DEA IN THE EVALUATION OF EFFICIENCY OF THE PERIMETERS OF DEVELOPMENT IN DIFFERENT AGRICULTURAL REGIONS

Wassila **HANAFI**[*]
Slimane **BEDRANI**[**]

Received : 02/06/2019 / **Accepted** : 01/ 09/2021 / **Pulished** : 18/06/2022
Corresponding authors : wassila.sellidj@enst.dz

ABSTRACT

The purpose of this research is the ex-post evaluation of the efficiency of agricultural development projects for the period 2000-2009. The analysis had been based upon a random sample of 244 agricultural perimeters spread over 15 departments among which 75 perimeters are located in the mountainous zone, 98 in the steppe zone and 51 in the Sahara zone. The DEA (Data Envelopment Analysis) method had been used to calculate the efficiency of development projects. The selected outputs represent the number of developed hectares, and the number of created jobs, the input, will be represented by the total amount of expenses. The analysis uses an output-oriented approach with either constant or variable scale models. Our analysis shows that only the 9 perimeters (3 in the mountains, 4 in the steppe and 2 in the Sahara) which have reached the DEA efficiency boundary, are operating at their optimal scale. The results have proved that although the efficiency has a low score for the three agro-ecological zones, they can reach an increase in production of about 77% and 62 % on average, depending on whether we suppose the constant or the variation in return having better use of the invested capital and higher returns.

[*] ensa, wassila.sellidj@enst.dz
[**] ensa, s.bedrani@ensa.dz

KEYWORDS

Agricultural; data envelopment analysis; technical efficiency; scale efficiency

JELCLASSIFICATION: **Q13 R15**

Application DEA dans l'évaluation de l'efficience des périmètres de mise en valeur dans différentes régions agricoles

RÉSUMÉ

Le but de cette recherche est l'évaluation ex post de l'efficacité des projets de développement agricole pour la période 2000-2009. L'analyse avait été basée sur un échantillon aléatoire de 244 périmètres agricoles répartis dans 15 wilayas, dont 75 situés dans la zone de montagne, 98 dans la zone de steppe et 51 dans la zone du Sahara. La méthode DEA (Data Envelopment Analysis) a été utilisée pour calculer l'efficacité des projets de développement. Les sorties sélectionnées représentent le nombre d'hectares aménagés et le nombre d'emplois créés, l'input, sera représenté par le montant total des dépenses. L'analyse utilise une approche axée sur les résultats avec des modèles à échelle constante ou variable. Notre analyse montre que seuls les 9 périmètres (3 situés en montagne, 4 dans la steppe et 2 au Sahara) ayant atteint la limite d'efficacité DEA fonctionnent à leur échelle optimale. Les résultats ont montré que bien que l'efficacité ait un score faible pour les trois zones agro-écologiques, elles peuvent atteindre une augmentation de production d'environ 77% et 62% en moyenne, selon que nous supposons la constante ou la variation de retour ayant une meilleure utilisation du capital investi et des rendements plus élevés.

KEYWORDS

Périmètresagricoles ; DEA (analyse d'enveloppement des données); efficacité technique ; efficacité d'échelle

JEL CLASSIFICATION: Q13 R15

التقييم DEA لكفاءة مشاريع التنمية في مناطق زراعية مختلفة

الغرض من هذا البحث هو التقييم اللاحق لكفاءة مشاريع التنمية الزراعية للفترة 2000-2009. استند التحليل إلى عينة عشوائية مكونة من 244 محيطًا زراعيًا موزعة على 15 ولاية، من بينها 75 محيطًا في المنطقة الجبلية، و 98 في منطقة السهوب و 51 في منطقة الصحراء. تم استخدام طريقة DEA (تحليل تغليف البيانات) لحساب كفاءة مشاريع التطوير. تمثل المخرجات المحددة عدد الهكتارات المطورة، وسيتم تمثيل عدد الوظائف التي تم إنشاؤها ، والمدخلات ، بالمبلغ الإجمالي للمصروفات. يستخدم التحليل نهجًا موجهًا نحو الإخراج مع نماذج ثابتة أو متغيرة الحجم. يوضح تحليلنا أن 9 محيطات فقط (3 في الجبال و4 في السهوب و 2 في الصحراء) التي وصلت إلى حد كفاءة تعمل على النطاق الأمثل. لقد أثبتت النتائج أنه على الرغم من أن الكفاءة لديها درجة منخفضة بالنسبة للمناطق الإيكولوجية الزراعية الثلاث، إلا أنها يمكن أن تصل إلى زيادة في الإنتاج تبلغ حوالي 77 ٪ و 62 ٪ في المتوسط ، وهذا يتوقف على ما إذا كنا نفترض أن الثابت أو التباين في المقابل الحصول على أفضل استخدام لرأس المال المستثمر وعوائد أعلى

كلمات مفتاحية

تحليل مغلف البيانات؛ الكفاءة التقنية ؛ كفاءة النطاق

تصنيف جال: Q13، R15

INTRODUCTION

Despite a myriad of successive development programs designed for the benefit of rural areas, understanding the causes of the neglect of agricultural land and the insufficient level of development of these areas remains in vain due to insufficient studies and analyzes in terms of impacts on farmers. These findings, therefore, highlight the undeniable importance of anchoring good evaluation practices in agricultural programs with a view to both assessing the effects of these programs and improving decision-making. However, the investigations carried out to reveal the little research work based on a rigorous methodology capable of allowing us to obtain usable results. Therefore, this research work, anxious to fill this gap, deals with the need to carry out ex-post evaluations supported by an appropriate approach and techniques. Supported by the approach based on quantitative and qualitative methods, the field survey, carried out in 2015 over a six-month period, made it possible to target three agro-ecological zones selected based on random sampling to allow exploration results in a broad and diverse context. The population of our study is thus made up of 224 perimeters, of which 75 are located in the mountains, 98 in the steppe and 51 in the Sahara. In addition, the need to feed our research with rich and quality data has led to targeting institutions with a solid base such as the Générale des Concessions Agricoles, the National Office for Rural Agricultural Development Studies, directors of agricultural services and the National Agricultural Land Office. On the other hand, the use of descriptive and econometric statistical methods as well as of simulations is part of the aim of interpreting quantitative data. This article proposes a contribution to assess the technical efficiency of the means involved in the development of rural territories. Note that technical efficiency is analyzed by DEA (Data Envelopment Analysis) to measure the efficiency of peer units against best practices based on input and output data. The DEA method can indeed be considered as a paradigm shift compared to the regression method (Badillo and Paradi, 1999) because if the regression measures a central tendency, the DEA analysis offers the opportunity to identify best practices.

The objective of this work is not to undertake a complete evaluation of the effectiveness of all investments, but rather to explore the methodology of an ex-post evaluation with quantitative and qualitative approaches, and to take advantage of the best practices in terms of effectiveness in supporting development in the three agro-ecological zones, namely the mountains, the steppes, and the Sahara. Then, compare the resources devoted to the pursuit of the objective to find the optimal size of the perimeter which will generate an economy of scale, and finally to orient future actions on the potentialities of gains in production or reduction of expenses for the zones potential.

1- MATERIALS AND METHODS

1.1- Data Envelopment Analysis (D.E.A)

Since the DEA model has been developed, this method, converting multiple inputs into multiple outputs, is used to assess the performance of enterprises, regions, etc. and particularly for modelling

The operational processes in the assessment of performances (Cooper, W.W., Seiford, L.M., Tone, K. 2007)

The Data Envelopment Analysis (DEA) is a non-parametric approach to identify the relative efficiency of Decision Making Units; these can involve units from public and private sectors (Cooper, W.W., Seiford, L.M., Tone, K. 2007)

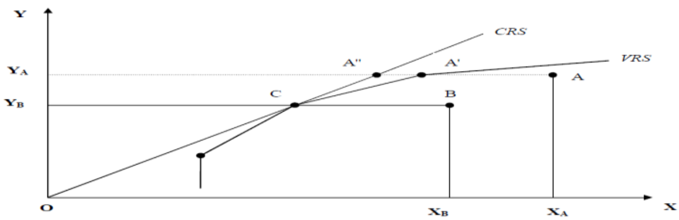
The Data Envelopment Analysis models can be oriented towards the inputs (aim: minimizing the inputs and keeping the same level of outputs) or based on production (objective: increase the outputs with the same level of inputs) (Malana and Malano 2006). In the case of maximizing the output, a decision-Making Unit is not efficient when it is possible to increase any output without increasing any input. Also , in the case of minimizing the inputs, a Decision-Making unit is not efficient when it is possible to reduce any input without increasing any other input. (Charnes A, WW Cooper and EL Rhodes 1981)

then, our main objective was to measure the efficiency assuming that a Decision-Making Unit can produce varied quantities in using the same quantity of inputs because each Decision-Making Unit uses a constant of inputs to produce different levels of output, the method compares each DMU with the most efficient DMU.

The DEA models are built according to different hypotheses. The original model proposed by (Charnes A, WW Cooper and EL Rhodes 1981) is known as the model mark CCR (Charnes Cooper Rhodes).

In practice, Farell (1957) suggests the use of the non-parametric approach according to which the establishment of a production frontier is not linked to a precise functional form but, on the contrary, estimated from a scatter plot above the frontier, known as Data Envelopment Analysis (DEA) in 1978. The construction of the production frontier under the assumption of constant variable returns to scale allows technical efficiency to be broken down into two types: pure technical efficiency and efficiency of scale. FIG. 09 illustrates the construction by the DEA method of these two boundaries in the single-product and single-factor framework. The VRS curve represents the frontier of all production possibilities with a technology with variable returns to scale while the CRS line represents the production frontier when the returns to scale are constant. Consider an organization defined by point A that uses an XA level of input to produce YA of output. Its projection on the VRS curve corresponds to points A ′and A′ ′on the line CRS; A ′and A′ ′are considered efficient according to the defined return to scale model. Under the assumption of variable returns to scale, the distance [AA ′] then designates the proportion of input that can be reduced without altering the output level. The measure of the technical efficiency of the DEA is thus defined by the ratio [Y A ′] / [Y A]. Likewise, the level of technical efficiency can be measured by the ratio: [Y A ′′] / [Y A] under the assumption of constant returns to scale. The scale efficiency of a DMU can be measured in terms of the distance between the VRS and CRS boundaries. The DMU at point A is inefficient in terms of scale, and [Y A ′] / [Y A]. = [Y A ′] is a measure of the extent of its inefficiency.

Figure. 1. CRS and VRS models



Source: Banker Charnes Cooper 1984

1.1.1. Constant model on the scale

The boundary of the optimal practice, which presents a constant feedback scale is determined by means of the CCR model (Charnes A, WW Cooper and EL Rhodes 1981).Let's suppose that there be n DMU, with each DMU (j=1,2,…….,…..,n) and consumes m inputs Xij (i=1,2,…,m) and produces s outputs Yrj (r=1,2,….,s).

Max ɵ $=\sum_{r=1}^{s} uryro$

$\sum_{i=1}^{m} vixio=1$

$\sum_{i=1}^{s} uryrj - \sum_{i=1}^{m} vixij \leq 0$, j=1,2,…….n ur,vi≥ 0

Where = Yro the number of outputs r of unit o, ur= the amount of input I at the unit o, ur = the weight given to the inputs r, vi= the weight given to inputs I and o= the number of units

1.1.2. Variable Model Scale

Banker R.D.et al. (1980) have extended a past work on the model CCR variable predictor can on the scale. The VRS model drawn below /

Maxɵ$=\sum_{r=1}^{s} uryrj - uo$

$\sum_{i=1}^{m} vixij = 1$

$$\sum_{r=1}^{s} uryrj - \sum_{i=1}^{m} vixij - uo \leq 0 \;\; j = 1,2,\dots\dots n \;\; vi \geq 0, ur \geq 0$$

Where uo refers to … at the origin and the later be free of sing can be positive or negative.

The efficiency scale sing (SE) is the ratio efficiency for the constant feedback scale (TE) on the efficiency for the variable scale feedback hypothesis.

SE= TE/PTE

For the analysis, we used DEA DEAP1.2, which permits the compilation of data under our option, respectively CRS (TE), VRS (PTE) and SE in an output-oriented model. Scale efficiency (SE) can present three situations. The first situation of constant scale feedbacks. An organization in such a situation has reached its optimal size (or its efficient scale). It operates at such a point where the size doesn't have any impact on productivity.

This situation occurs when the average consumption resources are minimized and do not vary with the increase in product output.

A second situation of increasing returns to scale (IRS). An organization in such a situation has not yet reached its optimal size. To improve its scale efficiency, it must increase its production. In a situation of scale economies, a variation in the output production of 1% implies a variation in the input consumption of less than 1%.

Consequently, in a situation of decreasing returns to scale -DRS-, an organization in such a situation has already gone over its optimal size. To improve its scale efficiency, it must reduce its production. In a situation of scale diseconomies, a variation in the output production of 1% implies a variation in the input consumption of more than 1%.

1.2- Tobit model

The Tobit model of James Tobin (1958) refers to limited dependent variable models for which the dependent variable is continuous but observable only over a specific interval. In other words, the domain of the dependent variable is constrained to a space limited by the possible observations. The dependent variable models are derived from the qualitative variable models, which are used when one wishes to assess the probability that the dependent variable belongs to the interval for which it is observable. The Tobit regression model can be formally presented as follows. A variable called Effic * is presumed to depend on several independent variables grouped in vector X, the effects of which are grouped in vector β. It is assumed that the observed values of Effic *, the Effic *, are the combination of the value predicted by the deterministic component of the model X'iβ, and of a residual, εi, the value of which varies randomly for each individual. However, it is assumed that the Effic * variable is not directly observable, but rather the Effic variable is observed. The Tobit model can be written: Effic * = α + Xiβ + εi, Where Effici * is the latent variable of the efficiency scores and Xi is the vector of the explanatory variables. Effic = 0 if Effic * ≤ 0 = Effic * if 0 ≤ Effic * ≤ 1 = 1 if Effic * ≥1 The Tobit random-effects model first includes an equation that relates the dependent variable of the model, Effic * to the independent variables, to which are added both a random effect and a residual: Efficiency * = α + Xitβ + vi + εit ∀i = 1, ……… .N∀, t = 1, …………, ni. In this equation, Efficient * represents the value that the continuous latent variable can take for the observation of individual I at time t, α represents the value of the y-intercept, Xit designates the set of independent variables as measured at time t for the individual I, β is the vector of the coefficients affecting these variables to be estimated, vi represents the value of the random effect associated with the individual I (this effect varies from individual to individual other, but takes only one value for all the observations made with the same individual) and εi constitutes the error of the model which differs for each observation. vi is distributed according to the law N (0, σv2) and εi also follows a law N (0, σε2). Our model can therefore be written: Efficiency * = α + β1IDHit + β2TCPRit + β3TERRAit + β4KDLit + β5IRRIGit + β6IDEit + β7TRENDit + vi + εit.**1.2 Data:**

The ex-post evaluation carried out for the evaluation of the development projects was based on two sources of information, the first source is the existing information of the project owner, the design office and the second source, field survey of beneficiaries.

1.2.1. Information gathering

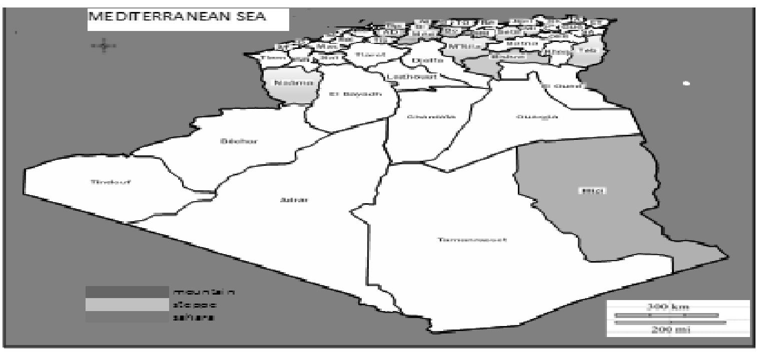
The collection was made with the owner (GCA, general agricultural concessions), the national office of study of rural agricultural development (BENDER), directors of the agricultural services (DSA) and ONTA (national office of the agricultural lands).

The information held for the evaluation is the database of the client (perimeter, area, amounts committed...) and the documents of the local authorities concerning the lists of beneficiaries, and contracts awarded after five years of implementation in place of the agricultural concession.

1.2.2 Field investigation

The survey took place from January to June 2015 (see fig.01).

Figure 2. Map of Algeria of sample ecosystems



Source: authors

It affected three agro-ecological with a stratified random sample of 224 perimeters spread over fifteen departments (Blida,Boumersdes,BouiraBiskra, Mila, Ain Defla, Medea, Tizi Ouzou, Bordj Bourreridj, Teresa, Tisimsilt, Naama, Setif, M'sila, Illizi).

Table 1. Perimeters sampled

	Member dept	Member dept sampled	fraction	Member perimeters	fraction
Mountain	24	7	3,43	266	37
Steppe	14	6	2,33	287	40
Sahara	9	2	4,5	171	24
Total	47	15	10,26	724	

Table 1. (Continuation of the table)

	Number perimeters sampled	Number perimeters Sampled*
Mountain	72	75
Steppe	78	98
Sahara	47	51
Total	197	224

*The perimeter was taken in its entirety

Source: investigation 2015

Including 75 perimeters in the mountainous area, 98 in the steppe zone and 51 in the Saharan zone. The regions were randomly chosen to allow the results to be explored in a wide different context.

Table 2. Descriptive statistics of sample

	Caracteristics	surface area value (Ha)	Beneficiaries permanents (unité)	amount investsment (DA)
Moutain area	Average	145	5	68807706
	Standard deviation	201	10	68479643
	Minimum	0	0	3665200
	Maximum	900	47	245000000
	Obsrvation	75	75	75
Steppe area	Average	133	8	77938693
	Standard deviation	141	16	64869802
	Minimum	0	0	4550000
	Maximum	672	98	342566000
	Obsrvation	98	98	98
Sahara aread	Average	144	15	134331734
	Standard deviation	102	40	82890313
	Minimum	4	0	33722500
	Maximum	554	269	431132576
	Obsrvation	51	51	51

Source: authors

To build the model, we should determine the most adequate inputs and outputs. The assessment of the efficiency of project development will performed at the level of the agricultural perimeter. The assessment is based on three indicators, among them, two are centered on the results, area, development, the number of permanent actors(five years after the closure of the program) and the third one is centered on the means, the amount of the works (equipment and plants).

1.2.3. Les variables de model Tobit

The broadening of the scope of the study leads us to proceed, in a second step, to the identification of factors likely to influence the efficiency score of the enhancement program through concessions. This objective therefore requires the appropriation and mobilization of an econometric model with a view to highlighting the relationship between the scores previously calculated by the DEA method and the causes of the effects observed in the field. The realization of this work led to retain three key variables: Insufficient studies (underestimation of the complexity of the tasks, poor study of the soil), supply (plants and equipment), land (eligibility of concessions) and financial capacity of the beneficiaries. First of all, it should be remembered that since arboriculture constitutes the main foundation of the development program, the presence of the water source necessarily becomes a key factor for the success of the plantation; moreover, it is important to note that the success of investments made in agricultural areas inevitably requires the design and implementation of a sufficiently detailed implementation plan. From a qualitative point of view, carrying out any study undoubtedly requires the integration of these two sine qua non conditions. However, it is clear that there is a penalizing existence of expenses for resuming studies in the development program in the various agro-ecological zones. Then, the success of the supply of plants and equipment depends on the respect and implementation of clear and rigorous conditions for the selection of service providers with proven skills. The effectiveness and efficiency of the supply system is fundamentally linked to perfect control over the procurement of the development project. In addition, it should be noted that, throughout its life cycle, the program has been marked by expenses for resuming plant purchases. In addition, the motivation and involvement of beneficiaries are closely linked to the transfer of ownership through the concession deeds of the development program. The weight of the land variable, measured by the number of hectares, is also decisive in this process when the pitfalls related to the allocation of the perimeter have given rise to harmful conflicts over ownership between the beneficiaries and the ancestors of the land. The agrarian revolution (agricultural heritage not updated). Finally, the external financial capacity of the beneficiaries is necessary to offset all the costs incurred during the period of non-production of arboriculture. This variable can include jumble of electricity charges (steppe and Saharan zone) and natural fires (mountainous zone). For the variables, social acceptance and choice of perimeters, their observation is limited to a single steppe region where the refusal of a break with the ancestral mode of production by the beneficiaries (farmers) was observed; in any event, these variables were excluded due to their low representativeness in the sample. Indeed, knowledge of the level of efficiency, through the DEA method, makes it possible to detect potential gains in production and operation. The causes collected will be regressed to explain the levels of efficiency scores obtained from the enhancement program. The "expenditure" variable is collected by extracting the database of the project manager GCA 2010 (general agricultural concessions) while the three variables "recovery of plants", "financial capacity" and "land" constitute the results of the survey carried out among beneficiaries.

2. RESULTS AND DISCUSSION

2.1- Results DEA

The analysis of efficiency scores of project development is performed for three agro-ecological regions. The unit of the analysis in our case is the agricultural perimeter; each perimeter gathers a group of actors who will benefit after five of the activity of a concession act.

To analyze the efficiency of perimeters for development, we are going to use at the same time the constant model feedbacks scale (CRS) de Charnes Cooper and Rhodes and the variable model feedbacks scale VRS to deduce the feedback scale.

2.1.1. Mountain area:

The mean efficiency score under the technology (CRS) in mountainous areas (annexe1. Scores CRS, VRS) is low on the order of 0.22 (area 0.22 and employment 0.11). This means that the investment did not give the expected results in terms of area and employment,

For technology (VRS), development projects have a score of 0.46 (area 0.30 and employment 0.21). This inefficiency can be explained by a problem of management of development projects, based on field observations, that there is "a lack of water resources at the level of the perimeters and the nature of the accidental soil does not solve the problem by traditional means, adding to that part of these perimeters have suffered fires that destroyed all plantations, nor a bank credit is possible (lack of land act) nor the profile of the beneficiary (unemployed) can solve the situation; as a result, the investment did not give a satisfaction of the increase of the agricultural surfaces, these join the works of (Huguenin.JM 2013) which show that the source of the inefficiency in VRS is related to a management perfectible see deficient.

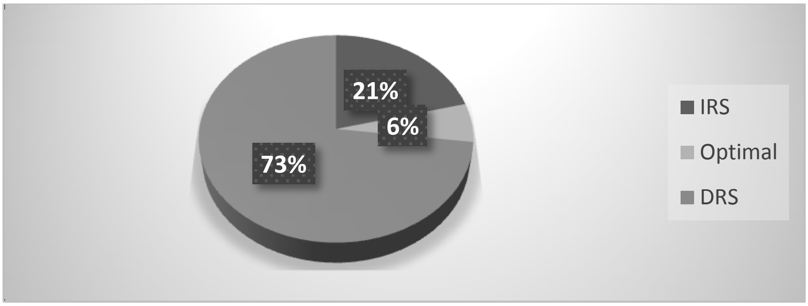
Table 3. Efficiency distribution in scores intervals

	area			employment			Area-employment		
	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE
<0.5	75	55	0	66	65	45	62	42	11
0.5-0.7	0	11	26	4	1	9	8	13	11
0.7-0.9	0	4	33	4	4	9	1	5	13
0.9-1	0	1	1	0	0	11	1	6	36
1	0	4	15	1	5	1	3	9	4

Source: authors

Also, the frequency of efficiency CRS (Table 03), shows that 87%(62/75)of development projects have a score <0.5 and only 6%(1+1+3)/75) in score between0.7-1, the source of this inefficiency will be explained by VRS and SE technologies;

Figure. 3. Efficiency scale in Mountain



Source: authors

And for scale efficiency (Fig.03), the scores indicate that 6% of the perimeters operate at the optimal scale (the investment is in line with the areas under development), 21% operate below the optimal scale and 73% operate above their optimal scale (see annex 2),these scores join the results of (Alexander J.K. Mack 2009) by analyzing Swiss forest holdings, he finds that around 7% of the perimeters show an efficiency of 100%; and also; it has been shown that 50% of logging operations are in increasing returns to scale

The source of this inefficiency of scale refers to a non-optimal size according to (Charnes A, Cooper WW and EL Rhodes 1981). That is to say, development projects are in a situation where the impact on productivity "output by input" no longer varies as in an economy of scale (a variation of the input implies a variation of the output). The field mission revealed that the additional expenses caused by the resumption of studies in the implementation phase and the resumption of plantations (due to a lack of regeneration), made the investment increase beyond its optimal size.

2.1.2. Steppe area

The variation in efficiency scores, in the steppe, shows an average of 0.29 (area 0.17, employment 0.07) under the assumption of constant returns to scale (CRS), that is, the productivity of the development was as inefficient as the mountainous area ()

This inefficiency is attributed to the results obtained by the other two measures: VRS, SE

For the hypothesis of the returns of variable scale, the scores are in the average of 0.31 (area 0.25, employment 0.18); a lower inefficiency than the mountain area, this supposes that there are more management problems in the steppe zone. Indeed, the field mission revealed; that a large part of the perimeter is abandoned because of the accumulation of electricity charges to recharge water which is an indispensable factor for established arboriculture; and also the decision not to allocate perimeters made subject to conflicts of ownership of land (land allocated to other programs), has created a decline in agriculture. (annexe 2 tableau 5)

Table 4. distribution of efficiency in score intervals in the steppe area

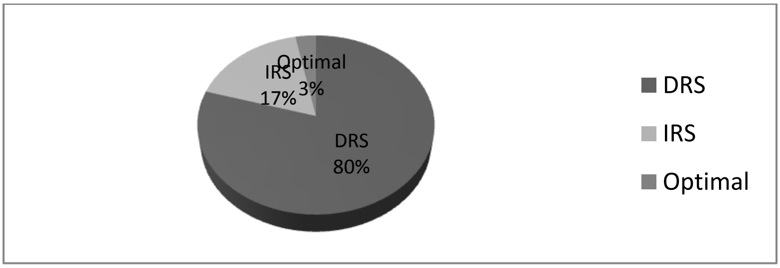
	area			employment			Area-employment		
intervals	**CRS**	**VRS**	**SE**	**CRS**	**VRS**	**SE**	**CRS**	**VRS**	**SE**
<0.5	96	84	30	96	93	77	91	81	28
0.5-0.7	0	6	18	0	0	0	3	9	24
0.7-0.9	1	4	27	0	1	1	1	1	24
0.9-1	0	0	20	1	1	19	0	2	19
1	1	4	3	1	3	1	3	5	3

Source: authors

The scoring frequency (TABLE 06) in all the results in CRS, is 92% (91/98) of perimeters exert in score <0.5 and at 4% ((3+1)/98) a score 0.7-1

The scale efficienc(Fig.03) shows that 3% of the perimeters operate at the optimal scale, 17% operate under an optimal scale and80% operate over their optimal scale(see annex 2)

Figure. 4. Efficiency scale in Steppe



Source: authors

For the hypothesis of the returns of variable scale, the scores are in the average of 0.30 (area 0.25, employment 0.18); a lower inefficiency than the mountain area, this supposes that there are more management problems in the steppe zone. Indeed, the field mission revealed; that a large part of the perimeter is abandoned because of the accumulation of electricity charges to recharge water which is an indispensable factor for established arboriculture; and also the decision not to allocate perimeters made subject to conflicts of ownership of land (land allocated to other programs), has created a decline in agriculture, and also a devastating anthropozoïque pressure has been accentuated in steppe. (Bouchetata Tarik B. and Arslan A. Bouchetata, 2005).

2.1.3. Sahara area

The mean efficiency score under the technology (CRS) in the Saharan zone (Annexe 3 Table 08) is low on the order of 0.26 (area 0.15 and employment 0.13).

This means that the investment did not give the expected results in terms of area and employment, and is similar to the inefficiency of the mountainous area,

Under the VRS technique, the scores are on average 0.35 (area 0.38, uses 0.35); an inefficiency very close to the steppe zone, though , smaller than the mountainous zone, this inefficiency returns according to the field survey to the choice of areas that do not meet the climatic requirements (salinity, absence of water, presence of limestone slabs...) and also the accumulation of electricity receipts

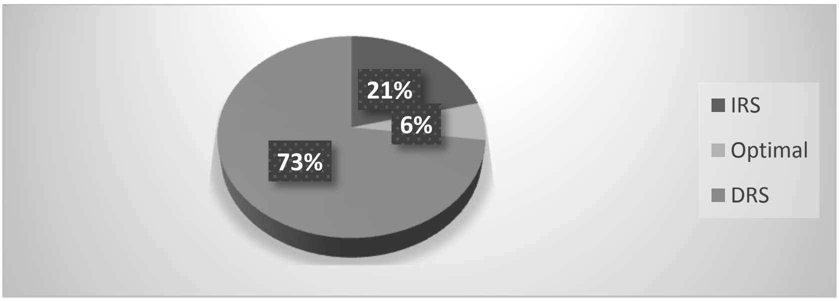
Table 5. distribution of efficiency in score interval in the Sahara

	area			**employment**			**Area-employment**		
intervals	**CRS**	**VRS**	**SE**	**CRS**	**VRS**	**SE**	**CRS**	**VRS**	**SE**
<0.5	49	25	10	47	15	33	45	49	1
0.5-0.7	0	16	31	0	22	14	0	0	3
0.7-0.9	0	6	8	2	4	2	2	0	20
0.9-1	0	0	0	0	4	0	0	0	23
1	2	4	2	2	6	2	4	2	4

Source: authors

Also, the frequency of efficiency (Table 09), shows that 88%(45/51) of development projects have a score <0.5 and only 11%(6/51) in score between 0.7-1, the source of this inefficiency will be explained by VRS and EE technologies;

Figure 5. Efficiency scale in Sahara



Source: authors

And for scale efficiency (Fig.04), the scores indicate that 4% of the perimeters operate at the optimal scale (the investment is in line with the areas under development), 45% operate below the optimal scale and 51% operate above their optimal scale, the source of this inefficiency of scale refers to a non-optimal size.

The efficiency of scale in the Saharan zone shows a lack of investment on 51%perimeters, on the other hand in the steppe zone 17%, and 20% in mountainous areas and conversely a waste of investment in Sahara for 45% of the perimeters and 79% for the steppe and 76% for the mountain.

This demonstrates that inefficiency is mainly due to poor organization and management of projects, development, or lack of resources. The waste of the investment comes back to the resumption of the soil studies and the purchase of the plants; and also the decision not to allocate the perimeters made subject to conflicts of ownership of the land (land allocated to other programs), created an agricultural slump.

2.2- Results Tobit

The results obtained from the Tobit model combining the explanatory variables of efficiency, indicate that only a few variables were found to be significant; these are expenses (studies and restructuring), land and financial capacity. The influence of the expenses incurred for the realization of studies is significant on the efficiency scores in the mountainous region, in particular, because of the delays in the realization and the budget overruns which inevitably result from the studies of the projects not detailed. The context of agricultural development projects is similar: the delay has had an ecological impact due to the abandonment of cultivated agricultural land. The resumption of studies in the construction phase for perimeters deemed suitable for development leads to the conclusion that there is no verification and validation of the studies.

Regarding the expenditure for restructuring the perimeters, the Tobit statistical results (Annexe 4 Table 10) show a positive influence on the efficiency of projects in mountainous and Saharan areas. These expenses come from a resumption of unsuccessful plantings and a replacement of wine vines by table vines. This result would explain the inefficiency of enhancement actions. This situation should lead the authorities to put in place procedures for selecting suppliers and to assign qualified personnel to choose the plants needed for each zone. As for the land variable, it shows positive results on the efficiency score of agricultural perimeters in mountainous areas. The decision not to allocate the completed perimeters subject to land ownership conflicts (land allocated to other programs) is at the origin of an agricultural abandonment causing visible environmental repercussions. In addition, the statistical results of the Tobit model have shown the positive impact of the financial capacity of beneficiaries on the level of efficiency of agricultural areas in the three agro-ecological zones (mountain, steppe, Sahara).

CONCLUSION

The evaluation of development projects in agro-ecological zones (mountain, steppe, Sahara) with the DEA method shows that the structuring of investments in agricultural zones gives poor results in terms of efficiency. The analysis shows that only 9 perimeters (3 in the mountains, 4 in the steppe and 2 in the Sahara) have reached the DEA efficiency limit and are operating at their optimum scale. More precisely, the average optimal size of these efficient perimeters is estimated at 135 ha in the mountains, nearly 250 ha on the steppe and more than 487 ha in the Sahara. This small surface recorded in mountainous areas could be explained in the unfavorable topographical conditions. In addition, the average unit cost of developing these efficient perimeters stands at 490,000 DA in the mountains and the Sahara and at 289,000 DA in the steppe, the existence of a myriad of unfinished perimeters constituting an explanatory element of this difference. 157 perimeters (57 in the mountains, 77 in the steppe and 24 in the Sahara) present a waste of investment without real development. These results show that increasing the level of development does not require an increase in demand for investment in rural development, but rather efficient management of resources; the remaining perimeters, 57 (15 in the mountains, 17 in the steppe, 25 in the Sahara) show a lack of investment to integrate the efficiency zone. However, to gain efficiency, the Saharan area requires more investment than the steppe and mountainous areas.

This weakness inefficiency is reflected in the shortcomings found in the field, some of which are mentioned below:

The program did not identify mechanisms that could prevent land abandonment and the sustainability of land use to escape ecological changes brought about by development.

Also, the decision not to allocate completed areas subject to conflicts of ownership of land (land allocated to other programs), created an agricultural abandonment.

However; decisions taken have had negative repercussions on the sustainability of the development program, as examples; targeting beneficiaries (the unemployed); reduced the chance of resuming the destroyed plants following mountain fires and also the choice of tree crops which goes into production from five years to seven years later; has caused an accumulation of electricity charges (water pumps) in steppe and Sahara.

The lack of expertise in studies of development projects by other specialized organizations (perimeters carried out on saline soils; limestone; lack of water), and the absence of governance of contract award operations; have caused overconsumption of the development budget.

However, it appears that there is the possibility of an increase in the development of around 77% and 62% on average depending on whether one is under the CRS or VRS hypothesis with only better use of the capital invested.

In terms of improvement, the evaluation of the efficiency of the enhancement program suggests some recommendations; which begins with a full ex-ante study supported by a study of the risks inherent in the program; then a control and monitoring to anticipate unexpected deviations and finally an ex-post evaluation of the results and impact of the program and this approach will only be effective if it is piloted and capitalized by an information system at the level of the regions and minster involved by the program

References

Aldaz N., & **Millán J. A., (2003)**. Regional productivity of Spanish agriculture in a panel DEA framework. *Applied Economics Letters*, 10(2), pp. 87-90

Alexander J.K. Mack (2009). *Léfficience des exploitations forestiéres publiques en Suisse* ; these présentée à la faculté des sciences économiques Université de Neuchatel.

Amores, A.F., Contreras, I. (2009) "New approach for the assignment of new European agricultural subsidies using scores from data envelopment analysis: Application to olive-growing farms in Andalusia (Spain)", European Journal of Operational.**Badillo, P.-Y. et Paradi J., (1999),** *La méthode DEA : analyse des performances*, Paris ,Hermes Science Publications.

Banker R.D., & **Morey R.C**., **(1980)**, The Use of Categorical Variables in Data Envelopment Analysis, Management Science, vol. 32, 1613-1627.

Bessaoud, O.(2006): « *Stratégie de développement rural en Algérie » Cahiers options méditerranéennes*. Série A/n° 71, pp81.82. in heurs et malheurs du Secteur Agricole en Algérie L'Harmattan. 2013

Bouchetata Tarik B., & **Arslan Bouchetata A., (2005)** « Dégradation des écosystèmes steppiques et stratégie de développement durable. Mise au point méthodologique appliquée à la Wilaya de Nâama(Algérie), in *Développement durable et territoire,* https://journals.openedition.org/developpementdurable/1339

Charnes A., Cooper WW., and **Rhodes E., (1981).** "Evaluating Program and Managerial Efficiency: An Application of DEA to Program Follow Through." *Management Science*, vol. 27, n°6.

Cooper W.W., Seiford L.M., & **Tone K., (2007).** "*Data EnvelopeAnalysis: A Comprehensive Text with Models, Applications, References and DEA-Solver Software*", Boston Kluwer.

Díaz J. A., Poyato, E. C., & Luque, R. L., 2004. Applying benchmarking and data envelopment analysis (DEA) techniques to irrigation districts in Spain. *Irrigation and Drainage*, 53(2), pp. 135-143

Estellita Lins M.P., Angulo-Meza L., Moreirada Silva A.C., (2014). objective approach to determine alternativetargets in data envelopment analysis, *Journal of Operational Research Society* 55 (2004)10901101.

Farrell M.J., (1957). The Measurement of Productive Efficiency, *Journal of the Royal Statistical Society*, vol. 9 (20), 253-281.

Huang L. J., Hu, T. Z., (2006). Study of agricultural production Efficiency in China's Western Region Based on DEA Method. *Journal Research of Agricultural Modernization*.

Huguenin J.-M., (2013). *Data Envelopment Analysis* (*DEA*), *IDHEAP*-cahier 278/2013 chaire finances publiques.

Malana N.M., and **Malano H.M., (2006).** "Benchmarking Productive Efficiency of Selected Wheat Areas in Pakistan and India Using Data Envelopment Analysis." *Journal. Irrig. Drain*. Eng 55(4): 383-394.

OECD (2009). *Méthodes de suivi et d'évaluation des incidences des politiques agricoles sur le développement rural* Paris : Ed. De la Performance, 2004. - 136 p.

Zhou L. & **Fawen Y., (2005)**. Analysis of Agricultural Productive Efficiency in We
st China-DEA Method. *Journal of China Rural Survey*.

Zhu X., & **Lansink A.O., (2010).** "Impact of CAP Subsidies on Technical Efficiency of Crop Farms in Germany, the Netherlands and Sweden", *Journal of Agricultural Economics*.

Annexes

Annexe 1. Scores CRS, VRS, and SE in mountainous

superficie					emploi					superficie-emploi				
perimetre	efficience technique score CRS	efficience pure score VRS	efficience d'échelle score EE		perimetre	efficience technique score CRS	efficience pure score VRS	efficience d'échelle score EE		perimetre	efficience technique score CRS	efficience pure score VRS	efficience d'échelle score EE	
1	0.038	0.113	0.337	irs	1	0,00	0.101	0,00	irs	1	0.038	0.045	0.854	drs
2	0.039	0.065	0.603	irs	2	0,00	0.39	0,00	irs	2	0.039	0.105	0.373	drs
3	0.04	0.213	0.189	irs	3	0,00	0.213	0,00	irs	3	0.04	0.041	0.972	irs
4	0.039	0.058	0.67	irs	4	0,00	0.031	0,00	irs	4	0.039	0.127	0.307	drs
5	0.039	0.276	0.142	irs	5	0.089	0.329	0.271	irs	5	0.089	0.092	0.969	irs
6	0.039	0.054	0.719	irs	6	0,00	0.026	0,00	irs	6	0.039	0.146	0.265	drs
7	0.038	0.069	0.558	irs	7	0,00	0.045	0,00	irs	7	0.038	0.091	0.42	drs
8	0.065	0.257	0.255	irs	8	0,00	0.252	0,00	irs	8	0.065	0.07	0.935	irs
9	0.236	1,00	0.236	irs	9	0,00	1,00	0,00	irs	9	0.236	1,00	0.236	irs
10	0.069	0.291	0.236	irs	10	0.328	0.486	0.675	irs	10	0.328	0.341	0.964	irs
11	0.819	1,00	0.819	drs	11	0.031	0.057	0.545	irs	11	0.082	0.266	0.363	drs
12	0.515	0.609	0.846	drs	12	0.035	0.057	0.614	irs	12	0.052	0.159	0.324	drs
13	0.708	0.857	0.826	drs	13	0.061	0.074	0.823	irs	13	0.076	0.222	0.324	drs
14	0.129	0.22	0.588	drs	14	0,00	0.137	0,00	irs	14	0.129	0.137	0.941	drs
15	0.131	0.206	0.635	drs	15	0,00	0.118	0,00	irs	15	0.131	0.143	0.916	drs
16	0.112	0.186	0.603	drs	16	0,00	0.113	0,00	irs	16	0.112	0.123	0.91	drs
17	0.23	0.381	0.603	drs	17	0,00	0.232	0,00	irs	17	0.23	0.241	0.954	irs
18	0.078	0.171	0.543	drs	18	0,00	0.132	0,00	irs	18	0.078	0.078	0.083	drs
19	0.158	0.292	0.541	drs	19	0,00	0.197	0,00	irs	19	0.158	0.16	0.986	irs
20	0.139	0.27	0.581	drs	20	0,00	0.151	0,00	irs	20	0.139	0.145	0.96	drs
⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮		⋮	⋮	⋮	⋮	
moyenne	0,22	0,303	0,64		moyenne	0,107	0,206	0,262	moyenne		0,239	0,46	0,96	

Source: authors

Annexe 2. CRS, VRS, SE, in the steppe

	area				**emploi**				**superficie-emploi**			
perimetre	**CRS**	**VRS**	**SE**		**CRS**	**VRS**	**SE**		**CRS**	**VRS**	**SE**	
1	0,41	0,50	0,82	irs	0,00	0,26	0,00	irs	0,41	0,42	0,97	irs
2	0,08	0,10	0,82	irs	0,17	0,17	0,98	irs	0,17	0,26	0,67	drs
3	0,28	0,31	0,92	irs	0,27	0,28	0,97	irs	0,36	0,38	0,96	drs
4	0,17	0,44	0,38	irs	0,17	0,55	0,32	irs	0,22	0,23	0,94	irs
5	0,07	0,15	0,47	irs	0,00	0,15	0,00	irs	0,07	0,08	0,87	drs
6	0,23	0,42	0,55	irs	0,00	0,41	0,00	irs	0,23	0,26	0,88	irs
7	0,18	0,28	0,65	irs	0,00	0,23	0,00	irs	0,18	0,18	0,99	irs
8	0,33	0,47	0,70	irs	0,00	0,34	0,00	irs	0,33	0,35	0,92	irs
9	0,36	0,47	0,77	irs	0,00	0,28	0,00	irs	0,36	0,38	0,96	irs
10	0,11	0,14	0,82	irs	0,00	0,07	0,00	irs	0,11	0,18	0,63	irs
11	0,31	0,55	0,56	irs	0,62	0,93	0,67	irs	0,62	0,85	0,74	irs
12	0,52	0,66	0,79	irs	0,00	0,37	0,00	irs	0,52	0,58	0,90	irs
13	0,72	0,83	0,86	irs	0,97	1,00	0,97	irs	1,00	1,00	1,00	-
14	0,05	0,05	0,95	irs	0,00	0,02	0,00	irs	0,05	0,30	0,17	drs
15	0,08	0,22	0,37	irs	0,00	0,22	0,00	irs	0,08	0,08	0,99	irs
16	0,04	0,11	0,40	irs	0,00	0,11	0,00	irs	0,04	0,06	0,76	drs
17	0,40	0,58	0,69	irs	0,00	0,42	0,00	irs	0,40	0,45	0,87	irs
18	0,05	0,09	0,48	irs	0,00	0,09	0,00	irs	0,05	0,06	0,72	drs
19	0,26	0,80	0,32	irs	0,00	0,80	0,00	irs	0,26	0,39	0,65	irs
20	0,53	1,00	0,53	irs	0,00	1,00	0,00	irs	0,53	1,00	0,53	irs
⋮	⋮	⋮	⋮		⋮	⋮	⋮		⋮	⋮	⋮	
mean	0,17	0,25	0,66		0,07	0,18	0,24		0,20	0,31	0,66	

Source: authors

Table 8. CRS, VRS, SE, in the Sahara

	area				emploi				superficie-emploi			
perimetre	**CRS**	**VRS**	**SE**		**CRS**	**VRS**	**SE**		**CRS**	**VRS**	**SE**	
1	0,04	0,26	0,16	irs	0,00	0,26	0,00	irs	0,04	0,08	0,54	drs
2	0,19	0,31	0,62	irs	0,00	0,26	0,00	irs	0,19	0,35	0,55	drs
3	0,18	0,27	0,66	irs	0,00	0,22	0,00	irs	0,18	0,38	0,47	drs
4	0,21	0,32	0,65	irs	0,00	0,27	0,00	irs	0,21	0,37	0,55	drs
5	0,13	0,16	0,78	irs	0,00	0,12	0,00	irs	0,13	0,46	0,27	drs
6	0,02	0,13	0,19	irs	0,00	0,13	0,00	irs	0,02	0,08	0,30	drs
7	0,09	0,54	0,17	irs	0,15	0,63	0,25	irs	0,21	0,29	0,73	irs
8	0,07	0,70	0,09	irs	0,00	0,70	0,00	irs	0,07	0,08	0,80	irs
9	0,03	0,71	0,05	irs	0,00	0,71	0,00	irs	0,03	0,04	0,78	irs
10	0,12	0,82	0,14	irs	0,00	0,82	0,00	irs	0,12	0,17	0,66	irs
11	0,08	0,69	0,12	irs	0,43	0,93	0,46	irs	0,43	0,83	0,52	irs
12	0,11	0,73	0,15	irs	0,48	1,00	0,48	irs	0,50	1,00	0,50	irs
13	0,04	0,39	0,09	irs	0,00	0,39	0,00	irs	0,04	0,05	0,79	drs
14	0,05	0,34	0,14	irs	0,00	0,34	0,00	irs	0,05	0,07	0,69	drs
15	0,08	0,17	0,47	irs	0,00	0,17	0,00	irs	0,08	0,21	0,38	drs
16	0,17	0,23	0,74	irs	0,00	0,18	0,00	irs	0,17	0,45	0,38	drs
17	0,01	0,27	0,02	irs	0,01	0,28	0,05	irs	0,02	0,02	0,92	irs
18	0,16	,068	0,23	irs	0,00	0,68	0,00	irs	0,16	0,19	0,82	irs
19	0,02	0,28	0,08	irs	0,11	0,34	0,31	irs	0,11	0,13	0,84	irs
20	0,04	0,27	0,13	irs	0,17	0,36	0,46	irs	0,17	0,20	0,85	irs
⋮	⋮	⋮	⋮		⋮	⋮	⋮		⋮	⋮	⋮	
mean	0,15	0,40	0,41		0,13	0,45	0,24		0,26	0,35	0,72	irs

Source: authors

Annexe The determinants of development efficiency

	CRS			VRS			SCALE		
Variables	coefficient	std.Error	prob	coefficient	std.Error	prob	coefficient	std.Error	prob
					Montagne				
capacité finacière	-0.111043	0.071564	0.1207	-0.113210	0.085008	0.1207	-0.112277	0.067426	0.0959**
ciblage des bénéfices	-0.251738	0.072173	0.0005*	-0.266511	0.085730	0.0005*	0.038358	0.068000	0.5727
nature du sol	-0.001478	0.064040	0.9816	0.011553	0.076070	0.9816	0.002509	0.060337	0.9668
qualité des plants	0.052948	0.058734	0.3673	-0.020600	0.069767	0.3673	0.167267	0.055338	0.0025*
coût unitaire	-0.000264	0.50E-05	0.0019*	-0.000287	9.79E-05	0.0019*	-0.000267	7.49E-05	0.0004*
					Steppe				
capacité finacière	-0.010094	0.017980	0.5745	0.009873	0.023046	0.6684	-0.616488	7.270452	0.9324
ciblage des bénéfices	-0.044227	0.80134	0.5810	-0.161794	0.098304	0.0998	8.160751	38.61940	0.8326
nature du sol	-0.027676	0.048542	0.5686	0.007940	0.59549	0.8939	51.09744	23.39410	0.0289*
qualité des plants	0.033185	0.037070	0.3707	0.115596	0.045475	0.0110	-11.45517	17.86535	0.5214
coût unitaire	-9.92E-08	159E-08	0.0000*	-1.25E-07	1.95E-08	0.0000	-3.52E-06	7.67E-06	0.6462
					Sahara				
capacité finacière	-0.054848	0.087689	0.5317	-0.058609	0.106205	0.8511	-0.106647	0.83152	0.1996
nature du sol	-0.052727	0.108771	0.6279	0.045034	0.131739	0.7325	-0.085756	0.103143	0.4057
qualité des plants	-0.031888	0.085366	0.7087	0.053955	0.103392	06018	-0.095502	0.080949	0.2381
coût unitaire	-1.68E-08	7.26E-09	0.0210*	-231E–08	8.79E-09	0.0085*	4.87E-09	6.89E.09	0.4792