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Factors Influencing Technical Efficiency Cow's Milk Production In Municipalities Of Saida Region, Using The Stochastic Frontier Analysis Method During The Period 2015/2020

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Abstract

This study aimed to measure the effect of the explanatory factors represented in climatic factors, credit loan, land ownership on the technical inefficiency of cow's milk production for the 16 municipalities of Saida region, using the Stochastic Frontier Analysis SFA method during the periode (2015-2020); The results showed that The statistically significant relative deviation of production from the border level due to inefficiency was (0.46), which means that 46% of the deviations are due to inefficiency and 54% are due to measurement errors or to random factors.

Keywords: Technical efficiency. Stochastic Frontier Analysis. cow's milk production Saida region. climatic factors

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1. INTRODUCTION

Millions of individuals worldwide who work in the dairy value chain rely on dairy products and milk for their livelihoods. The amount of milk produced globally about 81% cow milk, 15% buffalo milk, and 4% combined milk from goats, sheep, and camels grew by 1.1% to approximately 887 Mt in 2021(Mihai et al., 2023,p310), India and Pakistan saw the biggest increases in production because of the growth of their dairy herds and the availability of their herds' fodder thanks to favourable(OECD/FAO, 2022.p213).

Livestock has an important role in the daily lives of people, as consumers benefit from high-quality protein such as meat and milk, while farmers benefit from its revenues, and it is a means of living and earning a living for small farmers and herders who depend on Livestock, and cows are among the important animals in many countries of the world where they are a source of milk and meat production, and most of them are spread in Asia and constitute about 98% of the global herd, and their numbers in the Arab world are estimated at about (4.1) million heads. With about (3.8) million heads, then Iraq is in second place with an estimated number of about (286) thousand heads, and the number of cows in Algeria is 1.9 million heads (including dairy cows by 52%), equivalent to 6% of the total number of cows. Livestock(madrp. 2022), and in Algeria there is one local breed of cows called “Atlas” with a number of about 1.4 million heads. This breed has many sub-clans, which differ at the level of phenotypic shape, while the imported breeds are Holstein; Montbeliarde; Brune des alpes (Fattah et al., 2012.p4).

The milk sector in Algeria is one of the most important divisions whose production is still below the required level, despite the existence of potentials and resources to achieve self-sufficiency for the population, as Algeria is the first country consuming milk and its derivatives in the Maghreb, and the second world importing

country after China(Samira & Kamel, 2020,p2), and consume about 5 billion liters of milk and its derivatives, while per capita consumption is 145 liters of milk per year, compared to the global average estimated by the FAO at 90 liters per capita (Walid, 2020.p26).

Cow's milk is a biological product that contains 95% proteins and the remaining 5% non-protein materials. Milk proteins consist of two groups: casein 78.5% whey protein 16.5% The total protein content in milk varies according to cow breeds(Bosnić, 2003.p44), so livestock must be dealt with efficiently and effectively in order to achieve sustainable economic development in the long term.

Despite the subsidies provided by the Algerian state in the form of loans, the import of milk powder cost the country's government a sizable portion of its budget. To reduce the import bill and develop the milk sector, the state purposefully implemented new policies and development programs aimed at increasing the efficiency of agricultural production in general and the milk sector in particular, lowering imports of milk dust by 50% by 2019 The national economy continues to face difficulties and hazards that keep it constantly dependent on the global market, and milk production efficiency is still below the necessary level(Mahadi & Borich, 2020.p130).

The animal sector in Algeria in general and in Saida region in particular suffers from many institutional and economic problems, but most importantly climatic factors, In order to reach the level of efficiency in the use of economic resources, it is necessary to conduct many economic studies at the level of the sector in a manner that contributes to achieving desirable economic growth.

This study sheds the light at cow's milk production for 16 municipalities of Saida region during the period (2015-2020) and the application of technical efficiency criteria

and the identification of explanatory factors (climate, financing, and land ownership) that affected the inefficiency of the municipalities of Saida district in the production of cow's milk, and therefore the following problem can be raised:

What is the level of technical competence for cow's milk production for the municipalities of Saida district during the period 2015-2020, and what is the extent of the explanatory factors affecting the technical inefficiency?

The research is based on the hypothesis that:

The lack of optimum utilization of the economic resources available for the production of cow's milk in the study area made the level of technical efficiency far from the required level, which negatively affected milk production, which is affected by production factors and other uncontrolled factors directly and indirectly.

2. Theoretical framework of the study :

Stochastic frontier analysis method for measuring technical efficiency:

Stochastic Frontier Analysis (SFA) method represents the best practice for a specific sample of farmers, according to Coelli and Battese (1996) and it is the most reliable methodology for measuring farm efficiency in studies related to the agricultural sector for its ability to deal with random noise(Quesada, 2017.p2), and efficiency is measured by parametric and non-parametric methods(Lovre et al., 2017.p40).

The stochastic frontier analysis method falls within the parametric models, taking into account random error resulting from mischaracterization, along with the error generated by inefficiency, it is calculated in parametric methods by deviating from the limits. Efficiency in the coefficient of error, and the technical efficiency (TE) of the institution is defined by comparing the achieved production with the optimal production(Nezai et al., 2021.p127).

It is widely used in studies of agricultural economics, and measures technical efficiency of production, farm-specific technical inefficiency factors, and random factors affecting levels of technical efficiency, and their levels are estimated by measure the production limit, and determine the appropriate production functions , either a Cobb-Douglas function or the translog logarithmic function, which are the main functions used in determining the stochastic frontier production limit. In our study, the Cobb-Douglas function was chosen for the presence of three independent variables, as well as for its widespread use in Agricultural economy ,The outputs and inputs were expressed in logarithmic form, and the form of the Cobb-Douglas Stochastic Frontier production function is illustrated in the following equation:

$$\log Y_i = \log f(x_i, \beta) + (v_i - \mu_i)$$

whereas :

Y_i: output quantities for the Decision-Making Unit i.

x_i: input quantities for the DMU i.

β: Parameters to be estimated.

v_i: random error element and follows a normal distribution $\left(v_i \sim N(0, \sigma_v^2)\right)$

μ_i: It is a random variable, representing the value of the technical inefficiency of Municipal, which is always positive and follows a one-sided distribution, as previous studies showed that $\mu_i$follows a semi-normal distribution with a mean of zero and a variance of σ_μ^2 which $\left|N\left(0, \sigma_\mu^2\right)\right|$Or the truncated normal distribution with a mean m and a variance of σ_μ^2 (Hamadene et al., 2022.p10).

3.Literature Review

Reviewing and examining previous studies and research with a review of the most important results, indicators and recommendations reached by the researchers, which can be used, including research tools and work mechanisms, to address, justify and interpret the factors involved in the Production efficiency, The following is a quick and brief look at some of the studies that were possible, Obtaining them is as follows:

1-A study (Yilmaz et al., 2020) entitled :Analysis of technical efficiency in milk production: a cross-section study on Turkish dairy farming

This research aimed to evaluate the technical efficiency of farmers in the dairy production using cross- sectional data collected from 92 sample dairy farmers in the West Mediterranean Region of Turkey. By using the Stochastic Frontier Analysis (SFA) to measure the technical efficiency of farmers in milk production. The technical efficiency of the sample of dairy farms ranged from 0.30 to 1.00. The mean efficiency of the sample of farmers was 0.55, indicating the presence of substantial scope for improving the competitiveness of dairy sector in the region by improving the efficiency of farmers. While some of these variations could be attributable to random factors, we calculated that 97.3% of the variations was attributable to the inefficient use of inputs, leaving only 2.7% to random factors. This shows the possibility of increasing average output by about 0.45 without the use of additional inputs. The most significant factors affecting the efficiency of dairy production were household size, total number of cattle, and ratio of the total number of dairy cows to total number of cattle, technological level, barn type, and production of maize silage. This study, by measuring the levels of efficiency and by identifying factors explaining the differences in efficiency, gives useful information for designing policy interventions targeting to improve the competitiveness of the Turkish dairy sector(Yilmaz et al., 2020).

2- A study (Quesada, 2017) entitled:Technical efficiency of dairy farms in Uruguay: a stochastic production frontier analysis

This study's main goal is to examine the dairy farms in Uruguay's efficiency performance. This work estimates a Cobb-Douglas stochastic production frontier and technical inefficiency model for dairy farms using a cross-sectional database to ascertain the impact of each input on the production frontier and the key variables that contribute to variations in farm efficiency. The number of milking cows and the total amount of feed consumed, including concentrated feed, hay, and silage, are the two factors that have the greatest impact on productivity, according to the findings. Although veterinary, agronomic, and accounting support are important, farmers' specialization in dairy farming and use of artificial insemination are the main drivers of of efficiency disparities.Overall, farm profiles show that members of the high efficiency category produce more milk (Quesada, 2017).

3- Study (Bahta et al., 2021) entitled:An Analysis of Technical Efficiency in the Presence of Developments Toward Commercialization: Evidence from Tanzania's Milk Producers

The study aimed to estimate the level of technical efficiency, its determinants, and the quantity of marketing of milk-producing families. A sample of 469 dairy producers was designed using stochastic frontier analysis (SFA). For the years 2012 and 2013, the average technical efficiency (TE) was about 80%, with differences between locations. and largely reflect the levels of marketing. and TE is increased by more cattle, cows and crossbreeds, as well as more veterinarians and feed inputs, provided milk producers are rational. Numerous earlier research have been supported by these findings, and we added to them by expanding the study to include activities and value chain characteristics. In the development programs of commercial value chains, he recognized the processes of the possible direct and indirect effects of marketing. He

discovered that whereas non-livestock income lowers technical competence, access to finance, training, group membership, market engagement, and female household all increase it (Bahta et al., 2021).

4. Study variables

Outputs: y

The output of the study was represented in one output, is quantity of cow's milk production in liters for each municipality of Saida region

Input: xi

The inputs of the study were :

x_1: the number of heads of dairy cows for each municipality of Saida province;

x_2 : the number of heads of vaccinated dairy cows;

x_3: the quantities of fodder production estimated in quintals.

Additional explanatory variables affecting the inefficiency variable z_{it} are the variables affecting the inefficiency in the stochastic frontier production function for the municipalities of Saida .

The explanatory factors were chosen as variables represented by:

z_1: average annual temperatures °C;

z_2: the annual rainfall amounts in mm;

z_3: financial loans amounts are in Algerian dinars;

z_4: land ownership in hectares

These factors can affect the inefficiency of cow's milk production for the municipalities in saida province based on previous studies that dealt with this topic.

Description of the study variables:

Based on the quantitative data on all variables provided by the Directorate of Agricultural Interests and the Office of Economic Investigation of Saida Province for the period 2015-2020.

Table 1. provides descriptive statistics for the quantities of used inputs and outputs, and the explanatory factors for inefficiency, throughout the period between 2015-2020 (96 observations), The average amount of cow’s milk production in the study area was about 1635218.86 liters. The heads of dairy cows had a minimum of 123 and a maximum of 1926 heads, with an average of 699.68 heads, and the average number of vaccinated cows was about 898.55 heads, and the average amount of forage production was about 22336.44 quintals. In addition to that, the explanatory variables of inefficiency obtained an average temperature of 19.15 °C with a maximum of 21.67 °C and a minimum of 13.42 °C, and the average amount of precipitation falling during the years (2015-2020) is 634.82 mm, with a maximum of 1332 mm and a minimum of 293 mm, and the average of credit loans (DZD) estimated at 17057291.77 DZD, with a maximum equal to 54,000,000 DZD and a minimum of 1 DZD, and the average land ownership was estimated at 19262.87, with a maximum equal to 41459 hectares and a minimum of 3430 hectares.

Table 1. Description of the study variables

Variables	The number	Min	Max	Mean	Standard deviation
Amount of milk production (L)	96	373520	8446559	1635218.86	1263896.573
The number of heads of dairy cows	96	123	1926	699.68	463.516
The number of heads of vaccinated dairy cows	96	1	5799	898.55	1073.472
Forage production quantity (quintals)	96	1	201000	22336.44	29364.084
temperatures c°	96	13,42	21,67	19,15	1,03
Rainfall (mm)	96	293	1332	634,82	288,797
credit loans (DZD)	96	1	54000000	17057291,77	12283448,24
Land ownership (hectares)	96	3430	41459	19262.87	10857.931

Source: prepared by the researchers based on the output of SPSS

5. RESULTS AND DISCUSSION

Table 2. shows the results of estimating the parameters of the stochastic frontier production function for the cow's milk in Saida province for the period 2015-2020 using the method likelihood .

Table 2. The results of estimation of the parameters for the stochastic frontier

Variable	Parameter	Coefficient	standard-error	t-ratio
Frontier production function				
Constant	beta0	0.77**	0.14	0.54
The number of heads of dairy cows	beta1	0.11	0.12	0.90
The number of vaccinated cows	beta2	0.80	0.5	0.15
The amount of feed production(q)	beta3	-0.3**	0.17	-0.17
Inefficiency Model				
Constant	delta0	0.10**	0.99	0.10
Temperatures c°	delta1	0.18**	0.96	0.19
The amount of rains(mm)	delta2	-0.49**	0.87	-0.56
Credit loans (DZ)	delta3	0.16**	0.89	0.18
Land Ownership(H)	delta4	-0.11**	0.63	-0.17
Variance Parameters				
sigma-squared	$\sigma^2 = \sigma_u^2 + \sigma_v^2$	0.22**	0.10	0.21
Gamma	$\gamma = \frac{\sigma_\mu^2}{(\sigma_\mu^2 + \sigma_v^2)}$	0.99**	0.26	0.46
LR likelihood ratio test		0.15		
Log Likelihood		-0.14		
Degree of freedom		6		

Source: Prepared by the researchers based on the outputs of the program FRONTIER4.1

Note: *and ** indicate the variables are significant at the 5% and 10% level of significance

By observing the FRONTIER4.1 program output table 2, we can conclude that the value of gamma is the ratio of variance that measures the difference between the tabular value of t and the value of the t-ratio, at the level of statistical significance 0.05 and the level of degree of freedom 6. The statistically significant relative deviation of production from the border level due to inefficiency was (0.46), which means that 46% of the deviations are due to inefficiency and 54% are due to measurement errors or factors outside of the control of farmers. This shows that technical inefeciency was a major factor in the production deviation from the frontier level. It has a less significant impact on the variability of cow milk production in as a result, However, the event of inefficiency must be incorporated into production models since it continues to be significant in the production of cow's milk in the Saida province , The phenomena of inefficiency must be taken into account in production models even though it has a less significant impact on the variance of cow's milk output in the Saida province than measurement mistakes. As a result, So we reach the conclusion that the model selected is random and appropriate to estimate efficiency limits. This agrees with research by Kotosz (2018), Bai et al. 2019 and Lawson et al. (2004). Therefore, we accept the alternative hypothesis that there is a relationship between the additional explanatory variables and the technical inefficiency of cow's milk production for the municipalities in Saida for the time period (2015–2020). Additionally, it was discovered that the value of the LR test, which was 15, is statistically significant, therefore, it can be claimed that the OLS method cannot estimate the parameters, and The MLE approach is used to estimate the model, So the null hypothesis of the absence of inefficiency is rejected, there is a stochastic effect for the production of cow's milk inputs for the years between (2015–2020), and the stochastic frontier production function model is estimated as follows:

$$Lny_{it} = 0.77 + 0.11x_1 + 0.80x_2 - 0.30x_3 + v_{it} - u_{it}$$

The data of Table 2 through the 't' test indicate the significance of the constant of the independent variables for each of the number of heads of dairy cows (x_1), the number of heads of vaccinated dairy cows (x_2), and the quantities of fodder production (x_3), and the value of flexibility for these resources was about (0.11, 0.80, -0.30) respectively, and this indicates the positive relationship between x_1 . x_2 and the production of cow's milk in Saida province, as an increase in these inputs by 10% leads to an increase in cow's milk production by 1.1%, 8%,, respectively.

And an inverse relationship between input x_3 and cow's milk production ,As the decrease in the quantities of fodder production by 10% leads to an increase in the production of cow's milk by 3%,Increasing the size of the herd of dairy cows is a positive factor with a non-significant effect on the technical efficiency of cow's milk production, as studies have shown (Bahta et al., 2021), (Quesada, 2017), (Yilmaz et al., 2020), and (Maina et al., 2018) (Shamebo et al., 2021), (Dong et al., 2016) and (Kovács & Szűcs, 2020) when having cows of good breeds and excellent genetic traits, as indicated by a study (Demircan et al., 2010). It also showed a positive and significant effect of the variable number of vaccinated dairy cows, according to studies (Maina et al., 2018), (Quesada, 2017) and (Bahta et al., 2021). The technical efficiency of milk production is low, although 94% of the cows are imported with excellent genetic quality (Kaouche-Adjlane et al., 2015.p393) Increasing the size of the herd of vaccinated dairy cows is a major factor in productivity and has an important impact on the technical efficiency of cow's milk production, as it the spread of infectious diseases such as bovine tuberculosis, mastitis, brucellosis, and foot-and-mouth disease. All these diseases negatively affect milk productivity (Samira & Kamel, 2020.p5), and foot-and-mouth disease causes a decrease in dairy products from cows (Hashimi & Momand, 2020*),*as a result, the government gave animal health priority by undertaking

extensive vaccination campaigns twice a year. Animal health is the most crucial factor in milk production since unhealthy animals produce less milk and have lower fertility. According to the study, the proliferation of diseases in animals results in a slaughter procedure to eradicate them and reduce the amount of livestock, According to a study (Derks et al., 2014)

The quantities dry of fodder have a negative and statistically significant effect on the technical efficiency of cow's milk production because the nutritional value of the dairy cows' diet (forage) depends on criteria that determine the value of feed for the quality of animal products. In fact, the nutritional value of the diet depends on farming practices (such as choosing species and varieties fodder seeds, fertilization, irrigation, and soil quality), to obtain fodder with nutritional value and high quality and facilitate the flows of ingestion and digestion of ruminants, on the one hand, and to obtain animal products of nutritional value and health for humans on the other hand, and this is what studies have shown. (Ouchene -Khelifi et al., 2018), (Baumont et al., 2009) and (Musliu et al., 2019). Food is the main constraint for every dairy industry. So, there are areas for improvement by restructuring the land in order to scale farms with sufficient fodder space, recovering pasture and adjusting harvesting and forage conservation techniques (hay collection, especially silage) in order to ensure the profitability and sustainability of the farms identified. (Kaouche-Adjlane et al., 2015.p393) . There are several factors considered for its inefficiency. The lack of land, the spread of animal diseases, the lack of fodder for livestock in terms of quantity and quality, and the lack of capabilities (Shamebo et al., 2021.p19), the lack of fodder is also attributed to the lack of land needed for the production of fodder, or the cultivation of cash crops that do not produce fodder residues such as vegetables and fruits or Lack of funding to buy fodder from the market when prices are high. (Zhumanova et al., 2013.p33) In the case of scarce water and the presence of drought, breeders are required to provide stocks of fodder, and expand the cultivation of fodder of different types of herbs and legumes

that have the ability to resist drought and have a transition time to the growth stage as soon as the rains return. like sorghum (Delaby & Peyraud, 2009.p200).

We also note that the values of the coefficients of the explanatory variables of inefficiency ($\delta_1, \delta_2, \delta_3, \delta_4$) were respectively ($0.18, -0.49, 0.16, -0.11$), where The negative sign indicates the opposite effect on inefficiency, and therefore the relationship between additional variables and inefficiency can be derived as follows:

$$\boldsymbol{u = 0.10 + 0.18z_1 - 0.49z_2 + 0.16z_3 - 0.11z_4}$$

Through the relationship, we note the following:

An inverse relationship between the amount of rains and the inefficiency If the amount of rain increases by 10%, the inefficiency decreased by 4.9%, This indicates that the climate of the Saida province region is suitable for the cultivation of green fodder, which is considered the basic food for livestock, especially dairy cows, Green fodder need good watering, and the fodder remains associated with the state of climatic conditions that are characterized by rain falling on time and in the necessary quantities that affect crop yields and milk productivity. This result is also similar to that obtained by (Tenaye, 2020) (Auci & Vignani, 2020) and (Neumann, Verburg, Stehfest, & Müller, 2010). In order to face the scarcity of water and the threat of climate change, the management of water resources has become a major concern all over the world. With only 3% of the world's water resources, the Mediterranean basin is particularly vulnerable to water scarcity; The Mediterranean region is home to about 60% of the world's population who suffer from water poverty (DHEHIBI & CHEMAK, 2010p35). The efficiency of cows' milk yield is impacted by the utilization of local cow breeds, the infertility of rural lands that create grazing spaces for animals, the problem of water, and erratic rainfall. (Nakanwagi & Hyuha, 2015.p847), and therefore environmental changes affect production systems and climatic factors are a real challenge for many

producers in animal production during the coming decades. (FAO, 2007)

An inverse relationship between land ownership and inefficiency to produce cow's milk in Saida district, where the greater the land ownership of small farmers by 10%, the inefficiency decreased by 1.1%, and this indicates that small farmers who benefited from agricultural real estate within the framework of national programs to settle the problem of agricultural land tenure This process was accompanied also related to the acquisition of the agricultural real estate by the Cows breeders to be able to invest in milk production and compete for the development of large crops (grains and fodder). In this context, the public authorities aspire to promote the establishment of modern integrated farms for raising cows. Milking, grain, and fodder production within the framework of contracts-programs. In response to the concerns of breeders related to obtaining fodder and regulating the market for this product, it was decided to provide breeders directly with bran. It is also related to encouraging the use of the “Al-Rafiq” loan to invest in fodder production, while breeders’ cooperatives were encouraged to exploit irrigated areas, especially in the high plateaus and the south (Commerce, 2016).

There is a direct relationship between both temperature, obtaining credit and the inefficiency of milk production in saida , where the inefficiency of milk production increased by 1.8 %, 1.6% for each 10% increase on Temperatures ,Credit loans, respectively. The high temperature causes the cow's diet to dry out because it loses a lot of water, which has an adverse effect on the amount of milk produced ; On the contrary, sunlight provides vitamin D for animal Heath (Bórawski, 2020) ,the phenomenon of subsidized interest loans does not lead to an increase in the technical efficiency of cow's milk producers, so the credit program fails to increase the technical efficiency of farms involved in the production of cow's milk (Brümmer & Loy, 2000.p414).

And for the reconstruction of the countryside, the state paid attention to farmers producing milk through the approved political programs represented in supporting farmers with low-interest loans, and without interest, such as supporting production units with milking machines and tanks and providing financial subsidies for building rural housing. The state also contributed to green fodder farms by about 30% % to 50% of the investment cost and support the artificial insemination project by 100%. (Samira & Kamel, 2020.p5).

According to the results of Table 3, we notice that the municipalities of Saida have a technical efficiency value during the study period 2015-2020 estimated at 0.57, and it is clear through this, that the municipalities of Saida canton were able to maximize 57% of its production from the Milk using its available inputs. Maamoura municipality recorded the lowest technical efficiency in the year 2016 with 0.4097, and the municipality of , Daoui Thabet and Youb with a value of (0.4693 ,0.5391) for the years (2020-2018), respectively, and it was found that there is a discrepancy between saida municipalities in maximizing production from the cow’s milk , and it was discovered that there is a difference between saida towns in optimizing production from the cow's milk. This is because the available inputs are not being used to their full potential , as well as because of the explanatory factors causing Inefficiency, especially climatic factors, especially the amount of precipitation falling , while the municipality of Hounet recorded the highest value of technical efficiency in year 2015 with a value estimated at 0.8344 , and this is due to the favourable climate, hot in summer, cold and rainy in winter, the authorities' interest in investing in this municipality by growing cows and recovering enormous tracts of agricultural land for the production of barley and fodder, which are a basic diet for dairy cows.

Table 3. Distribution of technical efficiency of cow's milk product for the province of Saida

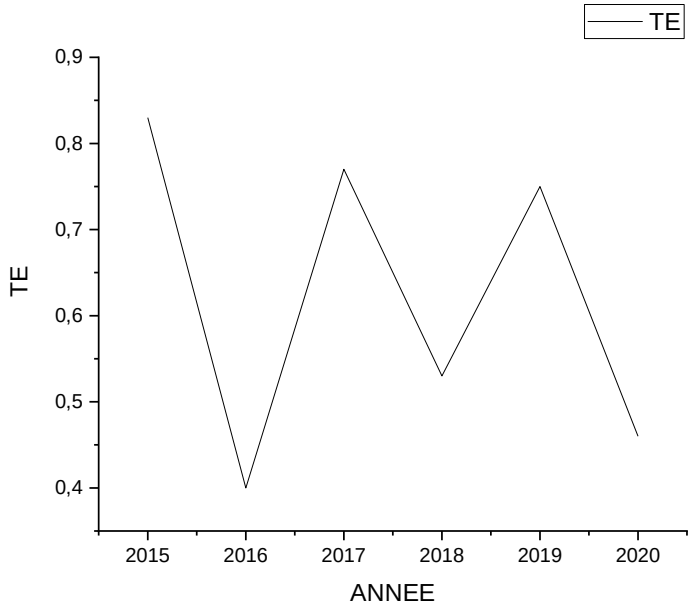
Years	Average Efficiency	Minimum	Maximum	Standard Deviation
2015-2020	0.5714	0.1041	0.9992	0.055
2015	0.8344	0.1773	0.8344	0.083
2016	0.4097	0.3217	0.5894	0.005
2017	0.7781	0.5210	0.9993	0.021
2018	0.5391	0.4434	0.6004	0.002
2019	0.7596	0.5359	0.9992	0,026
2020	0.4693	0.1042	0.9508	0.124

Source: prepared by the researchers Based on the outputs of the SPSS program

Comparing the average annual technical efficiency of cow's milk production, we note from Figure 1. that there is a decrease in the level of technical efficiency of cow's milk production in the years 2016-2018-2020, which were estimated at (0.4097,0.5391,0.4693), respectively, because the available inputs were not properly employed and the impact of The climatic and financing explanatory variables indicate an increase in the inefficiency of milk production in Saida province compared to other years. The average efficiency in the year 2015 represented the highest , which was estimated at 0.8344. compared to the years throughout the research period, a larger amount of precipitation, estimated at 12507 mm, was recorded, which helped reduce inefficiency, because the fodder green , needs large amounts of rain, which is one of the most important inputs for ruminant animals which is one of the most important inputs for ruminant animals, in addition to the lack of infectious diseases in dairy cows

, and not to pay for veterinary expenses, and a recorded improvement in the technical efficiency of cow's milk production was observed in the year 2017, which It recorded an increase in the amount of rain estimated at 9425.7 mm, which affected the technical efficiency, which was estimated at 0.7781.

Fig.1. The development of the average technical efficiency of cow's milk production in Saida Province for the period 2015-2020



Source: prepared by the researchers

4. CONCLUSION

The results of the study reveal that the municipalities of Saida state have the opportunity to reduce the amount of inputs from the number of heads of dairy cows, the number of heads of fertilized cows, and the amount of feed production to a large extent under the same conditions to increase the production efficiency of cow's milk, and the increase in temperature and the amount of rain and land ownership may reduce From the technical inefficiency of producing cow's milk in the municipalities of the

study area, and the lack of credit loans and the number of rainy days and rural housing increases the technical inefficiency, based on these results we propose the following recommendations to improve the technical inefficiency of producing cow's milk

- the need to equip breeders with concentrated fodder and support its prices,
- and improve and develop veterinary services in the study area. By providing all immunizations against epidemic diseases, providing veterinary medicines at a subsidized price, following up on veterinary clinics to perform the veterinary service in an appropriate and correct manner,
- developing a work mechanism, monitoring and tracking financial loans granted by the state to breeders such as credit loans and subsidies for rural construction in order to create investment It has a return in the cow breeding sector and works to raise the awareness of educators regarding the management and breeding of dairy cows and the importance of vaccination to prevent diseases,
- conducting future research studies that work on developing the genetic resources of cows, with everything related to it from milk and meat production, and what is related to nutrition, and animal health , selection of new breeds, and artificial insemination,
- the need to establish milk collection centers and receive milk from breeders at a subsidized price in the study area,
- the need to expand dairy cows breeding projects and take advantage of the advantages of large production.

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