

# Logit Model of Analysing the Factors Affecting the Adoption of Goat Raising Activity by Farmers in the Non-pastoral Centre Region of Cameroon

F.A. J. Jaza<sup>1\*</sup>, P.P. Tsafack<sup>1</sup> & F. Kamajou<sup>1</sup>

**Keywords:** Agropastoralism- Breeder- Livestock- Logistic regression- Cameroon

## Summary

Three years after the beginning of a goat project in the Centre region of Cameroon, the engagement of farmers in this activity has been timid. As this region is not a traditional pastoral zone, farmers have not yet incorporated the crop-livestock integration into their habits. Hence, this paper uses a logistic regression approach in order to analyse the factors affecting the adoption of goat raising activity by farmers of this locality. The computed odds ratio indicate that the practice of goat raising activity is significantly influenced by the farmer's age, gender, farming experience, practice of other livestock activities, frequency of contact with extension agents, access to credit and farm income. However, being a goat raiser does not depend on the farmer's marital status, education, farm size, household size, membership into a common initiative group. The study therefore recommends that the government authorities should give more attention to significant factors so as to popularize the goat raising activity in this region.

## Résumé

**Modèle logit d'analyse des facteurs influençant l'adoption de l'activité d'élevage des chèvres par les agriculteurs de la région non-pastorale du Centre Cameroun**

L'évaluation du projet chèvre, effectuée après trois ans d'exécution, dans la région du Centre- Cameroun a montré que l'engagement des agriculteurs dans l'activité d'élevage des chèvres reste timide. Une des raisons de ce faible engagement serait la localisation de ce projet dans une région traditionnellement non-pastorale. Les agriculteurs ne sont pas habitués à l'intégration agriculture-élevage dans leurs systèmes de production. Cet article utilise un modèle de régression logistique pour analyser les facteurs influençant l'adoption de l'activité d'élevage des chèvres par les agriculteurs dans cette région. Le calcul du rapport des cotes (odds ratio) indique que la pratique de l'activité d'élevage des chèvres est, significativement, influencée par l'âge de l'agriculteur, son sexe, son expérience agricole, la pratique d'autres activités pastorales, la fréquence de contact avec les agents de vulgarisation, l'accès au crédit et par son revenu agricole. Toutefois, l'adoption de l'activité d'élevage des chèvres ne dépend ni du statut matrimonial de l'agriculteur, ni de son éducation, ni de la taille de son exploitation agricole, ni de la taille de son ménage, ni de son adhésion à un groupe d'initiative commune. L'étude recommande aux autorités gouvernementales d'accorder plus d'attention aux facteurs influençant l'adoption de cette activité dans cette région.

<sup>1</sup>University of Dschang, Department of Agricultural Economics, Cameroon

\*Corresponding author: Email: ajazafol@yahoo.fr

Received on 17.11.16 and accepted for publication on 11.08.17

## Introduction

The Cameroonian economy depends on agriculture which accounts for about 27% of Gross Domestic Product (GDP), employs 70% of the active population and generates more than half of total export earnings. Within the agricultural sector, the contribution of the livestock sub-sector is important to the country's economy. During the previous decades, this sub-sector employed 30% of rural people, contributed to about 2.1% of the country's GDP and 30% of the revenue earned by the rural population (10).

The livestock herd is mainly made up of cattle, goat, sheep, pig and poultry. In 2015, the country counted over 5.1 million cattle, 3.8 million goats, 3.5 million sheep, 1.2 million pigs and 24 million poultry (4). The increasing livestock production over the years is not sufficient enough to compensate the rise in the demand for livestock products so as to satisfy the population's needs. The livestock sub-sector is particularly important because its derived products consumed in the form of meat, milk, dairy products, eggs and table birds contribute to the national nutrition and healthiness of the Cameroonian population and its neighbouring countries.

According to the Cameroonian Ministry of Livestock (10), the total consumption of milk and dairy products is estimated at 297,000 tons per year i.e. an average consumption of 19.8 kg/person/year. The fresh milk consumption in the country averages 14.5 kg/person/year, which is below the minimum estimated need of 21 to 22 kg/person/year (4). Hence, the national demand of meat and dairy products is unsatisfied, probably because of the serious problems that are encountered by the livestock sub-sector.

Among these problems, the main constraining ones are the mismanagement of agricultural exploitations due to the farmers' low experience on livestock activities; the farmers' old age and high illiteracy level; the high proportion of unskilled labour due to the insufficiency or lack of training offered to farmers; the low capital or limited access to credit for investment; the low partnership or grouping initiative between farmers; the limited number of infrastructures for collecting, processing, storage, marketing and the low organisation of market for livestock products. It is assumed that, the national livestock production could be improved if these constraints are alleviated (10, 13).

For the country to achieve its food self-sufficiency and become a middle income country by the year 2035, the strategic document for poverty reduction recommends the livestock sector to increase the supply of raised animals such as cattle, goat, sheep, pig and poultry (10). By considering the low investment cost and the easiest adaptability of goat at different zones of the country, breeders give much preference to raising goats than to other livestock activities.

Most often, the breeders appreciate goats to other livestock for their multiple functions (e.g. milk and meat supply as well as draught power to households), for the little investment in management technologies that would secure goats' survival in dry seasons, for the high performance and productivity of goats (11). These advantages motivated the implementation of the goat project in 2013 at the Centre region because of its proximity to Yaoundé (county town of the region and capital-city of Cameroon) in order to meet the increasing demand of meat in such a big city, to exploit the genetic characteristics of goat, to improve goat productivity and generate revenue to farmers engaged in this activity. However, that project did not consider the historical vocation of the population and was launched in a region where pastoral activities were neglected in the past in favour of cropping enterprises such as cocoa, maize, cassava, fruits, vegetables, etc. As the Centre region is not a traditional pastoral zone, its farmers have not yet incorporated the crop-livestock integration into their habits.

Three years since the beginning of the goat project, farmers have been timidly engaged in the goat raising activity. Nowadays, the Centre region counts over 57,000 goat raisers (about 13.1% of the national total) as compared to about 34,000 goat raisers who existed in the region before the project was launched. Recent studies (11, 12, 13) have been carried out on the genetic, productivity and profitability of goat raising but without specific consideration on the factors affecting the timidity of adoption of this activity. Hence, this study is undertaken to fill up that gap by analysing the socio-economic factors affecting the adoption of goat raising activity by farmers in this region.

## Materials and methods

### Study area and data collection

The field survey was carried out from April to June 2016 in the Centre region of Cameroon. The following six divisions of the region were surveyed: Mfoundi, Haute-Sanaga, Mefou-Afamba, Mefou-Akono, Mbam-et-Kim and Lekié. These divisions were chosen in order to benefit from the facilities offered by the goat project implemented in these areas since 2013. Furthermore, the survey intended to help the goat project to build up a strong database by collecting information on goats in the Centre region.

At each division, 26 to 27 farmers were selected so as to survey a total of 160 farmers (comprised of 100 goat raisers and 60 non-goat raisers) throughout the whole study area. The selected goat raisers were farmers practising the goat raising as main activity during the previous three years (since the launch of the goat project in 2013) and owning a herd size of at least five goats. The selected non-goat raisers were farmers with at least one year of farming experience in cropping or other livestock activities apart from goat raising.

Using a structured questionnaire and interview-schedule, cross-sectional primary data of the calendar year 2016 were collected from the selected farmers. Based on the literature review of the constraining factors to goat raising activity (10, 11, 12, 13), the data collected from each farmer were the farmer's group (whether he is a goat raiser or not), age, gender, marital status, education, farming experience, farm size, household size, previous practice of livestock activities, frequency of contact with extension agents, membership into a common initiative group, access to credit for financing activities, farm income, etc.

### Data analysis

In order to analyze the factors influencing the adoption of goat raising activity by farmers in this study, the weaknesses of the linear probability model do not allow the usage of an Ordinary Least Squares (OLS) technique (5, 16). Following Gujarati (5) and Wooldridge (16), the logit or probit model could be more convenient to this study because the dependent variable (adoption of goat raising activity by farmers) is qualitative in nature, the explanatory variables are a mix of continuous and qualitative variables, and the sample size is low (N=160).

The choice between logit and probit model is ultimately one of mathematical convenience, ready availability of computer programs and computational tractability. On this score, the logit model is generally used in preference to the probit model. By using the SPSS software program, the probit procedure is a bit laborious because it cannot compute the probabilities' predicted values whereas the logit model offers the possibility to save the predicted values automatically. For the above reasons, the logit model has been used in this study (14, 16).

The logit model uses the Maximum Likelihood Estimation (MLE) method in order to predict the logit of the probability of the occurrence of the event, that is, the natural log of the odds ratio of reaching one or the other alternative (adoption or non-adoption of goat raising activity by farmers). By denoting  $P$  as the probability of reaching an alternative from the predictors<sup>1</sup>  $X_1$  to  $X_{12}$ , the mathematical formulation of the binary logit model (5, 16) used in this study is expressed in Equation 1:

$$Y = \text{Logit}(P) = \ln\left(\frac{P}{1-P}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_{12} X_{12} \quad (1)$$

Where:  $P$ : Probability that farmer raises goat;  $1-P$ : Probability that farmer does not raise goat;  $Y$ : Farmer's group (with 1=goat raiser, 0=non-goat raiser);  $X_1$ : Age of farmer (in years);  $X_2$ : Gender of farmer (with 1=male, 0=female);  $X_3$ : Marital status (with 1=married, 0=single/divorced);  $X_4$ : Education (with 1=university/secondary/primary, 0=none);  $X_5$ : Farming experience (years);  $X_6$ : Farm size (ha);  $X_7$ : Household size (number of persons);  $X_8$ : Practice of other livestock activities (with 1=yes, 0=no);  $X_9$ : Frequency of contact with extension agents (number of times per year);  $X_{10}$ : Membership into a common initiative group (with 1=yes, 0=no);  $X_{11}$ : Access to credit for financing activities (with 1=yes, 0=no);  $X_{12}$ : Farm income (with 1=income>200,000 FCFA/year, 0=income≤200,000 FCFA/year).

In the logit model (Equation 1), the notations  $\beta_1, \beta_2, \dots, \beta_{12}$  (generally termed as  $\beta_k$ ) denote the slope coefficients of the explanatory variables  $X_1, X_2, \dots, X_{12}$  (generally termed as  $X_k$ ) and  $\alpha$  is the intercept term (constant). The model parameters (slope coefficients, intercept term) and descriptive statistics of explanatory variables were estimated by using the SPSS software program (version 21.0). The exponential  $\text{Exp}(B)$  of the slope coefficient  $\beta_k$  associated to the explanatory variable  $X_k$  is interpreted as the Odds Ratio (OR) of the occurrence of the event<sup>2</sup> (raising goat) for each increase in the predictor. A positive  $\beta_k$  coefficient generally displays an OR greater than one ( $OR > 1$ ) whereas a negative  $\beta_k$  coefficient usually indicates an OR lower than one ( $OR < 1$ ) (5, 14, 16).

## Results and discussion

### Field survey findings

The descriptive socio-economic variables affecting the adoption of goat raising activity by farmers in the Centre region (Cameroon) are presented in Table 1. The majority of surveyed farmers are goat raisers and belong to the age group ranging between 40 to 49 years (Table 1). Hence, most respondents are essentially made of farmers in the active age group, which is a great advantage as active labour hand is needed to tie, graze, hunt, chase away, displace or carry out goats from one place to another, depending on the necessity. According to Elzaki *et al.* (3), the goat raisers at that age have a good marketing experience, which they can use to maximize their farm returns (3).

Table 1 results also show that, two-thirds of respondents are male. According to Tchotsoua and Gonne (13), men are more active in livestock activities because they are physically strong enough thus are more powerful to take care/carry animals or to manage their mobility (13).

<sup>1</sup>Explanatory variables =Predictors in logit model=Factors affecting the adoption of goat raising activity by farmers.

<sup>2</sup>Odds=Number of cases an event occurs, divided by the number of cases in which that event does not occur. Hence, the odds in this paper are interpreted as the chance of adopting the goat raising activity by any farmer.

**Table 1**  
Socio-demographic characteristics of selected farmers in the study area (N=160).

Factor/Variable	Category of response	Frequency	Proportion (%)
Group	Goat raiser	100	62.50
	Non-goat raiser	60	37.50
Age	< 29 years	8	5
	[30-39[ years	59	36.88
	[40-49[ years	66	41.25
	≥50 years	27	16.87
Gender	Male	109	68.12
	Female	51	31.88
Marital status	Married	135	84.37
	Single/Divorced	25	15.63
Education	University	48	30
	Secondary/Primary	108	67.5
	None/illiterate	4	2.5
Farming experience	>10 years	18	11.25
	]3-10] years	137	85.63
	≤3 years	5	3.12
Farm size	>1 ha	36	22.5
	≤1 ha	124	77.5
Household size	> 5 persons	140	87.5
	≤5 persons	20	12.5
Practice of other livestock activities	Yes	40	25
	No	120	75
Frequency of contact with extension agents	>6 per year	103	64.38
	≤6 per year	57	35.62
Membership into a common initiative group	Yes	51	31.88
	No	109	68.12
Access to credit for financing activities	Yes	13	8.12
	No	147	91.88
Farm income	>200,000 FCFA/year	44	27.5
	≤200,000 FCFA/year	116	72.5

The high proportion of male with respect to female respondents could therefore be an advantage for the goat raising activity.

More than three-quarters of respondents are married (mostly with at least two wives) (Table 1). This is not surprising as regards to the age of most surveyed people which was earlier indicated as ranging between 40 to 49 years. In general, farmers of the Centre region use to get married before the age of 40 years so as to quickly have several partners/children which provide supplementary labour force for their farming or livestock enterprises (7). The non-married people beyond this age group are either divorced or widowed people. This latter group represents less than one-fifth of the respondents (Table 1).

One-third of the respondents have reached the university level, two-thirds of them have studied till the primary or secondary school level, and only few of them have never enrolled to any school (Table 1). Hence, most surveyed farmers are literate people, as testified by the 81% literacy rate in the country (4). The educational level might influence the farmers' decision because those who studied livestock/animal husbandry at school could easily weigh the advantages and disadvantages of goat raising before deciding to adopt this activity (8).

More than three-quarters of the selected farmers have a farming experience between 3 to 10 years (Table 1). This group of respondents have chosen the farming profession in order to benefit from the proximity of their locality to the capital city (Yaoundé), where their farm products are easily transported and sold. Yaoundé counts 1.8 million inhabitants, which are consumers of various agricultural commodities or livestock products produced in its vicinity (7). Hence, being a goat raiser could be a rewarding profession in this locality.

Three-quarters of respondents own land of less than 1 ha (Table 1), which is below the average size of 1.8 ha of agricultural exploitations in Cameroon (6, 7). Land is a scarce resource in the Centre region, which welcomes every year high number of migrants (at a 2.8% annual rate) coming from several parts of the country (10). In order to accommodate the migrated people, parcels of land previously devoted to farming activities are being cleared for building construction. This reduces the land size destined for farming activities in this locality.

More than three-quarters of respondents have a household size of more than 5 persons (Table 1).

This is not a surprising result as the majority of respondents are married in a polygamy union (with at least two wives per man). As mentioned earlier, polygamy is advantageous to farmers because it enables them to have enough partners/children in order to supplement the labour force necessary in their farming or livestock enterprises (12).

Only one-quarter of respondents have previously practised other livestock activities (Table 1). As the Centre region is not among the traditionally preferred zones for breeding animals in Cameroon, those farmers engaged in the goat raising activity would rather prefer to settle in the Adamawa or Northern regions of the country where they are sure to earn high returns by investing in such a business (13).

About two-thirds of respondents have been approached more than six times per year by the extension agents from the Ministries of Agriculture or Livestock (Table 1). That is a high frequency as compared to other regions of the country where extension agents meet farmers one to two times per year (10). Since the majority of extension agents reside in Yaoundé, which is a neighbouring city to most farms of the Centre region, it creates a proximity which facilitates the contact between farmers and the popularizing team.

More than two-thirds of surveyed farmers are not members of any common initiative group (Table 1). However, being member of such a group could raise the awareness of farmers or popularize the goat project (2). Furthermore, the integration into a peasant association would help the goat raisers to address the group-problem solving on issues like the transportation of goats to the market, food or vaccine to purchase from wholesalers, construction of common protected area for grazing goats, advertisement of market information, etc (8).

A negligible proportion of respondents have access to credit for financing their activities (Table 1). This could be justified by the country's economic situation which still suffers from the consequences of the economic crisis of the early 1990s. That crisis led to the closure of agricultural bank institutions which granted subsidized credits to farmers (6, 7). However, the credit could easily help any breeder to compensate the investment cost spent for its goat raising activity and quickly improve the farm returns (1). Hence, it would be important for the government to revamp the agricultural finance sector including the creation of agricultural banks which could offer subsidized credit to farmers with a viable project such as goat raising activity.

About three-quarters of respondents earn a farm income of less than 200,000 FCFA per year (Table 1). This result is in line with FAO (4) according to which more than 40% of Cameroonian farmers live below the poverty line (spending less than 1US\$ per day).

The use of archaic technology for crops' cultivation/breeding animals or the lack of credit access by farmers could explain this situation. However, the use of modern technologies or credit facilities could boost the productivity thereby increasing the farm returns or income (15).

### Results and discussion from the estimated logit model

Table 2 presents the logit model results from analyzing the socio-economic factors influencing the adoption of goat raising activity by farmers in the Centre region of Cameroon. Most coefficients of the explanatory variables show the expected signs. The estimated coefficients ( $\beta_k$ ) and odds ratio [OR or  $Exp(B)$ ] are separately interpreted for each explanatory variable  $X_1$  to  $X_{12}$  (Table 2).

#### Age of farmer ( $X_1$ )

The coefficient for the age of farmer is significant at 10% level and its negative sign indicates that, the old farmers are less likely to adopt the goat raising activity as compared to young category of farmers. The OR of this variable is 0.981 (lower than one) which implies that, for each additional year in the age of the farmer, the odds of adopting the goat raising activity decreases by  $1-0.981=1.9\%$  (Table 2). In the Centre region, the majority of young farmers are educated people (who have attended at least the primary level of education) so that they could easily understand the benefits or advantages from investing in livestock activities. This is in contrast with old farmers who are mainly illiterate people with a little knowledge in the livestock or goat raising activities. Besides, the aged people are physically weak whereas the young farmers are strong enough thus are more powerful to carry or manage the mobility of animals (8). The old farmers sometimes get sick after transporting goats from one place to another (probably because of the difficulty to follow up the mobility of these animals) whereas young people are most of the time healthy to take care of animals. By tradition in the Centre region, the old farmers rather prefer to undertake less difficult farming activities such as cultivating the cash or food crops (6). As old people are more vulnerable to diseases, an offer of health insurance (currently inexistent) subsidized by government authorities could encourage them to invest in the goat raising activity.

#### Gender of farmer ( $X_2$ )

This variable has a positive coefficient (significant at 1% level) which implies that, male farmers are more likely to adopt the goat raising activity as compared to female farmers. For this variable, the model suggests an OR of 1.037 (greater than one) which indicates that, a change in the gender of farmer (from female to male) increases the odds of adopting the goat raising activity by a factor of 1.037 (Table 2).

**Table 2**  
Logit estimate of socio-economic factors affecting the adoption of goat raising activity by farmers (N=160).

<i>Explanatory variables</i>	$\beta$	<i>Sig.</i>	Exp( $\beta$ ) [OR]
Age (years)	-0.019*	0.073	0.981
Gender (1/0)	0.036***	0.006	1.037
Marital status (1/0)	0.106	0.236	1.112
Education (1/0)	0.072	0.548	1.075
Farming experience (years)	-0.0198*	0.069	0.980
Farm size (ha)	0.019	0.143	1.019
Household size (number)	0.175	0.291	1.191
Practice of other livestock activities (1/0)	-0.009*	0.075	0.991
Frequency contact with extension agents (number)	0.019**	0.046	1.019
Membership into a common initiative group (1/0)	0.044	0.731	1.045
Access to credit for financing activities (1/0)	0.071***	0.007	1.074
Farm income (FCFA/year)	0.006***	0.009	1.006
Constant (intercept term)	-16.955	0.368	0.000

TOTAL Nagelkerke R<sup>2</sup>=0.717; -2 Log likelihood=33.051; Percentage of correct prediction= 91.30 % Omnibus test of model coefficients: X<sup>2</sup>=61.898\*\*\*; Hosmer and Lemeshow test: X<sup>2</sup>=8.823

\*\*\*: Significant at 1%

\*\*: Significant at 5%

\*: Significant at 10%

According to Bala *et al.* (2), men are physically strong enough thus are more powerful to carry or manage the mobility of goats. They are capable to tie, graze, hunt, chase away, displace or carry out goats, whenever it is necessary. Traditionally in the Centre region, animals of big weight/height (e.g. goat, cattle, sheep, pig, etc) are mostly raised by men probably because they are more capable to manage the mobility of these animals (6). Furthermore, raising these kinds of animals provide high returns needed by men to secure urgent family needs such as the children's school fees, health, marriage, funerals, building construction, *etc.* In contrast, women are more engaged in raising small/light/weak animals (e.g. poultry, duck, bird, rabbit, *etc*) which are easy to carry/manage in spite of their mobility. According to Tchotsoua and Gonne (13), small/light/weak animals are more convenient for women to raise because these kinds of animals require less labour and provide the minimum returns sufficient for this gender to secure the supplementary family needs (e.g. food, clothes, pocket money, *etc*) (13).

### Marital status ( $X_3$ )

The marital status displays an insignificant coefficient implying that, this factor does not affect the adoption of goat raising activity by farmers. With a positive coefficient, the model however suggests an OR of 1.112 (greater than one) which could testify that married farmers are 1.112 times more likely to adopt the goat raising activity as compared to single/divorced farmers (Table 2). As mentioned earlier, farmers of the Centre region usually prefer to get married with at least two wives so as to have large number of partners/children who could help them in their farming or livestock activities (12).

### Education ( $X_4$ )

The insignificant education coefficient indicates that, this factor does not affect the goat raising activity by farmers. Its positive sign implies a greater than one OR (1.075) testifying that, farmers with education are 1.075 times more likely to adopt the goat raising activity as compared to illiterate farmers (Table 2). Those farmers who studied livestock or goat raising at school could better weigh the advantages and disadvantages by adopting this activity (15).

### Farming experience ( $X_5$ )

The coefficient for farming experience is significant at 10% level and its negative sign indicates that, respondents with high farming experience are less likely to adopt the goat raising activity as compared to those with a low farming experience. The lower than one OR (0.980) of the variable implies that, for each additional year in a respondent's farming experience, the odds of adopting the goat raising activity decrease by  $1-0.980=2.0\%$  (Table 2). This assertion is related to a previous result according to which, old people are less likely to adopt the goat raising activity as compared to young farmers (8). In general, the young people compensate their low farming experience with the education they receive (most of them reach at least the primary school). A previous study by Jaza (6) shows that, the young farmers like adventurous situations such as the discovery of a new livestock activity such as goat raising. The old people with high farming experience are rather reticent to goat raising activity which is unfamiliar to their habits.

As the Centre region is not an important traditional or preferred zone for livestock activity in the country, the experienced breeders rather prefer to carry out this activity in the Adamawa region where it is more rewarding. The old farmers from the Centre region mostly have farming experience in traditional crops grown in this locality (e.g. cocoa, fruits, food crops, vegetables, etc) and none or low experience in livestock activities (15). By fear of taking any risk, the old age farmers prefer to continue the cultivation of their traditional crops rather than the newly implemented goat raising activity (13).

#### **Farm size ( $X_6$ )**

With an insignificant coefficient, the farm size does not influence the goat raising activity. The computed OR however implies that, farmers with large farm size are 1.019 times more likely to adopt the goat raising activity as compared to those farmers with small farm size (Table 2). Contrary to the cropping activity, goat raising is not undertaken directly in a parcel of land (although the goats need to be grazed from time to time in grassland). In the Centre region, the majority of farmers graze their goats in the community land managed by the municipalities (10). Hence in most cases, the goat raisers do not own the land used to graze their goats. The insignificant farm size coefficient could be justified on this premise.

#### **Household size ( $X_7$ )**

The household size does not significantly influence the goat raising activity. Its computed OR however implies that, farmers with large household size are 1.191 times more likely to adopt the goat raising activity as compared to those farmers with small household size (Table 2). As mentioned before, the goat raising activity needs strong people to manage the mobility of animals during their transport from one place to another. This is in contrast with the cropping activity where large number rather than strong people are needed to compensate the labour shortage (11).

#### **Practice of other livestock activities ( $X_8$ )**

This variable has a negative coefficient (significant at 10% level) which implies that, farmers who undertake other livestock activities are less likely to adopt the goat raising activity as compared to those with cropping as sole activity. The lower than one OR (0.991) for this variable indicates that, the engagement of a farmer in other livestock enterprises decreases the odds of this farmer to adopt the goat raising activity by  $1-0.991=0.9\%$  (Table 2). The field survey results (Table 1) already reveal that a negligible proportion of farmers in the Centre region have access to credit for financing their activities. This situation was justified by the economic crisis of the early 1990s which led to the closure of agricultural bank institutions which granted subsidized credits to farmers. Currently, farmers hardly succeed from borrowing money to invest because they lack sufficient guaranties or collaterals.

Hence, it would be difficult for any farmer to get enough funds to undertake multiple livestock activities (1). However as testified by the field survey results (Table 1), a few farmers practised other livestock activities even before the beginning of the goat project in order to acquire supplementary animal manure needed to fertilize their crops (8). Hence, by fear of risk and uncertainty, it would be difficult for such group of farmers to abandon their initial livestock activity into a new one (e.g. goat raising) which they do not master well. The likelihood for this group of farmers to shift into the goat raising activity is then low.

#### **Frequency of contact with extension agents ( $X_9$ )**

This variable is significant at 5% level and its positive sign indicates that, farmers with high frequency of contact with extension agents are more likely to adopt the goat raising activity as compared to those farmers who do not regularly meet the extension agents. The variable's OR of 1.019 implies that, for each additional contact of a farmer with an extension agent, the odds that this farmer would adopt the goat raising activity increases by  $1.019-1=1.9\%$  (Table 2). This could be due to the advertisement that the extension agent is expected to make in order to convince farmers to invest their money in goat raising at the detriment of other farming activities. For instance, raising goats could provide the animal manure necessary to fertilize the cropping activities of the same farm. According to Kay *et al.* (9), the crop-livestock integration is beneficial in terms of inputs used by the farm. Hence, it is assumed that those farmers who learn these advantages by approaching the extension agents would be encouraged to adopt the goat raising activity.

#### **Farmer's membership into a common initiative group ( $X_{10}$ )**

Although this variable is insignificant, its positive sign however indicates that farmers who belong to a common initiative group are more likely to adopt the goat raising activity than those farmers without adherence to any group. In other terms, the odds of farmers who are members in a common initiative group is  $1.045-1=4.5\%$  higher than the odds of those who are non-adherents to any group (Table 2). The integration of farmers into a common initiative group would help them to meet their colleagues (so as to share together the advices for the goat raising activity), to address the transportation issue and group problem-solving in goat management (6).

#### **Access to credit for financing activities ( $X_{11}$ )**

This variable has a positive significant coefficient (at 1% level) which indicates that, farmers with access to credit facilities are more likely to adopt the goat raising activity than those who depend on their own funds.

For this variable, the model suggests an *OR* of 1.074 (greater than one) which indicates that, a credit granted to a farmer increases the odds of adopting the goat raising activity by  $1.074-1=7.4\%$  (Table 2). Since the goat raising activity requires little investment in management technologies that would secure goats' survival in dry seasons, the use of credit would quickly boost this business in comparison to other livestock or farming activities (9, 11).

### Farm income ( $X_{12}$ )

This variable has a positive coefficient (significant at 1% level) which implies that, farmers with high income ( $>200,000$ FCFA/year) are more likely to adopt the goat raising activity as compared to those with low income ( $\leq 200,000$  FCFA/year). The greater than one *OR* (1.006) for this variable indicates that, as the farmer's income changes from low to high, then the odds that this farmer would adopt the goat raising activity increases by a factor of 1.006 (Table 2). It is assumed that those farmers with high income could use their supplementary returns to invest in the goat raising enterprise. Farmers with low income however have limited capital and would lack supplementary means to engage themselves in the goat raising activity (8).

All in all, Table 2 results reveal that the adoption of goat raising activity is significantly influenced by the farmer's age, gender, farming experience, practice of other livestock activities, frequency of contact with extension agents, access to credit for financing activities and farm income. However, the logit model displays insignificant coefficients for factors such as the marital status, education, farm size, household size and membership into a common initiative group. In general we could validate these model results (5, 16), as testified by the high Nagelkerke  $R^2$  (0.717) and overall goodness-of-fit measured by the significance of the Chi-Square statistic in the Omnibus test of model coefficients is high ( $\chi^2=61.898$ ,  $p<0.01$ ). The percentage of model's correct prediction is also good (91.3%). The Hosmer and Lemeshow test shows that the model adequately fits the data (the test was not significant at 5% level with  $p=0.357$ , thus, the null hypothesis could not be rejected) (Table 2).

### Conclusion

The goat project was implemented since the year 2013 in the non-pastoral Centre region of Cameroon in order to exploit the genetic characteristics of goats, improve goat productivity and generate high revenue to actors engaged in this activity. The project timidly attracted farmers in the activity. The socio-economic factors affecting the engagement of farmers in this activity have been analysed in this paper.

The selected farmers for the study were made up of a majority of goat raisers, male persons, aged between 40 to 49 years, married, with secondary/primary education, between 3 to 10 years of farming experience, with a farm size of less than one hectare, with the non-practice of other livestock activities, with more than six yearly contacts with extension agents, non-member of a common initiative group, without access to credit facilities and with low farm income. The logit model results suggest that there are a number of factors which significantly favour the goat raising activity by farmers in the Centre region. These are the farmer's age, gender, farming experience, practice of other livestock activities, frequency of contact with extension agents, access to credit for financing activities and the farm income. However, the adoption of goat raising activity does not depend on the farmer's marital status, education, farm size, household size and membership into a common initiative group. These are factors with insignificant coefficients in the logit model. Hence, the policy makers should give much attention to the significant factors if the goat raising activity is to be popularized in this region. This could enable the non-pastoral Centre region to become a pastoral zone for farmers to invest in livestock or goat raising activities in future.

### Aknowledgements

The authors are grateful to the goat raisers of the Centre Region (Cameroon) for their kindness during the data collection.



## Literature

1. Atieno R., 2007, Determinants of credit demands by smallholder farmers in Kenya: an empirical analysis, *Tropenlandwirt.*, **98**, 7, 11, 63-71.
2. Bala D.R., Bonar M.S., Kusnadi N. & Mohamad H.S., 2014, The impact of credit and capital supports on economic behaviour of farm households: a household economic approach, *Food Agric. J.*, **2**, 3, 81-91.
3. Elzaki R.M., Faki H.H. & Elobied H.A., 2007, Optimal crop combination and livestock integration in the irrigated agricultural sector in Sudan. In: Doppler W. & Bauer S. (eds.). *Farming and Rural Systems Economics. Issues and Challenges in Rural Development: Compendium on the Occasion of the 15<sup>th</sup> Years of Ph.D. Program Agric. Econ. Relat. Sci. Stud. Dev. Countries*, **86**, 1, 71-85.
4. FAO, 2015, *Balanced feeding for improving livestock productivity: increase in milk production and nutrient use efficiency and decrease in methane emission. FAO Animal Production and Health*, Paper N° 173. Rome, Italy.
5. Gujarati D.N., 1995, *Basic econometrics (third edition)*. McGraw-Hill: New York, USA.
6. Jaza F.A.J., 2014, Application of Coase theorem to analyze the welfare gain and loss in a conflict of herders' damage in croppers' land at the Adamawa region of Cameroon, *Quat. J. Int. Agric.*, **53**, 1, 1-24.
7. Jaza F.A.J., 2015, The determinants for the adoption of compost from household waste for crop production by farmers living nearby Yaoundé, Cameroon: descriptive and logit model approaches of analysis, *Int. J. Biol. Chem. Sci.* **9**, 1, 308-328.
8. Jera R. & Ajayi O.C., 2008, Logistic modeling of smallholder livestock farmers' adoption of tree based fodder technology in Zimbabwe, *Agrekon.*, **47**, 3, 379-392.
9. Kay R.D., Edwards W.M. & Duffy P.A., 2007, *Farm management (Sixth Edition)*. Mc Graw Hill, New York, USA.
10. Ministry of Livestock (Ministry of Livestock, Fishery and Animal Husbandry), 2015, *Annals of statistics of the livestock sector in Cameroon*, campaign 2014/2015. Direction of Livestock, Yaoundé, Cameroun.
11. Rooyen V. & Homann S. (Eds.), 2008, *Enhancing incomes and livelihoods through improved farmers' practices on goat production and marketing*. Proceedings of a workshop organized by the Goat Forum, 2-3 October 2007, Bulawayo, Zimbabwe.
12. Tambi E.N., 2014, Smallholder livestock production: Constraints on the adoption of improved technologies, *World Rev. Anim. Prod.*, **15**, 3, 51-67.
13. Tchotsoua M. & Gonne B., 2009, *Des crises socio-économiques aux crises environnementales sur les Hautes Terres de l'Adamaoua, Cameroun*. In: Seiny-Boukar L.P. and Boumard P. (éditeurs scientifiques), 2010. *Actes du colloque «Savanes africaines en développement: innover pour durer»*, 20-23 avril 2009, Garoua, Cameroun. Prasac, N'Djaména, Tchad; CIRAD, Montpellier, France, cédérom.
14. Terrell G.R., 1999, *Mathematical statistics: a unified introduction*. Springer-Verlag: New York, USA.
15. Tsafack P.P., 2016, *A socio-economic assessment of goat raising and distribution in the Centre Region of Cameroon*. Master Thesis in Agribusiness Management. Department of Agricultural Economics, Faculty of Agronomy and Agricultural Sciences, University of Dschang, Cameroon. 85pp.
16. Wooldridge J.M., 2009, *Introductory econometrics: a modern approach*. McGraw-Hill: New York, USA.

---

F.A.J. Jaza, Cameroonian, PhD, Associate Professor, University of Dschang, Department of Agricultural Economics, Dschang, Cameroon.

P.P. Tsafack, Cameroonian, MSc Student, University of Dschang, Department of Agricultural Economics, Dschang, Cameroon..

F. Kamajou, Cameroonian, PhD, Emeritus Professor, University of Dschang, Department of Agricultural Economics, Dschang, Cameroon.