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Estimation of stochastic frontier of the technical efficiency of the soybeans production's determinants in Benin: the case of the commune of Savé

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This paper assesses the socio-economic and demographic determinants the level technical efficiency in the soybeans' production in the commune of Savé. The Cobb-Douglas stochastic frontier production function was estimated using the program frontier of the STATA software 11. The results obtained show that producers are in the whole ineffective with 56% as technical efficiency score. The distribution of the efficiency indices shows that on a sample of 66 producers, 25 (either 37.87% of the sample) have registered the best scores (between 80 to 99%). This distribution has also revealed that small operators are more effective than the large operators technically. For a better level of effectiveness of concrete actions must be orientated toward certain exogenous factors such as the level of instruction, training, the sex and the area sown. Finally the article suggests producers a rationalization of the areas sown to operate an optimal combination of the factors available to augment yields in soybeans and in turn the improvement of the level of technical efficiency.

Keywords: Benin, commune of savé, stochastic frontier, soybeans.

INTRODUCTION

Agriculture is the basis of the Beninese economy. It contributes to about 40% to the national GDP, provides more than 50% of export revenues and provides relatively well being of approximately 70% of the population (PSRSA, 2011).

The Soybean is a strategic culture for the power supply for direct human in particular in the developing countries, for the producers of soybeans and the agro-industry. More than 20% of the world production of oil and fat food in are derived (FAO, 1977). After, artisanal or industrial extraction of the oil (20 to 25%), the residual meal contains 45 to 50% of high-quality protein whose composition in amino acid is close to the optimum defined by nutritionists, CIRAD *et al.,* (2002). The soy is of this fact, a potential source of protein to both animals and human populations rural low income and could not afford sometimes proteins of animal origin. Various forms of processing of soybeans is currently observe in the villages of Benin in particular in "Cheese of soybeans "locally called "Amon Soja" in Nago. Indeed, soy cheese, pulp consistent basis of soy milk coagulated, is widely consumed by the low-income populations as a substitute for meat. This practice in strong propensity is salutary and deserves to be encouraged because it contributes a lot to the reduction of malnutrition of vulnerable populations (children, lactating women or pregnant women and the elderly). The Soybean is a useful source of oil and protein and may be useful for improving the

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nutritional value of traditional foods. The seeds are transformed to produce flour, semolina or soy milk. The oil can be extracted leaving a semolina used for animal feed. The soy flour prepared in the form of ball can substitute the meat in the sauce. In Nigeria, the soybean is also used in the industries for the manufacture of biscuits. Its culture collects a climate with hot summers.

The Benin, known for its potential in the agricultural sector, is launched on the track of the agricultural diversification by the promotion of other agricultural sectors in order to reduce its dependence on the cotton sector. The Strategic Plan for the revitalization of the agricultural sector (PSRSA) has identified thirteen (13) agricultural sectors (pineapple, cashew, corn, cotton, manioc, yams, rice, oil palm, vegetable crops, meat, milk, egg, shrimp/fish), to benefit from the support of the State from 2011 to 2015 in the aim of constructing an emerging economy (PSRSA, 2011). However it should be noted that the channels prioritized in the Sectorial Agricultural Policy do not take into account the soy that yet is first of a strategic interest for the economic growth and poverty reduction (reduction of the poverty of many producers and producers who are engaged in the culture of the soybean). Then improves the fertility of the soils (agronomic and environmental benefits) and finally it presents a adequacy with the agro-industry in the production of vegetable oil and food for animals (feed) and many products derived from artisanal transformation and industrial semi to enrich the supply of children in protein (PAEPARD, 2011). [1]

The Culture of Soybean is introduced in Benin to the years 1945 (MDRAC, 1981 quoted by Ogouvidé *et al.,*(2004). It was mostly grown for the purposes of use for the nutritional recovery of malnourished children and its consumption was recommended to wet nurse in social centers. However, the national application of the soybeans increased during the second half of the decade 2000 - 2010 with the decline in the availability of cotton seed used primarily for the production of oil and oil-cake at the level of the major oil mills such as FLUDOR, SHB, and IBCG. Indeed, the production of cotton seeds in Benin who allowed the plants to dispose of cottonseeds for the oil production and meal is increased from 450,000 tons in 2004 to 210,000 tons in 2009 and then 150. 000 tons in 2010. This drop is even confirmed in 2011 with a production of only 137 000 tons, which corresponds to a decrease of approximately 70 per cent of the production between 2004 and 2011. During this time the national production of soybeans has experienced an exponential growth, 6.000 tons in 2004 it rose to 140,000 tons in 2015. Despite this emergence of the Soya Production Chain in the field of production, it is little valued in the sectorial policies of the government in the promotion of agricultural sectors. In the face of this identified problem, this article shall notify a certain number of questions likely to really apprehend the technical efficiency of soybean producers. Are there possibilities of increasing the level of current performance without increasing the level of input?; what are the socio-economic and demographic factors that influence the technical efficiency of the production of soybeans in the commune of Savé? This paper aims to determine the level of technical efficiency in the production of soybeans in the labor and capital factors in particular in the commune of Savé and to identify the socio-economic and demographic factors which explain this efficiency in order to identify suggestions for an improvement of the productivity, an increase in the incomes of producers and the reduction of poverty in Benin.

LITERATURE REVIEW

The concepts of efficiency are becoming more and more a major importance in agriculture, base of the economy of the developing countries, in particular south of the Sahara African countries. This important identifies itself through many works on almost all continents. These different works focused either agricultural products (cereals; cassava; cotton; rice; banana), either on the breeding of dairy cows and pigs. Several works have therefore assessed the effectiveness of the producers and the determinants. The first studies on the measurement of the effectiveness begin by Farrel (1957), which is based on the work of Debreu (1951) and Koopmans (1951) quoted by Nyemeck (1999), proposes a division of the effectiveness of an operation in two components: the technical efficiency which represents the ability of a farm to produce a maximum level of output from a given level of inputs and the allocative efficiency which represents the ability of a farm to use the inputs in optimal proportions, given their respective prices and production technology available. The combination of these two measures gives the level of economic efficiency. During the last decades, the method developed by Farrell (1957) has experienced improvements, which has fostered many studies on the measurement of the level of efficiency of the producers and rural households' farm. Although Farrel had been the precursor of the structure of the borders of production and of the efficiency indices measurement, Aigner and Chu (1968) have been the processors of the borders of parametric production. This parametric production function is represented by a Cobb-Douglas or TRANSLOG function type. The parametric production functions can be deterministic or stochastic according

1 The five (05) criteria that have allowed to retain three (03) Groups of agricultural sectors are: criteria:(i) the contribution of the sector to the Food and Nutritional Security; (ii) the contribution of the sector to the improvement of the economic growth; (iii) the contribution of the sector to the improvement of incomes of households; (iv) the degree of integration of the sector in the structure of the Beninese economy; (v) the balanced and sustainable development of the regions.

that there introduced or not the random term (or stochastic). The non-parametric methods have been introduced by Charnes, Cooper and Rhodes (1978), which defines a ratio of technical efficiency using an approach called Data Envelopment Analysis (DEA). This approach allows to extend the measures of Farrell (1957) in a context of multi- products to return to scale variables: a review in more detail this approach is contained in the work of Färe, Grosskopf and Lovell (1994). The DEA approach requires the use of the method of linear programming. Several work conducted in developing countries. Arouna *et al.,* (2005) have analyzed the technical efficiency, the allocative economic and production units of the cashew nuts in Benin from a parametric model, stochastic production. It is clear from the result of their study that there is to the inside of the different classes, the units of production technically and economically effective. The study concludes that the large farms are not effective as the small. These authors suggest therefore that any action for the promotion of the cashew nut industry in Benin must be oriented as well toward the large and small production units. This result seem to be similar to that obtained by Venkataramani *et al. ,* (2006) In a study of technical efficiency of *input*is specific to each district of India with the help of a Cobb-Douglas production function. They find that an improvement in health is associated with a significant increase in the technical efficiency. Also, Loureiro (2009) located that the differences in farmers'healthexplain the variance in the effectiveness of agricultural production in Norway. Therefore, the increase in access to inputs would be likely to increase productivity and reduce poverty. In addition, Costa *et al.,* (2013) examine the relationship between agricultural productivity and the food security of households in metropolitan areas Brazilian, taking into account the other individual factors. They find that the productivity gains are associated with a greater household food security, in proportions low due to the strong influence of particular characteristics such as education and income. In Benin, Adégbola *et al.,* (2008) and Adégbola *et al.,* (2010) analyze the levels of technical efficiency, the allocative economic and respectively in the rice-based production systems which are competitive in the center and the north-east and units of production and processing of cashew nuts using the production function stochastic. It is clear from these studies that the rice farmers are in the whole ineffective; 62% of the yield variation in rice is mainly due to the inefficiency technique. By contrast, the distribution of the indices of efficiency shows that for the technical effectiveness, 77% of rice farmers have an index of efficiency higher than 50%; 97% of the rice farmers with regard to the allocative efficiency and 50% for economic efficiency. They conclude that rice farmers the most effective are characterized by the use of herbicides, animal traction and improved varieties on small areas. These results are further developed more later by other authors as Mounirou(2015) In a study of the Perception and adoption of technical innovations in agriculture in the Coastal Basin of Banikoara in Benin reveals that variables such as: age, level of education and instruction, risks and uncertainties do not promote a good perception of the adoption of technical innovations in agriculture in the cultivation of cotton and of food products (maize, cassava, peanuts and mil). It suggests that programs and policies focusing on the intensification of the training in agricultural techniques to the base, the promotion of agricultural cooperatives are of appropriate conditions for effectively increase the best rates for a good perception of the adoption of technical innovations in agriculture in the basin. Also, is there in the different classes of producers, production units technically and economically inefficient and that the large farms are not more effective than the small. Labiyi *et al.,* (2012) have evaluated the technical effectiveness, the allocative economic and allocation of resources in the production of soybeans in Benin precisely in the communes of Ouèssè and Savè in the center of the country. They show that the average of the indices of technical efficiencies, the allocative Economic and are respectively 0.640; 0.747 and 0.476. Finally, they conclude that access to credit, the literacy of producers, the level of education, sex, the training and the number of years of experience are the factors determining the levels of technical and economic effectiveness of the soybean producers in the communes of Ouèssè and Savé and that the improvement of this level of economic efficiency of production will go necessarily by targeted actions on these variables. This result is confirmed by that of Yves-Roland Konan *et al.,* (2014) on "Analysis of the technical efficiency of the rice farmers in the face of the infestation of culture by the parasitic species Striga in Côte d'Ivoire". These results show that the frequency of infestation by the striga species and the level of education of the rice farmers have a positive impact on the level of efficiency of the rice farmers the studies carried out by Mouzoun in 2010, on the analysis of the determinants of the technical efficiency of producers of irrigated rice in the south-west of Benin with the stochastic approach of the frontier of production, have shown that the level of efficiency means of the producers of the area of study is 83,55% with a low variability. The producer of the less effective has recorded a score of effectiveness of 18.18% while that the more efficient has made a score of 99.99%. It concludes that the microcredit, the variety grown and the size of the exploitation negatively affect the technical efficiency, but an increase in the size of operation will also increase the level of technical efficiency. Ulimwengu (2009) uses the production function of the stochastic border to estimate the index of effectiveness in agriculture in rural Ethiopia. It has shown the negative impact of the state of health of farmers on both the farm efficiency and the reduction of poverty. It concludes that the improvement of the farm efficiency consecutive to an investment in the health of farmers may not lead to the reduction of poverty because, additional measures are

necessary to simultaneously achieve the increase of productivity and the reduction of the rate of agricultural poverty. Finally Ndegue *et al.,* (2011) in their study on "technical efficiency, environmental efficiency in agriculture" have shown that the more the seniority of the producers increases the less they are inefficient on the technical plan environmental and consequently the experience plays an important role on the efficiency. An element that emerged also in Mosheim and Lovell, (2009) in their analysis of the efficiency and economies of scale in the U.S. dairy industry. This review, although not exhaustive, has allowed us to situate it in relation to the current methods, which promote the analysis of technical efficiencies of production units. Two approaches are then appropriate to address these types of analyzes: it is in particular the parametric approach and the non-parametric one. The parametric approach part of a specification of the production function, cost or profit (Cobb-Douglas type) and allows to define the border of the whole of the production, which can then take two forms: that of a deterministic function or that of a Stochastic function "Stochastic Border" (*stochastic frontier)*. The method of maximum likelihood allows to make this estimate from the sample data. With regard to the non-parametric approach, it part of an analysis by the method of data wrapped (*Data Envelopment Analysis,* DEA), which requires no assumption on the form of the production function, of the cost function, or profit. It has recourse to the linear programming and is particularly suited to the measurement of the relative effectiveness of firms where the decisions of optimization of cost or profit does not constitute a priority. This approach is restrictive in the framework of our research, and therefore, will not be used, because our prime concern is to highlight the determinants that allow a minimization of the costs and the maximization of the production (output). Our choice in the framework of this study focuses on the first parametric approach is the same of the method by the stochastic frontier of production that must guide us in order to achieve the expected results.

Presentation of the study area and methodological framework of analysis

This section deals with the study area with its potentialities agro-ecological and methodological problems (choice of models, specification, and choice of variables estimation technique).

Presentation of the study area

The Department of the Collines has several agro-ecological potential. The choice of the commune of Savè is explained by the fact that it is from the first three producing Common of soy in the Department of collines (DEDRAS, 2012). The commune of Savé is located in the Department of Collines. It is limited to the north by the Commune of Ouèssè, to the south by the Commune of Kétou, to the east by the Republic of Nigeria and to the west by the Communes of Dassa and Glazoué. Savé, the chief place of the commune, is located, approximately 255 km of Cotonou. It is crossed by the RNIE 2 and the RNIE 5 (Savè-Oké-Owo). The climate which prevails there is of subequatorial type characterized by two rainy seasons (a large and a small) and two dry seasons (a large and a small). But since little this climate has given place to a tropical climate of sudanian type marked by a rainy season and a dry season. Average heights of rains are 1 100 mm per year. The territory of the commune belongs to the peneplain wavy crystalline and low altitude varying between 200 and 300 meters. It is marked by the presence of many rock outcrops, which are in the form of domes where the name "udders" that relate these Collines. The Soils meeting there are of tropical ferruginous soils which the fact of human exploitation are place by place to the lateritic soils infertile. There is also in the low-funds and the Valleys of water courses of soils. Hydromorphic On the whole these different types of soils are relatively fertile. The population of the commune of Savè is estimated, according to the 3th general census of the population and of the habitat (RGPH3) of February 2002, to 67 753 inhabitants is 12.64% of the population of the Department of Collines. Women are 33 795 inhabitants or 49, 87% of the total workforce of the communal population. There are 11 688 households with the average size is 6 members, 9 472 households are headed by men. The population density is 30 inhabitants per km2 (Capochichi, 2006).

METHODOLOGICAL FRAMEWORK OF ANALYSIS

The data used in this study are primarily derived from a survey carried out on the ground during the period of (August 2016) in the commune of Savé. Group interviews are conducted in 11 villages identified as producers of soy in the commune (Okounfo, Gogoro, Alafia, Dèguèdèguè, Ouoghi, Diho Katakou, 1 and 2, Dani, Boubou career, Boubou-pump), with the support of the responsible of the carder who we have oriented for these interviews. Then an individual investigation is conducted on a total of 66 producers. This survey focuses on the one hand on quantitative variables (production, the fixed capital, labor, the age, the area sown of Soya, the size of the operation, the number of years of experience, the area sown cotton, the quantities of seed, fertilizer and insecticide) and on the other hand on qualitative variables (sex, level of education, access to credit, training, the belonging to a grouping villagers, the application of the technique of inoculation, secondary activity). It should be noted that its information are those of the last campaign (2015). After the phase of survey, we have carried out the input mask of the questionnaires before to proceed with the seizure itself of the data collected. The software

version Access 2013 is used for this phase. This software has enabled us to achieve tables, queries, as well as forms of quantitative and qualitative data. The assessment of the degree of efficiency of a farm or of a firm is the result of the estimation of a production function border. Several approaches are developed to estimate the boundaries of production and to measure the level of effectiveness. These approaches can be classified according to the presumed form of the border, according to the nature and the properties assumed in the gap between the observed production and the maximum production. The first distinction allows you to classify two categories of approaches: parametric approaches and nonparametric approaches. The second distinction allows you to classify two categories of approaches: parametric approaches through two methods: the inferential methods (statistics) and the descriptive methods. The last differentiates the stochastic borders of borders deterministic.

The estimate of the production border and the calculation of scores of technical efficiency are carried out using the program frontier of the STATA software 11. By contrast, for the linear regression and the descriptive statistics, the SPSS software version 16 is operated. Taking into account the op citreasons, the approach by the stochastic border is used for the estimation of the border of production to producers of soy in the commune of Savé. This approach proceeds by the estimation of a border of production derived from the Cobb-Douglas type. Mathematically if one considers a producer i which combines the factors of production (seed, fertilizer, insecticide, labor, capital, area sown) for the production of soybeans. The functional form gives the following model:

$$\mathbf{Ln(Prod_i) = \beta_o + \beta_1 Ln(Sem_i) + \beta_2 Ln(Engr_i) + \beta_3 Ln(Insec_i) + \beta_4 Ln(Trav_i) + \beta_5 Ln(Capi_i) + \beta_6 Ln(Sup_i) + \mathcal{V}_i - \mathcal{U}_i \quad (1)}$$

$\boldsymbol{i}$ Represents the producers of soya i= $\mathbf{1} \ldots\ldots\ldots\ldots\ldots \boldsymbol{n}$

$\boldsymbol{n}$:The size of the sample;$\boldsymbol{\beta_i}$is the vector of parameters to estimate; it represents the elasticities because the production function is of type Cobb-Douglas;$\boldsymbol{Prod_i}$: production of soybeans in (Kg/ha); $\boldsymbol{Sem_i}$: the quantity of seed used in (Kg/ha); $\boldsymbol{Engr_i}$: total quantity of NPK fertilizers and urea used (kg/ha);$\boldsymbol{Insec_i}$: the quantity of insecticide used in liter (L/ha);Quantity of labor force used (family or employed) in man-day/ha;: here it is the fixed capital which includes the total value of linear depreciation for equipment having a duration of life greater than one year and the acquisition value for the materials having a duration of life less than or equal to one year Used in the production of soybeans for the campaign considered (in FCFA/ha);: $\boldsymbol{Sup_i}$The area sown soybean (ha);$\boldsymbol{\mathcal{V}_i}$**:** is the random error term;$\boldsymbol{\mathcal{U}_i}$**:** is the error term that reflects the technical inefficiency of the operator i ;

Note that the calculation of the time of the work is performed by choosing as the basic unit the man/day. For this, we used the weighting coefficients applied by the FAO. These coefficients are expressed in equivalent man/day. As well, the time of the work of the woman are multiplied by 0.75; for the less than 15 years the coefficient is 0.5.

Then we determine the time to work in man/day by dividing the total number of hour performed by 8 (a man/day is equivalent to 8 hours of work per day). Two hypotheses are to be considered in relation to the terms of errors: it is assumed that$\boldsymbol{\mathcal{U}_i}$follows a normal law of parameters $\mathbb{N}(\mathbf{0}, \boldsymbol{\sigma_{\mathcal{U}}^2})$and $\boldsymbol{\mathcal{V}_i}$follows a truncated normal distribution that is-to-say $\boldsymbol{\mathcal{V}_i} \rightarrow \mathbb{N}(\mathbf{0}, \boldsymbol{\sigma_{\mathcal{V}}^2})$. On the basis of its assumptions, it obtains from the program frontier of Coelli (1996), the coefficients and$\boldsymbol{\sigma^2 = \sigma_{\mathcal{U}}^2 + \sigma_{\mathcal{V}}^2}$;

$\boldsymbol{\lambda = {\sigma_u}/{(\sigma_u + \sigma_v)}}$. $\boldsymbol{\lambda}$Measure the part of the technical inefficiency in the total variation observed between the points on the border of production and the data.

The procedure for the estimation of the boundary function of production is the one adopted by Coelli, (1996). It is to maximize the natural logarithm of the likelihood function and to calculate a likelihood ratio LR.

The method frequently used to explain the levels efficiencies takes place in two steps. It consists first of all to estimate the level of effectiveness of the different operators, and then to make a regression of its levels of efficiency as a function of certain specific factors such as: the size of the exploitation, the age and the level of instruction of the operator, access to credit, the training received by the operator and its belonging to a grouping, the area sown cotton, sex. Thus, the regression performed during this second stage, may follow the linear regression model or the tobit model to take into account the character truncated (between 0 and 1) of the variable explained (technical effectiveness). Formally the model is as follows:

$$\mathbf{TE_i = \alpha_o + \alpha_1 Age + \alpha_2 Sex + \alpha_3 Inst + \alpha_4 Sup + \alpha_5 Taill + \alpha_6 Form + \alpha_7 Group + \alpha_8 Aces + \alpha_9 Supcoton + \alpha_{10} ACSEC + \alpha_{11} APPLI + \alpha_{12} EXP + \mathcal{W}_i \quad (2)}$$

TE: score of technical efficiency of the producer;$\boldsymbol{\alpha_i}$is the vector of unknown parameters of the determinants of the technical efficiency to estimate; $\boldsymbol{\mathcal{W}_i}$: is the error term; usual $\boldsymbol{Inst}$:level of instruction of the producer: binary variable (1 If educated and 0 if not);$\boldsymbol{Age}$: the age of the producer;: The area sown soybeans into the ha;$\boldsymbol{ACSEC}$ **:**secondary activity binary variable(1If the producer has a secondary activity and 0 if not);$\boldsymbol{APPLI}$ **:**Application of the inoculation: binary variable (1 If the producer applies the inoculation and 0 if not);$\boldsymbol{EXP}$ **:** Number of year of experience in the culture of the soybeans: quantitative variable (year) $\boldsymbol{Sex}$: The sex of the producer: binary variable (1 if producer is a man and 0 if women);$\boldsymbol{Taill}$: The size of the exploitation:

binary variable:1 If large operation (with an area emblavé greater than 5ha) and 0 if small operation (area less than 5ha);$\boldsymbol{Form}$: the formation of the producer: binary variable (1 If the producer is formed and 0 if not);: belonging to a grouping: binary variable (1 If the producer is a member of a grouping and 0 If not);: The variable access to credits Input and species of the producer. Binary variable (1 If yes; 0 if not):$\boldsymbol{supcoton}$: The area sown in cotton in (ha). This approach has several advantages: it is well indicated when it is assumed that more of a variable can explain the level of effectiveness of an operation; it takes well into account the variables both quantitative and qualitative; it is application is very easy and it allows you to test the impact of different variables on the level of effectiveness. It is important to point out that several variables that may explain the production of soybeans outside of these explanatory variables selected. Some explanatory variables retained here in our study are those which we have made the case in the literature review or that one can suspect to influence the production of soybeans. The choice of the variable area sown of cotton as a determinant of the technical efficiency of the producers of the soybeans is justified by the fact that the culture of the soybeans and that of cotton are during the same period and observe the same route technical as well as the same treatment. Therefore more the area sown of cotton by the producer is high the less it will be available to take care of the culture of the soybean. What can act negatively on the performance of the soybeans and in turn on the technical efficiency of the producer.

RESULTS AND ECONOMIC IMPLICATIONS

We present descriptive statistics, the results of the econometric estimates and the economic implications

Descriptive analysis of the data and the econometric results

Table 1: Descriptive Statistics of the quantitative variables

The variables	Description	N	Minimum	Maximum	Average	Standard deviation
Prod	*Production of soybeans (kg/ha)*	66	85	5000	1243.17	1404.13
Sup	Area sown (ha)	66	1	20	5.66	4.11
Capi	Fixed capital (FCFA/ha)	66	2400	200000	51646.97	54430.5
Sem	*Amount of seed (kg/ha)*	*66*	*20*	*175*	*107.5*	*48.30*
Insect	Amount of insecticide (L/ha)	66	0	10	3.54	2.41
Engr	Quantity of fertilizer (kg/ha)	66	0	500	141.89	123.69
Trav	*Quantity of Work(man/day)*	66	45	265	136.19	67.68
Supcoton	Cotton area (ha)	66	0	15	3.68	4.22
Age	The age of the producer (year)	66	20	75	36	14.72
EXP	Number of years of experience in the culture of the soybeans (year)	66	0	35	5	7 .06

Source: Survey Data 2016

An analysis of this table shows that the overall average production of soybeans per producer is 1243.17 kg/ha with a strong variation of 1404.13 kg/ha between the producers of the area of study. Its producers cultivatedinaveragearea of 5.66 ha of soybeans and 3.68 ha of cotton. It varies from 1 to 20 ha for soybeans and from 0 to 15 ha for the cotton. With regard to the fixed capital, it should be noted that the producers of the area of study constitute on average 51646.97 FCFA for the renewal of equipment and work materials with a strong variation of 54430.5 FCFA between them. For the semi, producers use on average 107.5 kg of seed per hectare with a low variation of 48.30 kg from one producer to another. This amount varies between 20 and 175 kg depending on the varieties and the middle of the operator. To improve their performance, some producers use on average, respectively 3.54 l/ha and 141.89kg/ha of insecticide and fertilizer (NPK and urea) with a strong variation of 123.69 kg found at the level of the fertilizer. It should also be noted that the average age of producers is 36 years with an average experience of 5 years in the culture of the soybean. While some are very experienced other have no experience in culture of soybeans. The less old producer is 20 years and the oldest is 75 years. It is used in 136.19 average man/day in the study area with a variation of 67.48 from one producer to another.

Results of the estimation of the stochastic function of the production of soybeans

The results of the estimation of the parametric border stochastic and of the production of soybeans by the method of maximum likelihood are presented in the table below.

Table 2: Result of estimate of the function of stochastic production

Variable	The coefficients	Z	P>|z|
(constant)	-2.71**	-2.70	0.007
	(1.003)		
Lncapi	0.290**	6.34	0.000
	(0.0457)		
Lnsup	-0.240**	-3.46	0.001
	(0.0693)		
Lnengr	0.157	1.45	0.147
	(0.0693)		
Lnsem	0.267	0.52	0.604
	(0 .33917)		
Lntrav	1.102**	6.05	0.000
	(0.1821)		
Lninsect	0.523**	2.22	0.026
	(0.23558)		
		The parameters of efficiency	
σ^2	1.472**	2.13	
	(1.382)		
λ	0.9807**	1.721	
	(0.56975)		

Log of the maximum likelihood function =-56.0557 ; test of the likelihood ratio =40.95

Degree of freedom = 6; n= 66; ( ): The numbers in parentheses are the errors-types ; prob>=chibar2 = 0.00. **Significant at 5%. Source : Calculated from Survey Data 2016

After estimation of the parameters of the model, the stochastic frontier of production of soybeans in the commune of Savè is the following:

$$\mathbf{Ln(Prod_i)} = \mathbf{-2.71 + 0.175Ln(Sem_i) + 0.157Ln(Engr_i) + 1.101Ln(Insec_i) + 1.102Ln(Trav_i) + 0.290Ln(Capi_i) - 0.240Ln(Sup_i)} \quad \textbf{(3)}$$

The performance of scale is equal to the sum of the elasticities of the factors of production significant. It amounts to 1.675. This figure is higher than the unit. The conclusion is that the yields of scale are growing at the level of producers of soy in the commune of Savé. The parameter □ is significant and different from zero. This allows you to reject the hypothesis of the absence of the effects of technical inefficiency of producers.

Distribution of levels of technical efficiency in the study area

Table 3: Distribution of levels of technical efficiency

New of efficiency (%)	Workforce	Percentage
[05-25[	*17*	25.76
[25-50[	11	16.67
[50-80[	13	19.70
[80-100[	25	37.87
Total	66	100
And Medium	-	**56**
Minimum		***5.82***
Maximum		**99**
Standard deviation		**0.3399**
Large operators	**26**	**54**
Small operators	**40**	**60**

Source: Authors from Survey Data 2016

The results of the estimation of levels of technical efficiency indicate that the level of technical efficiency of soya producers varies from 05 to 99% in the study area with an average of 56%. This score indicates that the producers are ineffective in the height of 44% and that no producer has recorded a score of 100%. The distribution of frequencies of effectiveness indicates that 37.87% of the sample have registered the best scores (between 80 to 99%), 19.70% with scores acceptable (between 50 to 80%), while 25.76% found themselves with insufficient scores (less than 50%). The distribution of frequencies of technical efficiency according to the categories of operator reveals that the large operators have a medium level of technical efficiency of 54% and small operators have 60%. Therefore the major producers are less effective than the small operators. It should also be noted a low variation in levels of technical efficiency of a producer to another (0.3399).

Analysis of the levels of technical efficiency's determinants

The descriptive statistics of the qualitative variables introduced in the model are presented in Table 4.

Table 4: Socio-economic characteristics of producers

Characteristics	Absolute Frequencies	Relative frequencies (%)	Characteristics	Absolute Frequencies	Relative frequencies (%)
Sex			Application of inoculation		
Male	39	59.1	Yes	18	27.27
Feminine	27	40.90	Non	48	72.73
Total	66	100	Total	66	100
Instruction			Secondary activity		
Yes	23	34.85	Yes	33	50
Non	46	65.15	Non	33	50
Total	66	100	Total	66	100
Access to credit			Size of the operation		
Yes	31	47	Large	26	34.4
Non	35	53	Small	40	60.60
Total	66	100	Total	66	100
Training			Belonging to a group		
Yes	32	48.48	Yes	36	54.54
Non	34	51.58	Non	30	46.46
Total	66	100	Total	66	100

Source: Survey 2016

The reading of this table shows that in the commune of Savé, men and women are engaged in the cultivation of soybeans with respectively of the proportions of 40.90% and 59.1%. Of the 66 producers of the sample 18 only apply the technique of inoculation (27.27%). This result reveals a low perception of technical innovations in agriculture in the study area. It is to be noted that a majority of producers have not received a formal education (65.15%) and 53% do not have access to credit. Even if more than half of the producers have a group of belonging (54.54%), (48.5%) only have followed a training concerning the culture of soybeans. It should also be noted that the sample is dominated by small farms (less than 6 ha) with a proportion of 60.6% and half of the producers investigated exercise the secondary activities.

The Determinants The effectiveness techniques of producers

The results of the estimation of the determinants to the technical efficiency of producers by the tobit model are recorded in Table-5.

Table 5: The technical efficiency determinants

The variables	Parameters	The values	Standard deviation	Likelihood
Constant	□ □	0.43096**	0.0295096	0.000
Area of the soybeans	□ □	-0.0252**	0.0047756	0.000
Area Of cotton	□ □	0.0115156	0.014204	0.418
The age	□ □	-0.001392	0.0033647	0.626
Sex	□ □	0.16183*	0.1400046	0.029
The training	□ □	-0.1787**	0.0357276	0.000
The experience	□ □	0.0000294	0.0052612	0.996
Secondary activity	□ □	-0.2518**	0.0865775	0.004
Application of inoculation	□ □	0.0480769	0.2120322	0.821

Table 5 cont'd

The statement	□ □ □	**0.72814****	**0.3173755**	**0.022**
Size of the operation	□ □ □	0.38590**	0.0477114	0.000
Belonging to a group	□ □ □	0.0778077	0.12251	0.525
Access to credit	□ □ □	-0.1796**	0.0556806	0.001
Log Likelihood		5.5207**		
Sigma		0.221033	0.0347119	

Source: The results of the estimation. *= significant at 10%, ** = significant at 5%,

The estimate of the production function has been made by the Boundary function of production of Cobb-Douglas type. The regression results show that the model is broadly significant at the 5% threshold (Table 4). The results indicate that the parameter λ is equal to 0.980 and significant at 5%. This means that 98% of the variation in the output is due to the inefficiency technique of producers and that 2% of this variability is then attributed to the random effects. It follows that the statistics of the distribution of student, which allows you to test the null hypothesis of the absence of the effects of technical inefficiency of the production is rejected because itλ is significantly different from 0 at the threshold of 5%. The specification in terms of border of production (>0) is therefore appropriate in this study. This stochastic formulation of the border, confirmed by the Student t test, shows that in this study, in addition to the technical inefficiency,λ account should be taken of the factors purely random.

The variables such as the fixed capital, the amount of insecticide, and the amount of labor used are positively significant. It follows that the quantity produced of the soybean in (kg/ha) is positively correlated by the fixed capital, the amount of insecticide, and the amount of labor. An increase in these factors would result in an increase of the quantity produced of the soybean. These results are in agreement with those of Amoussouhoui (2013) concerning the fixed capital (the amortization of equipment), and the quantity of labor for the production of seed rice in the south of Benin. These results are also similar to those of several authors including Kassimou, 2002). According to the latter, the workforce has often a positive meaning on the technical efficiency. Remember that the manpower in the case of species includes as well the family labor and that employee. By against this result is contrary to that of Labiyi *et al.* , (2012) according to which only the variable quantity of seed is positively significant in the production of soybeans in the departments of the hills and that the other variables have no effect on the production. With regard to the other variables in our model, only the variable "Area sown" proved to be significant at the 5% threshold with a negative effect, the others are non-significant. This negative sign of the area means that the increase in the area sown by the producer makes it more distant from the border of production. This result although it is surprising is that a confirmation of the fact that the small producers are more technically efficient that the large producers found more top. It finds its explanation of the fact that the producers operate in a random environment and of which the increase in the area increases the risk of technical inefficiency. It should be noted that the yields of scale are ascending at the level of producers which means that the increase of the factors of production (fixed capital, the quantity of labor and insecticide) an additional unit would increase the production more than proportionally. The indices of technical efficiency have been directly obtained with the program frontier (Coelli *et al.,* 1998). These results show that on the whole the soya producers of the commune of Savé have a medium level of technical efficiency of 56% (Table 5), that is to say that their degree of inefficiency is 44%. There are still opportunities to increase the production of 44% without recourse to additional inputs. There is still a huge margins of maneuvers to increase the production of soybeans in the study area on the basis of the resources currently used. Where the interest of the study and the identification of the determinants of the effectiveness of the soya producers of the commons Savé. The results of the analysis of the factors determining this level of technical efficiency of the producers are obtained from the Tobit Model of the STATA software 11 (Table 5).

These results reveal that the variables such as the area sown, the level of instruction, training, access to credit, and the secondary activities, the size of the operation are significant at the 5% threshold as well as the variable sex at the threshold of 10%. These variables are supposed to explain this level of technical efficiency of producers but it should be noted that the Variables area sown, access to credit, training and the secondary activity have negative effects on the level of technical efficiency.

With regard to the area sown, are negative effect is that a confirmation of previous results. This result is consistent with that of Arouna *et al* (2005) for the analysis of technical efficiency, the allocative economic and production units of the cashew nuts in Benin. These authors conclude that large farms are less effective than the small farms and therefore any action for the promotion of the cashew nut industry must be oriented as well toward the large that the small units. The positive effect of the statement is consistent with that expected.

As matter of fact, the statement allows the producer to assimilate the formations which it are exempt and to master the technical route. It is true that most of the awareness and training campaigns that perform the agencies of research and development are in the local language, however the statement awakens the mental faculties of the individual to assimilate rapid way the new knowledge acquired. It allows the individual to have a

spirit of openness and discernment. This who plays in favor of the adoption of new technologies. The instruction allows the soya producers to choose the quantities of inputs suitable and make a good choice taking into account the cultivation techniques available (Ahmadou *et al*., 2012). The Negative Significance of the formation shows that the producers do not apply the instructions given by the trainers. It is to recall also that more than 50% of the producers have never followed a training on soybeans. The secondary activity revealed a negative effect on the level of technical efficiency. This result is explained by the fact that the producers exercising other secondary activities do not have enough time to follow closely the culture of soybeans. The negative effect of the access to credit reveals a poor management of credits obtained by the producers. This result confirms the fact that the large farms are less technically efficient that the small farms. The variables as belonging to a group, the number of year of experience, the application of inoculation and the age of the operator are all non-significant. These results reveal that actions must be oriented toward the organization of the sector in order to contribute to the technical efficiency of the producers. Regarding the sex of operators it is positively significant then it is clear that men are more effective than women. The area sown of cotton contrary to what we hoped, it has no influence on the production of soybeans. This result is understandable because producers are a good distribution of labor for their different cultures.

CONCLUSION AND SUGGESTIONS

This article was concerned to assess the level of technical efficiency in the production of soybeans in the commune of Savé and identify the exogenous factors which explain this level of technical efficiency. The results of this study revealed that the producers have a score of technical efficiency of 56%. This result indicates an index of technical inefficiency of 44%. In other words the soya producers of the commune of Savé can increase their performance of 44% with the level of factors unchanged. This score is lower than that found by Labiyi *et al* ., (2012) (56% against 64%). This difference is justified by the fact that the study is concerned that the producers of the commune of gold Savé the results obtained by Labiyi *et al* ., (2012) are those of the communes of Savé and Ouèssè. A reading of these results also shows that the yields of scale are croissants. It would then be interesting to suggest measures at various levels in order to contribute to the increase of this level of technical efficiency. Regarding the explanatory factors of this level of technical efficiency, the study has revealed that the area sown (negative effect), the access to credit (negative effect) The sex of the operator (male), the level of instruction, training (negative effect), the exercise of a secondary activity and the size of the exploitation are the determinants of this level of technical efficiency. Following these different results obtained, it is urgent to suggest approaches for solutions to the different actors of the sector.

Extension Services

Although the influence of the training is negative, it is urgent to increase the awareness campaigns at the location of the producers so that they understand the quintessence of the subject before moving on to the training modules adequate. In effect it has been discovered that the level of education contributes to the improvement of the level of effectiveness. What makes that it is desirable to the limit to increase training and awareness sessions for producers in order that he may be able to know the usefulness of the technical route and meet the requirements of the calendar Cultural. The fact of the average age advanced in the sample (36years), it seems absurd to propose the increase of schools, colleges or high schools in order to raise the level of education of the area. The training can therefore not pass that by workshops useful and pragmatic to ensure that the farmers do not lose much time.

The producers of soybeans

Producers must go to the quest of the good information because the study has shown that 98%of the deviation of the actual production compared to the production boundary was virtually attributable to their inefficiency. Therefore they should no longer wait for the State, all the more that the major part of the production is used either to repay debts, either to feed the family or others. As well as the producer must abandon a certain behaviors brakes and seek the means which enable it to increase its production. The rationalization of the cultivated area must guide the producers in the combination of the factors of production because the area has a negative effect on the performance according to the revelations of the study.

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