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The Determinants of Marketing Efficiency of Cocoa Farmer Organization in Cameroon

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Abstract

Access to the market for smallholder is a permanent concern of actors of development in developing country. Many studies carried out arrived at conclusions according to which the smallholder still badly connected to the agricultural market (Key et al., 2000; Gabre-Madhin, 2001; Gabre-Madhin, 2009). One of the solutions is to improve the access of those smallholder to the market is the collective marketing of their product through the farmer's organizations (FOs). These FOs being regarded as small commercial firms, the question of their efficiency remains a permanent concern for the farmers who do always participate to this form of marketing. This article thus aims of measuring the differences in efficiency between the forms of FOs and identifying the determinants of these differences in efficiency. The estimation of efficiency levels is made by the DEA model and the identification of the determinants of these efficiency levels is made by the model of negative binomial regression. Globally, the results show that FOs commercial efficiency is still low. This level is estimated at 0.57. Besides, efficiency is significantly affected by FO's internal factors (FOs' age, number of years spent in the position by the FOs' administrative staff, governance level of FOs, education level of FOs' leaders and leaders' productive capacity) and external factor (area removal). In particular, the results indicate on the one hand that the age at which FO is mature for marketing efficiency is 32 months. This age which seems to be rather long may be due to the fragility of most of FOs. On the other hand, the estimation indicates that the weight of productive leaders encouraged them to meet the objectives of farmers.

Keywords: cocoa, farmer organization, marketing efficiency, Cameroon

1. Introduction

Cocoa represent an important economic and social issue in Cameroon (6% of exports in 2006, a contribution of 115 billion CFA francs to the national economy with about 260,000 farmers for 400,000 ha of area covering). Market access for small farmers is an ongoing concern of development actors in developing countries. Many studies have found that the small farmer is still not well connecting to the agricultural market (Key et al., 2000, Gabre-Madhin, 2001, Gabre-Madhin, 2009). One way to improve access of small farmers market is collective marketing of their product through the farmer organizations (FOs). The analysis of the importance of farmers' organizations is relatively new. Thus, the works which identify and evaluate the effects of collective action by farmers on their activity are few. Nevertheless, a number of empirical evidence produced in this field should be highlighted. First, if Gadzikwa et al. (2006) in work on the FO in South Africa and Hellin et al. (2009) through their study in Mexico showed that the collective action of FO allows firstly to facilitate access of their members to credit and inputs, and secondly to reduce transaction production and costs. Then there is the work of Devaux et al. (2009) that examined the effect of collective action on innovations in the marketing chain in Peru. The work found that collective action increase capacity building in term technological and institutional marketing innovations. Moreover, the work of Kruijssen et al. (2009) shows that farmer collective action in four countries (Thailand, India, Syria and Vietnam) allows increasing the added value of biodiversity products. In addition, the work of Catacutan et al. (2009) in the Philippines, and Gian Ruerd (2007) on FOs in Ethiopia, as well as those of Barham and Chitemi (2009) show that farmer collective action in Tanzania increases their access to potential markets. The work of Bernard et al. (2008a) shows that the impact of FO in Ethiopia (their members have access to credit and infrastructure) is limited firstly by the poor management capacity of FOs and secondly by weak availability of financial resources. Finally, the work of Bernard et al. (2008b) in Ethiopia shows that despite the fact that FOs can negotiate higher prices for their members; FO does not always succeed in increasing the quantity of products sold. In the same logic, the work of Bernard and Spielman (2009) in Ethiopia lead to

findings that action of FOs generates profits even to non-members of FOs.

In Cameroon, the appearing of FOs was located in trade liberalization policy. This liberalization began in 1991 with the dissolution of Office National de commercialisation des produits de base (ONCPB) on January 28, 1991, and the creation of the Office National du Cacao et du Café (NCCB) concomitantly with the Conseil Interprofessionnel du Café et du Cacao (CICC) on July 12, 1991. One objective of liberalization was to "professionalize" the operators of cocoa sector. Today's cocoa marketing landscape in Cameroon is the consequence of this liberalization. The cocoa marketing chain is simple organized [Figure 1 from Kamdem (2010)].

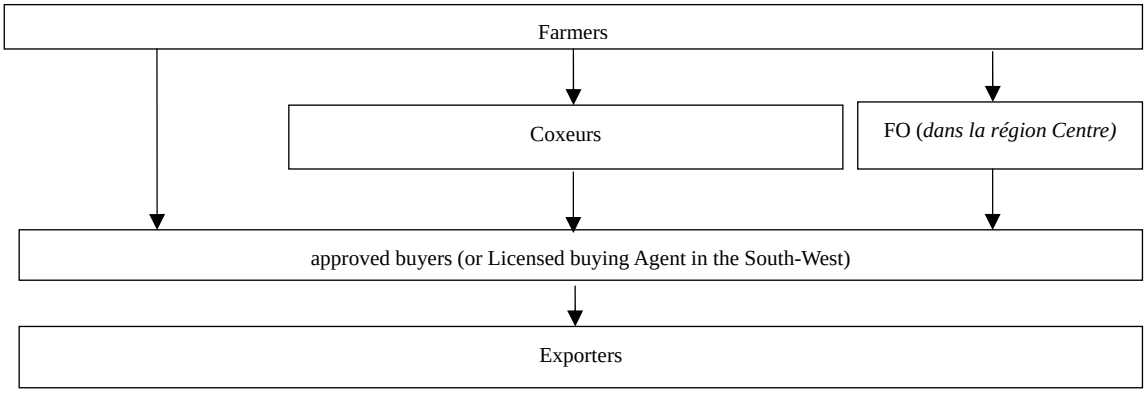

Figure 1. Cocoa marketing chain organization in Cameroon

Source: Kamdem (2010).

Thus, according to the work of Kamdem (2010), farmers can either sell to "coxeur" (who usually come to buy cocoa from farmers in their houses), or sell directly to approved buyers (although this often requires a long trip) or sell via a FO (in the Centre Region only because there is not really FO in the other region of production, the South-west). The first channel of marketing (direct sale to legal buyers) is mostly the fact of the large farmers. The second channel (sale to coxeurs) is very widespread as well in the Centre region as in South-west region. The third channel (sale via FO) exists only in the Centre region. The legal buyers resell the cocoa bought to the exporters. Face to this multiple channels of marketing; it arises that farmers generally need to choice between selling collectively and selling individually. Given that FOs in South-west are not collective selling, we will concentrate only in the centre region where we have both collective and individual sales.

The organization of FOs is pyramidal. CIGs and cooperatives are the basic. CIGs and cooperatives can be grouped into union of CIGs or cooperative union, respectively. Then, federations are groups of unions of GIC. At the top there is a confederation ridge which is linked federations of unions of CIG, unions of CIG, unions of cooperatives, CIG and cooperatives. Through the types of FOs and their operation, we can build three types of organizational structure of FOs (Table 1).

Table 1. Summary of different categories of cocoa Farmer's Organization

		Type of management (FOs Gouvernance)	
		Management by elected leaders	Management by bureaucracy staff
Level of centralization of FOs	Centralised Organization	Unions	Co-cooperative
	Less Centralised Organization	Federation	Non available

Source: Constructed by author.

These FOs are considered as small marketing firms, the question of efficiency remains an ongoing concern for farmers who still beyond to this form of marketing. The objective of any firm in neoclassical theory is maximizing its profit. Thus, it must either reduce its production costs for a given level of outputs or maximize production for a given input; production costs are funded by revenues from the sale of production. When considering FOs, their main function is to maximize the level of its revenue through the sale of their products members' under the constraint of their bargaining power and the environment in which they operate. In general, farmers' organizations, under the cooperatives principles, have always been faced with two types of challenges that come down to two questions: how to become efficient? And how to adapt to economic and social

environments? Indeed, the first challenge of the third millennium is to improve the efficiency of cooperatives (MacPherson, 1996). All cooperatives must operate within the market and it is why MacPherson said, they must be efficient.

Cooperatives are mostly farmers' organizations seeking to defend the interests of their members. According to Holyoake (1971) and Levay (1983) a feature of cooperatives or FOs is that their members are permanent claimants. These members are still demanding better service and disassociate themselves when services are not better compared to those obtained outside the cooperative. FOs need to offer their members the best possible service.

In Cameroon, in the cocoa sector, FOs produce service to their members while the cost is funded by withdrawals from the quantities that are marketed. Such farmers form unions of CIG which can beyond to federations of unions of CIG or cooperatives. Some of these FOs in cocoa sector are consolidated into a national body called CONAPROCAM (Confédération Nationale des producteurs de cacao au Cameroun). The main question of this work is: **how some farmers' organizations do manage to negotiate better prices, to their members than others?** The purpose of this paper is to measure the differences in efficiency between the types of FO and to identify the determinants of these differences in efficiency.

2. Methods

Efficiency measures the ability to achieve an objective under the constraint of available resources. Farrell (1957) was the first to clearly define the concept of economic efficiency by distinguishing the concepts of allocative and technical efficiency. Allocative efficiency is the ability to combine inputs and outputs in optimal proportions, given the market prices. Technical efficiency is the ability to avoid waste. The firm is said technically efficient if for inputs levels used and outputs produced, it is impossible to increase the amount of output without increasing the amount of one or more inputs or reduce the amount of another output. Technical efficiency is the sum of scale efficiency and pure technical efficiency. The scale efficiency is the ration of technical efficiency and scale returns for optimal activity levels. It characterizes the gap between actual performance and that would be obtained in a situation of long-term competitive equilibrium where the profit is zero. That means, compared to a situation where scale returns are constant. Thus, a production scale is inefficient if the initial situation is characterized by increasing or decreasing of scale returns (Borodak, 2007). The pure technical efficiency reflects the ability of a production unit to optimize its output for a given level of inputs and, symmetrically, to minimize resource consumption for a given level of production. It reflects the organization of work within the production unit, the ability to organize, motivate and effectively monitor employees and supervisors, or the ability to avoid mistakes and bad decisions. These aspects of efficiency are often classified under "X-efficiency". It is this measure that is appropriate for our study. Measuring the level of efficiency of FO will enable to generate efficiency scores for each FO. Efficiency scores will be used to identify their determinants. Thus, it is necessary to present in the firstly the model which will help to evaluate the commercial scores efficiency of FO. Secondly, the model to identify determinants of the commercial efficiency of FO is presented.

2.1 Evaluation Model of Farmer Organization Efficiency

The empirical model used in this study to measure the technical efficiency of FOs for their cocoa marketing function in Cameroon is a non-parametric DEA model. The DEA approach is typically used to assess the efficiency of a set of farmers (Borodak, 2007). It consists of using mathematical programming to construct a border fragments from the data set of production units. The model originally proposed by Charnes et al. (1978) assumes constant scale returns. But later, Banker et al. (1984) have proposed a model that allows relaxing this assumption. This model take into account the scale returns variable. Several applications of DEA have been made in the world and Africa such as the efficiency of railways in Sub-Saharan Africa (Mbangala & Perelman, 1997). The choice of DEA model for this work is justified by the fact that he can distinguish the pure technical efficiency from scale efficiency. The chosen orientation is the maximization of outputs (turnover of FO which is the price product by the quantity of cocoa sold) which we believe is more appropriate to the context of the marketing activity in Cameroon. An increased level of turnover on cocoa bought from small farmers in the available resources of FO seems in our view to be the ideal option for agricultural policy regarding efficiency of cocoa FOs in Cameroon. DEA method evaluates the relative efficiency of production units and generates comparable levels of efficiency from the information on inputs and outputs of firms. This assessment of efficiency can be oriented towards maximizing outputs for a given level of inputs or to the minimization of production costs for a given level of output. The objective of maximizing outputs is to assess the proportion to which the outputs can be increased without any change on the vector of inputs. In the contrary, the objective of minimizing production costs is to estimate the greatest possible reduction of production costs that can be

achieved without changing the vector of outputs. Both approaches yield the same results when scale returns are constant and different results when scale returns are variable (Afonso & Aubyn, 2006; Domazlicky & Primont, 2006; Lee & Worthington, 2008).

The empirical application of the evaluation of efficiency scores is done from the distance function of outputs that establishes a relationship between actual output and optimal production. The output of FO is the revenue obtained (at the end of the transaction), which can be produced by the FO, this means that all the output Y which can be obtained using a given quantity of inputs X. The function of the distance between the output and maximum output is given by the relation: $d_0(X,y) = \min\{\theta : (y/\theta) \in E(X)$. θ is distance function value and E(X) the production set, which means that all levels of output that can be obtained from a vector of input variables X. The value of the distance function is equal to unity when production is optimal. The inverse of this value of distance function $(1/\theta)$ expresses the greatest increase in outputs under the constraint that the observed production does not exceed the maximum output. More specifically, the inverse of distance function is a measure of technical efficiency (Farrell, 1957). An FO can thus be considered efficient if it maximizes its production for a given level of inputs. In other words if its level of technical efficiency is equal to unity, while his actual production is equal to the optimal production.

As suggested by Coelli (1996), the value of the distance function is obtained for each unit of output by solving the DEA linear optimization program as follows:

$$[d_0(X_i, Y_j)]^{-1} = \max \theta$$

$$s/c \begin{cases} \left\{ \sum_j^J Z_j Y_{jm} \geq \theta Y_{jm}, 1 = ...M \right. \\ \left\{ \sum_j^J Z_i Y_{ij} \geq \theta Y_{ij}, 1 = ...J \right. \\ \left\{ \sum_j^J Z_j \geq 0, 1 = ...I \right. \end{cases}$$

In this program, i represent the FO, M the number of outputs or services produced by each FO, Z a variable that defines the weight of each input j in the input bundle, J is the number of inputs used by the FO.

2.1.1 Specification of Input-output Variables in the FO

In most efficiency studies, it is usually the amount produced which is considered as output. But when it comes to assessing the commercial efficiency of FO, the use of the marketing quantity as output seems quite limited. The output of a commercial cooperative is considered by Porter & Scully (1987) as the value added or profit of the cooperative. In the case of cocoa FO in Cameroon, where there is no value added variable available, their output can be considered as the turnover of FO which express the level of price negotiated for their members and the quantity sold. Moreover, in agency theory, performance will depend on the ability of members of FO to encourage managers to make efforts to serve the general interest of FO, particularly by negotiating better prices for all members.

Concerning inputs, Porter and Scully (1987) identify three major in agricultural cooperatives: these are: the amount of work hours, the annual capital of cooperative, and type cooperative organization. Concerning cocoa FO in Cameroon, we identified two categories of input variables which are variables on which FOP can act: these are the variables related to the resources of FO (FO storage capacity, quantity marketed by FOs, equity and deduction taken by the FO to cover marketing costs) and variables related to FOs organization (type of administration of FO, FO approximation of farmer and number of FOs executive officers).

2.2 Identification Model of FO Efficiency Determinants

In the DEA model for evaluating the efficiency, we only consider the variables of FO on which they can act to change their level of efficiency. Concerning the method of efficiency determinants, we considered variables that may affect the efficiency of FO, but that they cannot change. These variables are: age of FO, education level of executive's officers of FOs, productive weight of FO executive's officers, market structure (competition level) and level of international price of cocoa.

The dependent variable (efficiency level) of the equation to estimate takes values in the interval [0 1]. This equation can be estimated by censored models such as Poisson model and generalized Tobit censored or

uncensored model. For the case of FO efficiency determinants, the dependent variable (the level of efficiency) is continuous in the interval [0 1]. This variable does not admit the value zero, making it difficult to use the censored Tobit model (Maddala, 1983; Greene, 1995). To overcome this difficulty, we can explain the inefficiency of FO, since the level of FO inefficiency takes positive values or zero. Moreover, the level of inefficiency is continuous in the interval [0 1]. In this new configuration, the censored Tobit model seems appropriate then to explain the inefficiency of the OP. Thus, the dependent variable (Y_i) represents the level of inefficiency (that means 1 - efficiency) of FO. A second difficulty of the model lies in the sample that we have, since it is small (only 25 FOs). To overcome this shortcoming, the Poisson model that does not require the assumption of normality is checked (Wooldridge, 2002) can be used to estimate the determinants of inefficiency FO. Poisson regression is only appropriate when the variance is equal to the means. When this condition is not verified, Wooldridge (2002) suggests the using of negative binomial or exponential regression. In this case, the data are such that the variance of FO inefficiency is greater than the mean. The effects of these factors on inefficiency levels are therefore estimated using negative binomial regression through Stata software. In general negative binomial regression is used when the Poisson model becomes inappropriate due to over dispersion of data (that means that the variance is greater than the mean). This analytical approach is modeled on Poisson model (Hausman et al.1984; Cameron & Trivedi (1986). This model is specified as follows:

$$P(Y = y_i / X_j = x_{ij},\ j = 1,2,...,\ p) = \frac{\exp(-\mu_i)\,\mu_i^{y_i}}{y_i!}$$

where y_i is the random variable of Poisson Y, with the parameter $\mu = (\mu_1,...,\mu_n)$ and conditioned by the explanatory variables X1, X2, …, Xp. The use of this model requires that the variance is equal to the average. The negative binomial regression model, which is an extension of Poisson model, is used when the variance is greater than the mean, which is the case for our data. The law of negative binomial model can be regarded as a mixture of Poisson and Gamma. This mixture can correspond to the assumption of Poisson variability (intra-FO) combined with variability within a Gamma distribution (inter-FO) with parameter k. For such a model, the estimated parameters (β_j^*) generally differ slightly from results obtained by the Poisson models. Assume that the parameter μ_i of the Poisson distribution follows a Gamma distribution of parameters (μ,δ). Given the gamma distribution, the negative binomial distribution is as follows:

$$pr(y_i) = \int_0^{\infty} \frac{1}{y_i} e^{-\mu_i} \mu_i^{y_i} f(\mu_i) d\mu_i = \frac{\Gamma(\gamma_i + y_i)}{\Gamma(\gamma_i)\Gamma(y_i + 1)} \left(\frac{\delta}{1+\delta}\right)^{\gamma_i} (1+\delta)^{-y_i}$$

The negative binomial distribution with parameters (γ_i, δ); mean $E(\mu_i) = e^{X_i\beta}/\delta$ and variance: $V(\mu_i) = e^{X_i\beta}(1+\delta)/\delta^2$. The ratio of variance with the mean in this case $(1+\delta)/\delta > 1$. Thus, when $\delta \to \infty$, the variance is equal to the average and one returns to the Poisson law. The model of negative binomial regression is the following:

$$\begin{aligned} \text{IndIneff} &= \beta_0 + \beta_1 \text{AgeOP}_i + \beta_2 \text{AgeOP}^2{}_i + \beta_3 \text{NbreAnPste}_i + \beta_4 \text{AgeLeadOP}_i + \beta_5 \text{DumInfosON CC}_i \\ &+ \beta_6 \text{Transac}_i + \beta_7 \text{ServiceOP}_i + \beta_8 \text{NivDemoOP}_i + \beta_9 \text{Educ}_i + \beta_{10} \text{TonDirOP}_i + \beta_{11} \text{NbBuyer}_i \\ &+ \beta_{12} \text{DistNgBuye r}_i + \beta_{13} \text{DistBuyerD la}_i + \beta_{14} \text{PCaft - 7} + \varepsilon_i \end{aligned}$$

2.3 Description of Data Collected from Farmers' Organizations

Data were collected on the characteristics of cocoa marketing of 25 FOs in the Central Region. Since in the South West FOs do not organize collective sales of their members' products, we are interested only on FOs in the Central Region who regularly hold collective sales. Data were collected from FOs at the end of 2005/2006 marketing season (April 2006). This covers the 2005/2006 cocoa marketing campaign and relevant on the transaction details (dates, price, quantity, etc.) made by each FO during the campaign. Data by transaction create the problem on effect of transactions number on the characteristic variables: for example a FO which markets 15 transactions will show characteristics identical 15 times in the sample, while a FO which markets only two transactions will show characteristics identical only 15 times in the sample. This can create bias in the regression. To avoid this problems of bias in the regressions (possibly related to effects on the characteristic variables), we calculated the average characteristics of the transactions in relation to each FO. These data are aggregated and FO and the unit of analysis is FO. The CIG is the first level of organization of FOs, the data collected indicate that CIG has not organized collective sales. However, only unions, federations and cooperatives did. Assessing

the level of efficiency will therefore affect only those levels of organization of FOs (union, federation and cooperative). Table 2 shows the distribution of this sample of 25 FOs used for our analysis.

Table 2. FOs in the Centre Region

Divisions	Numbers of unions	Number of federations	Number of cooperatives	Total per Division
Lékié	2	2		5
Mbam et Inoubou	4	1		5
Mbam et Kim	5	1		6
Nyong Ekéllé	2			4
Nyong et So'o	1	2	1	4
Nyong et Mfoumou		2	1	3
Mefou et Akono			1	1
Total per type of FO	14	8	3	25

Source: IITA FO data survey-2006.

This sample spans six departments of Central Region and has 14 unions, 8 federations and 3 cooperatives. Following the presentation of data collected of FO, it is necessary to describe the specified variables on one hand to evaluate the level of efficiency of FOs and on other hand to identify efficiency factors of FO.

2.4 Description of Variables Used to Evaluate the Efficiency of FO Marketing

The results obtained in this work assume that all of FOs sample is placed in the same conditions which mean that they use the same inputs to produce the same outputs. These results also assume constant technology (lack of technical progress). Table 3 presents descriptive statistics of input and output variables used in assessing the efficiency levels of FO.

Table 3. Descriptive variables used for efficiency levels

Type of Variables	Variables	Number of FOs	Mean	Std-Dev	Min	Max
input	Storage Capacity in binary (1 = having a store; 0 = don't have a store)	25,0	0,4	0,5	0,0	1,0
	Average quantity per sale (ton)	25,0	15,1	17,3	1,2	74,4
	Amount of FOs Funds in 10000 FCFA	25	118,6	276,5	0,0	1320,0
	Amount of deduction for FOs management (in FCFA/kg)	25	20,1	26,9	0,0	100,0
	Type of management of FOs in binary (1 = federations or unions managed by elected farmers; 0 = cooperative managed by appointed bureaucrats)	25	0,6	0,5	0,0	1,0
	Level of centralisation of FOs in binary (1 = union or cooperative more close to the farmer; 0 = federation more fare to the farmer)	25	0,9	0,3	0,0	1,0
	Number of FO staff officers	25	34,6	16,7	4,0	64,0
Output	Turnover of FO in million of FCFA (selling Price after deduction for quality time total sale quantity)	25	9,39	10,95	0,74	46,81

Source: Author from IITA FO data survey-2006.

The only output variable used in our analysis is the turnover of FOs. This turnover which is the product of the selling price of cocoa negotiated by FOs with the quantity of cocoa mobilized by the FOs, captures the performance of FOs. The price used is deducted from the allowance made to reflect the quality of cocoa sold. The use of turnover as output is original for our study, since most of efficiency studies achieved in rural sector use the quantity sold as output. Concerning inputs variable, we have two groups of variables: the resources of FOs and the internal organization of FOs. On the resources of FOs, we have four variables that contribute to the assessment of efficiency. The storage capacity is a binary variable that is used to enter if the FOs has or not a store. It helps to appreciate the contribution of the existence or not of a store on commercial efficiency of FOs. The average quantity per transaction is used to measure the effect of transaction size of FOs on its efficiency. The amount of own funds of FOs captures the impact of self-financing capacity of FOs on its efficiency. The deduction level is the amount of FOs per kilogram of cocoa sold by the farmer. Concerning the organizational variables of FOs we have three variables. The organization of the management of FOs is captured by the binary variable that takes the value 1 if the FOs is a union or federation (the leaders are elected farmers) and 0 otherwise

(where Cooperative leaders are appointed and are not necessarily farmers). This variable captures the potential positive effect of bureaucratic management of FOs on their marketing efficiency. The proximity of FO to the farmer is captured by a binary variable. This variable takes the value 1 if the FOs is a union or a cooperative and 0 otherwise (farthest federation of farmers). It allows us to appreciate the positive impact of possible reconciliation between the farmer and the management of FOs on their efficiency. The number of executives participating in the decision-making allows us to appreciate the negative impact of administrative heavy in decision making on FOs marketing efficiency.

2.5 Description of Variables Used in the Model of the Determinants of the Efficiency of FO Marketing

We have a number of variables that contribute to the explanation of the inefficiency of OP cocoa in Cameroon (Table 4).

Table 4. Description of variables used in negative binomial model

Variables	Description
IndIneff	dependent variable (inefficiency index)
AgeOP	Age of FO
AgeOP2	FO age square
NbreAnPste	Number of year been at this post
AgeLeadOP	FO leader age
DumInfosONCC	Dummy variable of information on price received from ONCC (ONCC is structure which is in charge of price information)
Transac	Number of transactions
ServiceOP	Number of services offer by FO to theirs members
NivDemoOP	Level of governance within FO (from 1 to 5)
Educ	Leader education level of FO (1= if Leader education level is at least equal to secondary school; 0= otherwise)
TonDirOP	Productive weight FO leader
NbBuyer	Number of buyer in this area
DistNgBuyer	Number of non-tarmac km between the point of sale and the port of Douala
DistBuyerDla	Number of km between the point of sale and the port of Douala
PCaft-7	Delayed CIF price (7days)

Source: Author from IITA FO data survey-2006.

The age of FO (AgeOP) shows the impact of aging FO (or Youth FO) on its efficiency. In order to assess its nonlinear effect, we have the square of this variable (AgeOP2) in the regression. The number of years spent in the position held by the leaders of FO (NbreAnPste) can discuss the impact of non-alternating to a position on FO efficiency. The leader age of FO (AgeLeadOP) shows the effect of a young leader (or an old leader) on FO efficiency. The price information that FO received from ONCCB (DumInfosONCC) allows assessing the effect of this information on the FO efficiency. The number of transactions made by FO during the cocoa season (Transac) lets see if the effect of fragmentation (or concentration) of transactions on FO efficiency. The number of services offered by FO to their members (ServiceOP) allows assessing the impact of the diversity of member services. The level of governance of FO (NivDemoOP) by a variable, that increasingly appreciates (between 1 and 5) FO governance. This variable allows us to appreciate the involvement of FOs members in making decisions on FOs efficiency. The FO leader education level (Educ) is assessed based on a variable that takes the value 1 if leader education level is at least equal to secondary level. This variable is equal to 0 otherwise. The education variable allows us to measure the effect of leaders training on FO marketing efficiency. The productive weight of FO leaders (TonDirOP) can appreciate the importance of entrusting FO management by largest farmers. The number of buyers in the surrounding area of FO (NbBuyer) enables to see how the competition of buyers acts on FO marketing efficiency. The number of kilometers of non-tarmac road from FO to Douala port (DistNgBuyer) allows assessing the impact of FO isolation on FO marketing efficiency. The number of kilometers from FO to Douala port (DistBuyerDla) allows assessing the impact of remoteness of FO on it marketing efficiency. The international price with a delay of seven days (PCaft-7) allows assessing the impact of international price transmission on FO efficiency. There is no reason to think an endogeneity of above variables, since these are all independent determinants of the FO behavior.

3. Results and Discussion

The estimation results of FO marketing efficiency of cocoa in Cameroon are presented, followed by estimation results of identification model of the determinants of FO marketing efficiency indices.

3.1 Evaluation of the Efficiency Levels of Farmers' Organizations of Cocoa in Cameroon

The efficiency index of FO were estimated using the DEAP software version 2.1 (Data Envelopment Analysis (computer) Program) developed by Coelli in 1996. These levels of efficiency (Table 5) are estimated under the assumptions of constant returns (crste) and variable yields (vrste). Having estimated the levels of efficiency under the option "output oriented" (maximization of output), then under the option "input oriented" (minimizing inputs), it was found that levels of efficiency does not change. That's why we have to analyze the determinants that levels of efficiency by constant scale returns. (Note 1: Un = Union; Fed = Federation; Coop = Cooperative).

Table 5. Efficiency and inefficiency levels of cocoa farmers' organizations in Cameroon

FO	FO	Efficiency			Inefficiency			Inefficiency in percentage		
	Type	crste	vrste	scale	Crste	vrste	scale	crste	vrste	scale
1	Fed	1,00	1,00	1,00	0,00	0,00	0,00	0	0	0
2	Un	0,13	0,13	1,00	0,87	0,87	0,00	87	87	0
3	Un	0,07	0,08	0,92	0,93	0,92	0,08	93	92	8
4	Un	0,57	0,57	1,00	0,43	0,43	0,00	43	43	0
5	Coop	1,00	1,00	1,00	0,00	0,00	0,00	0	0	0
6	Fed	1,00	1,00	1,00	0,00	0,00	0,00	0	0	0
7	Un	1,00	1,00	1,00	0,00	0,00	0,00	0	0	0
8	Coop	0,62	0,65	0,94	0,39	0,35	0,06	39	35	6
9	Fed	0,41	1,00	0,41	0,59	0,00	0,59	59	0	59
10	Un	0,12	0,12	0,94	0,89	0,88	0,06	89	88	6
11	Fed	1,00	1,00	1,00	0,00	0,00	0,00	0	0	0
12	Fed	0,14	0,16	0,87	0,86	0,84	0,13	86	84	13
13	Coop	1,00	1,00	1,00	0,00	0,00	0,00	0	0	0
14	Un	1,00	1,00	1,00	0,00	0,00	0,00	0	0	0
15	Un	0,14	1,00	0,14	0,86	0,00	0,86	86	0	86
16	Un	0,63	0,63	1,00	0,37	0,37	0,00	37	37	0
17	Un	0,29	0,31	0,93	0,71	0,69	0,07	71	69	7
18	Un	0,21	0,21	1,00	0,79	0,79	0,00	79	79	0
19	Un	0,27	1,00	0,27	0,73	0,00	0,73	73	0	73
20	Fed	0,62	1,00	0,62	0,38	0,00	0,38	38	0	38
21	Un	0,38	0,38	1,00	0,62	0,62	0,00	62	62	0
22	Fed	0,98	1,00	0,98	0,03	0,00	0,03	3	0	3
23	Un	0,15	0,15	0,97	0,85	0,85	0,03	85	85	3
24	Fed	1,00	1,00	1,00	0,00	0,00	0,00	0	0	0
25	Un	0,48	1,00	0,48	0,52	0,00	0,52	52	0	52
Mean	Mean	0,57	0,70	0,86	0,43	0,30	0,14	43	30	14
Var	Var	0,13	0,14	0,07	0,13	0,14	0,07	1340	1420	656

Source: Author from IITA FO data survey-2006.

Thus, the FO mean efficiency under the assumption of constant scale returns is 0.57. Implying that over 40% of potential FO efficiency is not exploited. This result is a bit lower than that found by Nyemeck et al. (2008) for cocoa farmers efficiency in Cameroon (0.65). However, this finding is lower that that was found by Acclassato (1999) for cotton and rice Farmer Organization efficiency in Benin (0,81 and 0.79). We then calculated levels of inefficiencies from which we generated the percentages of inefficiency (Table 5).

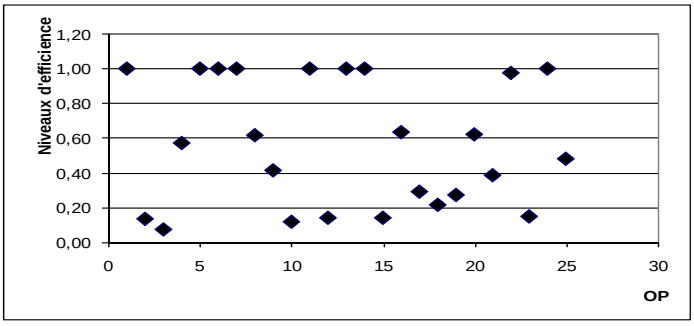

Figure 2. Levels of efficiency of cocoa Farmer organization in Cameroon

Source: Author from IITA FO data survey-2006.

As shown in Figure 2, the majority of FO is between 0 and 0.6. This implies that, in general, FOs are inefficient cocoa in Cameroon. This result confirms our hypothesis that FOs are weakly efficient in the marketing of their members.

Table 6. Inefficiency score per type of Farmer Organization in Cameroon

	Union	Federation	Cooperative
Inefficiency rate in percentage	61%	23%	13%

Source: Author from IITA FO data survey-2006.

As shown in Table 6, cooperatives represent the most efficient FO (with a score of 13% inefficiency). They are followed by the federations with a score of 23% inefficiency. As for unions, they seem relatively less efficient (their relative inefficiency rate is 61%). Given these results, the cocoa marketing in cooperatives seems to be the best alternative. This form of FO manages to develop a level of efficiency well above those of other forms of FO (union and federation). The marketing performance of cooperative may be explained partly by economies of scale which generates volumes of cocoa together. On the other hand the marketing performance of cooperative may be related to the reduction of transaction costs (including research, monitoring and enforcement costs), through its organization and running. Indeed, based on cooperative association that sets up a business is relatively more rigorous in its management than other forms of FO (union and federation). Moreover, the existence of differences between FOs efficiency to another makes us question the nature of the factors that could explain.

3.2 Efficiency Factors of Farmers Organizations of Cocoa in Cameroon

The estimated levels of cocoa FOs efficiency in Cameroon have been made from the DEA using the variables called discretionary variables (Afonso & Aubyn, 2006). This method does not take into account the non-discretionary variables. These non-discretionary variables which can be endogenous or exogenous factors explain the level of FOs efficiency. The fish model, in its form of negative binomial, used to analyze the determinants of the level of efficiency is only applicable if the values of the dependent variable are natural numbers. To identify the determinants of efficiency, we estimate the determinants of FOs inefficiency from the negative binomial model. This estimate considers the dependent variable percentages of FOs inefficiency. Our estimation was done only with FOs which marketed their cocoa members. The estimated negative binomial model using Stata gives us the results shown in Table7 and Table 8.

Table 7. Descriptive statistics of variable used in negative binomial model

Variables	Observations	Moyenne	Ecart-type	Minimum	Maximum
IndIneff	25	43,20	36,61	0,00	92,90
AgeOP	25	5,17	3,12	1,00	12,00
AgeOP2	25	50,53	48,84	1,00	121,00
NbreAnPste	25	14,33	9,16	0,00	36,00
AgeLeadOP	25	50,00	10,69	30,00	73,00
DumInfosONCC	25	0,16	0,37	0,00	1,00
Transac	25	9,00	6,68	1,00	23,00
ServiceOP	25	7,40	3,33	2,00	14,00
NivDemoOP	25	3,89	0,67	3	5
Educ	25	0,60	0,50	0,00	1,00
TonDirOP	25	97,12	148,38	0,23	545,22
NbBuyer	25	7,04	3,75	3,00	13,00
DistNgBuyer	25	12,88	16,60	0,00	48,00
DistBuyerDla	25	370,20	50,50	253,00	450,00
PCaft-7	25	809,44	12,30	786,75	841,92

Source: Author from IITA FO data survey-2006.

Table 8. Estimation of FO inefficiency[a] determinants

Variables	Taux d'inefficience (rendements constants)
AgeOP	0,257 (1,92)*
AgeOP2	-0,046 (2,04)**
NbreAnPste	0,108 (2,62)***
AgeLeadOP	0,085 (1,10)
DumInfosONCC	-3,954 (1,18)
Transac	0,381 (1,63)
ServiceOP	-0,215 (1,28)
NivDemoOP	-3,815 (2,01)**
Educ	-2,261 (1,77)*
TonDirOP	-0,007 (1,87)*
NbBuyer	0,027 (0,11)
DistNgBuyer	-0,015 (0,43)
DistBuyerDla	0,024 (1,76)*
PCaft-7	-0,079 (1,62)
Constant	68,423 (1,77)*
Observations	25

Note: [a] Negative effect on FO inefficiency are interpreted as negative effect on FO efficiency. * significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Author from IITA FO data survey-2006.

These results show that the negative binomial regression model is statistically significant (chi 2 = 21.62, df = 14, Prob > chi2 < 0.0867). The results of estimating determinants of FOs inefficiency lead us to conclude that six factors that significantly affect FOs marketing efficiency, five of them are internal while one is external. This confirms our assumption about the dominance of internal factors over external factors FOs efficiency. Thus, the age FO, the number of years already spent in the position held by the leaders of FOs, FOs governance, education level of FOs leader and productive weight of FOs leaders endogenously affect FOs efficiency while the access conditions act as external factors. These factors are interpreted as follows:

i) The age of FO that we have considered moving in a nonlinear way has a significant effect on FOs inefficiency. Initially, the age of FOs has a positive effect on its inefficiency. From a certain threshold (which is equal to 0.257 / (2 * 0.046) = 2.8 years), the effect of FOs age on FOs inefficiency becomes negative. We believe that the effect of age on FOs inefficiency could have a double understanding: first, its positive effect on inefficiency reflects a negative effect of age on efficiency which can be interpreted as a mature phase of FOs, which extends to 2.8 years. Then the negative effect on FOs inefficiency, which results in a positive effect on their efficiency, can be interpreted as the positive effect of experience on FOs marketing efficiency through their age. Well below the age of 2.8 years (32 months), FOs are inefficient; beyond this threshold, the FOs are mature and become efficient.

ii) The number of years past the post is positively significant on FOs marketing inefficiency. This positive effect results in a negative effect on the number of years already spent in the position held by an officer on FOs efficiency. Thus the lack of renewal of position held has a negative effect on FOs marketing efficiency. This lack of renewal results in a lack of democracy within FOs. Indeed, FOs managers who spend more time at their posts eventually develop strategies for colluding with buyers and become less demanding for them.

iii) The level of FOs governance has negative effect on inefficiency (i.e positive efficiency) reflects the positive impact of FOs democratic management on its efficiency.

iv) The level of education of FOs leader which is also negatively significant on FOs inefficiency (ie positively significant efficiency) reflects the fact that improving leadership training positively affects the FOs marketing efficiency. This finding is close to that obtained by Acclassato (1999). In fact the author found that Education is a significant determinant of cotton and rice Farmer Organization efficiency in Benin.

v) The productive weight of FOs leaders is negatively significant. Its negative effect on the FOs inefficiency reflects the fact that the weight of FOs leaders increases the FOs efficiency. This is interpreted as a positive effect of the most productive farmer on FOs marketing efficiency. Thus, the leaders of FOs produce the more FOs efficiency increases. Indeed, they feel more concern for the good marketing efficiency of FOs. This result confirms the theory of agency that in the presence of information asymmetry between principal and agent, the

solution is the establishment of an incentive mechanism whereby the agent's interest to satisfy the main objectives (Reynaud, 2005). Thus, to avoid moral hazard behavior of FOs leaders, the weight of productive leaders can serve as incentive mechanism that encourages managers (agent) to meet the objectives of farmers (principal). Moreover, a significant leader's productive weight inspires much confidence to buyers on the constant availability of cocoa. Finally, credibility is also required from members.

vi) The results show that the access conditions to FOs affect their marketing efficiency. Indeed, the removal of FO from Douala increases the FOs inefficiency. This translates into the fact that the remoteness of which are located FOs decreases their marketing efficiency and reconciliation of these areas increases their marketing efficiency. This finding is close to the that has been found by Nyemeck et al. (2008) who suggested that public investment in physical rural infrastructure is crucial for improving cocoa farmers' efficiency and revenue. In fact, Better roads and improved communications result in more timely field operations and reduced transaction costs.

vii) Finally, we note that some variables are not significant: this is age of FOs leaders, information obtained from ONCC, the number of transactions during the year, the number of services offered by FOs to their members, variables related to the level of competition of buyers in the FOs area and the international price.

4. Conclusion and Recommendations

In this study, we evaluated the FOs marketing efficiency levels using DEA method and identified the major determinants of FOs marketing inefficiency using a negative binomial regression model.

The estimation of FOs marketing efficiency levels enable to obtain an marketing efficiency mean equal to 0.57 for FOs considered. These results further indicate that cooperative seems to be FOs which is the most efficient in marketing matters. The use of negative binomial regression model to identify efficiency factors led to the result that FOs marketing efficiency is affected through internal factors (FOs age, number of years spent at occupied position by FOs officer, FOs quality of governance, education level of FOs leader and productive weight of FOs leaders) and external factors (access to FOs). This result also shows a predominance of internal factors on factors external to the explanation of FOs marketing efficiency. In fact, the estimate indicates that the age at which FOs is mature for marketing efficiency is 32 months. This seems rather long. This may be due to the fragility of most of FOs. On the other hand the estimation indicates that the productive weight of leaders encouraged them to meet the farmer's objectives.

The marketing efficiency analysis of FOs and its determinants has allowed us to make five recommendations.

1. First, the fact that the age of FOs contributes negatively to its efficiency up to a threshold (32 months) from which it becomes positive contribution inspires us to make the following recommendation: it is suitable that FO further strengthen their capacity and management structures to reduce their maturity age which is 32 months.
2. Concerning the number of years already spent in the position that is having a negative impact on FOs efficiency. It is thus suitable that FOs have to renew their entire management structure after a certain period in order to equip itself with a new dynamic to have farmer's confidence.
3. The positive effect of improving the FOs governance and education leaders enable us to believe that decision-making within the FOs must be democratic in order to ensure higher marketing efficiency of FOs. On the other hand, it is desirable that FOs leaders have an education level at least to high school to ensure their efficiency.
4. Furthermore, the leader productive weight contribution on FOs efficiency is fairly intuitive. It seems logical that the responsibilities entrusted to FOs are most productive farmers so they feel more involved in FOs marketing performance.
5. Finally, we note that government intervention on exogenous factor to FOs as improvement of access facilities to FOs area, including paved roads, could increase FOs efficiency. This challenges the rural development actors (government and NGOs) on the quality of their contribution. Indeed, the improvement of access to FOs could affect the attractiveness of buyers in these areas.

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