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A comparative cost-benefit analysis between fairtrade certified and non-certified cocoa production in the South-West region of Cameroon

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Abstract

In order to promote cocoa agroforestry by encouraging cocoa farmers to integrate fruit trees inside their cocoa orchards, cocoa certification was initially launched since 2012 in Cameroon. Nowadays, cocoa certification is adopted by a few farmers and makes up only 3 % of the national cocoa production. Using the most predominant Fairtrade certification in the South-West region, this study compared certified and non-certified cocoa production via a cost-benefit analysis. The results indicated that, in spite of its supplementary cost expenses (wages to hired workers, agrochemical expenses, transportation charges to cooperatives), certified cocoa production led to higher profit, net present value, internal rate of return, benefit-cost ratio greater than one and shorter pay-back period. For the certified farms, a scenario assuming no certification was analysed and its results testified that the young trees planted during cocoa certification further contributed to raise the farm profit. Overall, the profitability of cocoa agroforest was the highest if the farmer was certified, because of his/her premium earned, training received and adhesion to cooperatives where most group problems were solved. The study therefore recommended farmers to join cooperatives and regularly attend training programmes to learn more friendly environmental practices. In view of this, the government should increase cocoa premium or tie it with payments for full environmental benefits, including rewards for carbon sequestration and biodiversity conservation. The Fairtrade certification bodies should attract reticent farmers to certification by convincing them on the necessity to remove the old fruit trees and replace them with new species, which were more productive to raise their income.

Keywords: Cocoa agroforestry, fairtrade premium, certification adoption, financial appraisal, sacred trees

1 Introduction

With an annual production averaging 210,000 tonnes, Cameroon ranks fifth in the world as a cocoa (*Theobroma cacao*) producing country, after Côte d'Ivoire, Ghana, Indonesia and Nigeria (ICCO, 2016; Minader, 2018). Representing 2 % of the country's GDP while occupying 400,000 families, the cocoa sector nowadays faces new challenges: on the one hand, achieving increasing production targets to meet demand in constant growth and consumer exigencies in the world market; and on the other hand, cocoa production should fulfil societal considerations by prohibiting the employment of pregnant women in cocoa farming, by combating the non-payment of the market wage rate to hired labour, the destruction of the ecosystem, the encroachment on government reserves, the use of unapproved and non-recommended agrochemicals, the discarding of used cans of agrochemicals in nearby streams or rivers (Jagoret *et al.*, 2009; Olumide & Adewale, 2013; ICCO, 2016).

Overall, more emphasis is put on encouraging the schooling of children through the prohibition of child labour and

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discrimination in cocoa farming. Indeed, due to the lack of labour in rural areas caused by the rise in rural exodus, producers are sometimes obliged to use child labour in their cocoa farms (Jaza Folefack, 2015). In 2009, about 230,000 children were employed in cocoa plantations all over the cocoa producing countries including Cameroon (Fairtrade, 2012; ICCO, 2012; ICCO, 2016). The challenge of a more sustainable agriculture, in economic, environmental and social terms, but also more productive, therefore requires the development of environmentally more efficient cocoa production systems. Today, most of the country's cocoa orchards are aging and declining in productivity, while environmental friendly practices are quickly disappearing (Fairtrade, 2012; Jaza Folefack & Darr, 2021). It is in an attempt to overcome these challenges that cocoa certification was launched in Cameroon since 2012. Adopted by a few farmers nowadays, certified cocoa makes up only 3 % of the national cocoa production, and as such the country faces the threat of being banned from sales in international market if all its cocoa production is not certified by the year 2025 (Mbougha, 2015; ICCO, 2016; Ngwack, 2017). The three certification systems currently implemented throughout the national territory are namely: Rainforest Alliance/UTZ Certified, Organic, and Fairtrade. Since the merger in 2018, the UTZ certification programme joined forces with the Rainforest Alliance certified programme to promote responsible and beneficial cocoa production for both the producer and market. Rainforest Alliance/UTZ Certified requires producers to respect certain agricultural practices as well as social and environmental criteria and helps the cocoa producers to put into practice the farming systems that protect the environment (SAN, 2008; ICCO, 2012; Jaza Folefack, 2016; Nlend Nkott *et al*., 2017; Jaza Folefack & Darr, 2021). Organic certification's objective is to maintain ecosystem biodiversity, to improve/protect the health of producers and consumers while reducing poverty (ICCO, 2012; ICCO, 2016). Fairtrade certification's primary objective is to provide producers with fair market access. Its approach is to use trade as a lever for the development and reduction of inequalities, ensuring fair remuneration of producers so that they get better income from their activities. In addition to the funds derived from the marketing of their cocoa, Fairtrade certified producers benefit from a Fairtrade premium, which must be invested in local development projects (Fairtrade, 2012).

This study focuses on the Fairtrade cocoa certification system. Initially launched in 2012 together with the other ones, this is currently the most implemented cocoa certification system in the South-West region of Cameroon. The peculiarity of this certification system in this region is that it promotes respect for good agricultural practices within the cocoa farm such as: weeding techniques, sanitary harvest, pruning, shading adjustment, spraying method, fertiliser application methods, dosage of pesticides, harvesting and fermentation, respect of agricultural calendar, and namely the diversification of production. In fact, through Fairtrade certification, cocoa producers in this region of the country are encouraged to introduce domestic fruit trees into their orchards. The purpose of this diversification is to enable cocoa producers to diversify their incomes, protect biodiversity, improve shading and control certain diseases (Fairtrade, 2012; Minader, 2018).

Although Fairtrade certification requires even growing domestic fruit trees inside the cocoa orchards, the reticent farmers to certification continue to cultivate cocoa with existing/old fruit trees, which were traditionally inherited from their parents (Jaza Folefack & Darr, 2021). Besides the unwillingness of farmers to plant new fruit trees due to socioeconomic reasons described by Jaza Folefack (2016) (e.g. farmers' high illiteracy rate, low training and education level, ignorance, poverty), this is mainly justified from people traditions and customs in the study area according to which old tree species are protected areas where ancestors live to protect the village from unlucky events (Houngnihim *et al*., 2012; Jaza Folefack & Darr, 2021). Such a way of attributing much cultural or spiritual value to old tree species planted in (agro)-forests was already supported in previous studies by Tchouamo (1998) and Jaza Folefack *et al*. (2019), which revealed that old tree species are prevented from destruction in Western regions of Cameroon because the population believes that their ancestors were killed in the forests hosting these trees during wars and therefore, they are sacred seats or habitat for half-God replacing their forefathers.

Besides the cultural constraints preventing the majority of cocoa producers for removing old fruit trees from their farms, some of these farmers also think that it is less costly, less labour demanding and easier to manage cocoa orchards under their current state rather than planting new fruit trees which are expensive and time consuming for maintenance (Fairtrade, 2012; Jaza Folefack *et al*., 2015; Jaza Folefack, 2016). By refusing to renew their cocoa orchards, we therefore ask ourselves the question whether these reticent farmers to certification are right for not adopting Fairtrade or any other certification process in force in the country. Several recent studies conducted in West Africa have carried out cost-benefit analyses of cocoa production under Rainforest Alliance certification (Afari-Sefa *et al*., 2010; Gockowski *et al*., 2013; Norton, 2013; Olumide & Adewale, 2013; Aidoo & Fromm, 2015; N'Dri, 2016). In Cameroon, although studies on cocoa production systems have been quite extensive, less emphasis has been placed on using cost-benefit analysis both

as a technique for decision-making and an approach for evaluating net benefits of cocoa certification.

Our paper contributes to the literature at two levels: At a conceptual level, Fairtrade certification can be seen as a means of local economic development given that, farmers' training during certification, wages paid by certified farmers to their hired workers, transportation cost of cocoa to cooperative as well as higher farm income all contribute to a more dynamic local economy, increasing demand and consumption of products and services, increasing GDP, decreasing unemployment, preventing rural exodus/migration of young farmers to cities, etc. At the empirical level, understanding how the current/base situation (no certification in most cocoa farms) as compared to the ideal situation (certification scenario) can contribute to further developing local agroforestry systems and policies to promote fruit tree planting in cocoa orchards under such conditions. Overall, we would like to contribute to the debate on the economic, social and environmental impact of promoting Fairtrade certification in cocoa producing regions, which is particularly necessary in Cameroon in a context where most cocoa farmers hesitate on gains earned from certification process. Hence, the main objective of this paper is to evaluate the Fairtrade cocoa certification system in order to determine what costs and benefits they generate as compared to non-certified farms. More specifically, the paper aims to: (i) compare the certified cocoa farmers with the non-certified cocoa producers in terms of farm characteristics, cost, revenue and profit items and further financial appraisal indicators; (ii) simulate the scenario assuming no certification to certified farmers and compare its results with the base/current situation of the two farmers' categories.

2 Materials and methods

2.1 Study area and data collection

The field survey was carried out from February to June 2019 in the South-West region of Cameroon. By contributing to 50 % of national production of cocoa, this region was among the hot spots of cocoa production in the country and was chosen for this study because the cocoa production remained the most lucrative economic activity for its rural population (Minader, 2018). Furthermore, this region was engaged since 2012 in certified cocoa production with the predominance of Fairtrade certification in Konye sub-division/district, which was purposively selected for this study.

The survey respondents consisted of Fairtrade certified and non-certified cocoa producers in Konye district. They were selected in this locality through a two-stepwise sampling procedure. In step one, eight villages were randomly selected in the district. In step two, a total of 180 farmers i.e. 120 certified and 60 non-certified cocoa producers were randomly selected throughout the eight villages of the district.

A prepared questionnaire of closed and open ended questions were administered to certified and non-certified cocoa producers in order to request information on production costs (e.g. farm tools, mineral fertiliser, pesticides, family/hired labour, training for certification, transport of cocoa to cooperative, fruit transport to local market) and income from the sales of certified and uncertified cocoa and fruit trees integrated into the cocoa farms such as kolanut, orange, mango and avocado. These data were supplemented by reviewing the relevant literature to get the time series secondary data (from year 2012 to 2019) recorded since the launching of Fairtrade cocoa certification in the study area. These included the elements of benefits and costs, market prices of farm tools, cocoa, fruit species and various input prices used in the cocoa agroforestry system.

2.2 Data analysis

In order to achieve the study objectives, mainly the profitability analysis and financial appraisal from discounted and/or undiscounted revenues and costs variables were used in this paper. These were computed under the base/current situation (comparing certified to non-certified farmers) as well as for the scenario assuming no certification for certified farmers.

2.2.1 Mathematical expressions of computed variables

⇒ Profit computed from revenues and costs

The profit was computed from the revenues from cocoa and fruit trees associated to cocoa farms and main costs variables (depreciation of farm tools, mineral fertiliser, pesticides, family/hired labour, training for certification, opportunity cost of labour to attend training, transport of cocoa to cooperative, fruit transport to local market) for both the certified and non-certified cocoa farms by using data of the cropping season 2018/2019.

For a certified cocoa producer, the total cost was calculated according to the following formula:

$$\begin{aligned} TC = Cmat + Cpest + Cfert + Cwlab + Ccert \\ + Copp + Ctcoc + Ctfruit \end{aligned} \quad (1)$$

However, a non-certified cocoa farmer considered the family labour cost but neglected the training cost of certification, the opportunity cost of labour to attend training and the transport cost of cocoa to cooperative. Hence, the total cost for this

farmer's category was computed according to the following formula:

$$\text{TC} = \text{Cmat} + \text{Cpest} + \text{Cfert} + \text{Cwlab} + \text{Cflab} + \text{Ctfruit} \quad (2)$$

Where: TC: total cost; Cmat: farm tools' cost of depreciation; Cpest: cost of pesticides application; Cfert: cost of fertiliser application; Cflab: family labour cost; Cwlab: hired labour cost; Ccert: training cost for certification; Copp: opportunity cost of labour to attend training; Ctcoc: transport cost of cocoa to cooperative; Ctfruit: fruit transport cost to local market.

The total revenue of a certified cocoa producer was computed by considering the sales of cocoa and fruit tree products integrated into the cocoa farms as well as the premium paid to this farmer's category. Hence, for the certified cocoa farms, the total revenue was computed as follows:

$$\text{TR} = \text{Rsc} + \text{Rsf} + \text{Rprm} \quad (3)$$

By subtracting from Equation 3 the premium amount, which was not considered for non-certified cocoa farms, we obtained Equation 4 used to compute total revenue from non-certified cocoa producers as follows:

$$\text{TR} = \text{Rsc} + \text{Rsf} \quad (4)$$

For certified cocoa farms, profit was computed by subtracting TC (Equation 1) from TR (Equation 3) as follows:

$$\pi = (\text{Rsc} + \text{Rsf} + \text{Rprm}) - (\text{Cmat} + \text{Cpest} + \text{Cfert} + \text{Cwlab} + \text{Ccert} + \text{Copp} + \text{Ctcoc} + \text{Ctfruit}) \quad (5)$$

Likewise, profit for the non-certified cocoa farms was computed by subtracting TC (Equation 2) from TR (Equation 4) as follows:

$$\pi = (\text{Rsc} + \text{Rsf}) - (\text{Cmat} + \text{Cpest} + \text{Cfert} + \text{Cwlab} + \text{Cflab} + \text{Ctfruit}) \quad (6)$$

Where: π: profit; TR: total revenue; Rsc: income from the sales of cocoa; Rsf: income from the sales of fruit tree products; Rprm: income from the premium paid.

⇒ *Financial appraisal*

In this study, the returns of cocoa and associated fruit tree species in the certified and non-certified cocoa farms were measured by using the appraisal tools of Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR), and Pay-Back Period (PBP).

The NPV was the difference in monetary terms, between the discounted flow of benefits and the discounted flow of costs of the cocoa and associated fruit tree species over life span of Fairtrade cocoa certification system. It was mathematically expressed as:

$$\text{NPV} = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+i)^t} \quad (7)$$

The BCR was the ratio of discounted benefits over the discounted costs of cocoa and associated fruit tree species, expressed as:

$$\text{BCR} = \sum_{t=1}^{n} \frac{B_t}{(1+i)^t} \Big/ \sum_{t=1}^{n} \frac{C_t}{(1+i)^t} \quad (8)$$

The IRR was the discount rate at which the NPV was equal to zero. It was mathematically expressed as:

$$\text{IRR} = i_p + \frac{(i_n - i_p) * \text{NPV}_p}{(\text{NPV}_p - \text{NPV}_n)} \quad (9)$$

The PBP was the capital's recovery period, which corresponded to the year at which the cumulated cash flow of benefits was equal to the total cost initially invested into the cocoa and associated fruit tree species. Mathematically, it was expressed as:

$$\text{PBP} = \frac{C_0}{\sum_{t=1}^{n} B_t} \quad (10)$$

Where: B: was the gross benefit earned from cocoa and associated fruit tree species; C: was the total cost spent for the production of cocoa and associated fruit tree species; C_0: initial investment; t: was the time horizon lasting from year one (2012) to eight (2019) of the implementation of Fairtrade cocoa certification in the study area; i: was the discount rate; i_p: any discount rate with positive NPV; i_n: any discount rate with negative NPV; NPV_p: value of the positive NPV; NPV_n: value of the negative NPV.

As decision rule, the cocoa agroforestry system would be financially profitable when its PBP was very short, NPV was positive, BCR greater than one, IRR was greater than the money's interest rate in local banks (Jaza Folefack *et al.*, 2015).

2.2.2 *Scenario assuming no certification for certified farmers*

The scenario assuming no certification for certified farmers was analysed in this study in order to assess profitability of a Fairtrade certified farmer "with" and "without" Fairtrade certification related costs and revenues. The "without" Fairtrade certification scenario was based on research stations data recorded from cocoa orchard with similar charac-

teristics like certified cocoa farms in the study area (IRAD, 2019).

3 Results

3.1 Characteristics of certified and non-certified cocoa farms

From Table 1, the main highlight was that the certified cocoa plantations were smaller (6.2 ha) than the non-certified cocoa farms (7.1 ha). As certification was a new process recently launched since 2012 in the country, farmers needed a little bit more time to understand and get use to the process before transforming the entirety of their plantations from non-certified to certified ones. In Table 1, cocoa plants had the same density (1,111 trees m^{-2}) in the two groups. However, certified cocoa plants were younger (18 years) than non-certified cocoa trees (26 years). This is because Fairtrade certification validated young cocoa farms belonging to the stability phase (stage III) of Nerlove production function whereas the non-certified cocoa farms aged of 26 years were not validated because they were beyond their maturity stage (phase IV) which required renewal of cocoa plants (Nerlove, 1958).

In Table 1, the harvested fruit production varied from tree species and density of plantation. Overall, the certified cocoa farms planted higher number of fruit trees (23 trees ha^{-1}) than the non-certified cocoa farms (18 trees ha^{-1}) in order to conform to the minimum standard (20 shade trees ha^{-1}) set by the Fairtrade certification board and the Sustainable Agriculture Network (SAN, 2008).

Contrary to non-certified farmers (Table 1), certified producers did not employ family labour (0 vs. 39 manday ha^{-1} $year^{-1}$) due to the restriction imposed by certification bodies. Hired labour was however employed by the two farmers' categories, although certified producers used higher amount (76 manday ha^{-1} $year^{-1}$) than non-certified farmers (4 manday ha^{-1} $year^{-1}$) because of their permanent labour need to undertake difficult tasks imposed by certification bodies (e.g. trimming, weeding, phytosanitary treatment, fermentation, drying, etc).

By considering the farmers' age, Table 1 results indicated that certified producers (41 years) were younger than non-certified farmers (58 years). While on average older farmers less likely adopted cocoa certification in the study area, some previous studies however proved the opposite (Aidoo & Fromm, 2015; Jaza Folefack *et al.*, 2015) testifying that our results should not be overgeneralised.

The higher cocoa yield recorded in certified farms (452 kg ha^{-1}) as compared to the non-certified farms (354 kg ha^{-1}) could be attributed to the fact that most certified cocoa trees were at their most productive age according to Nerlove production function (Nerlove,1958). Besides, the certified cocoa farmers regularly received training (two times per month), good attention of technical services, pieces of advice from their cooperatives and certification bodies, and a premium of 25 kg ha^{-1} of cocoa sold (Table 1) (Nkouedjo *et al.*, 2020). Given that being a cooperative member was a precondition to become a certified producer, it was not surprising to see in our results that certified producers bore transport cost of cocoa to cooperative (0.2 kg ha^{-1}), as contrary to the non-certified farmers who sold their cocoa to door-to-door traders with no transport charge (Table 1).

Although the certification process required taking precaution on input application, our results surprisingly indicated that the certified farmers used higher amount of mineral fertiliser (297 vs. 144 kg ha^{-1} $year^{-1}$) and pesticides (297 vs. 144 liters ha^{-1} $year^{-1}$) than the non-certified producers (Table 1).

3.2 Elements of costs, revenues and profits for certified and non-certified cocoa farms

In Table 2, certified and non-certified cocoa producers were differentiated by considering the detailed elements of costs. The two farmers' categories used the same farm tools (wheelbarrow, hoe, cutlass, boat, etc) for their fieldwork thereby justifying the null farm tools' cost difference (Table 2). The other costs however differed between the two groups; but the divergence extents or expected results were not similar for each type of input. For instance, although the Fairtrade certification recommended the reduction of the use of agrochemical inputs, we were expecting a reduction of the aggregated mineral fertiliser and pesticides costs which were rather higher for the certified cocoa farms (118,538 FCFA ha^{-1} vs. 57,632 FCFA ha^{-1} in non-certified farms) (Table 2). This result might be justified by the fact that in Konye, the preponderance of heavy rains tended to facilitate the development of diseases (such as "black pod") which constrained the certified producers to obtain good quality cocoa (in order to have access to the best markets), to use more phytosanitary products in order to prevent or to get rid of these diseases which was not the case for non-certified producers. Another observation made on the field showed that certified producers who were members of the cooperative did not seem to master the exigencies of the norms of certification consequences; the good agricultural practices intended to enable them to reduce their use of chemical inputs were not applied by the majority of them.

With regard to hired labour costs, certified farmers spent higher amount (113,780 FCFA ha^{-1}) than non-certified pro-

Table 1: *Major characteristics differentiating certified (Cert) from non-certified (NCert) cocoa farms.*

		Cert (N=120)	*NCert (N=60)*	*Difference**
Plot size (ha)		6.2	7.1	-0.9 (-1.886)*
Plot age (years)		18	26	-8 (-2.878)***
Farmers' age (years)		41	58	-17 (-3.035)***
Family labour† (manday ha^{-1} $year^{-1}$)		0	39	-39 (2.009)**
Hired labour (manday ha^{-1} $year^{-1}$)		76	4	72 (2.775)***
Mineral fertiliser application‡ (kg ha^{-1} $year^{-1}$)		297	144	153 (2.119)**
Pesticides application‡ (liters ha^{-1} $year^{-1}$)		6.59	3.20	3.39 (1.885)*
Training for certification§ (n° times per month)		2	0	2 (1.666)*
Density of existing fruit trees	[K]	5	4	1 (1.860)*
(n° trees ha^{-1})	[O]	3	2	1 (2.333)**
	[M]	14	11	3 (2.444)**
	[A]	1	1	0 (0.000)
Harvested fruit production¶	[K]	3.67	2.95	0.72 (1.776)*
(kg ha^{-1} $year^{-1}$)	[O]	11.01	8.85	2.16 (2.113)**
	[M]	47.18	37.94	9.24 (2.217)**
	[A]	14.68	11.80	2.88 (1.449)
Fruit transport cost to local	[K]	0.2	0.2	0 (0.000)
market‖ (FCFA kg^{-1})	[O]	0.2	0.2	0 (0.000)
	[M]	0.2	0.2	0 (0.000)
	[A]	0.2	0.2	0 (0.000)
Fruit selling price (FCFA kg^{-1})	[K]	500	500	0 (0.000)
	[O]	300	300	0 (0.000)
	[M]	700	700	0 (0.000)
	[A]	500	500	0 (0.000)
Cocoa plants' density (n° trees ha^{-1})		1,111	1,111	0 (0.000)
Cocoa yield (kg ha^{-1})		452	354	98 (2.344)**
Transport cost of cocoa to cooperative‖ (FCFA kg^{-1})		0.2	0	0.2 (1.723)*
Cocoa selling price (FCFA kg^{-1})		1,000	850-900	100-150 (1.745)*
Premium received from cocoa sales (FCFA kg^{-1})		25	0	25 (2.344)**

Notes: [K]=Kolanut; [O]=Orange; [M]=Mango; [A]=Avocado.
* Cert minus NCert. † Non-certified farmers used mainly family labour. A family counted on average six persons of active age; with each person spending on average one hour per week for cocoa farming activity. Hence, the yearly family labour was: 1*6*52=312 hours i.e. 312/8=39 mandays (by considering one manday as eight hours of working time).
‡ Our computed figures were higher than the Fairtrade certification standard according to which a certified cocoa farmer should apply a maximum of 107 kg ha^{-1} $year^{-1}$ of mineral fertiliser and 480 ml ha^{-1} $year^{-1}$ of pesticides (SAN, 2008; Afari-Sefa *et al.*, 2010).
§ One training session lasted approximately four hours.
¶ The harvested fruit production based on research stations data for non-certified cocoa agroforests with similar farm characteristics in the study area was: 3.22 kg ha^{-1} for kolanut, 9.65 kg ha^{-1} for orange, 41.35 kg ha^{-1} for mango, and 12.86 kg ha^{-1} for avocado.
‖ Transport cost was computed based on the official transport rate of 40 FCFA t^{-1} km^{-1}. Since the cooperative and market were located to 5 km from most farms, transport cost was therefore 0.2 FCFA kg^{-1} in computations.
***,**,*: Significant at 1 %, 5 %, 10 %; t-value in parenthesis. 1 Euro = 656 FCFA; 1 USD = 580 FCFA.

ducers (6,293 FCFA ha^{-1}) (Table 2). This could be because the certified cocoa production required much more work; in particular for tasks such as trimming, weeding of the parcel (at least twice per season), breaking the pots using a stick and not cutlasses, fermentation, drying and phytosanitary application which generally required the services of a pre-trained staff. Furthermore, the non-certified farms employed children, pregnant women or family labour (58,500 FCFA ha^{-1})

Table 2: *Descriptive field results differentiating the certified (Cert) and non-certified (NCert) cocoa farms by considering the elements of revenues, costs and profits (in FCFA ha^{-1} year^{-1}).*

		Cert (N=120)		*NCert*	*Difference*‡	
		*Cert$_{base}$**	*Cert$_{scen.}$* †	*(N=60)*	*I*	*II*
Costs						
Farm tools		53,916	53,916	53,916	0 (1.012)	0 (0.000)
Mineral fertiliser[a]		88,904	88,904	43,224	-45,680 (-2.876)***	-45,680 (-1.845)*
Pesticides[a]		29,634	29,634	14,408	-15,226 (-2.443)**	-15,226 (-1.742)*
Family labour[b]		0	58,500	58,500	58,500 (1.889)*	0 (0.000)
Hired labour[c]		113,780	6,293	6,293	-107,487 (-2.443)**	0 (0.000)
Opportunity cost of labour to attend training[d]		18,000	0	0	-18,000 (-1.778)*	0 (0.000)
Training cost of certification		1,967	0	0	-1,967 (-1.785)*	0 (0.000)
Transport cost of cocoa to cooperative[e]		90.4	0	0	-90.4 (-1.888)*	0 (0.000)
Fruit transport cost to local market[e]	[K]	0.734	0.644	0.590	-0.144 (-1.776)*	-0.054 (-1.888)*
	[O]	2.202	1.930	1.770	-0.432 (-1.912)*	-0.160 (-1.742)*
	[M]	9.436	8.270	7.588	-1.848 (-2.404)**	-0.682 (-2.006)**
	[A]	2.936	2.572	2.360	-0.576 (-1.787)*	-0.212 (-1.892)*
Total Cost (TC)		306,307	237,260	176,353	-129,954 (-3.016)***	-60,907 (-2.987)***
Revenues						
Sales of cocoa production[f]		463,300	382,500	318,600	-144,700 (-1.862)*	-63,900 (-2.002)**
Sales from fruit trees associated to cocoa[g]	[K]	1,835	1,608	1,475	-360 (-1.777)*	-133 (-2.176)**
	[O]	3,302	2,894	2,656	-646 (-2.305)**	-238 (-2.443)**
	[M]	33,024	28,942	26,555	-6,469 (-2.967)**	-2,387 (-1.777)*
	[A]	7,339	6,432	5,901	-1,438 (-2.222)**	-531 (-2.315)**
Total Revenue (TR)		508,800	422,376	355,187	-153,613 (-1.722)*	-67,189 (-1.888)*
Profit						
Profit π =TR-TC		202,493	185,116	178,834	-23,659 (-2.002)**	-6,282 (-2.771)***

Notes: [K]=Kolanut; [O]=Orange; [M]=Mango; [A]=Avocado.

* Cert$_{base}$: Base/current situation; † Cert$_{scen.}$: Scenario assuming no certification. Our assumption was based on research station data for cocoa orchards with similar characteristics like certified cocoa farms in the study area (see IRAD, 2019).

‡ Difference I: NCert minus Cert$_{base}$; II: NCert minus Cert$_{scenario}$

[a] Contrary to our expectations, certified cocoa farmers were more commercial than friendly environmental oriented. Hence, they used mineral fertiliser and pesticides at dosage requested by research stations (297 kg ha^{-1} and 6.59 liter ha^{-1}, respectively) rather than lower dosage requested by certification agencies (see Table 1). Costs were computed by assuming market prices of 300 FCFA kg^{-1} and 4,500 FCFA liter^{-1} for mineral fertiliser and pesticides, respectively.

[b] Family labour cost was computed by multiplying the yearly use of family labour (see Table 1) to the labour wage rate (1,500 FCFA per manday) in the study area. In the scenario assuming no certification, since this farmer's category was not prohibited from employing children and pregnant women in cocoa farming, they would use family labour rather than hired labour, which was more expensive. Hence, they would use exactly the same amount of family labour as non-certified farmers.

[c] Hired labour cost was computed by multiplying the yearly use of hired labour (see Table 1) to the labour wage rate (1,500 FCFA per manday) in the study area.

[d] For certified farmers, training (four hours per session) was undertaken two times per month i.e. eight hours (one manday) per month equivalent to 12 mandays per year. Labour was remunerated at 1,500 FCFA per manday i.e. 12*1,500=18,000 FCFA per year.

[e] Transport cost of cocoa to cooperative and fruit transport cost to local market were based on the official transport rate of 40 FCFA ton^{-1} km^{-1}. Since the cooperative and market were located to 5 km from most farms, transport cost was 0.2 FCFA kg^{-1} in computations.

[f] Sales of cocoa production was based on cocoa yield of 452, 425 and 354 kg ha^{-1} respectively for Cert$_{base}$, Cert$_{scenario}$ and NCert. The selling cocoa prices were 1,025 FCFA kg^{-1} for Cert$_{base}$, and 900 FCFA kg^{-1} for both Cert$_{scenario}$ and NCert (see Table 1).

[g] Sales from fruit trees associated to cocoa were computed based on harvested fruit production and the market fruit prices of Table 1.

***,**,*: Significant at 1 %, 5 %, 10 %; t-value in parenthesis; 1 Euro = 656 FCFA; 1 USD = 580 FCFA.

as compared to the certified farms whose use of children or pregnant women was prohibited for farming, which might justify their null value for family labour (Table 2).

As far as certification cost is concerned, the only cost to certified producers was the transportation cost to the training site. The training itself was usually under the responsibility of the cooperative's partner. The cost of audits was usually subtracted from the premium that producers receive. Thus, certified producers spent an average of 1,966 FCFA year^{-1} as travel expenses to the training site; but the opportunity cost of labour for this farmer's category to attend the training was valued at 18,000 FCFA year^{-1} (Table 2).

In total, Table 2 results showed that certified cocoa producers spent 306,307 FCFA ha^{-1} while non-certified farmers spent 176,353 FCFA ha^{-1}; thus a difference of 129,954 FCFA ha^{-1}. This difference might be due to the high labour cost to apply good agricultural practices and high training cost spent by certified farmers in order to obtain validation of their plantation by the auditing committee in charge of certification.

It is clear from Table 2 that the certified cocoa farms generated higher revenue (508,800 FCFA ha^{-1}) than the non-certified cocoa farms (355,187 FCFA ha^{-1}); thus a difference of 153,613 FCFA ha^{-1}. Overall, it could be remarked from Table 2 results that the profit (as well as total revenue or cost) of the scenario assuming no certification ($Cert_{scenario}$) ranged between the profit value of certified farmers under base/current situation ($Cert_{base}$) and that of non-certified producers (NCert). This testified that a standard Fairtrade certified farmer, just because of his/her young age or more productive cocoa orchard was more profitable than the other group even if he/she would not be Fairtrade certified.

3.3 Results from financial appraisal of certified and non-certified cocoa farms

Table 3 presents the results from financial appraisal of certified and non-certified cocoa farms. The financial appraisal was based on the costs and benefits' elements of the different farms over a period of eight years (from 2012 to 2019) and by using a 15 % discount rate corresponding to the interest rate that was practiced by microfinance institutions in the study area (Table 3).

According to the Pay-Back Period (PBP) criterion, it appears that non-certified farmers spent much more time for recovering the capital invested (4.15 years) as compared to certified producers who needed only 3.60 years to recover their initial investment (Table 3). This finding was consistent with the fact that although certification brought new costs elements, the latter were quickly covered by the additional income received by certified producers when they sold their cocoa. In Table 3, the PBP of the scenario assuming no certification (3.94 years) ranged between the two previous PBP values, suggesting that even if they did not undertake certification process, the certified farmers would still recover more quickly the capital invested than non-certified producers in reason of the young age of their cocoa plants and the application of agricultural inputs in their plantations. Indeed, in addition to the fact that the certified cocoa producers had higher income than non-certified producers, they also enjoyed a premium of 25 FCFA on each kilogramme of cocoa sold, which shortened their PBP (Nkouedjo *et al*., 2020).

According to the Net Present Value (NPV) criterion, Table 3 indicates that the two cocoa-based systems were profitable. However, compared to the non-certified farmers (NPV=801,892 FCFA ha^{-1}), the certified producers were more profitable both under the base/current situation (NPV=908,789 FCFA ha^{-1}) and the scenario assuming no certification (NPV=830,801 FCFA ha^{-1}); probably because of the same reasons highlighted by using the PBP criterion.

According to Internal Rate of Return (IRR) criterion, Table 3 indicates that the two cocoa-based systems were profitable because their computed IRR values stood above the 15 % interest rate of funds borrowed in banking institutions in study area (Jaza Folefack *et al*., 2015). Overall, the certified farmers recorded the highest performance with an IRR on scenario assuming no certification (35.77 %) ranging below the base value (42.83 %) and that of non-certified farmers (29.64 %).

The difference of IRR in the two systems gave 13.19 % (base situation) or 6.13 % (scenario assuming no certification), which implied that even if a certified cocoa farmer borrowed money to renovate its plantation in order to fulfil the certification criteria, he/she would still refund that money with so much ease. The difference between the IRR and the money's interest rate implied that the certified farmer would still gain 42.83 % minus 15 %=27.83 % (base situation) or 35.77 % minus 15 %=20.77 % (scenario assuming no certification) of funds after reimbursement. However, the non-certified farmers would be able to gain only 29.64 % minus 15 %=14.64 %, which was relatively small if we considered that farming activities were subject to risks and uncertainties.

The Benefit-Cost Ratio (BCR) criterion shows that the two cocoa-based systems were profitable. However, with a ratio equal to 1.66 (base situation) or 1.78 (scenario assuming no certification), the certified cocoa farms appeared to be less profitable than the non-certified cocoa farms with a ratio equal to 2.01 (Table 3). The lower BCR of certified producers might be due to high labour and training costs that this farmer's category spent in order to conform to certification process and the purchase of fertiliser and pesticides for the unfriendly environmental practices undertaken by this group for phytosanitary fight, although forbidden by Fairtrade certification bodies (Jaza Folefack *et al*., 2015; Ngwack, 2017).

Table 3: *Financial appraisal indicators of comparison between certified (Cert) and non-certified (NCert) cocoa farms.*

	Cert (N=120)		*NCert*	*Difference*‡	
	$Cert_{base}$ *	$Cert_{scen.}$ †	*(N=60)*	*I*	*II*
PBP[a] (years)	3.60	3.94	4.15	-0.55	-0.21
NPV[b] (FCFA.ha-1)	908,789	830,801	801,892	106,897	28,909
IRR[c] (%)	42.83	35.77	29.64	13.19	6.13
BCR[d] (ratio)	1.66	1.78	2.01	-0.35	-0.23

* $Cert_{base}$: Base/current situation; † $Cert_{scen.}$: Scenario assuming no certification. Our assumption was based on research station data for cocoa orchards with similar characteristics like certified cocoa farms in the study area (see IRAD, 2019).
‡ Difference I: $Cert_{base}$ minus NCert; II: $Cert_{scenario}$ minus NCert
[a] PBP = Pay-Back Period; Computed by considering an initial capital investment of 875,000 FCFA ha^{-1} for cocoa plantation in the study area (Ngwack, 2017).
[b] NPV=Net Present Value; Computed by taking a discount rate of 15 % valid in study area (Jaza Folefack *et al*., 2015).
[c] IRR=Internal Rate of Return; [d] BCR=Benefit-Cost Ratio.
1 Euro = 656 FCFA; 1 USD = 580 FCFA.

4 Discussion

4.1 Certified cocoa producers bore higher input costs

Our field survey findings testified that certified cocoa farmers bore higher input costs as compared to non-certified producers (Table 2). However, the input costs bore by the certified farmers could even be higher if this farmer's category purchased specific farm tools such as personal protective equipment and suitable storage facility, which were strictly recommended by Fairtrade certification but unfortunately not used by this farmer's category in the study area (SAN, 2008; Afari-Sefa *et al*., 2010). These results were in line with Norton (2013) study in Ghana, which demonstrated that certified cocoa production required additional means to purchase improved inputs that were generally more costly than those used in the conventional cocoa production system. This author mentioned the example of manpower requirement, which was needed in higher amount; hence costly for certified producers in order to obtain a better cocoa quality at the end of their production.

In the same line, our results were in conformity with another study by Mbougha (2015) which indicated that in all types of certified cocoa farms (UTZ Certified, Rainforest Alliance, Organic and Fairtrade) in the Centre region of Cameroon, labour costs were the highest (75 % of total annual costs) with hired labour amounting to more than half (53 %). These were further confirmed with another study by Olumide & Adewale (2013), which demonstrated that because of the high labour and training costs, the production of certified cocoa was more costly than that of uncertified cocoa in Ondo State, Nigeria.

However, according to Aidoo & Fromm (2015) these high input costs should be considered as opportunities rather than threats to certification because they were easily covered by intangible benefits earned through training, premium award and various other advantages received from certification bodies. Nlend Nkott *et al*. (2017) argued in the same line like Aidoo & Fromm (2015) by recommending the cocoa producers to organize themselves into cooperatives to alleviate group sales and high transportation cost issues, the creation of awareness about certification and continuous education of cocoa farmers in order to stimulate adoption of cocoa certification to achieve sustainability in the cocoa industry.

4.2 Certified cocoa producers were compensated from various agronomic and economic advantages in spite of their unfriendly environmental practices

Our results (Tables 1 and 2) testified that certified cocoa producers were compensated from various agronomic (e.g. young cocoa plants, training on good agricultural practices, access to improved inputs) and economic advantages (e.g. transport solved issues through group sales by cooperatives, premium earned by the certified farmers in spite of their unfriendly environmental practices in the field).

A review of recent literature found similar results in a previous study by Ngoucheme *et al*. (2016) who demonstrated that because of their young age, Fairtrade certified cocoa farms yielded 174 kg ha^{-1} more cocoa than non-certified cocoa plantations, providing a beneficial margin difference of 233,280 FCFA ha^{-1} as well as various intangible benefits or positive effects from preserving agroforest ecosystems. Ngoucheme *et al*. (2016) used a different certification scheme but reached a similar conclusion indicating that in the Centre region of Cameroon, certified cocoa production under UTZ certification significantly improved producers' incomes. Their results were also in line with those of

Olumide & Adewale (2013), which demonstrated that certified cocoa production in Nigeria increased producer income. However, according to Gockowski *et al*. (2013), the profitability of Rainforest Alliance certified shade-grown cocoa production (RA-Cocoa) in Ghana, even though generated positive returns, was in all of the policy scenarios, inferior to that of high-tech (no-shade intensified system) production promoted by government as a tool for attaining its objective of one million tonnes of cocoa production in 2012.

Nevertheless, although certification is being advertised and promoted by governments of the main cocoa producing countries who seek to maintain their leading position in a competitive cocoa international market requiring to ban the purchase of non-certified cocoa from its customers from 2025 onwards; care should however be taken to deliver certification documents only to more environmental friendly producers rather than to producers seeking just their profit maximization. Our field survey results indicated the high use of agrochemical products by certified farmers, which implied that Fairtrade certification was not effective in terms of increasing sustainability of cocoa production. It suggested that the more commercially oriented farmers sought Fairtrade certification and aimed to maximize their production. It might also suggest poor implementation and weak enforcement of the Fairtrade standard requirements.

Nonetheless, other previous studies revealed opposite results by testifying that, certified agroforestry based cocoa systems were generally considered to be more environmental friendly and might also limit soil erosion and enhancing soil fertility and biodiversity. This was the case of the study of Gockowski *et al*. (2013) which, concluded that the environmental services maintained at the plot level of RA-Cocoa production system were greater than those of the high-tech production system in Ghana. This corroborated findings in West and Central-Africa by Sonwa *et al*. (2014) that perennial agroforestry systems such as cocoa agroforestry were assets for Payment for Environmental Services (PES) such as carbon storage and biodiversity conservation, because of the potential of the resources that they could generate.

4.3 Financial appraisal indicators were more favourable to certified cocoa farms

Results indicated that being a certified cocoa producer was more advantageous because it generated higher profit, NPV, IRR, BCR greater than one and shorter PBP. These results were consistent with those obtained by Olumide & Adewale (2013), which demonstrated that in Ondo State, Nigeria, certified cocoa production was more profitable with NPV equal to 2,238,090 FCFA ha^{-1} and 1,062,329 FCFA ha^{-1} for certified and non-certified farms, respectively. Another previous research by Magne *et al*. (2014) in comparing the traditional cocoa agroforest systems with the intensified models of cocoa agroforest systems (similar to certified cocoa systems in this study) in southern Cameroon indicated that all farm types had positive NPV and the intensified systems had the highest NPV at all discounted rate scenarios.

These results were also similar to those obtained by Afari-Sefa *et al*. (2010) in Ghana who demonstrated that certified cocoa production was more profitable (BCR=1.05) than non-certified cocoa (BCR=0.97). However, this slight difference might not provide enough incentive for a producer to certify cocoa production. According to Asare *et al*. (2014), cocoa agroforest premiums alone are not attractive enough for farmers to shift from no shade cocoa to cocoa agroforestry. To encourage cocoa farmers to do so, premiums from cocoa agroforestry need to be tied with payments for full environmental benefits, including, rewards for carbon sequestration and biodiversity conservation.

5 Conclusion and recommendations

Cocoa certification is an innovation that is becoming more and more widespread in the main cocoa-producing countries. Its main objectives were to improve the quality of cocoa marketed, protect the environment and improve the well-being of the producers through income improvement programmes. Nevertheless, it remains an innovation of niche in Cameroon and whose effects are yet to be fully perceived. The cost-benefit analysis of Fairtrade certification carried out in the South West region of the country revealed that non-certified cocoa producers had lower production costs than certified producers. However, certified producers had higher income than non-certified producers. The financial appraisal indicators of Pay-Back Period (PBP), Net Present Value (NPV), Internal Rate of Return (IRR) and Benefit-Cost Ratio (BCR) testified that the certified cocoa farms were more profitable than the uncertified cocoa farms. Hence, encouraging cocoa farmers to adopt the certification would increase their returns thereby improving their living conditions.

For the certified farmer's category, a scenario assuming no certification was analysed and the results testified that the profit as well as the value of each appraisal indicator (PBP, NPV, IRR, BCR) of this scenario ranged between the value of certified farmers under base/current situation and that of non-certified producers. This testified that even if a certified producer was not Fairtrade-certified, he/she would still earn higher profit than the non-certified group because of his/her younger and more productive cocoa orchard. We therefore conclude that material differences that character-

ised each farmer's category strongly affected the profitability of their operations.

Notwithstanding, the current Fairtrade certification in no way obliges cocoa farmers the transition from non-certification of their farms to certified cocoa agroforestry-based cultivation systems. Nurturing a more extensive transition to certified cocoa agroforestry-based system would require close collaboration between cocoa producers, their organisations and certification bodies. It becomes imperative to cultivate and nurture such collaboration to promoting growth of more sustainable cocoa-growing systems in Cameroon.

In order to implement a successful transition from non-certified to certified cocoa agroforestry-based cultivation systems in Cameroon, it is recommended that the certified cocoa producers should regularly attend training programmes relating to certification and ensure careful application of more friendly environmental practices or good agricultural techniques that would allow them to reduce the costs of phytosanitary products and chemical fertilisers, improve their yield, and obtain better quality of cocoa. Furthermore, the non-certified producers should join the cooperatives in order to be able to sell at better prices and also to benefit from all the other services that the latter offers, inter alia, access to improved inputs, access to training and certification schemes, etc.

To the Cameroonian government, in order to harmonise and regulate the certification process of cocoa in the entire territory, the administrative authorities should set up a price stabilisation mechanism through a policy of the minimum price as it is done in the other cocoa producing countries. Such a price mechanism with a clear and significant difference between the purchase price of certified and conventional cocoa would encourage more producers to go to certification and thus improve their income. Furthermore, in order to motivate non-certified producers to engage the certification of their farm in future, the current cocoa premium (25 FCFA kg^{-1}) from cocoa certification need to be improved or tied with payments for full environmental benefits, including, rewards for carbon sequestration and biodiversity conservation.

To the Fairtrade certification institutions, in respect to people's religion, culture and tradition in the study area; they should cooperate with reticent farmers' category by convincing them on the necessity to remove the old fruit species ("sacred trees") and replace them with new ones, which are more productive to raise their income.

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Conflict of interest

The authors declare that they have no conflict of interest.

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