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Diversification of Cocoa and Cashew facing climate change in Côte d'Ivoire

Strategies of farmers and farmer-based organizations in Eastern Côte d'Ivoire facing
changing agri-climate zones with a focus on cocoa and cashew

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Acronyms

| | |
|-----------|--|
| ANADER | Agence National du Développement Rural; National Office for Rural Development |
| CCA | Conseil du Coton-Anacarde; Cotton-Cashew Council |
| CCC | Conseil du Café-Cacao; Coffee-Cocoa Council |
| CIF price | Cost, Insurance and Freight Price |
| CNRA | Centre National de Recherche Agronomique; National Center for Agronomic Research |
| FBO | Farmer-based organisation |
| FIRCA | Fonds Interprofessionnel pour la Recherche et le Conseil Agricoles ; Interprofessional Fund for Agricultural Research and Advice |
| INA | Initiative for sustainable agricultural supply chains |
| OPA | Organisation Professionnelle Agricole; Professional Agricultural Organisation |
| RCN | Raw Cashew Nuts |
| SME | Small and Medium Businesses |

Introduction

Tree crops such as cocoa and cashew play a vital role in the economy of Côte d'Ivoire. However, in recent years, cashew cultivation has made significant progress in some forest areas that were once high cocoa production zones (Vavoua, Bonon, Gonaté, Daloa, Bayota, Daoukro, Tanda and Agnibilékrou). This study entitled "Factors and potentials for the diversification of cocoa and cashew at the level of their cultivation and marketing" had as goal to identify diversification potentials in cashew and cocoa cultivation in selected region in Cote d'Ivoire. In particular, the marketing and cultivation practices of the FBOs and their members should be examined for potentials and hindering elements. Thereby, the perceptions of the different actors were strongly included in the analysis. The study is intended to contribute to the identification of economically sustainable production systems and to provide producers with a better and more resilient income under the changing environmental conditions and enable Farmer-based organisations (FBO) to better adapted their services to the needs of their producers.

In order to find a clear answer to these questions, the project PRO-PLANTEURS and ComCashew on behalf of the Sustainable Agricultural Supply Chain Initiative (INA) commissioned this study conducted by YEYA Négoce, which was selected following a call for tenders.

The study targeted 12 FBOs whose producers cultivate either solely cocoa or cashew, as well as in combination. The FBOs are active in the areas of Abengourou, Agnibilékrou, Tanda and Bondoukou (regions in Indénié-Djuablin and Gontougo).

This summary is based on the French report's summary and conclusion with some additional information from the main part of the study by Yeya Négoce.

Executive Summary

The study was conducted in 2020. The respective report is divided into 7 parts. At the beginning, the methods are presented. Then, an overview of the Ivorian cocoa and cashew sector is provided, also covering aspects of climate change-related policies and land use change (LUC) due to agricultural activities. The third section of the report outlines the study area with its agro-climatic conditions and provides a socio-economic characterization of the producers and their production system. Motivations and threats to the commercialization of cocoa and cashew, respectively, are given for the Farmer-based organisations (FBOs) interviewed. The following portion addresses the perceptions of the FBOs and their producers about climate change and its impact on their professional activities. While the next two sections analyse the strategies adopted by producers, as well as farmers' organizations. Part 6 focuses on recommendations for diversification, and section 7 concludes on next steps.

1. Methods

The data collection was based on literature review, visits to the management and supervisory structures of the regions studied, data collection from the 12 targeted FBO's as well as the communities through focus groups and finally an individual survey of cocoa and/or cashew producers.

A digitalized questionnaire was developed and used, and the data collected was processed and validated with the software Stata and R. The audio data was transcribed.

An "exploratory" mission was carried out in the departments selected for the study. During this mission, visits were made to the headquarters and subsidiaries of each of the 12 FBO's. The specific objectives of the exploratory mission were to

- Get to know the targeted FBOs and their environments
- Conduct focus groups in each of the 12 FBOs targeted by the study, these groups were divided into:
 - administrative and management staff at the FBO's headquarters;
 - producers in at least one subsidiary per FBO.
- Pilot and finalize the questionnaire for the cocoa and/or cashew producer survey;
- Establish the sampling frame for the producer survey;
- Identify a facilitator in each FBO for the producer survey phase.

After the exploratory mission, data was collected at FBO's, producers and community level (see Table 1). The surveyed groups and persons can be structured as follow:

Table 1: Sample of the study

| Target group | Cocoa | Cashew | Cocoa and Cashew | Total |
|---------------------------------|-------|--------|------------------|-------|
| Farmer-based organisation | 07 | 01 | 04 | 12 |
| Producers | 84 | 06 | 70 | 160 |
| Communities (sections of FBO's) | 07 | 01 | 03 | 11 |

2. Overview of the cocoa and cashew sectors in Côte d'Ivoire

Table 2 describes the strengths and weaknesses of the cocoa as well as cashew sectors in short. For a more detailed overview, look at the original French report.

Table 2: Strengths and weaknesses of the sectors

| | Strengths | Weaknesses |
|--------------|---|--|
| cocoa | <ul style="list-style-type: none"> • Strong involvement of the State in the regulation of the sector • Strong collaboration between the public and private partners of the sector • Favourable climatic conditions • Mastery of the technical itinerary of cocoa production by the producers • Existence of a production sales channel | <ul style="list-style-type: none"> • High consumption of fertilizers and pesticides due to the aging of the Ivorian cocoa orchard • Low yield per hectare of cocoa (450 to 550 kg/ha) • Low level of income for producers (54% of producers have an income below the poverty line) • Inexistence of curative treatment against swollen shoot • Price instability making it difficult for producers to forecast earnings from one year to the next |

| | | |
|---------------|--|--|
| | <ul style="list-style-type: none"> • Presence of research and production supervision structures (CNRA, FIRCA, ANADER, etc.) • Presence of external development partners • Existence of a certification structure • Existence of a traceability system • Presence of cocoa manufacturers and processors (grinding and chocolate) • Presence of SMEs and exporting FBOs | <ul style="list-style-type: none"> • Low level of local cocoa processing • Low share of overall value added in the value chain (13% of total value-added earnings) • parafiscal levies and taxes (22% of CIF price) • Poor condition of roads in some production areas • Low rate of adoption of new technologies • Unavailability and high cost of labour to carry out cultivation operations |
| cashew | <ul style="list-style-type: none"> • Existence of producers' organizations from the grassroots to the national level; • Existence of associations of nurserymen, industrialists and exporters; • Good organization of the actors of the nursery, processing, domestic marketing and export links; • Good functioning of the organizations of actors other than producers; • Institutionalization of the National Days of Cashew Exporters of Côte d'Ivoire as days of reflection, experience sharing, etc. for the benefit of all the actors of the sector. | <ul style="list-style-type: none"> • Low membership of producers in grassroots FBOs; • Weak understanding between the leaders of producer organizations; • Difficulty for federations and unions of producers of national scope to prove their representativeness by mobilizing 15% of producers (with membership cards and a good membership base) and 15% of nut production (with well-kept statistics); • While processors, exporters and buyers are well known (and approved) by the state, there is no reliable database of producers |

3. Climate change impacts on cocoa and cashew in Côte d'Ivoire

Climate change policies

Climate change is a global climate phenomenon characterized by a general increase in average temperatures, in particular linked to human activities, and which durably modifies the meteorological balances, the ecosystems and by repercussion of the microclimates. The impact of climate change is already being felt through increased rainfall variability, flooding, rising sea levels and coastal erosion. This impact is expected to increase if the right measures are not taken to mitigate it. In the medium term, warmer temperatures will decrease moisture and reduce soil fertility. The threat of climate change is very real in the cocoa sector. According to the World Bank Group's 2019 report on the state of the cocoa sector in Côte d'Ivoire, the areas suitable for cocoa cultivation are expected to shrink considerably by 2050.

Côte d'Ivoire is one of the African countries that have presented a mitigation strategy in both the short- and long-term. As a signatory to the Paris Agreement, the country was among those to set the most ambitious unconditional CO2 reduction rate in the entire ECOWAS region by 2030, namely 28%. This commitment has already been translated into several actions, including projects with the World Bank

to combat deforestation and coastal erosion. The government's commitment is also reflected in the National Development Plan adopted in 2016. This plan provides a strategic reference framework that integrates the challenges of climate change over the years 2016-20. It is based on a number of sectoral strategies such as the National Climate Change Program (PNCC, 2012), and the National Strategy for Combating Climate Change (2014). More recently, Côte d'Ivoire has committed to accelerating Zero Deforestation Agriculture and Zero Deforestation Cocoa production. Côte d'Ivoire is engaged in the Cocoa and Forests Initiative and the REDD+ program.

Two types of actions are carried out in order to mitigate the effect of climate change on the cocoa and cashew industries.

The first aims to reduce the impact of these crops on deforestation. In 2014, at the World Summit on Sustainable Development held in New York, the Ivorian government took a clear position by committing to implement a cocoa production that would no longer attack the forests, starting in 2017. This commitment has since been translated into several initiatives, including a support project supported by the World Bank, and a strategy developed jointly with the main companies operating along the chain. To be effective, the fight against deforestation must include sanctions against producers who do not respect the rules, but also incentives. The logic is simple: in order for producers to stop attacking the forests, they must be given the means to improve their yields through an adapted policy of improved seed production and orchard maintenance. Their income can also be increased by valorising, for example, agricultural waste from cocoa and cashew by-products. The cocoa pods offer bioenergy potential for domestic combustion or to produce bioelectricity for community use. Successfully creating green jobs in cocoa farming requires targeted training and financial support programs. More generally, emphasis should be placed on innovation in agricultural practices and post-harvest processing, research and development of improved species, and valorisation of cocoa crop waste (United Nations Development Programme UNDP, 2013).

The second action is part of the adaptation strategy that Côte d'Ivoire must pursue to mitigate the adverse effects of climate change on cocoa and cashew farms. Beyond moving plantations to more fertile areas over time which was discussed in the previous section, there are several avenues, some of which are mentioned below (Kroeger et al., 2017):¹

- Increase shaded areas
- Increase agroforestry zones
- Improve grafting techniques, soil fertilization and irrigation trials
- Encourage the creation of new varieties.

Land use change

The agricultural landscape of Côte d'Ivoire has been undergoing progressive changes over the last 50 years. A strong degradation of the dense forest to the benefit of mosaïque cultivation/fallow land, which has gone from an occupation of 17.93% in the land use/land cover in 1969 to 26.58% in 2004 and 55.64% in 2015 was observed.

¹ see for a more detailed discussion the original French report

Table 3: Area of different vegetation types in CIV by year in hectares

| Vegetation cover | 1969 | 2004 | 2015 |
|---|------------|----------------------|----------------------|
| Dense forest | 10.364.198 | 3.157.048 (-70%)* | 724.937 (-77%) |
| Degraded forest | | 4.971.932 | 2.015.014 (-59%) |
| Light forest mosaïque / wooded savannah | | 1.513.263 | 1.396.958 (-8%) |
| Tree savanna mosaïque / shrubs | | 8.133.722 | 9.303.157 (+14%) |
| Mosaïque cultivation / fallow land | | 12.828.239 | 16.854.484 (+31%) |

Note: * variation in percentage in comparison to the preceding indicated year in brackets

Source: CIGN, authors calculation

The history of cocoa in Côte d'Ivoire is marked by the geographical shift of high production regions, referred to as the "cocoa belt". From the "South-East Front" in the 1880s-1950s, to the "South-West and Central-West Front" 1970-1990, via the "Central-West Front", 1960-1970 (Ouattara, 2019), the cocoa belt is currently moving towards the West and North-West of the country. Cashew trees, for their part, developed in the Northeast, and then experienced a strong progression in the North and Center where they supplanted cotton cultivation. (Ministry of Environment and Sustainable Development, 2016).

Cashews have a potential as diversification crop in some transitional zones. For the past decade, an increasing production of cashew in the former cocoa belt was observed. In the span of 20 years, the country has positioned itself as the world's leading cashew producer. Despite the 2016 drought and clandestine sales to Ghana, the 700,000 tons threshold was officially crossed in 2017.

The cashew tree is less demanding in water, soil quality and inputs, such that it appears to be the ideal alternative to alleviate the negative developments in cocoa production. CIRAD (2019), Ruf et al., (2019) and ENGREF (2002) state that the reasons for the shift of the cocoa belt and the diversification of cocoa towards cashew are, among others,

- Stagnant cotton and cocoa prices, while cashew prices rose. While cotton prices have remained low over a long period, cashew prices have been marked by two phases of high prices (1994-2000 and 2014-2017, until the very beginning of 2018), which played a triggering role.
- Structural decline in cocoa revenues, resulting from price fluctuations and subsequent decline in yields due to aging and disease (e.g. Swollen Shoot) in many regions.
- Low yields lead to an increase in the use of chemical inputs. As a result, the cost of maintaining mature plantations has increased.
- After 35 years of deforestation to plant cocoa trees and the exploitation of natural resources and " the forest rent ", agricultural practices in the Ivorian forest zone have changed as a result of the increasing impoverishment of land under cultivation. An ecological transition in order to adapt to the depletion of the forest rent and to climate change was made on some farms.

The cashew tree, in its agroforestry dimension in the form of association with the cocoa tree, reduces the mortality of young cocoa plants, and its adoption takes all its sense of agro-ecological transition.

- Land security because it constitutes a land marker (it provides informal land security in the migrant farmers' village of origin, but also in their cocoa village)
- In addition, Cashew is resistant to drought and, for the time being, to disease, and does not require a lot of inputs, even on impoverished soils, both in the plantation creation phase and in the production phase. The establishment of a cashew plantation is inexpensive if done by sowing "non-improved" seeds in plots under food production for two to three years (Dugué, 2002).

These factors accelerated the spread of cashew into former cocoa-growing areas. However, according to CNRA researchers, cashew cultivation is not economic in some transition zones and moving towards the south of the country. In their opinion, the plants will certainly be vegetated, but the yields and quality of the nuts will remain too low. Therefore, these researchers recommend the practice of integrated farming (the combination of cash crops, food crops and livestock) to improve the income and resilience of producers in the face of climate change.

Agro-climatic data of the study zone

The targeted region of this study is mostly the sub-region Indénié-Djuablin and partly the sub-region Gontougo. Abengourou, a target zone of PRO-PLANTEURS, is located in the Indénié-Djuablin region, while Gontougo is north of Indénié-Djuablin (see Figure 1). Indénié-Djuablin is more favourable for cocoa production, Gontougo for cashew production.

Indénié-Djuablin has been characterized by four seasons in the last three years on the basis of average monthly rainfall totals and potential evapo-transpiration:

- Two rainy seasons: the long season extends from mid-March to mid-July and the short rainy season from September to mid-November (in total 6,5 months)
- Two dry seasons: the long season lasts from mid-November through mid-March and the short season lasts from mid-July to August (in total 5,5 months).

The average annual rainfall for the Indénié-Djuablin region is 1.248 mm with an average of 78 rainy days. In 2002, it was 1656 mm of rain. In the last five years, the average annual rainfall in the Region has not reached 1500 mm of rainfall (ANADER, 2017). Thus, the comparative analysis of the rainfall data for 2017 and those of the last five years (2012-2016), reveal a relative decrease in the level of rainfall as well as its distribution over the period in terms of watered days (ANADER, 2017).

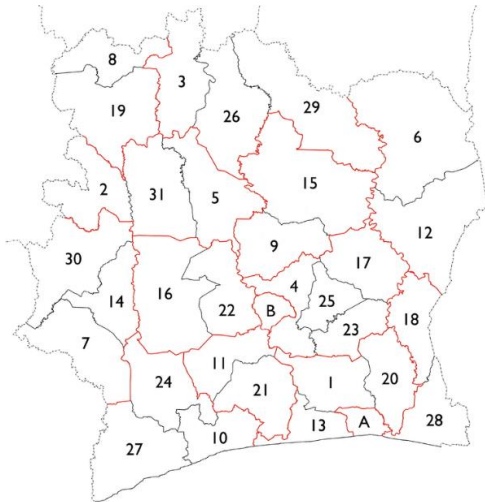


Figure 1: Sub-regions of Indénié-Djuablin (18) and Gontougo (12)

Source: Good Olfactory, Wikipedia

The vegetation of the Indénié-Djuablin Region is characteristic of the dense forest in its southern part, with clearings in its northern part. This forest cover, with an area of about 12,000 hectares, represents nearly one-fifth of the overall area of the Region (PEDEM-CI, 2015). The vegetation is essentially characterized by the presence of two (2) types of dense formations. These are:

- The semi-deciduous formation in the north and centre of the Region (Abengourou and Agnibilékrou).
- The evergreen humid forest formation located in the south of the Region (Béttié)

These forest formations are largely disturbed by logging and agricultural activities (ANADER, 2017).

4. Cocoa and Cashew farms in the study zone

Characteristics of cocoa and cashew farmers in the study area

Cocoa and cashew farming in the study area is mainly carried out by men. Of the people interviewed, 84% were men. A high proportion (68%) of the respondents went to either primary (29%), secondary (38%) school or university (1%).

96% of producers interviewed cultivated cocoa, 48% cultivated cashew, thus 43% cultivated both crops. In the more northern regions (Gontougo, see Figure 1), there are more cashew farmers, in the more southern regions of the study area (Indénié-Djuablin), there are more cocoa farmers. The interviews reveal that cultivating one or the other is highly dependent on heritage, meaning family knowledge of techniques and land acquisition.

Most farmers (targeted households were cocoa and/or cashew farmers), cultivate cocoa, then cashew, coffee and/or caoutchouc. Most producers cultivating cash crops also grow food crops (93%). In terms of food crops, the preference for a crop could be justified by the strong preponderance of these agricultural crops in the nutritional habits of the local population (e.g. sweet potato, cassava, tarot). Plantain is mostly associated in plots with cocoa. Animal husbandry is only practiced by a few (nine) households.

When looking at the cropping systems practiced in the study area in more detail, cocoa is grown by 96% of producers interviewed. Furthermore, of those growing cocoa, 84% plant cocoa in association with other crops and 36% grow cocoa in monoculture. 21% of interviewed cocoa producers use both systems. Reasons for planting cocoa in association with other crops (83% with food crops and 30% with

cash crops) are diversification, protection of cocoa trees and for a small percentage of producers also reconversion (see Figure 3).

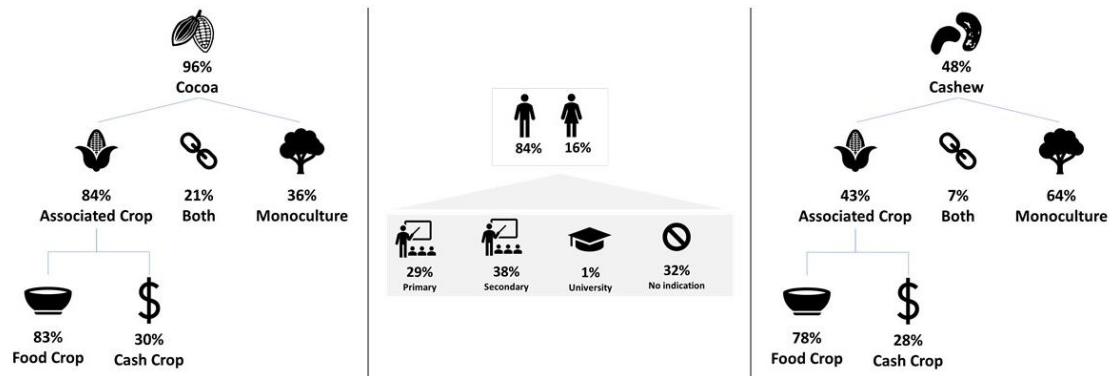


Figure 2: Production systems and education level of interviewed producers

Cashew is grown by 64% of the producers in monocultures and by 43% in association with other crops. 7% of cashew planters use both systems. Associated crops are comparable to cocoa mostly food crops (78%) rather than cash crops (28%). These data show a more pronounced tendency to combine crops among cocoa producers than among cashew producers.

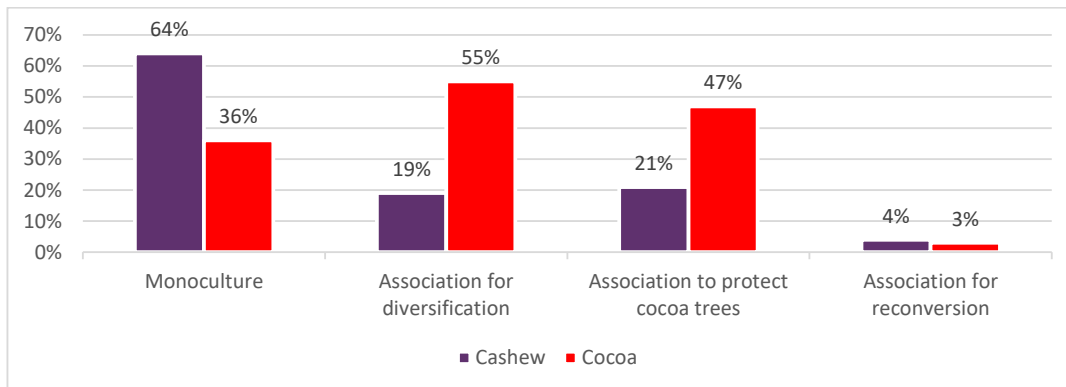


Figure 3: Production systems in detail by interviewed producers

Some respondents indicated that even though the price per kg of raw cashew nuts (RCN) is not yet equal to that of cocoa, some producers are converting or abandoning cocoa farming in favor of cashew farming. 89% of those interviewed stated that they had never had a conflict over their land. The conflicts encountered are related either to the boundaries of the land or to the ownership of the land itself.

Labour force used by producers is mainly made up of family workers (61% of farms). Survey responses indicate that inputs are overall available in the area at relatively affordable prices. It appears that the extension and supervisory services (CCC, CCA, ANADER, OPA, etc.) are the main actors that supply most phytosanitary products and fertilizers to producers in the target zone. However, regarding seeds, own production is still widely practiced.

Household income and expenses

Survey responses suggest that the majority of households in the study's target group derive their income mainly from agricultural crop production activities (cash crops and/or food crops). Income

levels are low, among others due to the decline in agricultural yields and the instability of prices. In 2017, the average revenues for cocoa, cocoa & cashew and cashew farmers in the study were relatively close, between 800.000 FCFA (cashew) and 1.150.000 FCFA (cocoa). While cocoa farmers' and cocoa & cashew farmers' average revenue increased by 23% respective 12% in the period from 2017 to 2019, cashew farmers' revenue decreased by about half.²

The majority of households is unable to cover all of the daily expenses, particularly with regards to schooling, transport, health and other expenses (contingencies) (see Figure 4). This finding reflects the state of poverty in which some producers find themselves, forcing them to save and borrow from buyers (especially trackers) and peers to make up for their low income. Some producers in difficult living conditions receive transfers from their families as support. These are generally households where the head of the household is either widowed or where the agricultural plantations are very old.

The average household can almost cover its food expenses. Reasons for the high coverage could either be that households consider food expenditures to be a priority and therefore allocate their income to this line of expenditure as a priority, or the agricultural production of households allows for self-consumption, thus making food expenditures less burdensome.

The respondents' highest expenditures are directed at agricultural production, notably the purchase of phytosanitary products, labour costs, and other agricultural expenses. In turn, the households manage to cover 82% of their agricultural expenses.

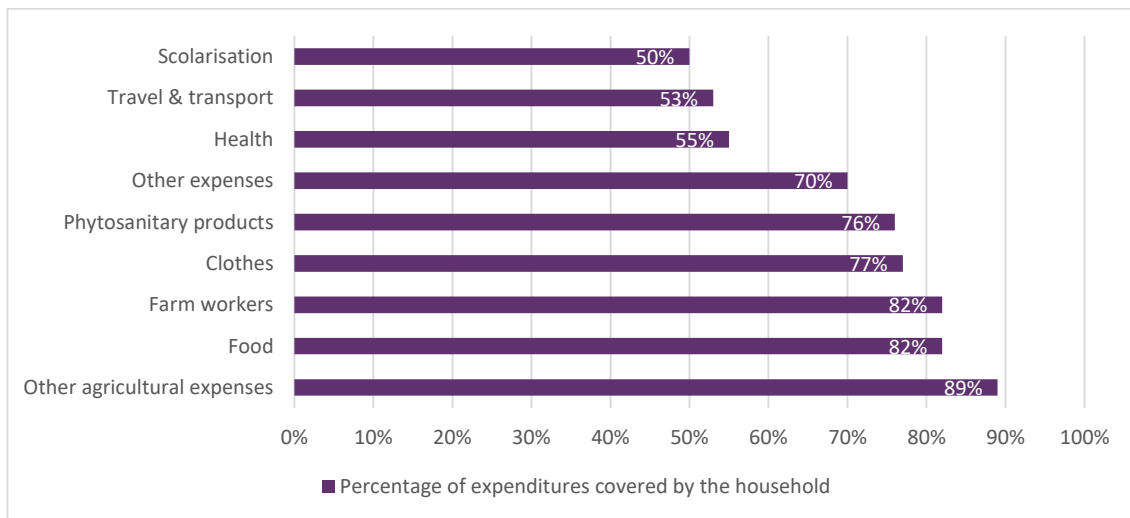


Figure 4: Percentage of expenditures households achieve to cover (averages)
 Note: respondents' own estimation.

5. Cocoa and Cashew Farmer-based organisation in the study zone

This study on the diversification of cocoa and cashew nuts was conducted among twelve (12) Farmer-based organisation (FBO's) located in the following sub-prefectures:

² Note: the limited number of household interviews do not allow for representativeness of quantitative data for the farmer groups. A number of factors influence revenue levels which are not accounted for in detail in this study. However, the comparison over a time period shows the direction in which revenues are evolving.

Table 4: Location of the FBO's

| Sub-prefectures | Nr. | Name of PO | Commercialisation of Cocoa &/ Cashew |
|-----------------|-----|--------------------|--------------------------------------|
| Bondoukou | 1. | SOCOPACAB COOP CA | Cashew |
| Tanda | 2. | SOCOPRAG SCOOPS | Cocoa & Cashew |
| Akoboissue | 3. | BENKADI COOP CA | Cocoa & Cashew |
| Abengourou | 4. | CAMAYE COOP CA | Cocoa & Cashew |
| | 5. | CAPRESSA COOP CA* | Cocoa & Cashew |
| | 6. | CAEMIN COOP CA* | Cocoa |
| | 7. | COOP CA CAPA* | Cocoa |
| Agnibilékro | 8. | ANONKLON COOP CA*+ | Cocoa |
| Amélékia | 9. | SOCOPACA COOP CA* | Cocoa |
| Niablé | 10. | COOP CA ABOTRE* | Cocoa |
| | 11. | COOP CA ESPOIR* | Cocoa |
| Aniassue | 12. | COOP CA SCAANIAS* | Cocoa |

Note: The FBO's integrated in the study commercialise also other agricultural products. The focus here is marketing of cocoa and/or cashew. *FBO's working with PRO-PLANTEURS. +commercialised cashew in the past, n=12.

Motivations for cocoa and cashew commercialisation

By asking for the motivation of FBO's to commercialize the products in their portfolio, these can also be interpreted as favourable factors for their commercialisation. It is notable, that the motivation to commercialize either cocoa and/or cashew is the same for both crops (number of FBO's):

1. Availability of agricultural product in sufficient quantity and/or quality (12 responds)

The availability of cashew and cocoa in sufficient quantity and quality is the most important reason to have these agricultural products in the portfolio. According to the eleven cocoa-FBO's, cocoa was the reason for their creation. Producers, aware of the large quantity of cocoa produced in their area, decided to group together in order not to be at the mercy of the middlemen (trackers, "pisteurs") and to deal directly with the exporters.
2. Existing sales market / demand (11 responds)

Even if the cocoa market remains poor according to the FBO's, it is seen as a stable market. That is, they are sure that each year's production will be purchased. It was therefore more interesting to group together in order not to be prejudiced by buyers and to be in direct contact with the exporter.
3. Prospects for future development (6 responds)

The third motivation for cocoa commercialization in the Indénié-Djuablin and Gontougo regions is similar to the first. Since these two regions are forest regions, even though largely reduced, they are favourable to cocoa production.
4. Level of profit (2 responds)
5. Other, e.g. improvement of the living conditions of the members

Improvement of the conditions of the members by striving to have the best profiles in order to make social achievements.

Threats for cocoa and cashew commercialisation

Contrary to the motivation, threats for the commercialisation of cocoa and cashew differ. Threats for cocoa commercialisation according to the questioned 11 FBO's commercialising cocoa are (n=11).

For cocoa

1. Changes of agro-climatic conditions (11 responds)
2. Side selling (10 responds)
3. Plant diseases (10 responds)
4. Land pressure (4 responds)
5. Other attractive activities in the region, e.g. gold mining (4 responds)

The threats need to be put into perspective of the study zone which is characterized by the proximity of neighbouring Ghana with often better prices in the past than in Côte d'Ivoire. Furthermore, the Swollen Shoot Virus is widely spread in the zone, which is attributed to be a consequence of climate change.

Furthermore, perceived threats for cashew commercialisation for the FBO's commercialising cashew (and who have commercialised cashew in the past) in this study are (n=6).

For cashew:

1. Price fluctuation (7 responds)
2. Side selling (5 responds)
3. Changes of agro-climatic conditions (4 responds)
4. Plant diseases (2 responds)
5. Other attractive activities in the region (2 responds)

Similar to cocoa, the proximity to Ghana is a challenge for the FBO's. Side selling is also apparent due to higher prices in the neighbouring country. Contrary to cocoa, land pressure was not mentioned as a threat to cashew commercialisation. Changes of the agro-climate is less of a threat to cashew as cashew can grow also under harsher climatic conditions. However, the cashew tree would do better with a good synchronization of the rainy season with flowering.

6. Analysis of climate change perceptions and their impacts on cocoa and cashew production and commercialisation

Perception of climate change and the impacts of climate change by producers and their organisations

Farmers change behaviour among others according to experiences and expectations. Thus, in this analysis, farmers' perceptions on changing weather patterns and adaptation strategies were analysed. The study does not go deep into observed weather and climate data. Perceptions of only the period of the last ten years were asked for, as long time periods also lead to less precise data and perceived changes in weather patterns could already been observed. Nevertheless, these perceptions of

changing weather patterns seem to match climate data and can most likely be attributed to climate change (global or local).

The analysis of producers' perception of climate change shows that producers perceive climate change or changing weather patterns through different elements. Thus, for producers, from 2010 to 2020, they perceive that:

- it rains less and less, the level of rainfall is decreasing,
- the dry seasons are longer than the rainy seasons,
- and temperatures are increasing.

The only indicator with mixed results was the appearance of inundations. Most producers perceive that floodings were decreasing in the last ten years, however, some did not see any change and a small proportion even experienced an increase in floodings. While a large majority experiences increasing temperatures overall, it is worth noting that a small proportion also perceives colder temperatures during the cold season.

The FBO's responses differed for the regions. In the more northern regions of the study zone, the respondents highlighted more the increasing temperatures. The FBO's see also a decrease of precipitation. The period of the rainy season would shorten but also the volumes would be insufficient for the crops' needs. In the past (more than ten years) heat used to be followed by rain. In their opinion, the missing rain after heat dries out the vegetation, including the cocoa trees.

Impacts of changing climate on producers and their organisations

The variations in weather patterns or climate change have an impact on the activities of both producers and FBO's.

The impacts on the producers interviewed are in the order of importance:

1. Disruption of the crop calendar
2. Reduction of cultivable land
3. Decrease of soil fertility
4. Decrease of yields
5. Degradation of quality of production
6. Increase of agricultural expenses
7. Spreads of new diseases

The variation of the rainy seasons disturbs the crop calendar and is listed as the most important or most felt impact by the producers. For the majority of cocoa farmers, the gradual disappearance of the forest means a reduction in the area available for cocoa cultivation. This is due to the fact that cocoa farming is still considered to be a favourable crop only in forest areas. The interviewed farmers

realize a reduction of soil fertility by lower yields, slower plant growth, the disappearance of certain plant and animal species (typically those in forests) and the reduction of forests itself once the savanna advances.

The impacts on the FBO's interviewed are (number of FBO's mentioning the impact):

1. Reduction of sales volume (12)
2. Degradation of product quality (7)

Regarding cocoa, the perceived scarcity of precipitation decreases the cocoa yields in the FBO's opinion. Furthermore, it triggers the advancement of the savanna into former forest areas which would have a negative impact on cocoa plantations, as the cocoa tree's favourable conditions for quantity and quality are in forest conditions.

For cashews, according to the FBO's, a lack of rain during flowering has an impact on the yield of cashew trees. Flowers dry out and thus reduces the formation of cashew fruit, which leads to a lower yield of cashew nuts. However, this has no impact on the quality produced.

Additional to the reduction of sales volume and degradation of quality, less accessibility of the product and low prices were mentioned.

8. Strategies adopted by producers in response to climate change

To cope with perceived variations in weather patterns or climate change, and the impacts laid out previously on cocoa and cashew production and commercialisation, strategies and actions are being taken by producers.

Basically, producers opt for three strategies (see Figure 5):

1. Establishment of new plots (19%)
2. Utilisation of plant protection products and fertilizers: A part of the producers uses inputs such as phytosanitary products (39%) and fertilizers (6%) as a means to tackle changing climate impacts, e.g. declining yields and diseases.
3. Diversification including reconversion: Most producers opt for the diversification of the production system as adaptation strategy to climate change by integrating additional crops in their plots (41%). 37% of producers decide for a reconversion of plots, thus, giving up the crop and transitioning to growing new crops.

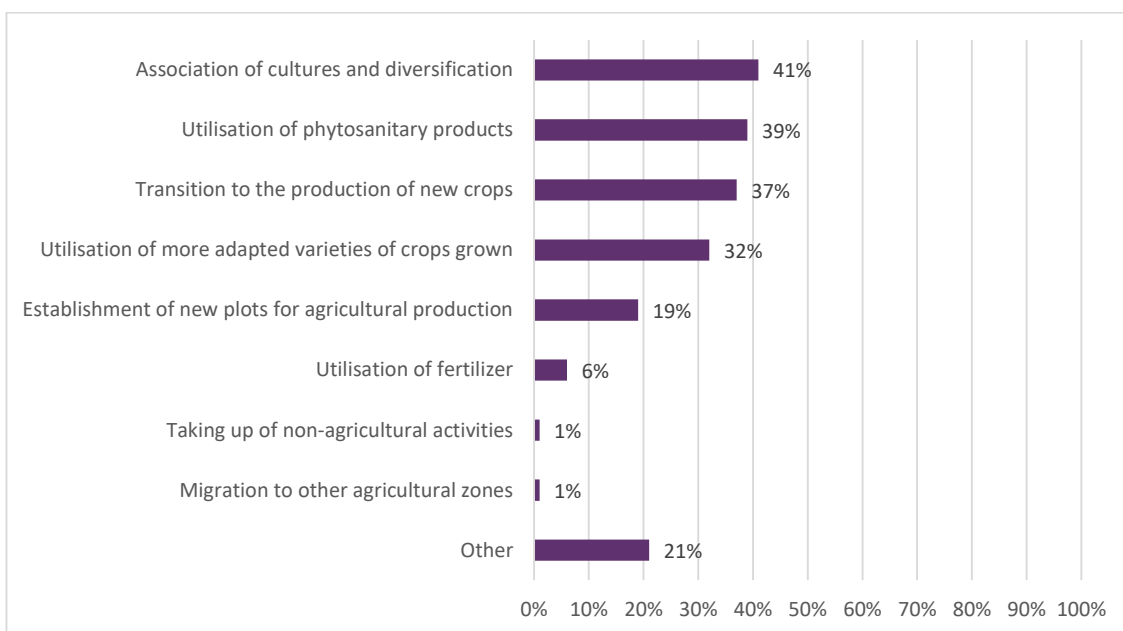


Figure 5: Actions taken by producers in response to climate change

Analysis of viability of strategies adopted by producers

In a first step, the conditions for success and viability of the strategies are analysed according to the information given by the producers.

Strategy 1 is based on the availability of non-developed land. In fact, according to the interviews, in the Indénié-Djuablin region, producers still have some hectares of non-cultivated land at their disposition. In Gontougo, pressure on land seems to be more pronounced.

The availability of labour on farms is a crucial factor for production, in particular, if more land is being cultivated, but also for the other strategies. Cocoa producers use more hired labour than cashew producers. The proportion of producers whose cocoa production is half, mostly or totally done by hired labour is 54%. In contrast, cashew production is mostly carried out (about 79%) by household labour. And only 11% of farms are half, mostly or totally operated by hired labour. On average, the producers can cover the cost of labour by 82%. It is therefore manageable by the producers. However, the producers indicate an increasing unavailability of hired labour force. This unavailability is due, on the one hand, as was mentioned several times in the focus groups, to the impatience of young people to wait for the revenues from the land. They are increasingly moving towards activities with daily, weekly or at most monthly income in urban areas. On the other hand, it is due to the increasing schooling rates of young people. After school, they are often learning handicrafts and services, while there are less and less unscholarised or early dropouts seeking work in the fields or in FBO's.

The means of implementing the strategy 2 are the availability of plant protection products and fertilizers. According to the producers questioned, plant protection products are available to 91% of producers and fertilizer to 37%. Producers receive subsidies for plant protection products and fertilizers. Also, the Conseil du Coton et de l'Anacarde distributes phytosanitary products to them annually, yet, the producers judge these subsidies as insufficient.

Concerning environmental effects and long-term sustainability of strategies, strategy 2 is the least convincing. The usage of plant protection products as in strategy 2 can have a negative impact on the environment. The producers questioned argue that they would use it professionally as they received trainings on proper usage, which would decrease its negative effects compared to uncontrolled usage, yet, even though smaller, it still has an impact.

With regards to the time needed to put a strategy into place, strategy 2 can be quickly implemented. Strategy 1 and 3 with food crops are feasible in a time span of a year. Strategy 1 and 3 with cash crops, e.g. cashew (minimum 3 years for first yield), would need more time to put into place.

Consequently, all the three strategies can be viable under favourable conditions.

Analysis of revenues of strategies adopted by producers

In a second step, the revenues generated by the producers according to their practiced strategies are analysed.

Farming new plots of land is economically, the most efficient strategy. Producers who have chosen to develop new agricultural land (strategy 1) have the highest average annual income of around 3,200,000 FCFA. However, as described above, this can only be a strategy if suitable land is available to the producer.

Producers who adopt new or associate crops (strategy 3) attain with an average annual income of 1,600,000 FCFA nearly over half of the value achieved by strategy 1.

However, users of chemical inputs, such pesticides and fertilisers (strategy 2), have the lowest income.

Analysis of resilience of strategies adopted by producers

In a next step, the challenges and resilience of the adopted strategies are analysed.

1. Establishment of new plots

Challenges of the strategy and the producers' capacities to overcome them:

- Land pressure, thus, lack of cultivable land. Acquisition of new land (purchase, loan, sharecropping, or move to other agricultural areas) is a great challenge under land pressure. Thus, this strategy will not be effective or sustainable.
- Availability of labour: producer perceive that availability of external hired labour is decreasing over the period 2010-2020 while the need for labour of cocoa farmers in particular is high. More than half of the target population, practicing cocoa, depends on at least half of the external hired labour force for the operation of their activities. To face this challenge, producers organize in groups to help each other (39%), yet, this solution is weakened by the age of the producers. Another share of 38% of producers adopt sharecropping and/or share planting. Further, some producers (26%) hire labour in other zones or use phytosanitary products and/or fertilizers. Additionally, PRO-PLANTEURS and other structures put into place service units to tackle the lack of labour.
- Agro-climatic conditions: even if land and labour is available, favourable agro-climatic conditions are crucial for the success of the strategy according to the producers. Also, the

success of tree nurseries depends on rain. Because of the scarcity of rainfall, the soil becomes hard. Not only does digging the holes become difficult, but once the planting is completed, the producers witness the death of the new plants due to lack of water. To overcome the challenge, producers plant shade trees as they learned in awareness-raising sessions. This activity aims at the reconstitution of the forest zone and thus recondition the micro-climate favourable to the exploitation of their activities.

It should be noted that producers practice an adaptive response to the various challenges they face. According to them, the information they have on changing weather patterns and climate is not reliable. Thus, it is the presence of a situation that leads them to seek solutions. So as long as the situation does not arise, there is no reason to look for solutions. This means, that producers hardly have a capacity to anticipate or plan responses to arising problems.

2. Usage of plant protection products and fertiliser

Challenges producers face when applying this strategy are:

- Lack of supply: Insufficient supply of products for 75% of producers. On average, the producers can cover 76% of their needs for plant protection products.
- Agro-climatic conditions: in the absence of rain, fertilizers have no effect because they cannot dissolve in the soil to feed the plants and phytosanitary products cannot be applied to dehydrated plants

Regarding the producers' ability to anticipate their response to the problem, it was mentioned above that producers' income does not cover all household expenses (Figure 4). Most of them are unable to make forecasts for the next crop year when purchasing plant protection products. Thus, producers are unable to anticipate their responses to this challenge.

3. Reconversion or diversification

A challenge to this strategy is soil depletion; by growing multiple crops on the same land, the soil can become overexploited and depleted. Producers can meet this challenge by applying fertilizer on the assumption that producers can cover the costs (compare Figure 4).

The producers' abilities to anticipate their response to the challenge are similar to the second strategy. Producers are unable to anticipate the solution to this challenge because their income in one year does not cover all their expenses in that year. Therefore, they cannot purchase products if the need does not arise.

9. Strategies adopted by Farmer-based organisations in response to climate change

As a response to the threats Farmer-based organisations (FBO's) perceive by climate change (see chapter 6), they carry out the following actions:

1. diversification of sources of income and
2. support to members.

FBO's commercialise in 2020 not only cocoa or cashew, but also coffee, caoutchouc, palm oil, or vegetables, but also animal products, in particular chicken. At their creation, FBO's were usually created for one crop e.g. for cocoa, coffee or cashew commercialisation. With time FBO's diversified their portfolio. Cashew and also caoutchouc became more and more available in the study zone, thus

were more and more integrated in commercialisation activities. (technical, financial, etc.). The reasons for the diversification are first, diversification of revenue sources with decreasing cocoa quantities to cover administrative costs, and, second, the discharge of the member's production. Furthermore, some FBO's extended their activities up the value chain e.g. transformation of cocoa in cocoa powder, as well as sales of phytosanitary products.

The supports to their members the FBO's offer are technical support, financial support, material and lobbying with partners. The FBO's make staff available in their different communities that is trained by the FBO to execute certain tasks for the technical support of their members, such as in good agricultural practices, sustainable agriculture. Material, e.g. phytosanitary products, bags, tree nurseries, is made available in order for the members to implement the trainings. The financial support of the members includes school loans, loans for the lean agricultural season to cover subsistence costs and social loans for events like marriages or funerals. The financial support is also directed at retaining members, moreover, these services are seen by members as minimum that a FBO needs to offer. Furthermore, village pumps are repaired and schools renovated by the FBO, or the FBO lobbies for these issues as well as reforestation by planting of shade trees or interventions with women with their partners.

Analysis of viability of strategies adopted by Farmer-based organisations

As for the producers, the conditions for success and viability of the strategies are analysed according to the information given by the FBO's.

For the diversification strategy:

- Availability of means to implement diversification measures: diversification of the activities of FBO's consists of integrating other crops into commercialisation activities. When members produce a crop in quantity, they expect the FBO to find a market for it, which in turn, has an impact on the FBO's decision to commercialise a crop. Thus, the quantity of crop available among members is decisive for this strategy.
- Accessibility to the means of implementing diversification measures: each section has central warehouses to which the products are conveyed by the producers and stored. Then, the collection is done by the FBO's at the level of the sections. Thus, according to the FBO's, the crops are accessible;
- Quality of environmental protection: With the technical support provided to members through training on sustainable agriculture and good agricultural practices of the different crops, the FBO's would participate to increase the protection of the environment through diversification activities;
- Cost of staff to implement the measures: According to the FBO's, there is no additional staff hired for the commercialisation of additional crops. Thus, no additional costs are incurred as a result of diversification, as the diversification is undertaken with the objective of meeting the expenses that the original activity cannot meet in its entirety such as the cost of staff;
- Implementation time: The implementation time for integrating new crops in the commercialisation portfolio is the time needed to establish the administrative documents necessary to commercialise a given crop. In addition, the implementation time can be the time needed to modify the FBO's purpose. Indeed, in case a FBO embraces activities outside those

included in its statutes, it is called to amend its social objective in order to widen its field of intervention. This time therefore depends on the competent administration for the establishment of these different documents.

- Control of the process itineraries: According to the FBO's, they do not control the commercialisation process of products for diversification. For them, this control would be synonymous with the elaboration of prices (a price defined by the market with the participation of all stakeholders). However, the crops for diversification of the FBO's (cashew, rubber, coffee and food crops) are in a price fixing system. Thus, the price of these products is set by one actor and is imposed on the other actors in the value chain. FBO's are therefore subject to the prices in the different value chains in which they intervene. This means that they do not have full control over the process of diversifying their activity.

In conclusion, diversification initiatives, which are mostly recent in the activities of the FBOs visited, are facing various constraints. These include the rigidity of the legislative framework, which does not favour the positioning of FBO's in certain links of the value chain, particularly for those engaged in processing and exporting. These constraints are mainly the difficulties in obtaining approval or authorization to carry out these activities easily. As for non-agricultural activities, discussions with the leaders of FBO's suggest satisfactory results. However, the lack of financial resources is a real obstacle to the development of these activities. These constraints are therefore likely to mitigate the results obtained so far.

For the strategy to extend members' services:

- Availability of means to implement members service: For FBO's, the means to choose and implement different member support options are available;
- Accessibility of the means to implement diversification measures: the means to implement the various supports are accessible. Each year, a budget is allocated to the different supports according to their economic weight in the FBO's income;
- Quality of environmental protection: this support aims to meet the needs of members but also to improve the environmental sustainability of cultivation techniques;
- Sustainability of the expected effects of the strategy: Sustainable agriculture aims at restoring the forest little by little. On the other hand, the financial support lasts only one year; the loans for bridging the gap, schooling and social support only have an effect for one year. Financial support is increasingly difficult to provide because of the non-repayment of loans by members.
- Cost of personnel to implement the measures: this cost is covered by the FBO's;
- Implementation time: Budget allocations are done each year for the services chosen and provided;
- Mastery of the process itineraries: the material and technical support is mastered according to the FBO's. However, they cannot say the same for financial support and lobbying actions.

In conclusion, FBO's provide financial support to retain members but are faced with non-repayment by these members. They have no way of forcing members to repay these loans and are therefore faced with a low repayment rate.

Analysis of revenues of strategies adopted by Farmer-based organisations

To address the threats of climate change, FBOs have taken actions including diversification of income sources and support to members. By adopting these strategies, these FBO's intend to either maintain or increase their income.

FBO's that adopt diversification of activities as their main strategy have much higher revenues than those that adopt other strategies, such as technical support, material support, lobbying with partners, or financial support. In contrast, the FBO's that are most affected by income pressure are those that adopt financial support to their members as their main strategy. Diversification of activities thus appears to be the most economically advantageous strategy.

Analysis of resilience of strategies adopted by Farmer-based organisations

The analysis of the resilience of the strategy of diversification of the activities of the FBO's resides in the analysis of this strategy vis-à-vis the following elements

- Challenges to be met by the diversification of marketed crops: The first challenge faced by FBO's is price instability of the commercialised crops throughout a given season. Thus, the FBO's do not know the selling price before the season (cocoa and RCN) or how the price will behave during a given season (RCN). The second challenge is demand. Demand depends on supply and other factors. Since production is not controlled, demand can be very low (coffee and RCN in the last three years) or even non-existent (RCN).
- The FBO's capacity to meet the challenge (face and solve the problem): FBO's are powerless to face the challenges related to the integration of other crops in their activity. Thus, there is no such capacity in FBO's. However, they support their members in order to be able to commercialise quality products.
- The FBO's capacity to anticipate (adaptive and rational) its response to the problem (reliability and use of available information): FBO's rely less and less on the information to which they have access. According to them, the information available to them is very often false rather than true. So, they adapt to all the difficulties that arise.

From this analysis, it emerges that the diversification strategy adopted by FBO's to deal with climate change is not resilient. Indeed, the FBO's have no means either to meet the challenges that arise from the practice of these activities or to anticipate this resolution. They try to adapt as best they can to the situation when it arises. They are therefore in uncertain markets.

This lack of resilience has already been demonstrated by the cessation of cashew marketing by ANONKLON COOP-CA. Indeed, the administrative managers of this FBO have ceased commercialisation of this after several sales failures. In addition to cashew, several FBO's have dropped coffee commercialisation because of their inability to meet the low demand. And the FBO's that still commercialise cashew and coffee deplore their powerlessness in the face of the difficulties that arise in these sectors. They fear that they will abandon these activities if the market does not change in the coming years.

Thus, the strategy adopted by some FBO's to cope with climate change by diversifying the crops commercialised is, according to the data in this study, viable but far from resilient. It is therefore recommended that in order to manage these challenges, FBO's should be provided with better

information on market opportunities for alternative products on the one hand, and that they should be supported in achieving this diversification on the other hand.

10. Recommendations to promote diversified production systems

Recommendation for support for diversification options for producers

As the arable land becomes increasingly unfavourable for the production of cocoa and more favourable for the production of other crops, farmers should undertake crop diversification. However, developing new land would increase deforestation. Thus, cocoa farmers whose fields are infested with diseases and/or pests, whose soils have become increasingly unfavourable for cocoa production, or whose fields are producing less and less due to climate change should use part of their plot to convert to crops better adapted to changing climatic conditions. Farmers need to adopt new, adapted farming methods and plant shade trees to protect their fields and production.

Crop diversification has been traditionally practiced by producers in the region. It has been largely focused on subsistence with food production (self-consumption). However, in the face of climate change impacts, the practice of growing other cash crops to compensate for low revenues from cocoa or cashew has emerged, in some cases at the expense of food crops. Cocoa producers say they have been forced to introduce other crops because agroclimatic conditions for cocoa production are deteriorating, while conditions for other crops such as cashew, rubber trees, coffee, oil palm, as well as food crops such as rice, corn, and taro would be improving. Others turn to livestock farming, with cattle, goat or chicken farming being the most popular among producers. A marginal share takes up non-agricultural activities.

Crop diversification is undertaken under the assumption that there is a lucrative market for the respective products. Crops tend to be grown by imitation without market analysis. It therefore becomes imperative to support these producers in this transition, to enable them to rationalize their decisions and, above all, to accompany them in the management of the diversification activities chosen.

Recommendation for support for diversification options for Farmer-based organisations

As described above, commercialisation of specific agricultural products is closely linked to availability among members. As part of the support and services provided to their members, FBO's accompany producers in the marketing process.

However, due to the lack of market, they refrain from moving into this area. Thus, they would need technical support, product promotion and market structuring actions, in order to successfully integrated different crops in their activities.

11. Conclusion

This study, which examines the contours of diversification with cocoa and cashew or other activities at the level of FBOs and producers, provides the beginnings of an answer to the following major questions:

- Could the diversification of cocoa through cashew constitute the spearhead of sustainable development for these FBOs?
- Could it be a strategy for the development of climate-smart agricultural activities?

- Could it ensure an agro-ecological transition in the face of the socio-economic and environmental implications of climate change to guarantee the resilience of FBOs?

From the different analyses carried out, we can retain that:

1. The cashew nut marketing activity is carried out by very few FBO's in the study area due to the numerous constraints encountered by these actors. These include the low availability of the product and, above all, the lack of control over the marketing system, which remains lightly regulated compared to that of cocoa. For the moment, cashew do not offer a secure market outlet for most of the FBO's visited, unlike cocoa.
2. The promotion of cocoa-cashew diversification is not a relevant option for FBO's. However, this option is still highly appreciated by producers, particularly cocoa producers, who have gradually modified their cropping system by integrating cashew in association with cocoa. This was done in order to protect their cocoa plantation in the context of climate change (protective role of the cashew tree) and, above all, to obtain an additional income through cashew.
3. Although economically unprofitable for the majority of FBO's, the encouragement of cashew-cocoa diversification at the producer level would make it possible to guarantee a stable or even improved supply of the main product commercialised (cocoa). This is due to the positive agro-ecological effect of the cashew tree on the cocoa tree.
4. Producers diversify their sources of income by growing other food crops and livestock. However, it appears that FBO's hardly accompany the producers in this dynamic. This is a major limitation that should be corrected.

Throughout the study area, there a great interest among FBO's and producers was encountered in discussing the key issues of the study.

However, the unavailability of certain actors and, above all, the absence of time series data on the climatic variables of the study areas and on the activities of the FBO's and producers did not allow for the development of certain models retained in the basic technical offer. Thus, some specific objectives, namely the prediction of potential commercialization and crop changes based on climate change predictions could not be addressed. To effectively address such an objective, an observatory or permanent data collection and processing system should be established.

Although cashew are one of the crops that are resistant to the agro-climatic conditions of this study, the commercialization of cashew nuts is very difficult. The instability of the price, the non-respect of the fixed price, the instability of the demand are brakes for the practice of this activity.

To this end, the study recommends

- Conducting consolidation and development actions in agroforestry and on sustainable agriculture. According to the FBO's and producers, many shade trees are cut down during the cleaning of the fields by laborers because they do not know the difference between a tree and a grass of the same size. There is a need to expand awareness-raising and training activities for agricultural laborers. Material support, inputs and adapted shade plants are desired;

- Implement capacity building actions in order to strengthen/develop the cooperative spirit of producers and the mastery of the cashew and cocoa commercialisation system by the FBO's
- Support FBO's to better position themselves in the value chain (processing, export) of cashew and cocoa in order to benefit from a substantial margin of the added value created and especially to reduce their vulnerability to the effects of climate change;
- Support FBO's to integrate the agricultural products produced by their members. The support should focus on market research (to enable them to better sell the products already marketed or to introduce new products into their activity) or on the promotion of their local products.

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