

# A NEW READING OF THE ANIMAL PRODUCTION SUBSIDY PROGRAM FOR THE SAHARAN REGIONS: OPPORTUNITIES AND CONSTRAINTS

Ali BENSABA<sup>1</sup> , Hocine BENSABA<sup>2</sup>  and Lahcen BENSABA<sup>1</sup> 

<sup>1</sup>Faculté des sciences économiques et commerciales et des sciences de gestion, Université de Ghardaïa BP 455 Ghardaïa, 47000 Algérie

<sup>2</sup>Unité de Recherche Appliquée en Energies Renouvelables, URAER, Centre de Développement des Energies Renouvelables, CDER, 47133, Algérie

✉ Email: [muguet78@gmail.com](mailto:muguet78@gmail.com)

↳ Supporting Information

**ABSTRACT:** Like in other Saharan regions, the Animal Production Subsidy Program has increased the herd in Ghardaïa. The creation of breeding farms in such areas has generated specific dynamics through a set of measures that have had different impacts on the components of this sector. The data from the guides addressed to the various stakeholders illustrates that the management of the breeding farms presents shortcomings at different levels and even compromises its sustainability. In our model, around 49 % of farmers are renting their farmland, while 51 % are managing their own land. A significant portion of breeders (approximately 75.88 %) expresses the view that the main obstacle hindering the progress of these treatments is the insufficient availability of outreach programs. Applying this management results in young breeders abandoning the farms and using them for other activities. As a solution, the government must revise its agricultural programs and investments in order to achieve the long-term development goals that have been set. The measures to be taken are discussed to preserve the sector and explain the substantial investments made by the public authorities.

**Keywords:** Agricultural policies, Algeria, Animal production, Breeding farms, Saharan region, Subsidy program.

**RESEARCH ARTICLE**  
 PII: S222877012200046-13  
 Received: April 19, 2023  
 Revised: July 24, 2023  
 Accepted: July 25, 2023

## INTRODUCTION

In the Saharan region, various agricultural reforms and policies (socialist era) have discarded family farms in agrarian development (Baci, 1999; Abdelhedi and Zouari, 2020; Baghdad, 2022). So, the agricultural sector remains the third sector of the economy in terms of value-added formation (Djaafri and Abdelli, 2019). It represents 9.2% of the Gross Domestic Product, which does its ranking after the hydrocarbons (38%) and services (21%) sectors (Bedrani, 2008). In addition, it fulfills only 25% of the employment needs of 42% of the total labor force (Bensaha et al., 2015).

Bensaha et al. (2013) stated that, to implement this program was a decisive stage in the history of agricultural policies in Algeria; it promoted the role of the farmer as an active economic player. Moreover, the program mutated the traditional relationship between the farmer and agricultural administrations into a confident, responsible, and cooperative relationship (Adrian and Green, 2001).

So, these policies proved to be efficient ways to achieve higher production levels, mainly regarding food security (Dhehibi and Lachaal, 2006). For this reason, the government implemented a policy of aid and support for the agricultural sector by creating the National Fund for the Agricultural Regulation and Development (FNRDA) in 2000, with the objective to reduce the importation of foodstuffs and ensure the food security of the country (Benyoucef, 2005). However, food production has never satisfied domestic needs due to the scarce studies investigating the implemented profitability and sustainability strategy (Forbord and Vik, 2017; Govindan, 2018).

The incentive agricultural system has witnessed various revisions. The new subsidy system has been implemented in 2000, it aimed to improve the expansion of private investment in agriculture through the instauration of new economic supports and the encouragement of aggregation.

A significant proportion of "young" farmers and a territory in which agricultural activities occupy an important place a priori reflect a region where the agricultural sector is important, which would be rather favorable to an increase in milk production. According to MADR (2018), another strategy was fostered between 2000 and 2018, called the National Plan for Agricultural and Rural Development (NPARD), where a substantial budget of 350 billion Algerian dinars (DZD) was granted and 14 billion of the debts were annulled for the farmers. However, the exported agricultural products only increased by \$ 3 billion in 2003, \$ 8 billion in 2008 and \$ 11 billion in 2011. Moreover, Thabet et al. (2002) found that approximately 80% of food subsidies went to urban areas, at the expense of the rural ones, despite the fact that more than 40% of the Algerian population lived in rural areas. This showed that food subsidies were ineffectually administrated and unequally distributed between rural and urban consumers. Therefore, specific policies had been implemented to secure the supply of food and create wealth and labor opportunities through the use of the natural resources: arable and range lands, animal wealth and irrigation water. However, in the absence of public policies tradition assessment in

Algeria, the management authorities hardly establish physical and financial assessments instead of an actual evaluation (Akerkar, 2015).

This study presents the data of the obtained results related to breeder's investment in the region of Ghardaia (North Sahara of Algeria) in the era between 2005-2018 the need for evaluation of the various aids received by breeders is highly important. It also attempts to investigate the actors for the production development, and to provide recommendations that can be used by the actors concerned with the sustainable development of the Saharan regions.

## MATERIALS AND METHODS

### Presentation of the study area

Our study area (Ghardaia region) is located in the north of the Saharan Algerian; it is represented by thirteen communes (municipalities), as indicated in figure 1. It is an agricultural zone and a dairy basin, with an area of 1 370 911 ha. The total population of the Ghardaia region is estimated at 363,598 inhabitants, with a density of 4.3 inhabitants per km<sup>2</sup> General Census of Population and Habitat (GCPH, 2008), 53% of the population live in rural areas, and 61% are between 20 and 60 years of age. Agricultural potentials of this region have produced significant changes in Saharan agriculture thanks to the fostering of specialized breeding systems (Table 1). The study was used to point out the current situation of the farms and to provide a retrospective study considering the previous decades to identify the transformations in Saharan agriculture related to the climatic condition's changings. The choice of this region is based on the importance of agriculture and the ruminants breeding in their economic activity.

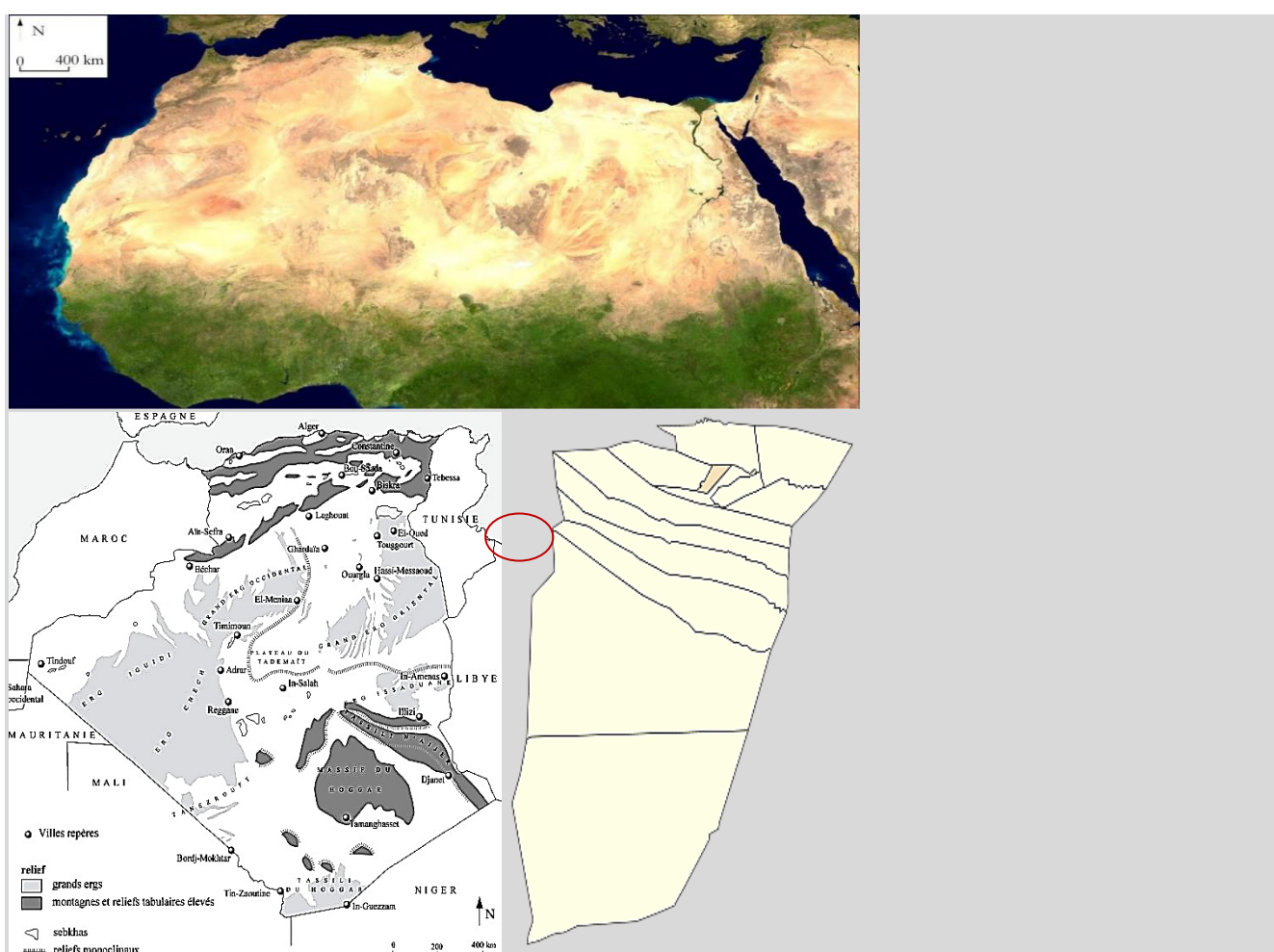


Figure 1 - Situation of the study area.

Table 1 - Overview of the agricultural potential in the study region of Ghardaia.

Animal production		Livestock	
Production	Quantities	Sheep	365 000 heads
Red meats	45 223 Qx	Cattle	4 000 heads
White meats	2 415 Qx	Goats	161 400 heads
Milk (10 <sup>3</sup> liters)	28 990 L	Camels	11 650 heads
Of which milk collected (10 <sup>3</sup> liters)	11 287 L	-	-
Honey	6000 kg	Beekeeping	2 020 hives

### Data sources and estimation procedure

In order to carry out the annual data on the value of projects number by activity, investment amount, jobs, and overlapping percentage are subjected to be investigated. Data collection is based on the responses of the farmers, on our own observations and on farm records if they exist, as well as on engineers from the Agricultural Services Direction. It is based on an analysis of the database provided by the Agricultural Services Direction (DSA) of Ghardaia region. It registers the exploitations received from the state aid under the agricultural development fund. This database contains several projects presented at this program (2005-2018). Our efforts are focused on monitoring and evaluating the physical implementation rate of the subsidized projects. The results are compared with the referred objective. The size of the sample, which is admittedly small, helps to carry out an adequate detailed analysis of the practical situations. Data processing is conducted through a descriptive analysis via XL-Stat.

### Brief overview of the subsidy program: dynamic trigger

The agricultural policies of the last thirty years have been marked by a clear liberal orientation and a frank choice for the development of Saharan agriculture, which is considered as an essential part to solve food dependency problem of the country (Mutin, 2000). These agricultural policies have contributed to lifting the constraints of access to productive resources and have significantly boosted agricultural development in some areas of the Sahara, as is the case in the region of Ghardaia. The Algerian government has long given priority to the development of the rural sector. It allocated a significant portion of the planned investment budgetary funds to it. Thus, many milestones at the institutional, legislative, regulatory and organizational levels have been settled to pave the way for the gradual and harmonious achievement of sustainable development.

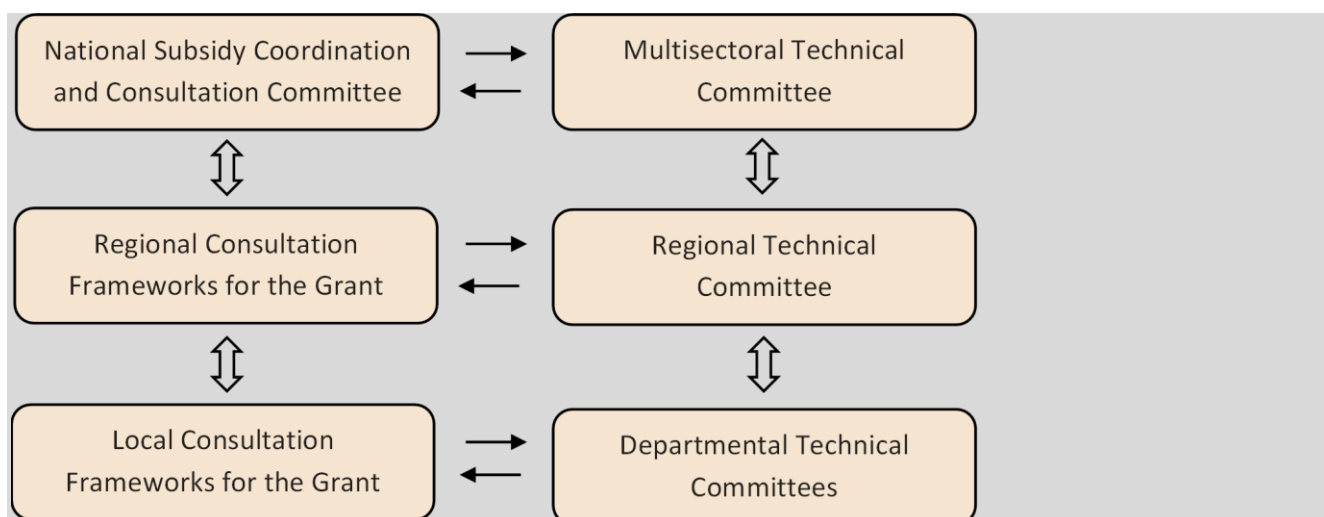
As a reminder, the program is based on three pillars, namely:

1. Increased food supply and reduced hunger.
2. Agricultural research, extension and adoption of technologies enabling sustainable growth in production.
3. Sustainable development of livestock, fisheries and forests.

Development programs also address socioeconomic imperatives. In short, it is about improving the incomes of farmers and the fight against poverty (Khiati, 2007). It also includes close extension and technical support programs for farmers, involving specialized technical institutes, the local agricultural administration and chambers of agriculture. According to Maghni (2013), the primary purpose of the new policy is the national food security and revitalization of rural areas.

In 2021, the Minister of Agriculture noted that: "Bureaucracy is the first obstacle that the farmer faces in Algeria". Our study shows that, it is necessary to improve administrative procedures, where large farmers more easily put together the files to apply for a subsidy. Also, used to establishing oral contracts (informal land and water markets), smallholders perceive the use of written documents as a cumbersome and time-consuming process; it is also necessary to call on someone well-informed and to commute to various administrations. To cope, such the government is preparing to launch a new financing mechanism for farmers, while promulgating an instruction to simplify the procedures for obtaining credit (Figure 2). The services of the agricultural sector are currently working on the creation of new financing mechanisms in favor of farmers in order to revive agricultural activity and finance all sectors.

The Bank of Agriculture and Rural Development (BADR), which is responsible for supporting farmers, examine the obstacles that compromise obtaining credit for a short period. At the same time, the conditions of access to the subsidy are simplified by the creation of a one-stop shop. Nonetheless, the gaining of subsidies and farming strengthening did prove successful due to the intermittent of actions in time and space. The outcome of the current study indicated that farm improvement policies in drylands should be compliant and account for the heterogeneity of agriculture, in particular socio-economic factors.



**Figure 2 - The key steps for applying for and obtaining a subsidy**

## RESULTS AND DISCUSSION

### Integration of young people and availability of the workforce

Agricultural employment poses a dilemma for policy makers in Algeria (Bensaha et al., 2015). In the current global context, family farms represent more or less 1.4 billion people, and 96% of family farms are sited in southern countries (Ferraton and Touzard, 2009).

As discussed in Figure 3, the common age of farmers receiving aid in our study is 40 years, and the excessive standards ranged from 20 to 70 years. Approximately 49% of farmers in our model are tenants, and 51% operated their own farmland. The latest overall employment situation contributes to the diminution of the joblessness rate by 9% in rural areas and 6% in the area. The employment rate Feminine represents 13% in the rural setting, mainly crafts and small livestock, and 10% in the municipal environment, particularly in the administration. At present, the employment tendency recorded during the period (2005-2018) remains not worth mentioning in view of the growth of the rural workforce predictable at 7%, even though the number of farms augmented by 4.66% but they are mostly small (51% with an area of less than 3 ha), which is shaped as a single unit occupied by a single employment post, with low returns and incapable to turn out the minimum essential for the safeguarding of families; agriculture remains a less critical and seasonal activity for a considerable part of the agricultural population.

In this organizational context, the countryside employment condition in the Ghardaia region is similar to the common of Saharan areas, which is characterized by the dim training of the workforce, the lack of an alteration of farmers in old age, poor integrating circumstances of agricultural institutions and organizations (30% adhering to the Chamber of Agriculture, 16% insurance, 5% to both at the level of institutions and organizations bank and represented only by 5 associations of low activity), these are young investors, university graduates, the beneficiary of the aid program. They employ one or two permanent workers in order to free themselves up for farm management tasks. This wrong observation reflects the fact that the Algerian labor market is characterized by early-life migration from the countryside to metropolitan areas, many leaving agricultural farms in the hands of women and elderly workers.

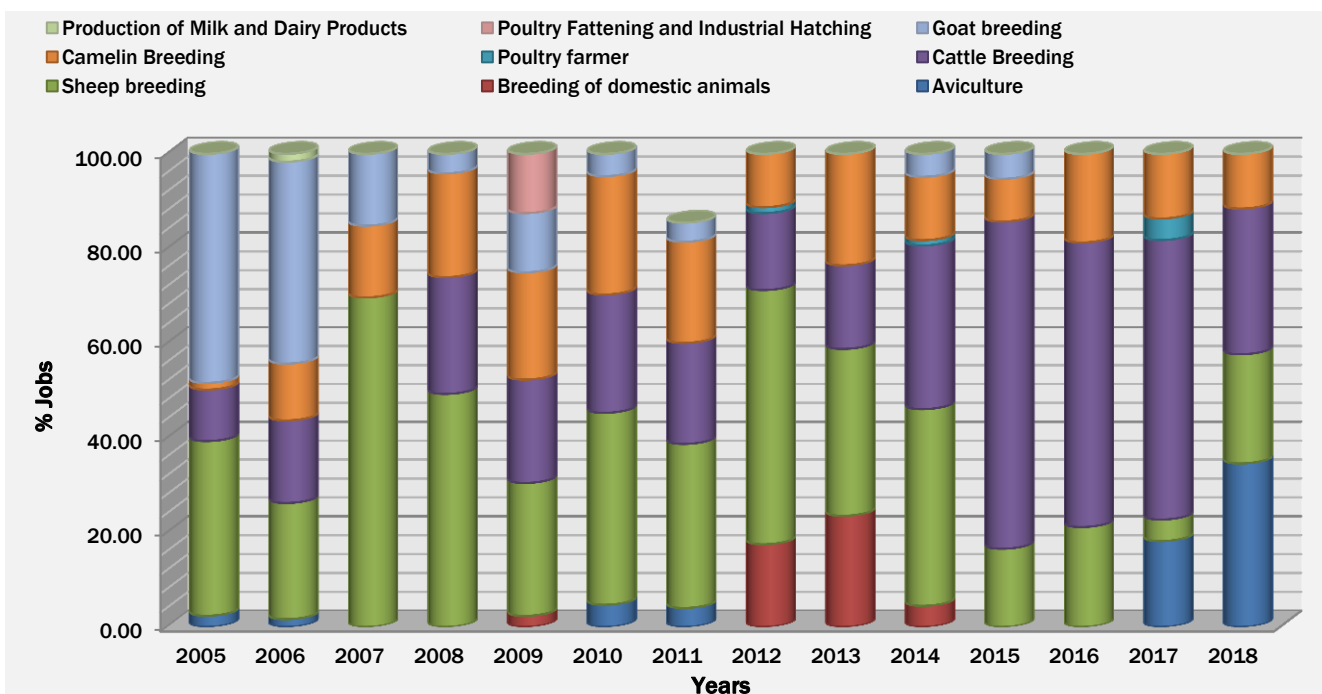


Figure 3 - Integration of young farmers in the sector

### The number of projects by activity and the investment: dynamic trigger

Starting from the purpose of the subsidy program is to progress the farming and living standards of countryside populations (Bensaha et al., 2013). As well as, an immense flow in food demand has surfaced (Lampietti et al., 2011), mainly in animal products (meat and milk), implying, as in many other developing countries the need for a "Livestock Revolution" (Delgado, 2003). These programs have also powerfully supported the renewal and industrialization of the farm animals' sector and have motivated the start-up of livestock production farms (Figure 4).

As shown in Figure 4, many reported operator's loans receiving support through the PNDR program. This need for external financing is explained by the significant cost of activity financing and by the vast sum that is necessary to start a new farm. This has been combined with the fact that breeding in Ghardaia has breathed new life into Saharan agriculture by allowing the diversification of agricultural production systems and the extension of other speculation. According to Daoudi and Lejars (2016), the development of animal husbandry has been accompanied by the development of the entire supply chain for agricultural inputs and equipment. Changes in livestock numbers are positively related to changes in the number of farmers and the degree of micro-credit.

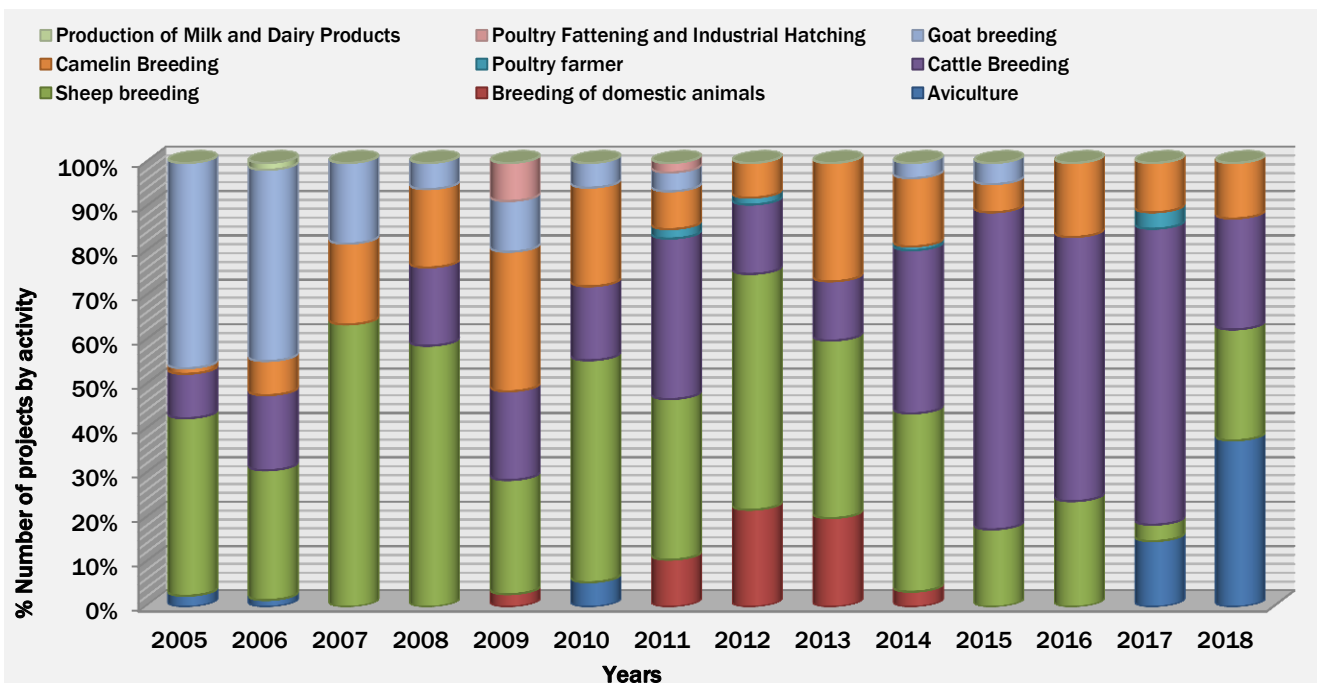


Figure 4- Number of projects for different activities

For our study, many breeders ignore their positive impact and those wishing to apply them do not master the technique. The majority of breeders (75.88%) believe that the lack of outreach programs is the major impediment to the development of these treatments. For this purpose, they should provide the necessary resources to the actors in charge of monitoring / evaluating agricultural investment programs (vehicle, computer, bonus ...) in order to help breeders for improving their production strategies. Such subsidies are mostly used to finance buildings or machinery. For livestock buildings in our case, breeders have built 30 sheepfold housing and 57 stables housing. Conversely to the situation of the vegetal production, for the rearing, the farmers (the area is <05 hectares) have benefited more than 50% of subvention distributed between 63% for the stables rearing, 77% for equipment and 25% for genetic amelioration.

It is worth mentioning that the remarkable evolution of production was observed from one commune to another. The good financial income obtained by large farms can be explained by the good management of breeding which is reflected by the low veterinary costs compared to the total costs. Large farms also potentially benefit from economies of scale that reduce unit production costs (Mosheim and Lovell, 2009) and promote increased regional production.

Inventory of investments and subsidies by type of project: Intensification of plant production, subsidies for agricultural equipment represent two-thirds of aid granted to this category, followed by units for the enhancement of agricultural products. In this context, breeders primarily invested in dairy and meat production, followed by forage farming for animal feed (Figure 5).

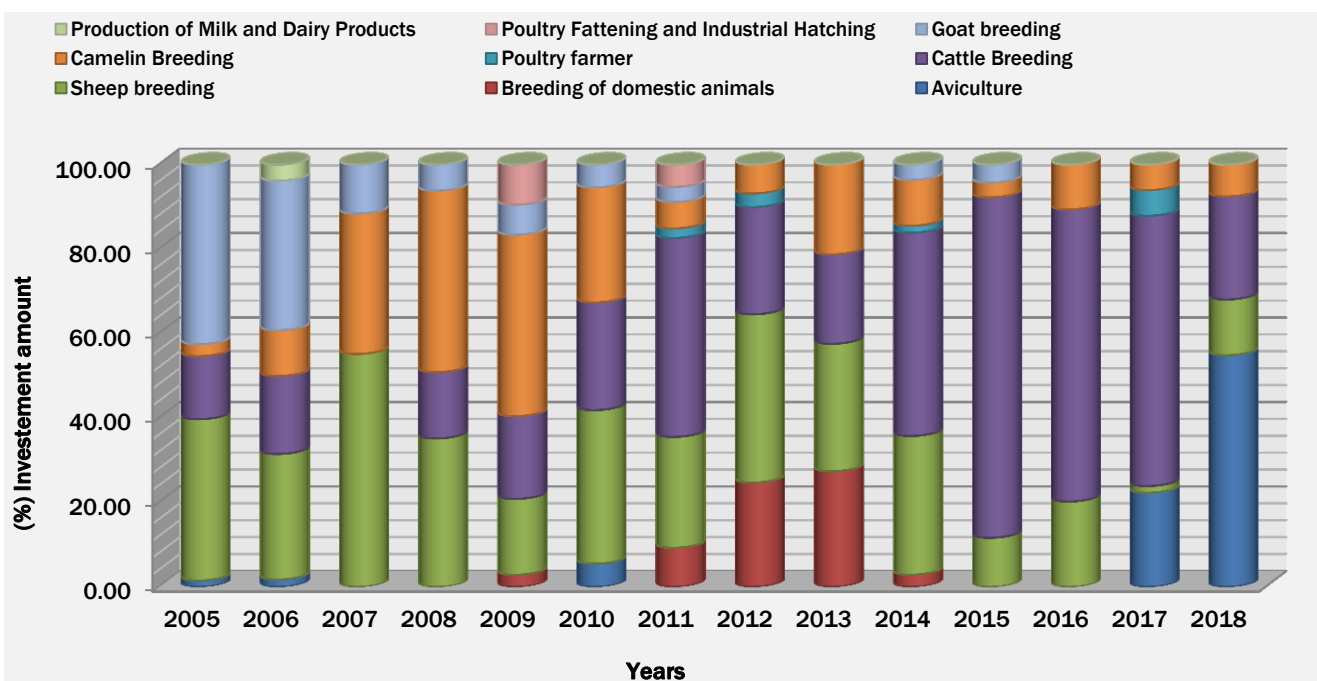


Figure 5 - Amount of investment for different activities



According to our study, the major investments of the exploitations in equipment linked to the attainment of battery farming (Hens, Rabbits) with 58 new units, equipment for slaughter units, and equipment for heifer nurseries with 09 units. These three types represented more than 90% of the investment and financial support quantity (Figure 5). Private investment incorporates a great vehicle of innovation, economic development, and paucity diminution (Musvoto et al., 2015; Tomich et al., 2019).

Indeed, 41% of investors' states that they enhanced their income due to investment, and 59% of the investors are implicated in future investment projects. Even though there are numerous investment practices, the most frequent technique is to boost the amount of land under cultivation, particularly forage (alfalfa) and orchards, and to boost livestock husbandry or increase the number of heads. Bensaha et al. (2020) noted that the importance of livestock mortality hazard management for breeders is enlarged by the obvious presence of low income in Algeria, characterized by multiple herd size balances such that losses push a breeder below a critical threshold.

#### Development of associative movement and scientific research

As part of training in the field of animal husbandry, the region has a number of training activities (Table 2). These associations will aim to rehabilitate the niche for better production and better support and moralization of farmers who have specialized in the agri-food industry. According to MADR (2018), these types of associations are for the maintenance of agriculture, and they present a form of a special partnership that is established between an agricultural producer and a group of consumers.

**Table 2 - Training activities in the agricultural and agri-food sectors.**

Distribution across the 13 municipalities of the region	
Agricultural associations	38
Friends of nature and animal protection club.	02
Agricultural Vocational Training School	01

This communication device includes multimedia information campaigns on agricultural development programs which will be carried out under the aegis of the National Agricultural Extension Institute (MADR, 2018). This system also includes, in terms of information and communication, multimedia information campaigns on agricultural development programs to be carried out under the aegis of the National Agricultural Extension Institute (Bensaha and Arbouche, 2015).

The number of farmers who gain from training and expansion is still not sufficient. It does not go beyond 10% of the objective for training or a collective of 111 farmers, 42% in crop production, and 58% in animal production. Serge and Jacqueline (2009) specify that the associations and the state have thus formed a decisive couple. Associations have often played pioneering roles in detecting new needs of producer farmers and transferring know-how. They are dedicated mainly to technical vocational training. These training courses are based on a network of partner farms in order to be as close as possible to the needs of farmers. According to DSA (2018), this helps farmers to organize themselves into associations, cooperatives, and unions in order to influence decisions during market negotiations and also to fully integrate into the activities of the date sector taken as a whole.

However, our study shows that the objectives of these agricultural training activities through associations, clubs, and schools have yet to prove to be satisfactory. This is due to the negligence of young farmers by their low levels of education. As well as these activities need to be endowed with appropriate logistics. According to Tebani et al. (2019), this meager result is justified by the big number of farmers in old age, uneducated and indifferent to agricultural technology, such as the restricted experience of expansion workers, the lack of means of travel, and of partnership between local authorities.

In addition, it should be noted that there is no effective involvement of actors and partners to take into account the issues of farms in their specificity, as well as the absence of articulation and a global vision Research / Training / Agricultural Council, which induces a low rate of adoption and dissemination of knowledge in terms of improved technologies. The main interventions to be developed will focus on the reorganization of the research system as well as the strengthening of its human, logistical, and financial capacities (Bensaha et al., 2013).

Finally, the current professional organizations of breeders should be restructured and strengthened for greater efficiency in the supervision and promotion of the sector. In addition, the poultry sector (family and semi-industrial) is likely to experience faster development through financial support actions for investments and training and supervision of breeders (Bensaha et al., 2020).

## CONCLUSION AND POLICY IMPLICATIONS

Through its subsidy program, the State intends to encourage animal husbandry and the intensification of production by modernizing the livestock systems. The significant contribution of the state at exploitations investment for the putting in place of heifer nurseries encourages farmers to put into practice breeding techniques. Nevertheless, the prospects for

extending this existing policy and the revival of the agricultural sector remain possible, but for the objectives to be realized on the ground, it will be important to:

- Determine the practical objectives along with the real latent of each region
- Jointly address the economic and social justified through realistic projects
- Repair the administration responsible for the implementation of the programs and supply it with suitable means, defining the responsibility of each element responsible for the job awaiting it.
- Reform the actors implicated in rural development with a view to improving the sector organization and the real participation of farmers in their own projects.

### **Promoting the technical skills of technicians for program assessment and training and raising farmers' attentiveness**

The positive impact of public investment suggests that Algeria should now devote more comprehensively to its own agricultural infrastructure, mainly to efficient livestock building management technologies. To sum up, the animal farm remains the backbone of farming in the study region and continues to supply significant economic and social functions. Moreover, animal farms play a significant role in maintaining the rural population and developing dryland areas. However, animal farm development policies should be modified considering the heterogeneity of agriculture, such as socio-economic factors. Yet, subsidies and farming strengthening have proven significant due to the non-continuity of action in time and space. Policymakers should support such investments in the agricultural sector through by implementing well-targeted public-private partnerships that fund structural projects.

## **DECLARATIONS**

### **Corresponding author**

Hocine BENSAHA

E-mail: muguet78@gmail.com

### **Authors' contribution**

From my point of view, it is consistent and concise work.

### **Conflict of interests**

The authors have not declared any conflict of interest.

### **Acknowledgments**

Thank you for your cooperation in the preparation of your work for publishable version.

## **REFERENCES**

- Abdelhedi IT and Zouari SZ (2020). Agriculture and food security in North Africa: A theoretical and empirical approach. *Journal of the Knowledge Economy*, 11(1):193-210. <https://doi.org/10.1007/s13132-018-0528-y>
- Adrian Jr JL, and Green TW (2001). Agricultural cooperative managers and the business environment. *Journal of Agribusiness*, 19(345-2016-15197):17-33. <https://ageconsearch.umn.edu/record/14685>
- Akerkar A (2015). Study of the implementation of the national agricultural and rural development plan (PNDAR): case of the Wilaya of Bejaia. *Revue Nouvelle Economie*, 12(1) : p. 15-29. [Article link](#)
- Baci I (1999). Les réformes agraires en Algérie. *Options Méditerranéennes*, 36: 285-291. <https://om.ciheam.org/article.php?IDPDF=C1020488>
- Baghdad C (2022). The Algerian agricultural sector between the question of food security and its implication in economic diversification strategy. *World Food Policy*, 8(2):263-275. <https://doi.org/10.1002/wfp2.12049>
- Bedrani S (2008). Agriculture, agri-food, fishing and rural development in Algeria. *Options Méditerranéennes*, 61: 36-73. <https://om.ciheam.org/article.php?IDPDF=800133>
- Bensaha H, Abdelhakem S, and Bensaha L (2015). Impact of foreign labor on the dynamics and sustainability of agricultural production units, case of Ghardaia region (Algeria Northern Sahara) *Research Journal of Applied Sciences, Engineering and Technology*, 10(4): 408-413. <http://dx.doi.org/10.19026/rjaset.10.2506>
- Bensaha H and Arbouche F (2015). Conduct of practices of breeding dairy cattle in the Saharan regions, Zootechnical consequences: case of Ghardaia region (South of Algeria), *International Journal of Advanced Life Sciences*, 8(1): 67-74 February - 2015. <http://unitedlifejournals.com/ijals/view-article.php?id=333>
- Bensaha H Bensaha A and Bensaha L (2020). Situation of livestock insurance in the region of Ghardaia (Algerian Northern Sahara). *Agricultural Engineering International: CIGR Journal*, 22(2): 145-150. <https://cigrjournal.org/index.php/Ejournal/article/view/5807>
- Benyoucef MT (2005). Systematic diagnosis of the milk sector in Algeria. Organization and processing of information for analysis of delivery profiles in dairies and production parameters of farms. Thèse de Doctorat en sciences agronomiques. INA. Alger, 2 tomes: p. 396. <http://dspace.ensa.dz:8080/jsui/bitstream/123456789/2925/3/Benyoucef.pdf>
- Daoudi A and Lejars C (2016). From oasis agriculture to Saharan agriculture in the Ziban region. Actors of dynamism and factors of uncertainty /De l'agriculture oasisienne a l'agriculture saharienne dans la région des Ziban en Algérie. *Acteurs du dynamisme et facteurs d'incertitude*. *New Medit*, 15: 45-53. [Article Link](#)
- Delgado CL (2003). Rising consumption of meat and milk in developing countries has created a new food revolution. *The Journal of Nutrition*, 133: 3907S-3910S. <https://doi.org/10.1093/jn/133.11.3907S>

- Dhehibi B and Lachaal L (2006). Productivity and economic growth in Tunisian agriculture: An empirical evidence. *African Development Review*, 18 (10): 248-257. <https://core.ac.uk/download/pdf/7055895.pdf>
- Djaafri D, and Abdelli I (1990). The reality of the agricultural sector in Algeria: Econometric Study during the period. *Journal of Economic Growth and Entrepreneurship*, 3(1): 27-40. <https://www.asjp.cerist.dz/en/downArticlepdf/612/2/4/122740>
- DSA (2018). Directorate of Agricultural Services of the wilaya of Ghardaïa; Short- and medium-term economic recovery support program (2004-2017), Ghardaïa, 120.
- Ferraton N and Touzard I (2009). Understanding family farming: Diagnosis of production systems. Quae Editions, Paris.
- Forbord M, Vik J. (2017). Food, farmers, and the future: Investigating prospects of increased food production within a national context. *Land Use Policy*. Sep 1; 67:546-57. <https://doi.org/10.1016/j.landusepol.2017.06.031>
- GCPH (2008). General Census of Population and Habitat. Algeria, p.78. <https://www.ons.dz>
- Govindan K (2018). Sustainable consumption and production in the food supply chain: A conceptual framework. *International Journal of Production Economics*, 195:419-431. <https://doi.org/10.1016/j.ijpe.2017.03.003>
- Hocine B and Fodil A (2013). Characterization of dairy cattle breeding in a Saharan region (Ghardaïa, Algeria): Socio-professional profile of producing breeders. *Lucrări Științifice-Universitatea de Științe Agricole și Medicină Veterinară, Seria Zootehnie*, 59:183-189. [Google Scholar](https://scholar.google.com/citations?user=...)
- Khiati M (2007). Strategies, policies and agronomic knowledge systems, Cîva de Médéa, 10-13 Juin 2007, p.6. [Article Link](#)
- Lampietti JA Michaels S Magnan N McCalla AF Saade M Khouri N (2011). A strategic framework for improving food security in Arab countries. *Food Security*; 3(Supplement 1):S7-S22. <https://doi.org/10.1007/s12571-010-0102-3>
- MADR (Ministère de l'Agriculture et du Développement Rural) (2018). Revue of the agricultural sector in Algeria Analysis of the sector's evolving development policies Synthesis Report, first version. Ministère de l'agriculture et du développement rural. Alger. Mai 2018.
- Maghni B (2013). Analysis of Algeria's agricultural support policies. Université de Béjaïa-Algérie, Presentation at Agro West Campus, les 12, 13 décembre 2013.
- Mohamed T and Khalladi M (2019). Monitoring and evaluation of the agricultural and rural renewal program in Algeria: Case of the ouarsenis area. *Revista de Economia e Sociologia Rural*, 56(4), 719-728. <https://doi.org/10.1590/1234-56781806-94790560410>
- Mosheim R Lovell CAK (2009). Scale economies and inefficiency of U.S dairy farms. *American Journal of Agricultural Economics*, 91 (3): 777-794. <https://www.jstor.org/stable/20616235>
- Musvoto C, Nortje K, De Wet B, Mahumani BK, Nahman A (2015). Imperatives for an agricultural green economy in South Africa. *South African Journal of Science*, 111(1-2):1-8. <http://dx.doi.org/10.17159/sajs.2015/20140026>
- Mutin G (2000). L'eau dans le monde Arabe. Enjeux et conflits. Paris: Edition ellipses.
- Serge, C.and Jacqueline, M. 2009. Associations for agriculture and rural life, the government, and public policy. *Pour* 2009/2 N° 201, pp. 51- 68.
- Thabet B, Boughzala M, and Ammar BB (1994). Agriculture and food policy in Tunisia. Allaya M.(comp.), Thabet B.(comp.), Allaya M.(collab.), Thabet B.(collab.). Food and agricultural policies in the Middle East and North Africa: Egypt, Lebanon, Morocco, Sudan, Tunisia, Turkey. Montpellier: CIHEAM, 181-220.
- Tomich TP, Lidder P, Coley M, Gollin D, Meinzen-Dick R, Webb P, et al. (2019). Food and agricultural innovation pathways for prosperity. *Agricultural Systems*, 172:1-5. <https://doi.org/10.1016/j.agsy.2018.01.002>