priority value chains was a lengthy process and consequently reduced the time allotted for the evaluation itself.

Despite these constraints, this study is consistent with the value chain approach and sheds light on agricultural risks in Madagascar and specifically, the maize and groundnut value chains.

The study has prioritized the identification of agricultural risks in Madagascar and the current risk management tools and mechanisms. It then quantifies the risks and harm, based on the existing data and the information gathered, including the gender dimension in each stage. In the final stage, it issues recommendations for action for holistic management of the main risks.

5.1. List of actors found

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