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Combining Qualitative and Quantitative Methods in Assessing the Impact of Agro-pastoral Programs on the Productivity of Farmers Organisations: The Case of Cameroon

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Abstract

Between 2001 and 2007, the poverty headcount in Cameroon has remained steady around 40%. In fact, poverty has reduced in urban areas while it has increased of about 3 points in rural areas. This, despite the numerous agro-pastoral programs that were undertaken by the government between 2002 and 2008 in favour of rural people. The aim of this study is to assess the impact of these actions on the productivity of famers' organisations.

The methodology is based on a combined assessment approach combining both qualitative and quantitative aspects. The qualitative analysis uses Likert scale. The quantitative approach is based on Rubin's causal model and uses propensity score matching techniques. The main data used are those of the survey on the assessment of the impact of programs (EIPA) conducted by Ministry of Economy and Planning in 2009.

The results obtained with both methods (qualitative and quantitative) are consistent and indicate that programs implemented by Cameroun government and donors between 2002 and 2008 have had a positive impact on the productivity of farmers' organizations. The analysis of satisfaction, while indicating an overall appreciation of programs by leaders and members of Famers organisations (FOs), shows that the level of satisfaction seems to be negatively correlated with the regional level of poverty. The matching techniques revealed that FOs aid recipients have experienced a 4% increase in their productivity. More specifically, the study reveals that the impact of government programs is more important in the livestock sector (16%) and in the crops growing sector; it is quite null. Furthermore, non-beneficiaries organisations of the livestock sector could have had an increase of their productivity of about 10% if they had benefited from government assistance.

The study therefore recommends that the government to (i) put more means in the livestock sector, which seems to be very promising and can emerge as an important growth leverage of Cameroon economy; (ii) revise the assistance strategies of FOs engaged in the agriculture sector by adopting more targeting approaches and, (iii) establish a monitoring –evaluation system.

Keywords: Famers organisations, Matching, Likert scale, Productivity, Cameroon.

1. INTRODUCTION

By ratifying the Millennium Development Goals (MDGs) in 2000, the Heads of States and Governments of developing countries decided to make the fight against extreme poverty and hunger one major concern for development policy in the medium and long term. It was therefore question, as well as ensuring macroeconomic stability, to halve, between 1990 and2015, the proportion of the population living below the poverty line. In this context, several countries have adopted strategies to reduce poverty. The key idea of these strategies was targeting the poor and vulnerable to allocate more resource towards them (Lavallée *et al*., 2009).

In Cameroon, this international commitment has resulted in the implementation of the Poverty Reduction Strategy Paper (PRSP) between 2003 and 2008. The results of this policy remained mixed. According to the third Cameroon Household Survey (ECAM3), poverty rate stabilized at around 40% between 2001 and 2007. Thus, the renewed growth since 1996 and redistribution mechanisms that have been implemented have were not efficient for boosting economic development and social progress of all Cameroonians. This stability of the poverty headcount at the national level hides differences when referring to the area of residence. Indeed, the rural area remains plagued by a growing impoverishment of its population. According to ECAM3, the poverty rate rose from 52% to 55% in rural areas between2001 and 2007; whereas it has fall of about six points in urban areas.

To make growth be pro-poor, several initiatives were implemented towards rural localities. Thus, from 2002 to 2008, rural communities have benefited from about 33 programs to support local initiatives in order to boost agricultural development. Generally, these programs aimed to improve the access of farmers to modern farming techniques and high efficiency through the establishment of regional distribution of fertilizer, farm machinery, improved seed and rejuvenation of eroded land in some areas. There was also support for breeders of ruminants, pigs and poultry. In addition, efforts have been made in the domestication of wild species of animals to fight against poaching. With regard to community development, many development plans were elaborated and funding was granted to community micro projects through local development institutions.[2].

[2] PNDP (Programme National de Développement Participatif). PADC (Programme d'appui au Développement Communautaire). PCRD (Projet de Crédit Rural Décentralisé) FIMAC (Fonds d'investissement de Matériel Agricole au Cameroun).

These efforts seem not to have a real impact (in terms of productivity and better living conditions). In 2009, the country adopted the Growth and Employment Strategy Paper (GESP) as the new framework of government policy until 2020. The development of agro-products is among the major objectives to support vigorous growth of the economy in the medium term and achieve the status of emerging market in the long term. Thus, the impact assessment of development projects in rural areas that the state began implementation between 2002 and 2008 is therefore of paramount importance in order to draw lessons and identify avenues for the implementation of the new guidelines.

This study aims to assess the impact of agro-pastoral projects and programs undertaken by the government and development partners between 2002 and 2008 on FOs productivity and their members' satisfaction according in rural area in order outline the causal change in rural area due to government supports. Specifically, it first present the evolution of poverty in rural areas in Cameroon between 2001 and 2008, assess the state of satisfaction of people who have received support and assess their impact on the productivity levels of farmers' organizations[3] (FOs).

The document is divided into six sections. The next section describes the rural area and presents the programs that were implemented. Section 3 is about a brief literature review on impact evaluation approaches; section 4 presents the methodology of the study. Section 5 describes the data used. Section 6 presents the results; it leads to section 7 which concludes the document.

2 -DESCRIPTION OF THE RURAL AREA AND PRESENTATION AND PROGRAMS AGRO-PASTORAL IMPLEMENTED BETWEEN 2002 AND 2008

2.1 Evolution of poverty between 2001 and 2007 in rural areas

According to ECAM3 data, the population of Cameroon was estimated at 17.9 million in 2005 with 11.6 million (64.7%) living in rural areas. The national poverty headcount was estimated at 40%. However, this national average masks huge disparities according to place of residence and region. Indeed, one can note that 55% of people living in rural areas are poor while only 12% of the urban population is affected by poverty. In addition, between 2001 and

[3] FOs are associations created and managed by farmers themselves to defend their common interests. In principle, their activities take place without state intervention. According to the Ministry of Agriculture, their total number was estimated to 90 000 in 2009.

2007 the gap in living standards between urban and rural areas has increased: poverty has reduced by about 4.7 points in urban areas while it has increased by 3 points in rural areas.

At the regional level, we can note that rural poverty is unevenly distributed between the different regions. Nearly a third of the rural poor live in the Far North region (32.2%), followed by North (16.2%) and Northwest (13.5%). The Littoral and South each have less than 3% of rural poor. Between 2001 and 2007, poverty rate has increased in four regions namely: the Far-north (13.6 points), the North (18.3 points), Adamawa (10.2 points) and the East (+8.3 points).

Furthermore, according to the Socio Economic Group of the head of the household, ECAM3 report (2010) indicates that people living in households where the head is engaged in the agriculture sector (arable farming, pastoral farming, fishery, hunting, etc..) are the most affected by poverty. These people live mostly in rural areas. They have not benefited sufficiently from economic growth and were more affected than urban by the rising prices of essential commodities. Thus, the rate of poverty in these households has increased by 3 points between 2001 and 2007 reaching 60%. In contrary, the incidence of poverty has dropped by at least 6 points for the other categories of households.

Table 1: Indicators of monetary poverty in the rural area

	Structure of rural population (%)		Number of poors in the rural area		Poverty incidence in rural area (%)				Distribution of poors in the rural area	
Regions	***2001***	***2007***	***2001***	***2007***	***2001***	***2007***	***Difference***		***2001***	***2007***
Adamawa	4,7	6,2	250 665	454 400	52,5	62,7	↗	10,2	4,8	7,1
Centre	11,0	10,6	571 221	531 200	51,4	43,0	↘	-8,4	10,9	8,3
East	6,5	6,2	313 595	403 200	48,0	56,3	↗	8,3	6,0	6,3
Far-North	24,2	24,4	1 442 095	2 060 800	59,0	72,6	↗	13,6	27,4	32,2
Littoral	4,3	3,0	206 254	108 800	47,8	30,7	↘	-17,1	3,9	1,7
North	8,6	12,1	480 516	1 036 800	55,3	73,6	↗	18,3	9,1	16,2
North-west	14,1	12,8	872 941	864 000	61,2	58,0	↘	-3,2	16,6	13,5
West	13,7	11,1	605 031	422 400	43,8	32,8	↘	-11,0	11,5	6,6
South	4,7	4,7	154 282	166 400	32,5	30,4	↘	-2,1	2,9	2,6
South-west	8,2	9,0	358 043	352 000	43,5	33,7	↘	-9,8	6,8	5,5
Total rural	65,2	64,7	5 254 644	6 400 000	52,1	55,0	↗	2,9	84,5	89,2
Urban*	34,8	35,3	962 415	700 000	17,9	12,2	↘	-4,7	15,5	10,8
National	***100***	***100***	***6 217 059***	***7 100 000***	***40,2***	***39,9***	↘	***2,9***	***100***	***100,0***

Source: EIPA Report, MINEPAT 2009.

2.2 Presentation of the some characteristics of the agriculture sector

The main agricultural activities include crop production, (cereal, root, tubers, fruits, cash crops), livestock (sheep, goats, poultry etc), fishery and traditional hunting.

The survey on employment and the informal sector carried out in Cameroon in 2005 reveals that this sector is the largest donor of jobs. At the national level, it has 55.2% of the workforce, which is predominantly composed of women (53%). In the rural area, 73% of workers are in this sector. The agriculture sector accounts for about 27% of Cameroon gross domestic product.

Workers of the agriculture sector are relatively young compared to those working in the formal sectors. Indeed, the average age is 33.5 years against 36 years in formal private sector and 39.6 years in the public sector. Regarding the level of instruction, it should be noted that, workers of the agriculture sector are less educated than workers of other sectors. They have, on average, completed only 3.2 years of study. These workers have the lowest wages, more than half of them earn less than4200 CFAF (9 USD) per month and the average income is 11

100 CFAF (25 USD).In contrast, the average income in the public sector is 125600 CFAF (280 USD) per month.

Table 2: Some descriptive statistics of the labour market.

	Distribution of workers (%)	Average age	Proportion of women (%)	Years of study completed	Average income
Urban					
Public	10.5	39.7	31.8	12.3	146,2
Formal private	11.8	36.1	20.4	10.9	122,6
Informal non agricultural	67.4	31.2	45.4	7.0	33,0
Agriculture	10.3	37.2	57.4	5.2	16,3
Together	**100**	**33.3**	**42.2**	**7.8**	**53,6**
Rural					
Public	2.6	39.4	25.8	11.3	91,0
Formal private	2.0	35.9	15.4	7.6	55,3
Informal non agricultural	22.5	31.9	55.0	4.3	19,7
Agriculture	72.9	33.3	52.7	3.2	10,7
Together	**100**	**33.2**	**51.8**	**3.8**	**15,7**
Cameroon					
Public	4.9	39.6	29.5	11.9	124,6
Formal private	4.7	36.0	18.9	9.9	102,6
Informal non agricultural	35.2	31.5	49.8	5.8	26,9
Agriculture	55.2	33.5	53.0	3.4	11,0
Together	**100**	**33.2**	**49.1**	**4.9**	**26,4**

Source: Survey EESI 2005. Our calculations

2.3 Presentation of agro-pastoral programs implemented in the rural area between 2002 and 2008

As noted in the GESP, a strong and sustainable growth necessarily involves the emergence of the agriculture sector. However, this sector, which is characterized by the predominance of small farms with low productivity, fails to meet the major challenges it faces: (i) contribute to the fight against poverty, (ii) ensure food security, (iii) the successful integration in trade and, (iv) ensure sustainability of agriculture performances.

In order to boost the agriculture sector, the Cameroonian government, with the support of development partners has undertaken some major programs. These state interventions include multiple domains and were based on thirteen axes:

Axis 1: This is sensitization on the opening of the hunting season, environmental education, training on safety, training on standards of agriculture and food products required in national, sub-regional and international markets.

Axis 2: Financial and material assistance. The financial grant is for the establishment of young farmers and ranchers and the supply of equipments to producer organizations. It is also the distribution of transformation tools to producer organizations in order to boost and local processing or production.

Axis 3: Strengthening the capacity of existing local institutions.

Axis 4: Developing community infrastructure. This axis concerns mainly the construction and maintenance of infrastructure to improve access to production areas, forest management and development of marketing infrastructures.

Axis 5: Promoting the participatory approach. It is about strengthening the involvement of beneficiaries in the economic and social development with the promotion of farmers' organizations.

Axis 6: Restoring production potential. It is about the restoration of production potential and genetic resources for sustainable development.

Axis 7: Dissemination of technical and technological innovations. In this axis, supports are oriented towards the dissemination of technical and technological innovations to improve the yields of farmers.

Axis 8: Promotion of appropriate and streamlined funding mechanisms. It is about facilitating access to credit to FOs.

Axis 9: Strengthening research- development activities

Axis 10: Phytosanitary protection and the fight against animal diseases. The major points of this axis are promoting the use of pesticides and the extension of techniques to fight against animal diseases.

Axis 11: Promotion of national and international markets. It is a matter of promoting national and international markets for agro-pastoral and forestry products.

Axis 12: Improving the legal and regulatory framework. It is a about implementing regulatory measures to facilitate, encourage and promote agricultural activities.

Axe 13: Institutional development and partnerships. This is the renovation and modernization of public service to enable the government to exercise its sovereign functions also the promotion of private institutions and associations to ensure a better functioning of markets.

3. LITERATURE REVIEW

3.1 The concept of productivity

Evaluating the effects of government support on FO's productivity can be view as a particular application of the more generally applicable methods of productions economics. But, some special problems arise as suggested in the research case by Alston et al (1995) like the long lags in relationship between a support from government and the effect of that support or investment on production (or productivity). In many theoretical and empirical frameworks, the evaluation goes beyond estimating the relationships between inputs and outputs.

Until the early 1970s, the production economics used entirely the primal approaches in which the quantity of output was modelled as a function of input quantities (Alston et al, 1995). Some of these models were adjusted to take into account the technological changes and their sources, distinction between conventional (labour and capital) and unconventional inputs. Simultaneity between the inputs and the output is the general problem of this approach. This means that the error term and some included of the input move together or the government support and the residual might move together. As Marschak and Andrews (1944) first pointed out, routine regression model are inappropriate in such circumstances.

Other models have been developed to assess the impact of a non-conventional input effect on production (or productivity) in 1970s; development of flexible for such as the Fourier flexible form (Gallant 1982; Chalfant 1983), a non-parametric model in 1990s have been developed and applied to measure the impact of research on agricultural production (e.g. Chavas and Cox 1992).

Most econometrics studies of return of a specifics variables- research, supply of fertilizer to the farmers, adoption- have used parametric model to estimate the productivity growth attributable to the identify factor. Since we are interested primarily in the effect of government support on FOs productivity literature on production function is examined.

Ex-post evaluation of agricultural programs involves specifying a production function $f(.)$, in which agricultural output for a farmer i $(i.e. Q_i)$ depends on the quantities of conventional inputs, X_i, various variables such as public investment in infrastructure (such as roads,

communication, irrigation, and education), Z_i, the flow of services from the stock of knowledge, K_i (which we can represent by technology index, τ_i), government direct support such as credit and research, S_i, and uncontrolledfactors such as weather and croquets invasion, U_i:

$$Q_i = f\left(X_i, Z_i, \tau_{i,} S_i, U_i\right)(1)$$

As suggested by Alston et al (1995) in agricultural research case, government investment can lead to a change in productivity (output per unit of conventional inputs,Q_i/X) by changing thequality or price of conventional inputs and outputs i.e. through a change in a technology, quantities of inputs used in production process) or by increasing the stock of knowledge or the use of stock of knowledge by training or sensitization.

As describe in the previous section, Cameroon government had focused during the period from 2003 to 2008, in may axes in order to enhance productivity of the agriculture sector such as the financial and material assistance, the development of agricultural training and community infrastructure, the dissemination of technical and technological innovations and strengthening research (PRSP, 2003).Thus, the state of government support acquirement by FOs, S_i, may be endogenous in part because of reception of grant depends upon relative factor prices,the stock of farmers knowledge, the extent and quality of the public service and others nonconventional factors such as youthfulness of the FOs, political affiliation, ethnicity or "networks".

3.3. The quantitative approach

In this point, we deal with the quantitative approach of impact assessment that, in recent literature is used, to evaluate the causal effect of a given action on agricultural production. This approach relies on two ways: the experimental or verification methods and the random non-experimental or quasi-experimental methods.

The experimental evaluation

The experimental evaluation was introduced by Cochran *et al* (1973), Rubin (1974) and is the most robust impact assessment approach (Baker, 2000). It suggests to randomly assigning individual who are interested into the project between the control group and the treated group (Brodaty, Crepon, Fougère, 2002).The idea is to construct two samples of individuals which are similar in every point but the only different from the fact that that one of the two groups is

involved in the program and the other not. As mentioned by Atchade (2005), randomizing the only way to ensure that this happen.

This approach however raises a number of practical problems: first, the randomization can be enforced as a result of moral rejection of the beneficiaries (Baker, 2000). Secondly, it may be politically difficult to provide an intervention to a group rather than to another. Third, the scope of the project may be such that there is no control group (the case of nationwide programs that cover the entire population). Fourth, it can be difficult to ensure that the selection is truly random. Finally, experimental designs can be costly and time consuming in certain situations, particularly if a new data collection has to be done (Baker, 2000).

The quasi-experimental method

This method (non-random) can be used to conduct an evaluation when it is not possible to constitute the treated and control groups by an experimental design. This technique generates a control groups that resemble the treatment group relatively to some observable characteristics. This method was introduced by Heckman and Hotz (1989) and extended by Heckman and Smith (1995).The quasi-experimental method is often more practical to adopt for evaluation. Indeed, it has the advantage that it can be implemented using existing data; it is faster and usually less time consuming. In addition, it can be executed after the project has been implemented if existing data are sufficient.

However, the method has some limits: (i) the reliability of result is often reduced because the methodology is less robust statistically; (ii) the statistics techniques used are often complex and, (iii) there is a problem of selection bias that cannot be completely reduced (Brodaty, 2002).

3.4 The qualitative approach of impact assessment

Quantitative techniques provide results in measuring the causal impact of projects or programs. However, they do not identify the mechanisms by which the impact is formed and how people feel the changes in their wellbeing. To overcome these drawbacks, the qualitative approach is used to assess the confidence that beneficiary group attach to the project (Mohr, 1995). Its use has grown in impact assessment in the 1990s.

In contrast, of causal inference methods, the underlying idea in the qualitative approach is to understand the perception of people, their behaviours and the conditions in which the project was implemented (Valadez and Bamberger, 1994). For example, qualitative methods,

especially participant observation can help to understand the ways through which households and local communities perceive a project and how it affects them (Baker 2000).

The implementation of this method requires, among other things, a data collection to identify beneficiary satisfaction. Qualitative data collected must be quantified to measure the changes brought by the project or programme (S. Garbarino and J. March, 2009). As in marketing, satisfaction is measured based on a differential scale built using the techniques of Thurstone (1921), Thurstone and Chave (1929) or Likert (1932). These techniques are powerful instruments of validity, but they do not isolate the factors underlying the attitudes measured (D. Szabo et al., 1968).

4. METHODOLOGY

The methodology of this study consists of a combined approach of quantitative and qualitative methods. The quantitative dimension is estimated using a causal model inspired by Rubin (1974) and the qualitative assessment is based on Likert's scale.

4.1 Impact of agro-pastoral programs: the quantitative approach

This problem has been asses using Rubin's (1974) framework that is largely developed by many authors: Brodaty T. et al (2002), Fern (2005, 2007), Heckman, Lalondre, Smith (1999), Cavaco S. *et al* (2002) and Cavaco (2003).

Impact assessment intendeds to measure the performance of a program by comparing two situations: the situation with the program and the situation in the absence of the program. Determining clearly the variable of interest on which the proposed program or project would improve and also the target population is extremely important for an impact assessment.

Let us suppose that productivity is a random variable Y with a mean E (Y) in the population of FOs. For agricultural programs that aim actually to alleviate poverty in Cameroon rural area, the goal is typically defined in terms of global income or income per person (*productivity*) according to the sustainable livelihood framework.

Let Y_i be the productivity of the FOs i and n the number of FOs in the sample. FOs which received the support of the government are the "treated" and those who do not received the supports, are the "untreated" in this case. Rubin (1974) postulated two values of the target variable for each individual or organization i , the value of the target variable or outcome

(FOs productivity in our case) Y_i is (Y_i^T) when the FO i is treated and (Y_i^C) its productivity when untreated .

The gain of the FO i in relation to programs is $G_i \equiv Y_i^T - Y_i^C$. In the literature G_i is called "gain", "impact" or "causal effect" of government support on FOs i productivity. Following the literature, this presentation will focus mainly on the average impact of FOs in the population of those that benefited support from the state (treated, $\Delta^{TT} \equiv (G \mid T = 1)$). In the case of anti-poverty programs Δ^{TT} is the average impact on poverty in the group oftreated andthe average impact in the group of untreated is $\Delta^{TU} \equiv (G \mid T = 0)$ and the average impact across the population is Δ^{ATE} (Ravaillon, 2005) with

$$\Delta^{ATE} \equiv E(G) = \Delta^{TT} \Pr(T = 1) + TU \Pr(T = 0) \qquad (2)$$

All the parameters are estimated according to the corresponding sample. It is interesting in some casesto estimate the parameters conditionally to the vector X of FO's characteristics. In this case, $\Delta^{TT}(X) \equiv E(G \mid X, T = 1)$, $\Delta^{TU}(X) \equiv E(G \mid X, T = 0)$ and $\Delta^{ATE}(X) \equiv E(G \mid X)$.

One method commonly adopted for the introduction of the characteristics of OP in the estimate is to assume that the productivity of OP is linearly dependent on the parameters mentioned above and the error terms μ^T and μ^c so:

$$Y_i^T = X_i \beta^T + \mu_i^T \; (i = 1, ..., n) \qquad (3)$$

And

$$Y_i^C = X_i \beta^C + \mu_i^C \; (i = 1, ..., n) \qquad (4)$$

We define the parameters assuming that X is exogenous ($E(\mu^T \mid X) = E(\mu^C \mid X) = 0$) so the conditional average impact parameters are:

$$\Delta^{TT}(X) = ATE(X) + E(\mu^T - \mu^C \mid X, T = 1) \qquad (5).$$

$$\Delta^{TU}(X) = ATE(X) + E(\mu^T - \mu^C \mid X, T = 0) \qquad (6)$$

$$\Delta^{ATE}(X) = X(\beta^T - \beta^C) \qquad (7)$$

The critical issue here is that it is not possible to have simultaneously the productivity levels of FOs in the case that it receives support and if it does not. For that, it is not possible to have a direct measure the impacts means defined above.

However, a starting point for this would be to make a simple difference between the average productivity oftreatedFOsand the untreated:

$$D(X) \equiv E(Y^T \mid X, T=1) - E(Y^C \mid X, T=0) \qquad (8)$$

This difference can also be estimated by ordinary least squares. For parametric models with control variables (X), it can be done an estimate of (1) in the sub-sample of treatedand (2) in the rest of the overall sample:

$$Y_i^T = X_i \beta^T + \mu_i^T \; si \;\; T=1 \qquad (9)$$

$$Y_i^C = X_i \beta^C + \mu_i^C \; si \;\; T=0 \qquad (10)$$

In practical the most commonly method used assume that all the idiosyncratic characteristics of the FOs are the same $\mu_i^T = \mu_i^C$ so, $G_i = \Delta^{ATE} = \Delta^{TT} = \Delta^{TU}$ and $Y_i = \Delta^{ATE} T_i + X_i \beta^C + \mu_i^C$.

Even if this constitutes a starting point for assessing the average impact of programs, several assumptions are necessary to ensure an unbiased estimate of the impact parameters. To be convinced consider the difference between the average productivity of treated FOs and untreated $D(X)$:

$D(X) = \Delta^{TT}(X) + B^{TT}(X)$ Where $B^{TT}(X) \equiv E(Y^C \mid X, T=1) - E(Y^C \mid X, T=0)$ is the selection bias by using $D(X)$ to estimate Δ^{TT} (Heckman et al., 1998).

Let us discuss the main practical methods for estimating the impacts of programs as formulated above.

In estimating the causal effect, there are two main types of bias. The first one is related to observable differences across the available data. For example, variables such as region, education level of the leader of the organization, the age of the FO, etc. The second type of bias is due to unobservable variables (or variables not available in the database).In fact, it is possible that factors like the ability of the leader affect both the likelihood of befitting of Government assistance and the level of production of the FO.

These two sources of bias can seriously affect the results of the study. Therefore, the challenge of non-experimental methods used for this paper is to try to model the selection process in order to ensure the comparison between the treated and the controlor untreated groups. However, matching can only consider the bias related to observable characteristics

that are available in the database and can do nothing about the bias due to unobservable variables.

Matching on observable characteristics is a technique frequently used (Heckman et al., 1998). In this study, the control group is paired with the treated group based on the predicted probability (propensity score) of receiving a grant. The first step in implementing the method is to model, using the variables available in the database, the process through which FOs receive government support; this is done using *logit* model as describe as follows.

T_i is the variable that takes 1 if the OP i has been supported and 0 if not, y_i^* a latent variable and x_i the observable characteristics of the FO i :

$$\begin{cases} T_i = 0 \ si \ y_i^* \leq 0 \\ T_i = 1 \ si \ y_i^* > 0 \end{cases} \qquad (11)$$

Thus,

$$pr(benef_i = 1) = pr(y_i^* > \beta X + \mu_i) = pr(\mu_i < y_i^* - \beta X) = \Phi(y_i^* - \beta X) \qquad (12)$$

Where $\mu_i \rightarrow \log it(0, \frac{\Pi^2}{3})$.

The predicted probabilities or propensity score are determined as follows:

$$pr(T_i = 1) = \frac{e^{\beta X}}{1 + e^{\beta X}} \qquad (13)$$

The property of independence usually requires consideration of many variables that makes it difficult to match. This problem is solved by Rosenbaum and Rubin (1983) showing that if $(Y^T, Y^C) \perp T \mid X$ then $(Y^T, Y^C) \perp P(T \mid X)$. Meaning that the propensity score is appropriate to match individuals of the two groups when observable variables are correctly identified.

To pair FO using propensity score, the Epanechnikov kernel matching was implemented which Heckman, Ichimura and Todd (1998) have shown its convergence (at a speed of $\sqrt{N}$) and its asymptotic normality under certain assumptions of regularity. This method associates a treated FO with a fictional non-beneficiary FO using the propensity score. The counterfactual is then constructed with Mahalanobis distance and considering all the FOs that are within a bandwidth *h*.

To assess the causal effect, the focal point was only on the agriculture sector and the livestock sector.The other agro pastoral activities (fishery, fish farming, hunting, etc.) were excluded due to their high heterogeneity.Ordinary and two matching methods were implemeted: one-to-

one matching with replacement and kernel Epanechnikov matching. Both matching methods have been restricted to the common support because the inclusion of FOs that are out of this support may bias the estimates.

Variables

The variables used to compute the matching are:

1- Size ofthe FO: less than10 members, 10 to 12members, 13 to 20 members, 21 to 30members andmore than 30members;
2- Agro ecological zone: forest,high mountains,andSahel;
3- Ageof FO ; less than 4 years, 5-7 years, more than 7years);
4- Domain of activity: agricultureand others (hunting, fishery, etc.);
5- Proportion ofwomen (quantitative variable);
6- Proportion of youths(quantitative variable; youth are people aged less than 35 years);
7- Genderof the leader: male and female);
8- Level of education of the leader: Never go to school, primary education, secondary first cycle, secondary second cycle and university).
9- Age of the leader

4.2 The qualitative approach

For the qualitative approach the level of satisfaction of the farmers' organisations was analysed at the level of leaders and members using Likert' scale. This method provides information on the intensity of agreement or disagreement of respondents on each statement and it offers aggregation possibilities (Page-Bucci, 2003).

The principle of this likertscale is simple. The satisfaction of the subject vis-à-vis the object from a series of items was measured, the sum of scores for each item gives the satisfaction (or appreciation) score. The score can be described as "an intensity of satisfaction or dissatisfaction". This scale is additive.

Likert scale was applied using section 2.3 of the questionnaire, which is about indicating how state interventions have influenced activities and living conditions. The answers of each question (item) have beenrecorded as follow: negative= -1; null=0 and positive=1. In total, we have considerer 11 items (*see appendix*).

The total score of a person *i* (leader or member) is given by:

$$SC_i = \sum_{j=1}^{11} score\ item\ j \quad (14)$$

And, the average score of all the leaders (or all the members) is given by:

$$SC = \frac{1}{n}\sum_{i=1}^{n} SC_i \qquad (15)$$

Where *n* is the total number of leaders (or the total number of members).

5. DATA

5.1 The survey

The data used in this studyis from the Survey on the impact assessment of agro-pastoral programs in Cameroon (EIPA). It was realised in 2009 by the Ministry of Economy and Planning (MINEPAT). Its main objective was to appreciate the changes in living conditions of rural household due to government intervention, assess the management of different supports, assess the effectiveness of administrative control and collect suggestions for improving government interventions.

In this survey, Agro-pastoral activities were grouped into three categories: (i) the subsistence farming: cereals, tubers, bananas, fruits and vegetables; etc., (ii) the cash crops: cocoa, coffee, cotton, bananas, palm; and (iii) livestock and related activities, hunting, fishery, forestry.

The scope covers all the 10 regions of Cameroon. The sample consists of (*see more details in appendix, table A2*):

- 60 heads of departments or managers of programs/projects;
- 340 heads of decentralized services;
- 1350 leaders of association or group of producers;
- 1350 members of these organizations (one member was interviewed in each selected FO).

This survey has two main databases. The database of "Members" has information on the demographics characteristics of the members, their opinions on changes in their living conditions, the management of various supports and the major constraints. The “leader” database has information on leaders and on characteristics of famers’ organisations.

Non-response is very common in this survey. Hotdeck Random method was used to treat missing values. This method produces an “artificial valve" to replace the missing value with a

value chosenin its neighbourhood. Variables having non-response rate higher than 30% were dropped.

5.2 Some descriptive statistics of the data

Table 3 below shows that FOs are relatively small, more than 50% have less than 13membersand about 15% have more than 30 members. In average, they consist of about4 8% women and 33% of young people. Therefore, there is an overall gender balance in FOs. However, young people (persons under 35 years) are underrepresented, while they constitute over 60% of the Cameroonian population.

It was noted that some 67.8% of FOs are headed by a male. Nevertheless, 51% of FOs headed by a woman have benefited against 50% of those headed by a man. By field the domain of activity, it was noted that 67% of sample FOs are exercising in agriculture, 24% in livestock and 9% in other agricultural activities (fishery, hunting, etc.). The fact that an FO is beneficiary or notmay depends on its age. Indeed, only 43% of FOs aged 8 years or above are beneficiaries, whereas 71% of young FOs (less than 2 years) received support from the state.

In the sample, more than half of respondents FOs have benefited from a state project or programme. It was found that there were 50.3% of beneficiaries against 49.7% of non-beneficiaries. The beneficiary FOs are more profitable than the non-beneficiary; their average annual production per capita estimated 136 000 CFAF (275 USD) versus 128 000 FCFA (256 USD) for non-beneficiary FOs.

Table3: Some statistics on the sample of farmers' organisations by agro-ecological zone

	Sahel zone	Mountains 'zone	Forest zone	National
Average Production per capita in (thousand of CFAF)	114.1	101.0	159.6	131.5
Proportion of women (in %)	46.2	55.2	44.2	47.7
Proportion of youths (in %)	34.4	30.6	34.4	33.4
Domain of activity				
Livestock	18.3	26.5	26.0	23.9
Agriculture	66.7	67.4	67.0	67.0
Other activities	15.0	6.2	7.1	9.2
Together	100.0	100.0	100.0	100.0
F0 size (numbers of members)				
less than 10 members	21.4	18.6	38.0	28.2
10 to 12 members.	27.7	20.3	23.6	24.0
13 to 20 members	29.8	26.5	19.8	24.4
21 to 30 members	10.2	15.1	7.6	10.3
more than 30 members	10.8	19.6	11.1	13.2
Together	100.0	100.0	100.0	100.0
FO Age				
Less than 2 years	7.8	4.2	8.0	7.0
2-4 years	45.9	35.1	42.8	41.7
5-7 years	29.4	30.6	35.2	32.3
more than 7 years	16.9	30.2	14.1	19.0
Together	100.0	100.0	100.0	100.0
Sex of the leader				
Male	69.7	68.0	67.6	68.3
Female	30.3	32.0	32.4	31.7
Together	100.0	100.0	100.0	100.0
Level of education of the leader				
Never go to school	25.2	7.2	1.3	9.8
Primary	32.1	38.3	22.2	29.1
Secondary 1st cycle	24.9	25.5	34.4	29.4
Secondary 2st cycle	14.7	15.9	28.5	21.3
University	3.0	13.1	13.6	10.4
Together	100.0	100.0	100.0	100.0

Source : EIPA Survey (2009). Our calculations

6. RESULTS

This section presents the results on the impact evaluation of agro pastoral programs on farmers' organizations. The first point is about the quantitative approach based on the Kernel matching and the second point focuses on the qualitative approached using Likert' scale.

6.1 Analysis of the satisfaction of the beneficiaries of grants

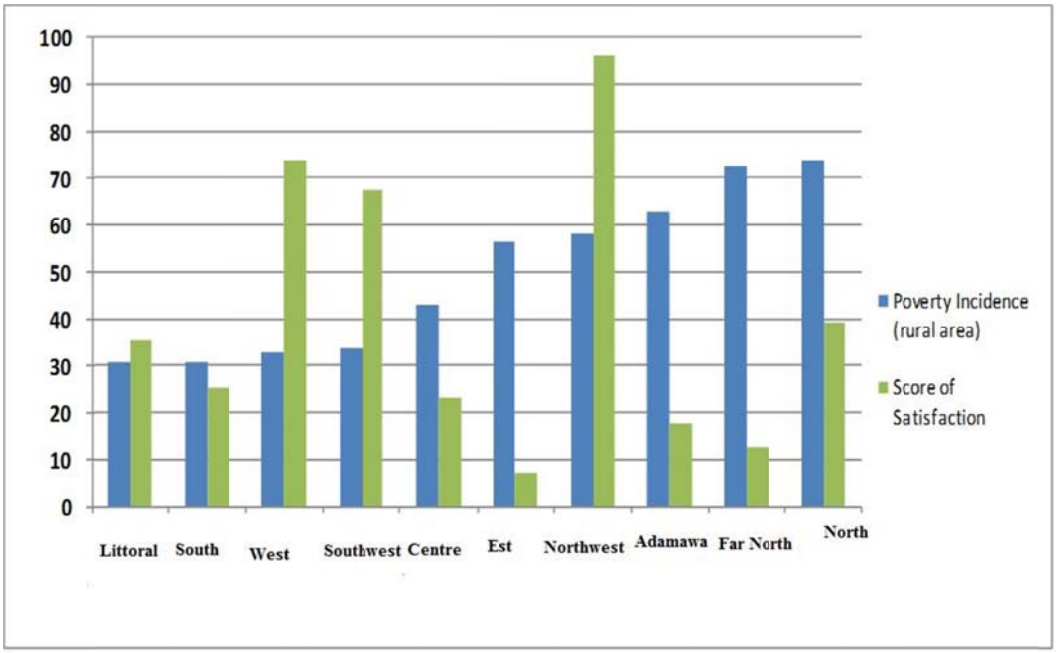
This analysis is based on leaders and members of FOs. It is alsodone according to the regional level and the domain of intervention of programs.

6.1.1 Analysis of thesatisfactionof the leaders

The satisfaction score calculated is positive, indicating an overall satisfaction of leaders of farmers' organizations vis-à-vis of the grants they received from the state over the period 2002-2008. However, there are regional disparities. The satisfaction of the leaders seems to be negatively correlated to the level of poverty of the regions. The poverty level of the Centre, the Far-north, the Adamawa, the East and the North regions, which is above the national level (39.9%), are significantly less satisfied with grants than other regions. However, the nonparametric test of Spearman and Kendall does not support this idea at the threshold 5%.

A more detailed analysis of the level satisfaction of leaders reveals that they appreciate the impact of subsidies on social development (education, health, etc.). All regions are satisfied about this aspect although the greatest satisfaction levels are found in regions where poverty levels are quite low. They also mention an improvement in their socio-cultural development in terms of empowerment of women, promotion of youth, the disabled and other vulnerable people. By cons, they feel that efforts in improving information on prices and market access were unsatisfactory.

Figure: Level of satisfaction of leaders and rural poverty incidence by region



Source : EIPA Survey (2009), ECAM 3 (2007). Our calculations

6.1.2Analysis of thesatisfactionof the members of farmers' organisations

In the case of members, five focus areas of the state and its partners were selected: social progress, diversification of production, improved farm management, the security of employment, work productivity, access and use of inputs.Satisfaction levels, the highest as in the case of leaders, are more important in regarding social progress. As for the social progress, all regions are satisfied. However, members of organisations of the Far North as well as their leaders feel dissatisfied with the actions of the State and its partners regarding the improvement of productivity.

6.2 Assessing the impact of agro-pastoral programs in Cameroon: the quantitative approach

6.2.1 The propensity score: likelihood of benefiting

This is the first step in implementation the matching based on predicted probability. In this step, it comes to model the probability for an FO benefit of a state agro pastoral project. To do this, logistic regression was conducted where the dependent variable is the variable T (*T = 1 if the FO is a beneficiary and 0 otherwise*). Explanatory variables are the agro-ecological zone, the domain of activity, the size, and age of the FO, and some socio-demographic characteristics of the leader of the organisation.

Table 4 summarizes the results. The quality of the model is satisfactory as it explains 30% of the variability and denotes that the treatment process is not misspecified. Regarding the characteristics of the FO, it can be noted that the proportion of youth (people aged less than 35 years) significantly increases the probability of an FO to receive support from the state. Indeed, the government policies give more importance to the insertion of young people in the agriculture sector, which is a promising sector as in terms of jobs. On the other hand, the proportion of women seems to reduce it.

The relationship between the likelihood of benefiting and the size of the FO seems to be nonlinear. On the order hand; the government seems to give more focus to younger FO; the likelihood of receiving subsidies decreases with the FO age. Indeed, a FO of 5-7 years is threetimes less likelyto have the supportof the State compared to a young FO (under 4 years), the odds ratio increases to over 15 when FOs of more than 7 years old were considered.

According to the characteristics of leaders, FOs headed women are more likely to be beneficial than FOs headed by men. In fact, since the 2000s, authorities are giving more importance to the participation of women in income generating activities and, there are many programs focus on their specific situation. When referring at the age of FOs, we can note that an FO whose leader is over 40 years is more likely to benefit compared to an FO whose leader is under 40. There seems be no relation between the level of education of the leader and the likelihood of benefiting.

Table 4: Logit model estimation: the propensity score

Variable	Odds ratio	Robust Standard Error
Proportion of women	0.977***	0.004
Proportion of youths (*people aged less than 35 years*)	1.032***	0.004
Number of members*(ref= less than 10)*		
10 to 12 members	2.158***	0.545
13 to 20 members	1.510**	0.376
21 to 30 members	1.273*	0.459
more than 30 members	1.820**	0.519
Agro ecologic zone (*ref. forest*)		
Mountains	1.427*	0.337
Sahel	0.304***	0.072
FO age		
5-7 years	0.369***	0.073
more than 7 years	0.063***	0.018
Domain of activity (*ref. livestock***)**		
Agriculture	0.120***	0.026
Other agro-pastoral activities	20.517***	10.137
Sex of the leader (*ref. male***)**		
Female	4.021***	0.971
Level of education of the leader *(ref. Never go to school)*		
Primary	1.146	0.400
Secondary 1st cycle	0.915	0.328
Secondary 2st cycle	0.961	0.363
University	0.680*	0.302
Age of the leader *(ref. Less than 40 years)*		
40 years and above	3.065***	0.703
Statistics of the model		
Number of Observations	1 146	
Prob > chi2	0.000	
AURC (area under ROC curve)	0.831	
Pseudo R2	30.3%	

Source: EIPA Survey (2009). Our calculations: significant at 10 %;**: significant at 5 %;***: significant at 1 %.*

6.2.2 Estimating the causal effect

We can note that in the livestock sector, the average effect of agro programs is positive regardless to the method used. According to recent studies, it appears that the growth of the livestock sector may also stimulate the growth of the overall economy (Pica, Pica-Ciamarra

and Otte, 2008) and that small farmers have their part in this phenomenon (Delgado, and Narrod Tiongco, 2008).

According to the OLS method, the average overall effect is 16% (about 42 USD per member). The matching methods show that the average effect on beneficiaries FOs is an increased of 18% to 21% of their annual output per capita. Non-beneficiary FOs would have experienced an increase of their productivity of 7% to 22% if they had benefited.On the other hand; subsidies seem to have had no significant impact on FOs exercising in food crops and cash crops. OLS suggests a positive overall average impact of 1.4%; however, this figure is not statistically different from zero at the threshold 10%. The one-to-one matching indicates that the average effect of programs on subsidized OP is only 0.4%.

Table 5: Returns to government's subsidies/assistance

		Returns to government grants/subsidies (in %)		
		Livestock	Agriculture	Together
Difference of productivity before matching		25.9	1.4	10.6
Ordinary Least Squares (OLS)		16.1**	-1.9	4.0
One to one matching	Effect on the treated (ATT)	20.9**	0.4**	3.4
	Effect on the non-treated (ATNT)	7.4***	11.1**	6.6
Kernel Epanechnikov	Effect on the treated (ATT)	18.9***	-4.4*	-0.2
	Effect on the non-treated (ATNT)	21.9***	2.1**	12.1

Source: EIPA Survey (2009). Our calculations: significant at 10 %;**: significant at 5 %;***: significant at 1 %.*

7. CONCLUSIONS

The study aimed to evaluate the impact of programs on productivity and satisfaction of farmers' organizations in Cameroon.

The results reveal a convergence in appreciation between leaders and members of organisations. As for the social progress, all regions are satisfied. However, members of organisations of the Far North as well as their leaders feel dissatisfied with the actions of the State and its partners regarding the improvement of productivity.

The relationship between the likelihood of benefiting and the size of the FO seems to be nonlinear. The government seems to give more importance to younger FO to the extent that the likelihood of receiving subsidies decreases with the FO age. In addition, a FO headed by a woman is more likely to be beneficial than a FO headed by a man. In addition, a FO whose leader is over 40 years is more likely to benefit compared to a FO whose leader is under 40.

The matching techniques revealed that farmers' organisations aid recipients have experienced an of 4% increase in their productivity. More specifically, the study reveals that the impact of government programs is more important in the livestock sector (16%) and in the agriculture sectoris quite zero. Furthermore, non-beneficiaries organisations of the livestock sector could have had an increase of their productivity of about 10% if they had benefited from government assistance.It appears that agro pastoral programs and projects would be a better way for government to support effort against poverty alleviation in rural Cameroun. In fact, many economic researches have confirmed the positive effects of raising the productivity of farm households (Alston et al., 2000). From all sectors of the economy, agricultural growth is the one that contributes most significantly to poverty reduction (Thirtle et al. 2001; Datt and Ravallion, 1998, Gallup, Radelet and Warner, 1997; Timmer, 1988).

About policy recommendations, there is a need to increase the impact of programs on the development of rural activities, and thus to reduce poverty, the study therefore recommends the government to:

- Put more means in the livestock sector, which appears to be a very promising. This sector can emerge as an important growth leverage of Cameroon economy. By focusing on the production of short-cycle species (non-conventional farming, small ruminants and aquaculture);
- Review the assistance strategies of farmers' organizations engaged in agriculture and adopt more targeting approaches and making the process of awarding grants more transparent. In fact, many farmers confessed that grants were often awarded based on segregationist, political affiliation and ethnicity criteria.
- Establish a monitoring-evaluation system of subsidies granted to farmers' organizations so as to increase their impact on the living conditions of populations. One important issue will consist of updating the existing file of FOs, providing contact information, as it was noted that some beneficiary FOs have ever existed.

However, this study has not taken into account the fact that the performance of farmers is also affected by a number of external factors such as credit constraints, availability of infrastructure, availability of fertilize and other unobservable variables like ability, social network, etc. These aspects may be addressed in further studies.

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APPENDIX

Table A1:Section 2.3 of the questionnaire “perceptionof the impact ofstate interventions”

S2Q15	Indicate howstate interventions have influencedyour activities andliving conditionsin terms of:	***1= Positive*** ***2= Null*** ***3= Negative***	**Explain ?**
S2Q15a	Access and use of inputs (fertilizers, pesticides, improved seeds, land, water, raw materials, ...)	|__|	……
S2Q15b	Knowledge of innovative practices, production techniques	|__|	……
S2Q15c	Farm productivity	|__|	……
S2Q15d	Safety Conditions	|__|	……
S2Q15e	Improved farm management (harvesting, storage, ...)	|__|	……
S2Q15f	Diversification of production	|__|	……
S2Q15g	Price information and market access	|__|	……
S2Q15h	Structuringyour organization and its contacts with otherstructures	|__|	……
S2Q15i	Environmental preservation	|__|	……
S2Q15j	Social development(housing, education and health for themselves andrelatives)	|__|	……
S2Q15k	Cultural development (women's empowerment,youth development, disabilities, other vulnerable people, ...)	|__|	…… ……
S2Q15l	In general, howdo you assess the impact of state interventions in the agro pastoral?	|__|	……

Source : EIPA Report, 2009

Table A2 : Summary of the sample design

Region	***Total number of FOs***	***Number of F0s sampled***	***Number of beneficiaries***
Adamaoua	2 638	120	75
Centre	22 683	240	160
East	4 112	120	75
Far-nord	12 930	150	100
Littoral	8 769	120	75
Nord	5 468	120	75
Nord-west	11 564	120	75
West	8 175	120	75
South	6 420	120	75
South-west	6 561	120	75
Cameroon	***89 320***	***1350***	***860***

Source : EIPA Report, 2009

TableA3: Some statistics on the sample of farmers' organisations

	Beneficiary FOs	Non-Beneficiary FOs	Together
Average Production per capita in (thousand of CFAF)	135.9	128.2	131.5
Proportion of women (in %)	46.2	49.1	47.7
Proportion of youths (in %)	34.5	32.3	33.4
Domain of activity			
Agriculture	46.3	53.7	100.0
Livestock	56.9	43.1	100.0
Other activities	63.8	36.2	100.0
F0 size (numbers of members)			
less than 10 members	50.5	49.5	100.0
10 to 12 members,	52.8	47.3	100.0
13 to 20 members	50.0	50.0	100.0
21 to 30 members	47.0	53.0	100.0
more than 30 members	48.7	51.3	100.0
FO Age			
Less than 2 years	70.5	29.5	100.0
3-4 years	51.6	48.4	100.0
5-7 years	49.7	50.3	100.0
more than 7 years	43.2	56.8	100.0
Sex of the leader			
Male	50.1	49.9	100.0
Female	51.1	48.9	100.0
Level of education of the leader			
Never go to school	46.4	53.6	100.0
Primary	50.6	49.4	100.0
Secondary 1st cycle	51.0	49.0	100.0
Secondary 2st cycle	51.6	48.4	100.0
university	48.7	51.3	100.0
Together	***50.3***	***49.7***	***100.0***

Source : EIPA Survey (2009). Our calculation