Impact of Cash Crops (Cocoa, Rubber Tree) on the Farmers’ Life Quality in Abengourou Department (East of Côte d’Ivoire)

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Abstract—Like Côte d’Ivoire forest area, Abengourou department has not escaped anthropic pressure. The forest in this area was the scene of intense Cocoa farming activities. However, due to the weaknesses and constraints observed in the Cocoa sector, it has been seen that from years 1990 - 2000, most of the farmers have abandoned their Cocoa farms in favor of a gradual conversion in Rubber farming. In fact, this crop is considered to be a new booming income crop that tends to improve and guarantee the farmer’s life quality. This situation leads to an amalgam for the growing of Cocoa or Rubber. This study aims to determine the impact of Cocoa and Rubber farms on the farmer’s life quality in Abengourou (Côte d’Ivoire). Thus, field missions, documents analyze and directive surveys of farmers, cartographic and statistical processing have made it possible to establish correlations between Rubber tree or Cocoa farming and the farmer’s life quality. It follows from the correlations, that after analysis, the Rubber tree would have a positive influence on the farmer’s life quality than Cocoa. Moreover, Human Development Index (HDI) was measured respectively between the Cocoa and Rubber growers in the study area. The HDI of the Cocoa farmers is 0.455 and that of Rubber is estimated to 0.461. So, it is confirmed from these analyses that, in 2016, the growing of Rubber improves the farmer’s life quality more than that of Cocoa in the study area.

Index Terms—Abengourou-Côte d’Ivoire, Cocoa, Farmer’s Life Quality, Rubber.

I. INTRODUCTION

Like African countries, Côte d’Ivoire isn’t immune to the vast movement of degradation of its forest area. This is the result of shifting and extensive cocoa farming [1]. However, Cocoa was and remains the pillar of development and the economy. This situ 1960s, this locality has been the scene of intense cocoa farming activities. It was therefore subjected to strong anthropogenic pressures and undoubtedly suffered from this fact, deforestation and degradation of its landscape. Over 20 years later, faced with all these difficulties, most producers abandoned their cocoa orchards or converted them to rubber plantations [7], [8]. Consequently, there’s a change in the agricultural landscape, but especially in household incomes.

In this context, the objective of this study is to contribute to improving the farmer’s life quality through the production of cocoa and rubber. It’s specifically a question of determining the impact of the production of cash crops (Cocoa and Rubber) on the farmers’ life quality.

II. METHODOLOGY

A. Study area

Located in the east of the Ivory Coast 210 kilometers from Abidjan on the Abidjan-Bondoukou axis, Abengourou department covers an area of 5 200 km², or 2.1 % of the national territory. The study area covers the southern half of this department and covers an area of around 240 000 hectares with an active population of 88 235 inhabitants [9]. It is part of a quadrilateral delimited by longitudes 6°43’47” North and latitude 3°29’47” West (Fig. 1). It includes the Bossematie and Beki Protected forest of 21 550 ha and 16 190 ha, respectively, which have been subject to excessive exploitation since the mid-1980s [10].

The population is made up mainly of Agni from the Kwa culture group, a strong community of Ivorian natives (Dioula, Baoulé, Bété et...). Coffee and Cocoa are the two main cash crops. However, rubber tree appears to be the most popular cash crop [11].

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I. INTRODUCTION

Like African countries, Côte d’Ivoire isn’t immune to the vast movement of degradation of its forest area. This is the result of shifting and extensive cocoa farming [1]. However, Cocoa was and remains the pillar of development and the spearhead of the colonial economy [2]. It has always played a considerable role not only in promoting the employment of several people, but above all in creating significant sources of foreign exchange [1], [3].

Average annual production is estimated at 1.3 million tons, making Côte d’Ivoire the world’s leading producer of Cocoa [4]. It is clear that weaknesses and constraints are observed, with the consequences of senescent and unproductive coffee and Cocoa orchards which pose serious threats to the sustainability of the coffee and Cocoa economy. This situation prompted later the adoption of rubber, considered family farming and analysed as a process of innovation [5].

However, the regularity of income, the low operating cost during the mature phase and the fairly long production period are all qualities that make rubber cultivation a safe investment, thereby spurring a rush for this agricultural practice [6].

Abengourou department (Capital of the former cocoa loop and capital of the Indénié-Djuaablin region) is not on the fringes of this reality. Since the 1960s, this locality has been the scene of intense cocoa farming activities. It was therefore subjected to strong anthropogenic pressures and undoubtedly suffered from this fact, deforestation and degradation of its landscape. Over 20 years later, faced with all these difficulties, most producers abandoned their cocoa orchards or converted them to rubber plantations [7], [8]. Consequently, there’s a change in the agricultural landscape, but especially in household incomes.

In this context, the objective of this study is to contribute to improving the farmer’s life quality through the production of cocoa and rubber. It’s specifically a question of determining the impact of the production of cash crops (Cocoa and Rubber) on the farmers’ life quality.
B. Material and methods

1) Investigation period and Sample choice for surveys

When you submit your final version, after your paper has been accepted, prepare it in two-column format, including figures and tables. The investigations took place in several periods. The first took place from October 30 to December 03, 2013. Then the second took place from January 16 to 22, 2014, then from April 17 to 27, 2014. And finally a fourth mission was carried out from July 15 to 30 October 2016.

The surveys are based on a previously designed interview guide at the end of which 402 farmers distributed in 14 localities shown in Fig. 2, were interviewed on the basis of a simple random sample without replacement or by reasoned choice [12] for a mother population estimated at twenty-five thousand nine hundred fifty-six (25 956).

2) Collected and analysed data

The collected data was encoded, entered on EXCEL version 2016 for Windows, and then implemented on SPHINX from which the counting and statistical tests of Chi-square were carried out. The level of significance chosen for these analyses must be less than 5%, ie (p < 0.05). It is a classification criterion to compare the different means at the 5% probability threshold.

3) Human Development Index (HDI)

Human Development Index (HDI) aims to address the shortcomings of the Gross Domestic Product (GDP) per capita as an indicator of the development of a country. It has been calculated since 1990 by the United Nations Development Project (UNDP) in order to classify countries according to their qualitative and not only economic development. It is characterized by the following indicators: Long and healthy life, Access to education, Decent standard of living (measured by gross national income (GNI) per capita, expressed in constant 2011 international Dollars converted to the parity rate of purchasing power (PPA).

According to the Human Development Index (HDI), which takes into account the state of health and education of the populations in addition to income, Côte d’Ivoire is a country with low human development (0.474) [13] with HDI threshold lower than the average of sub-Saharan Africa.

To have the Human Development Index (HDI), you must first calculate each of its component indexes. These are: Life expectancy index, Literacy rate index, Education rate index.

The formula improved in 2011. It looks like this:

\[
HDI = \left( \frac{LEI \times LRI \times ERI}{Maximum value-Min value} \right) \quad (1)
\]

Then the standard of living index is calculated from the following formula:

\[
Income\ Index = \frac{[\ln(Actual\ value) - \ln(Min\ value)]}{[\ln(Max\ value) - \ln(Min\ value)]} \quad (2)
\]

Finally, HDI is determined by the formula:

\[
HDI = \sqrt[3]{[LEI \times LRI \times ERI]} \quad (3)
\]

With, \( LEI \), Life expectancy index (0.536)
LRI, Literacy rate index (0.299)
ERI, Enrollment rate index (for Cocoa, 0.588 and for rubber tree, 0.612)

Human Development index (HDI) value is:
HDI (Cocoa farmer’s) = 0.455 and,
HDI (Rubber farmer’s) = 0.461

4) Situation and Analysis of the Monetary Poverty threshold

The monetary poverty analysis is based on the determination of a minimum level of consumption called the poverty threshold. This threshold separates population into two distinct groups. In Côte d’Ivoire, this threshold is set at 269 075 CFA francs is monetarily poor [9].

5) Agricultural yields and evolution of cash crops on the farmer’s life quality

a) Estimating of Cacao and Rubber production on an empirical basis

The estimation of production costs is originally based on the direct recording of detailed farm accounts. Difficulties in adapting to contexts are sometimes very different. However, there is no standard in this area [14].

b) Determination of the cocoa quantity by a mathematical relation

The number of pods per foot was determined on healthy cocoa pods from different plots under the uniform shade condition. To do this, a method is based on the weighing of healthy ripe pods and the transformation of this weight (in kg) of fresh beans, by multiplying it by the coefficient of transformation of the weight of pods into weight of fresh beans. This method has been used partially and published in all plots of varietal selections in Côte d’Ivoire since the 1980s and its effectiveness has been demonstrated [15]. [16] and [17] formulated the equation for the Quantity of marketable cocoa (Q) in a Cocoa farm (kg) as follows:

\[ Q = Nmc \times Pmf \times (Ct) \times Nc \]  

With:
- Production of marketable Cocoa or Quantity of marketable Cocoa (Q) in kg
- Average number of pods per Cocoa tree: Nmc
- Average weight of fresh beans per pod (kg): Pmf
- Processing coefficient weight of fresh beans/weight of marketable Cocoa: Ct
- Number of Cocoa trees per ha or density of Cocoa trees: Nc

Thus the characteristics of Cocoa during the harvest is presented as follows (Table I).

<table>
<thead>
<tr>
<th>Period</th>
<th>Number of Pods per tree</th>
<th>Weight of pods (g)</th>
<th>Average number of beans/pods</th>
<th>Average weight of beans/pods (g)</th>
<th>Cocoa trees density (plants/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little harvest</td>
<td>40 to 50</td>
<td>200 to 400</td>
<td>25 to 50</td>
<td>100 to 115</td>
<td>1150</td>
</tr>
<tr>
<td>Great harvest</td>
<td>100 to 150</td>
<td>400 to 1000</td>
<td>40 to 100</td>
<td>100 to 120</td>
<td>1150</td>
</tr>
</tbody>
</table>

The weight of fresh beans per pod (Pmf) and the transformation coefficient weight of fresh beans/weight of marketable Cocoa (Ct) being fixed, the mathematical relationship for determining the production of marketable Cocoa (kg) can finally be written as follows:

\[ Q = (Nmc \times 0.115 \times 0.35) \times Nc \]  

Quantity of Cocoa (Little harvest) = (40 x 0.115 x 0.35) x 1150 x 6502 = 12 038 453 kg

Quantity of Cocoa (Great harvest) = (100 x 0.115 x 0.35) x 1150 x 6502 = 30 096 132.5 kg

Total amount of Cocoa = 42 134 585.5 kg.

The data collected was analysed using the Student-Newman-Keuls 5 % test. So we have 40 027 856.22 kg is obtained.

III. RESULTS

A. Impact of the production of cash crops (Cacao and Rubber) on the farmer’s life quality

1) Productivity of Cocoa and rubber crops on an empirical basis

The surface areas of the Cocoa plots are estimated at 62 799 hectares. In 2016, during the period known as “Little harvest”, the total declared production of these people was estimated at approximately 9 547 250 kg. Thus, the yield was evaluated at 152.03 kg / ha. In the case of "Great harvest", the production was around 28 641 750 kg. This is equivalent to a yield of 456.08 kg / ha. In total, Cocoa production was at least 38 189 000 kg for a yield of 608.11 kg/ha/year.

2) Production of Rubber and cultivated areas

With regard to rubber, the total area of the plots was 23 981 ha with an estimated monthly production of 21 000 210 kg or 231 002 310 kg per year. This gives a yield 875.7 kg/ha/month, or 9 632.72 kg/ha/year.

3) Productivity of Cocoa crops by the mathematical relationship

The amount of Cocoa is expressed as follows:

Quantity of Cocoa (Little harvest) is 12 038 453 kg and Quantity of Cocoa (Great harvest) is 30 096 132.5 kg. The total amount of cocoa is 42 134 585.5 kg, applied to the Student-Newman-Keuls test at 5 %, 40 027 856.22 kg is obtained.

B. Correlation between Rubbers cultivated area and farmer’s life quality

The rubber farmer’s distribution according to the poverty threshold and cultivated area is presented (Table II).

It indicates that 28.35 % of the farmers interviewed have Rubber farms in production against 71.64 %. Among the farmers who do not have rubber farms in production, 142/288 or 49.30 % have an annual income per capita below the poverty threshold against 50.69 % who have an annual income per capita above the poverty threshold. This threshold was established at 269 075 CFA francs in 2015 according to the report on the household standard of living survey published by the National Institute of Statistics. Among the farmers who have Rubber farms in production, there is 29/114, which is 25.43 % of farmer’s households who have an annual income below the threshold against 74.56 % whose annual income per capita is higher than the poverty threshold.

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The difference between the two groups of farmers is not highly significant according to the poverty threshold through. It can therefore be concluded that the cultivation of Rubber tree positively influences the farmer’s life quality in the area.

C. Correlation between Cocoa cultivated areas and the farmer’s life quality

The distribution of Cocoa farmer’s according to the poverty threshold and to the cultivated area is presented as follows (Table IV). It shows that all of the growers interviewed have Cocoa plantations. Of these, 70.64 % of them have less than 7 ha of Cocoa parcel and 29.35 % hold more than 7 ha. Among the farmers who have less than 7 ha, 45.42 % have an annual income less than 269 075 CFA francs against 54.57 % whose annual income is greater than this amount. While, among those who have more than 7 ha of Cocoa, 35.59 % of farmers have an annual income below the poverty threshold against 64.40 % whose income is above this threshold.

D. Correlation between Cocoa and rubber production and the farmer’s life quality

Table VI shows the proportion of farmers declared poor and Table VII shows the proportion of farmers declared no-poor according to the production of Cocoa and Rubber.

For the proportion of farmers declared poor according to the production of Cocoa and Rubber, it appears that out of 94.15 % of the farmers who produce less than one ton of Rubber, there are respectively 37.43 % who produce less one ton of Cocoa; 26.32 % deliver one to two tons; 19.88 % supply between three and four tons and 5.26 % grow four to five tons of Cocoa. On the other hand, only 2.92 % and 1.17 % of these growers respectively deliver 2 to 3 tons and 6 to 9 tons of Cocoa.

In contrast, 5.85 % produce more than one ton of Rubber. Of these, 2.34 % grow less than a ton of Cocoa. It’s only 1.17 %; 1.75 % and 0.58 % which respectively recorded a production of Cocoa of 1 to 2 tons, 3 to 4 tons and 6 to 7 tons.
For the farmers declared no-poor (Table VII), there are 81.82% of the farmers who produce less than a ton of rubber. Among them, 32.03% estimate to have harvested 3 to 4 tons of Cocoa. 11.69%, 10.39% and 8.23% respectively provide 4 to 5 tons, one to 2 tons and more than 9 tons of Cocoa.

On the other hand, it is 18.18% of the farmers declared no-poor who produce more than one ton of rubber. Among them, 2.16% record between 4 to 5 tons and 7 to 9 tons. It should therefore be noted that 4.33% of these farmers deliver 6 to 7 tons and 3.46% grant more than 9 tons. This class of farmers represents the largest farmers in the region. However, in total 6.06% of the farmers declared non-poor produce both more than one ton of Rubber and about 4 tons of Cocoa. So, we can say that Cocoa and Rubber are the two cash crops in the region which certainly improve the farmer’s life quality. But, Rubber seems to be the most attractive.

**E. Farmer’s life quality on the basis of the Human Development Index (HDI)**

The human development index for the study area is illustrated in Table VIII and IX below.

The respective Table VIII and IX show that 54.6% of farmers have a life expectancy of around 56 years, higher than the national standard (51.7 years). This indicates an estimated longevity index of 0.536. In terms of education, 72.4% of the farmers surveyed have a low level of education equivalent at most to the primary level. This is equivalent to an index of 0.299.

The standard of living is measured by the gross per capita income obtained from the production of cash crops of either Cocoa or Rubber. The analysis shows that in 2016, the income index of Cocoa farmers is estimated at 0.588 and that of farmers of Rubber trees is 0.612. Thus, the human development index of Cocoa farmers in the study area is **0.455** compared to **0.461** for that of farmers of Rubber.

You could confirm that during this period, Rubber production improved the farmer’s life quality more than Cocoa.

**IV. DISCUSSION**

**A. Determination of the annual Cocoa production according to the cultivated area**

Cocoa production in the world is carried out by small family farms, all located in the humid tropics, and the cultivation of Cocoa is generally practiced in agroforestry systems [18]. If the theoretical annual production expected per tree is around 100 to 200 pods, their productivity is actually 30 to 40 pods per year [19], from which losses due to pests must be removed. Although the Cocoa tree is considered a shade plant, its productivity increases when involved in agroforestry systems [3].

Another method, based on visual assessments of the number of pods per cocoa tree, has shown that it is possible to assess the productivity of Cocoa trees in a simple
and reliable way [23]. The limit linked to the non-weighing of fresh beans, however, lies in the fact that the weight of fresh beans per pod was considered to be a constant value. The average value of 115 g of fresh beans per pod was obtained, obtained by Babin [24] following measurements carried out in 2003 and 2004 in agroforestry Cocoa plantations similar to those of our plots of farmers and located in the same study areas.

B. Cocoa production and farmer’s life quality

After analyzing the distribution of Cocoa producer’s according to the cultivated area and the poverty threshold, it appears that the difference between the two groups of farmers is not highly significant (chi-square = 3.295; ddl = 1, p = 0.069). It can therefore be concluded that the practice of cocoa cultivation does not have a great influence on the farmer’s life quality in the study area. According to Patric Poirez (Industrial Chocolate President), Ivorian Cocoa is not sustainable because farmers do not live decently from the fall-out from the Cocoa. Ivorian Cocoa is confronted to the unstable price. In principle, the standard of the production of Cocoa is ton per hectare, whereas the general observation is 700 kg / ha.

C. Farmer’s life quality based on the Human Development Index (HDI)

In 2016, human development index for cocoa farmers in the study area was 0.455 compared to 0.461 for that of farmers in Rubber. It can be said that during this period, the production of rubber trees improved farmer’s life quality more than cocoa. However, these indices are low compared to the national standard which was 0.474 in 2015 and places the country in the “low human development” category.

NDP (United Nations Development Program) has published its 2019 report on human development in the world. The document which looks at inequalities of development in the world on a human scale classifies countries according to the three components of the HDI (Human Development Index): longevity, education and income per capita. The report sets out 3 categories of countries in its classification, between countries with low human development (HDI less than 0.550), countries with average human development (HDI between 0.550 and 0.699), countries with high human development (HDI between 0.700 and 0.799) and countries with very high human development (HDI greater than 0.800). Côte d'Ivoire, a member of UEMOA, has a development index raised to 0.516 in 2019. It is therefore located among the countries with low human development [25].

V. CONCLUSION

For nearly 30 years, the drop in cocoa prices and the virtual absence of services provided to farmers have accentuated the structural impoverishment of cocoa farmers in a continuous and drastic way. In addition, the scarcity of forest resources and cultivable land caused by demographic pressure has worsened the financial situation of farmers. The consequences of this impoverishment are the fall in the supervision and distribution of agricultural inputs (seeds, fertilizers and a slackening of social investment), a fall in agricultural productivity.

Also, the difficulties of access to land, the destruction of forest capital, the aging of the agricultural population, the inadequacy of the organization of the farmer world hamper the development of agriculture with as a corollary food insecurity, the lack of financial means in keeping the home, lack of health care, lack of community support, high illiteracy of farmers, accentuated dropout of children. Added to this are natural causes, such as floods, climatic disturbances, etc.

This fact created discouragement and the loss of confidence of cocoa farmers. Thus, they are turning away from the Cocoa crops for Rubber considered to be a popular crop. This crop will therefore take an increasingly important share in land resources, labor and capital. Its predictable success (the Rubber boom expected and already underway), is certainly a good thing for Côte d'Ivoire, but public policies should carefully consider the price to be paid in terms of production and income. Without a rapid increase in the price to farmers, Côte d'Ivoire can probably expect a decline in production. This will certainly have an impact on the world market price.

RECOMMENDATION

The most important recommendation of such a study rests on the increase and the stability of the purchase prices of these perennial crops (Cocoa, Rubber). This could guarantee income and in turn improve the farmers’ life quality. An increase in the price to the farmer is an essential element in boosting the confidence and expectation of the Cocoa farmers. This recommendation may seem simplistic. But, it is deep and emerging from this severe diagnosis of the loss of confidence of the Cocoa farmers, at the moment when they discover new alternatives like the Rubber tree.

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