Original Research Article

Productivity of Palm Oil Extraction Technology in Cameroon

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Abstract

Agriculture and forestry remain the leading sectors in Cameroon, accounting for some 36% of the merchandise exports and for more than 40% of GDP in 1998/99. Agriculture alone accounts for more than 30% of GDP and provides employment for about 68% of the active population.

The Cameroon government and industry stakeholders have continually expressed concern about the impact of rising food import on the local industries and the rural communities especially as vegetable oils, particularly the palm oil, has a vital role to play not only as nutritional source for the Cameroon population, but for their contribution to rural incomes and employment opportunities. Particularly, Cameroon government is expecting a significant progress in implementation of new oil extraction technology where mainly in the palm oil processing technology the value added chain in this commodity is expected.

Cameroon's oil palm industry still plays a significant role in the national economy, providing oil for house hold consumption, industrial use as well as employment for thousands of Cameroonians who are engaged in production, processing and marketing.

This project aims at bringing clarity on to what extent the up to date oil extraction processing technology installed in a concrete rural district, and under a clear management and regulatory structure and environment, outperforms in terms of productivity (tons of palm oil produced), quality (price of the crude palm oil) and income generation, the existing traditional manual processing palm oil producing system.

The methodology applied within this study consists of comparing key indicators across populations of small scale palm oil processors in interaction with traditional non sophisticated technology with different work environment, production capacity, socio-economic status and income levels (cross-sectional statistical analysis).

Keywords: Cameroon; oil extraction technology; palm oil, productivity; value added chain.

INTRODUCTION

African oil palm originated in the tropical rainforest region of West Africa along the coastal strip between Liberia and Angola, from where it spread north, south and east to Senegal, the Indian Ocean, Zanzibar (Tanzania) and Madagascar. Since its domestication, oil palm has been introduced and cultivated throughout the humid tropics (16°N to 16° S) elsewhere in the world.

Typically, oil palm plantations are planted at a 9 m by 7.5 m spacing and the resulting 148 palms per hectare produce one new frond every three weeks, each new leaf adds 45 mm to the trunk height i.e. (0.8 m per year, 20 m in 25 years), and goes on to form one bunch either male or female. Typically under well managed conditions, 10 - 15 bunches can be harvested per palm in a year. They weigh 15 - 20 kg each. Total yields are thus 15 - 30 tons of fresh fruit bunches (FFB) per hectare per year.

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Social and economic impact of palm oil production

Social and economical factors have a large influence on the prospective development of palm oil production and availability of waste material. There are some critical issues which need to be mentioned. Growing demand for vegetable oil caused an increase in area under oily crops cultivation, and palm oil is not exception. Currently vegetable oil made from palm oil fruit covers 35% of world consumption.

In Cameroon, major Agro-industries involved in palm oil production are: SOCAPALM (25,000 ha), C.D.C (15,000 ha), PAMOL (10,000 ha), SPFS (7,000 ha) and SAFACAM (4,000 ha). They contribute up to 80% of the total edible oil needs.

Data from questionnaires presents that area about 5 ha of oil palm were planted by small and medium size farmers each year during the last decade, making a total of about 90,000 ha palm area in Cameroon at present.

In mid 2008, the price of crude palm oil (CPO) was higher than the selling price of petroleum-derived diesel, given that its cost, on average about 10 US cents per liter to convert crude palm oil into biodiesel.

Oil palm was enthusiastically cultivated in Cameroon mainly because of its large number of uses; which are deeply

embedded in local cultures. Demand from international markets, however, has also played a great part in convincing Cameroonians to cultivate oil palm.

Oil palm is spreading throughout the tropics, most notably in Southeast Asia. In 2008, Malaysia's Federal Land Development Authority (FELDA) announced plans to establish oil palm plantations in Kalimantan (20,000 ha), Aceh (45,000 ha), Papua New Guinea (105,000 ha), and Brazil (100,000 ha) (Wilcove and Koh, 2010). In May 2009, SIME DARBY, the world's largest oil-palm company, also announced plans to invest 800 million US dollars in oil palm and rubber plantations in Liberia, covering around 200,000 ha (80% for oil palm) (Lopez et al., 2008). Given that large expanses of forested areas in these regions are suitable for oil palm, oil palm will likely continue to replace tropical forests (Laurance et al., 2010). Along with employment, large oil palm plantations provide a variety of facilities for employees and their families, including housing, water, electricity, roads, medical care, and schools. In some rural areas, palm oil plantations offer the only livelihood option (Koh and Wilcove, 2007).

Large palm oil plantations have also been associated with corruption of community members, the decline of cultural traditions (the result of large inflows of immigrant workers), dependence on palm oil plantations and companies, and the loss of biodiversity. The loss of biodiversity is reducing opportunities for hunting, fishing, use of forest products, and access to clean water (Colchester et al., 2006).

In response to social concerns associated with palm oil production (as well as legal, economic, and environmental issues), the Roundtable on Sustainable Palm Oil (RSPO) was formed in 2004 to develop and implement global standards for sustainable production. The RSPO members are associated in the fifteen groups and now include 257 ordinary and 92 affiliate members, who represent about 35 % of palm oil production in the world (RSPO, 2013).

Expansion of palm oil plantation can have a negative effect to the environment and can lead to irreversible losses of natural heritage. A report prepared by WWF shows that clearance of tropical forests for oil palm plantations has caused many negative effects (WWF, 2005). The removal or destruction of significant areas of forest has resulted in ecology instability to the natural habitat of the forests. For instance, animal species like Asian elephants, Sumatran rhinos and Sumatran tigers, which can only be found in Sumatran and Borneo Island, are facing extinctions due to the high rate of tropical forests being converted to oil palm plantations. When their natural habitats are destroyed, these animals would not be able to survive and become endangered (Tan et al., 2009).

Glastra et al. (2002) claim that most of the deforestation in South East Asia has been carried out using land burning where large scale clearance caused numerous, large and

persistent fires in Sumatra. For example, it is claimed that the 1997 haze around South East Asia region was caused by this activity. Apart from that, it was also reported that from 5 million hectares of former forest in Indonesia, 3 million hectares are now covered with oil palm (Glastra et al., 2002).

Palm oil has been shown to be the most suitable candidate among all vegetable oils as the source of biodiesel production. High yield and low production cost are two of the major factors that made this vegetable oil attractive in terms of economic and environment. However, issues concerning this crop are damaging its image as an environment friendly vegetable oil. Besides, it is obvious that there is a need to introduce policies/strategies that will guide palm oil producers towards sustainable production and development. Hence, all parties involved with palm oil, from growers to consumer product manufacturers, should work closely to ensure that sustainable production is to be realized. Consequently, palm oil can become the major source of biodiesel in the world (Tan et al., 2009).

Even though the economic literature suggests a positive correlation between labour productivity and wages, there is still considerable missing evidence as to be able to define under which concrete circumstances this positive technological changes directly translate into replicable and widespread pro-poor income gains. It is therefore the aim of this study to bridge the gap between theory and practice by looking at the impact of a standard and concrete technological leap forward's contribution on income variables in Cameroonian rural selected communities. In other words, this study aims at bringing clarity on to what extent a 2-ton per hour palm oil mechanized processing technology installed in a concrete rural district, and under a clear management and regulatory structure and environment, outperforms in terms of productivity (tons of palm oil produced), quality (price of the crude palm oil) and income generation, the existing traditional manual processing palm oil producing system.

If it is successfully proven that a new technology increases production and marketability through better quality and productivity, assisting in alleviating poverty within the rural areas of Cameroon, then, this result could be used in the design of better development policies, and favour economic growth creation, poverty reduction and youth employment. Hence, if the treatment results are positive by enhancing the economic status of livelihoods within the selected areas for the intervention, then this treatment could be recommended to the Government of Cameroon as an effective tool towards pro-poor income generation, tax revenue expansion, economic structural change and job creation in these rural areas.

Income in this case indicates salaries of the workers within the installed 2-ton per hour palm oil mills.

The specific objective is to measure the effect on income generation capacity in selected rural communities of

Cameroon through the establishment of a 2-ton per hour palm oil processing technique and compare this with the income produced with the existing processing system.

MATERIALS AND METHODS

Theoretical background

The literature on the determinants of household income and poverty is well established, dating back from the literature on human capital development, economic growth, and poverty reduction (e.g. Schultz, 1961; Welch, 1970) to more recent analyses of household data (e.g. Hassan and Alhamdan, 1991; Lanjouw and Ravallion, 1995; Simler, 2004; Otsuka and Yamano, 2006). The main determinants include household size, the age and gender composition of the household, education, health, social capital, assets and endowments, and employment, among others.

Purpose of the study

To determine whether an improved palm oil processing technology has a positive effect on productivity (FFB processed and crude palm oil produced per worker), efficiency (palm oil extraction rate), and profitability (output price) of crude palm oil processing units and whether this ultimately improves the income level of its related workers. Results are compared against traditional processing centres.

To quantify the impact in terms of income of processing capacity, productivity and efficiency with respect to traditional centres.

To determine which processing equipment is more determinant in increasing the income of the workers

To issue recommendations regarding the adoption of a particular technology/processing equipment, in order to maximize income for processor workers.

Methodology

The methodology applied within this study consists of comparing key indicators across populations of small scale palm oil processors with different work environment, production capacity, socio-economic status and income levels (cross-sectional statistical analysis). The main advantage of this methodology relies on its practical feasibility and limited cost as compared to other methods. Given the regional context (Sub-Saharan Africa) it seems a prudent and rational option.

Two categories were defined for data collection at the processing level:

Traditional method: This is the method used by old traditional centres using primitive manual oil processing

techniques which are to be considered artisanal.

Modern method: This is the method used by more advanced centres with mechanized oil processing techniques. The palm oil processing machinery with capacity of at least 2-tons per hour together with auxiliary technology.

The research method

The following steps were provided for this study: Data collection (questionnaire); data analysis and comparison; presentation of the results; prediction, estimation and inference; limitations and assumptions.

Data collection (see questionnaire, p. 59):

Data were collected directly in the field from primary sources for a selected representative sample.

- Data collection methods contend: - Surveys through questionnaires which were conducted by professional surveyors. - Interviews. - 480 questionnaires with 32 questions each were collected in 4 different rural regions of Cameroon namely, the regions are: Sombo, Mkpot, Misaje and Edea. - Out of the 480 a total of 240 questionnaires were collected from community-level processing units (Traditional) and 240 from more advanced processing centers (Modern) - Statistical analysis (descriptive, estimation and post-estimation) was conducted with the statistical software: Stata/IC 12.0 for Windows (32-bit)

- The target groups were: - Direct workers and entrepreneurs within the processing mills.

The key indicators were identified and included in the surveys. Suggested indicators of reported perceptions are as follows: - Income level per palm oil processing worker or entrepreneur, - Worker productivity (unit output/unit input), - Total CPO production, -FFB pulp press capacity, and other 25 factors listed in the questionnaire (p. 59).

Data analysis and description:

The collected data were transferred from the questionnaires and inserted into an excel spread sheet and imported to the Stata software. To do so, quantitative and qualitative (dummy variables) were created, for mutually exclusive categories (sex, education, region among others).

Data were analyzed using Stata software and is presented through descriptive, inferential and predictive statistics. Visual tools such as tables, graphs, scatter plots, or tables were used. The predictive part utilized simple and multiple regression models and parametric ordinary least squares for estimating variables. In order to avoid misleading results typical tests were performed (e.g. heteroskedasticity, endogeneity, or multicollinearity). Additionally, the research study explored different models to attempt to find conclusive and significant relationships.

Limitations and assumptions:

The limitations of our study will be determined by: - Size of the sample, - The representativeness of the sample

Table 1. Summary descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Region	474	2.487342	1.113462	1	4
age	474	47.91139	11.49522	0	78
Sex	474	.7616034	.4265531	0	1
edu	474	2.888186	.7653625	1	4
housiz	474	6.580169	2.910015	1	20
inc	474	375482	631934.4	39500	6944000
land	474	.9177215	.2750788	0	1
cultarea	474	4.839135	7.984482	.5	100
agrpr	474	1.814346	.9006252	0	3
ffbpri	474	6118.143	16259.61	0	52000
totwork	474	4.835443	2.9639	0	35
worexp	474	10.29536	7.195349	0	50
equage	474	5.300844	3.931765	0	19
ffbpro	474	6.514884	11.90232	0	124
cpopro	474	.7352595	1.599244	0	18
cpoavgpr	474	498.6519	179.3527	0	775
electr	474	2197.354	5500.254	0	30000
ffbrece	474	3.635021	6.233962	0	100
ffbthr	474	.0168776	.3674522	0	8
ffbste	474	.7805422	1.135737	0	9
ffbdig	474	1.265823	27.55891	0	600
pulppress	474	.6491561	.8284894	0	4.5
oilclar	474	.5764304	.8867035	0	8
oilpack	474	18.22785	6.119216	0	30
wastman	474	1.544304	1.228252	0	3
tech	474	.4936709	.5004882	0	1
avgtim	449	5.518374	2.4002	0	12
cpoprow	428	.1632811	.2538411	.0083333	2.17
cpoprowhat	428	373275.1	493578.8	117075.7	5803367
oer	428	.1061503	.0222941	.05	.18
cpopro2	428	3.425194	24.09339	.0025	324
ffbprow	428	1.364596	1.693986	.0833333	15.5

(whether or not our sample has similar characteristics as the population in which we want to make inference in), - The particular socio-cultural context, - Problem of attribution in isolating the changing factor (was it really the technology

that increased the income of the workers, or could there be other explanations?), - Lack of treatment group and control group data (even though we will be able to collect data on a sample before and after the treatment, we will not be able

to compare it with a control group who did not suffer the treatment)

Assumptions: - Data are acceptably reliable (people are not lying, etc.), - Processing units are running and operational

A questionnaire for palm oil mill operators was created (see Annex)

RESULTS

Selected results

Table 1 presents the summary descriptive statistics collected during the survey. The following list provides the abbreviations used in the forthcoming tables and graphs.

Productivity

The results show that the traditional method can process less Fresh Fruit Bunches (FFB) per worker per year than the modern method. Modern mills can process a total of 1.8 tons of FFB per worker per year, compared to 0.98 tons/worker/year in the traditional ones (statistically significant at 95%) (Figure 1). The figure describes the relationship between the total quantity of FFB processed (t/year) in the y-axis, and the total number of workers required to do so in each of the 2 groups considered (modern and traditional centres) in the x-axis. As we can

see, for a given amount of FFB processed, traditional centres require more workers.

Controlling for the number of workers, modern mills will, on average, be able to process additional 8 tons of FFB per year than traditional mills (Table 2).

Results also show that modern mills produce a total of 0.22 tons of crude palm oil per worker and year, whereas traditional mills produce only 0.10 tons per worker and year.

Crude Palm Oil (CPO) per worker in modern centres is on average 0.12 tons per year higher than in traditional ones (Table 3), this is, 120% higher productivity.

Given the same number of workers, modern mills will, on average, be able to process additional 1.38 tons of CPO per year than traditional mills.

Figure 2 describes the relationship between the total quantity of CPO produced (t/year) in the y-axis, and the total number of workers required to do so in each of the 2 groups considered (modern and traditional centres) in the x-axis. As we can see, for a given amount of CPO produced, traditional centres require more workers.

Table 4 shows that on average, an additional worker increases the CPO production by 0.25 tons per year. This represents approximately a 30% increase with respect of the mean estimation for the CPO production for both groups.

Additionally, in traditional centres, the effect on CPO production of an additional worker is 0.11 tons per year (an increase representing 17% of the mean

Figure 1. Relationship between total FFB processed and number of workers

Table 2. Regression of FFB processing on total workers

Linear regression					Number of obs =	428
					F(2, 425) =	5.26
					Prob > F =	0.0055
					R-squared =	0.2961
					Root MSE =	10.364
ffbpro	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
totwork	2.645754	.9372409	2.82	0.005	.8035495	4.487959
tech	8.024812	2.485227	3.23	0.001	3.139946	12.90968
_cons	-10.17098	5.610654	-1.81	0.071	-21.19906	.8571074

Table 3. Hypothesis test for the difference in mean CPO produced per worker and year in traditional and modern centers

Two-sample t test with equal variances						
Group	Obs	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]	
Traditio Modern	231	.106427	.0097867	.1487447	.087144	.12571
	197	.2299476	.0232114	.3257872	.1841715	.2757237
combined	428	.1632811	.0122699	.2538411	.1391643	.187398
diff		-.1235206	.0239088		-.1705145	-.0765267
diff = mean(Traditio) - mean(Modern)				t =	-5.1663	
Ho: diff = 0				degrees of freedom =	426	
Ha: diff < 0		Ha: diff != 0		Ha: diff > 0		
Pr(T < t) = 0.0000		Pr(T > t) = 0.0000		Pr(T > t) = 1.0000		

Table 4. Effect of an additional worker on total CPO production

Linear regression					Number of obs =	428
					F(1, 426) =	5.05
					Prob > F =	0.0251
					R-squared =	0.1955
					Root MSE =	1.4942
cpopro	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
totwork	.2588851	.1151695	2.25	0.025	.0325138	.4852563
_cons	-.525508	.5584511	-0.94	0.347	-1.623171	.5721546

Figure 2. Relationship between CPO produced and number of workers

CPO production for this group), compared to 0.63 tons in modern centres (an increase representing 60% of the mean CPO production for this group). For more details on the regression see Table 5.

Even though modern mills have a smaller average number of workers (3.76 vs. 6.37), modern mills are more productive because they have on average more experienced workers (9.9 vs. 11.5 years of experience), and more capital (higher pulp press capacity on average).

The research yielded the following outputs:

Significant difference in pulp press capacity (0.25 tons per hour traditional vs. 1.25 tons per hour modern, on average)

Significant difference in the number of workers (6.37 workers in traditional vs. 3.76 in modern on Average)

Significant difference in processing capacity scale (6.7 tons of FFB per year vs. 7.8 tons of FFB per year on Average)

Significant difference in output production (0.7 tons of Crude Palm Oil Traditional per year vs. 0.95 tons of Crude Palm Oil Modern per year on Average).

None of the 2 categories reported to apply quality control system nor had a digester or thresher.

DISCUSSION

In Cameroon, palm oil is gradually being transformed from a famine-reserve subsistence commodity and rural

food to cash crop for urban consumption. For the oil palm transformation to advance take place to the next stage of human consumption and industrial raw material, access to technology and labour-saving quality production, harvesting and processing technologies are needed to reduce costs, improve productivity and make oil palm more competitive.

The major problems of the cooperative group are production capacity, product quality and hygiene conditions and limited management skills.

As suggested by Rist et al. (2010), the expansion of small-scale palm oil processing will likely provide higher returns to land and labour for rural communities, but must be accompanied by the correct set of friendly production public regimes in order to translate private gain into general interest.

As suggested in similar experiences in the region, a direct impact will be felt in the production and processing capacity & quality (Aletor et al., 1990) of the existing palm oil production units. Increased quality and quantity of Crude Palm Oil (CPO) production and other by-products will generate recurrent revenue and will attract investment in service related activities. In a broader sense, the local community as a whole will benefit from new employment opportunities, which ultimately would lead to reducing the poverty and improving the food security levels. The new technology will also support the competitiveness of the local industry by developing quality products that comply with required standards. Product diversification and market

Table 5. Effect of an additional worker on total CPO production sorted by the different centers technology

-> tech = Traditional						
Source	SS	df	MS	Number of obs = 231		
Model	18.812202	1	18.812202	F(1, 229) = 39.93		
Residual	107.894881	229	.471156687	Prob > F = 0.0000		
				R-squared = 0.1485		
				Adj R-squared = 0.1448		
Total	126.707083	230	.550900362	Root MSE = .68641		
cpopro	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
totwork	.1163258	.0184094	6.32	0.000	.0800524	.1525992
_cons	-.1200989	.1257774	-0.95	0.341	-.3679278	.12773
-> tech = Modern						
Source	SS	df	MS	Number of obs = 197		
Model	538.105267	1	538.105267	F(1, 195) = 210.38		
Residual	498.762759	195	2.55775774	Prob > F = 0.0000		
				R-squared = 0.5190		
				Adj R-squared = 0.5165		
Total	1036.86803	196	5.29014299	Root MSE = 1.5993		
cpopro	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
totwork	.6352964	.0437998	14.50	0.000	.5489142	.7216786
_cons	-1.3527	.2004976	-6.75	0.000	-1.748122	-.9572779

participation will thus drag and enhance local production and will generate earnings, investment and tax income to a state and country level. These strategies have been long suggested to developing countries as a path out of poverty (Jabara, 1980).

It is worth mentioning that in the palm oil sector it is the scale of production that matters and directly affects profitability. A 5-ton per hour is more profitable than a 2-ton per hour mill.

The results of this study are in line with other research on the capacity of agricultural growth to serve as an effective instrument for poverty reduction (The World Bank Research Observer, 2010).

Given the fact that research in this professional field seems to be the first for Cameroon as well as for the whole territory of the Equatorial Africa, it is possible to consider this research and its findings original with exceptional outputs.

The New Technology Performance calculations in this article are based on the data from questionnaires. The questions in the questionnaires were designed to also reflect efficiency indicators and a degree of Value addition in the Value Chain. There are possibilities to process the acquired data to reflect other additional positive impacts of the New Oil palm Processing Technology.

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Annex

VARIABLE LABEL	VARIABLE DESCRIPTION
Region	Sombo (1), Mkpot (2), Edea (3), Misaje (4)
age	Age (years)
sex	Male (1), Female (0)
edu	Education level: illiterate (1), Basic (2), Intermediate (3), Advanced (4)
housiz	House hold size (number of persons)
inc	Income (Central African Franc - FCFA, per year)
land	Land: inherited (1), Purchased (0)
cultarea	Total palm oil cultivated area (ha)
agrpr	Applies fertilizer (1), improved seeds (2), Both (3), None (0)
ffbpri	Price of Fresh Fruit Bunches (FFB) sold to processors (FCFA/t)
totwork	Number of workers in the processing centers (# of workers)
worexp	Working experience (years)
equage	Age of the equipment (years)
avgtim	Hours per day the center operates (hours)
ffbpro	Total FFB processed per year (tons)
cpopro	Total Crude Palm Oil production per year (tons)
cpoavgpr	Crude Palm oil average selling price (FCFA)
electrc	Total cost of electrical power per month (FCFA)
ffbrec	FFB receiving area capacity (surface area, meters)
ffbthr	FFB threshing capacity (tons/year)
ffbst	FFB sterilization capacity (tons/hr)
ffbdig	FFB fruit digestion capacity (tons/year)
pulppress	Pulp pressing capacity (tons per hour)
oilclar	Oil clarification capacity (tons per hour)
tech	Overall technology level: Traditional (0), Modern (1)
oilpack	Oil packaging capacity (CPO liters)
oer	Oil extraction rate measured as CPO (t/year) divided by FFB (t/year), expressed in percentage (%)
wastman	Waste management technique applied: manure (1), biomass (2), other (3)
cpoprow	Crude palm oil per worker and year (tons per year)
cpoprowhat	Predicted -or fitted- values for cpoprow
cpopro2	Experimental variable for cpoprow to test different hypothesis
ffbprow	FFB produced per worker (tons of FFB per year)

Questionnaire for palm oil mill operators

PERSONAL INFORMATION:

1. Name of Village: Region 1 ☐ Region 2 ☐ Region 3 ☐ Region 4 ☐
2. Region name: Region 1 ☐ Region 2 ☐ Region 3 ☐ Region 4 ☐
3. Age: years old
4. Sex: Male ☐ Female ☐
5. Education: Illiterate (can't read or write) ☐ Basic (can read) ☐ Intermediate (can read & write) ☐ advanced (certified) ☐
6. Household size: people living in the same house
7. Your income per month or year for working in the palm oil processing center is FCFA.

ECONOMIC ENVIRONMENT:

Agriculture level (in the case where you are also a farmer)

8. Your land is: inherited ☐ purchased ☐ rented ☐
9. Cultivated area? Hectares
10. Do you apply fertilizers ☐ improved seeds ☐ irrigation techniques other techniques ☐
11. You harvest Kg of fresh palm fruit nuts per month / season
12. The season lasts months
- 13 The FFB you produce is sold to the processors at FCFA per Kg

Processing

General

14. How many workers work in this processing center?
15. On average, the workers have years of working experience in processing
16. The processing equipment is on average years old
17. The palm oil processing center operates on average hours per day
18. How much can you process? Kg/t of FFB per day/month
19. What is the total production of palm oil? Kg per day / month
20. What is the highest Crude Palm Oil (CPO) selling price? FCFA
21. What is the lowest CPO selling price this year? FCFA
22. Is the output sold in bulk or packaged? Bulk ☐ Packaged ☐
23. What is the total cost of electrical power per season? FCFA

Specific

24. Does the processing center where you work have a FFB receiving area? Y ☐ N ☐
If so, what is its FFB reception area total capacity Kg/t of FFB
If not, what is the FFB reception capacity? Kg/t of FFB
25. Does the processing center where you work have a FFB thrasher? Y ☐ N ☐
If so, what is the total threshing capacity of the center? Kg of FFB / hour
If not, what is the center threshing capacity? Kg of FFB / hour
26. Does the processing center where you work have a FFB sterilization/cooker? Y ☐ N ☐
If so, what is its capacity? Kg of FFB / hour
If not, what is the center sterilization/cooking capacity? Kg/hour of FFB
27. Does the processing center where you work have a fruit digester? Y ☐ N ☐
If so, what is its capacity? Kg of Fruit per hour / day
If not, what is the center fruit digestion capacity? Kg per hour / day
28. Does the processing center where you work have a mechanical pulp press? Y ☐ N ☐
If so, what is its capacity? Kg / t of pulp per hour / day
If not, what is the center pressing capacity? Kg / t of pulp per hour / day
29. Does the processing center where you work have an oil clarifier? Y ☐ N ☐
If so, what is its capacity? Kg / t of oil per hour / day
If not, what is the center clarifying capacity? Kg / t of oil per hour / day
30. Does the processing center where you work have an oil-storing place? Y ☐ N ☐
If so, what is its capacity? m³ of storage tank capacity
If not, what is the center storing and capacity? m³
31. Does the processing center have an oil-packing unit (bottler)? Y ☐ N ☐
If so, what is its capacity? Kg / Liters of packaged palm oil per hour / day
If not, what is the center bulk container capacity? Kg / Liters
32. What is the oil extraction ratio/rate (Kg of CPO / Kg of FFB) of the processing unit where you work? %
33. Does the processing center where you work have a quality control system? Y ☐ N ☐
If so, what is the average % Free Fatty Acids in the oil that you produce?
34. Do you apply any waste management technique? Y ☐ N ☐