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Economic Analysis of the Impact of Development Programs on Buffalo Milk Producers in the Marshes of Iraq as A model

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Abstract:

The research examined the impact of development programs on local buffalo milk producers in the marsh areas of Iraq, focusing on productivity levels and residents' living standards. Data was collected from 200 producers in the governorates of Dhi-Qar, Maysan, and Basra, all participating in the development program.

The research assumed that the introduction of modern technologies and the provision of production requirements by international organizations or government initiatives would enhance the production levels and productivity of the rural population. Consequently, this improvement may reflect their standard of living and strengthen their connection to the land, thereby reducing migration. These individuals not only require support to maintain their self-reliance without the need for future aid but also to evolve into a dynamic economic force contributing to the development of the national economy.

Using a superior logarithmic production function analyzed by the Frontier statistical program, the study found that the number of buffalo and the amount of hay positively affected milk production. At the same time, bran and barley had a negative impact. Technical efficiency varied widely among breeders, with the highest efficiency at 0.9341 for a participant breeder and the lowest at 0.2910 for a non-participant. Those adopting technology had an average efficiency of 0.78 compared to 0.55 for non-adopters. The findings emphasize the positive role of technology in improving efficiency and underscore the need for increased adoption of these practices among producers. Furthermore, buffalo breeders in the marshlands produce with low technical efficiency due to their inefficient use of production resources. The study recommended increasing the use of modern technologies, urging breeders to increase their use, and facilitating their adoption of this technology.

Keywords: Molasses Technique, Technical Efficiency, Superior Logarithmic Function.

1. Introduction:

Milk is one of the most consumed animal products in the world, as it is an almost complete food that contains many nutrients necessary for the growth and vitality of the body, and it is a source of high-value animal protein. The Food and Agriculture Organization recommends that the average per capita share of milk should reach about 150 kilograms per year and not less than 90 kilograms per year, which is the minimum for proper nutrition (FAO, 2019). Where cow's and buffalo's milk are the main source of milk production in Iraq, as buffalo milk is classified as the second milk in the world in terms of the amount of production after cow's milk, and it constitutes 12% of the amount of global milk production. It is characterized by its composition and nutritional properties that make it suitable to produce many dairy products. It contains more calcium, fats, phosphorus, proteins, and lactose than those found in cow's milk. Buffalo breeding also has an important economic impact on buffalo breeders, as it is a major source of improving the income of breeders. By increasing buffalo breeding projects, an increase in the production of buffalo milk is achieved, which in turn contributes to the production of wide products of butter, cheese, cream, and milk as well. Buffalo breeding also contributes to creating many job opportunities for a large number of individuals and their families in the local community. In Iraq, the factors affecting the technical competence of buffalo milk producers in the marsh areas were identified and estimated.

Contributing to achieving food security and providing business opportunities, as well as striving to raise the standard of living of the population and adopting successful businesses, is a message that governments and development institutions from different countries of the world are trying to provide to certain segments, in addition to providing the best administrative and technical support services efficiently and effectively for projects. Sustainable agricultural development and enhancing food security are among the most important strategic targets due to the steady increase in population, climate change , and limited natural resources, especially water, which constitutes one of the most important elements of the environment and an essential element for all aspects of development, especially in light of Iraq's increase in this resource with the rise in population and economic and social development and what Iraq suffers from the water policies of neighboring countries. (Al-Ani 2017). All these challenges represent challenges that must be dealt with alongside other problems such as land salinity, desertification, environmental pollution, low investments in the agricultural sector, soaring production input prices, and low volume of agricultural technology (Husain, 2017). That requires developing the agricultural sector, raising productivity, and providing the necessary resources for farmers. Promote agricultural diversity, improve agricultural water management, and develop modern technologies in agriculture. (Ahmed et al., 2022). Promoting scientific research and innovation in the field of agriculture and strengthening regional and international cooperation to exchange knowledge and experiences. Local producers in rural areas, especially in the marshes of Iraq, suffer from backward production methods. The inability to finance their projects, which are mostly home production conducted by family members, is also reflected in the standard of living of the inhabitants of those areas. Those areas are often affected by environmental fluctuations, such as drought, and reflected in their local industries. The importance of analyzing and evaluating development projects that provide services to develop and improve the efficiency of production and living standards for diverse groups of society comes from the importance of studies for those in charge of these programs to know the results of their investment in public service.

With no aim at profit as much as assisting the beneficiaries of those programs and providing advice to decision-makers in drawing future policies to support the target segments after proving the success of those programs and circulating them to all groups that the introduction of modern technologies and the provision of production requirements by international organizations or government initiatives lead to an improvement in the levels of production of the rural population and the efficiency in their productive work, which in turn reflects on their standard of living and increases their adherence to their land and non-migration, as these populations lack only support to continue to rely on themselves and not need aid in the future, which leads to their transformation into an economic driving force in development of the country's economy. The research aims, in general, to show the impact of development programs applied to local producers in improving the efficiency of their productivity levels and the standard of living of the inhabitants of the marshes in Iraq.

The primary data of the research were collected through cooperation with the Food and Agriculture Organization of the United Nations within the project (Restoring and Strengthening the Resilience of Food Systems in Southern Iraq) for a sample of 200 views from the governorates of Maysan, Dhi Qar and Basra, compare users of nutrition technique (molasses) with those who do not use it.

The Restoring and Strengthening Resilience of Food Systems in Southern Iraq project is part of the EU Action Document to Support Government and Create Sustainable Jobs in Iraq. Several international organizations (FAO, ILO, IOM, ITC, and UNESCO) are collaborating to implement the Food Business Development Program.

The overall objective of the program is to contribute to the Iraqi economy by improving the agricultural sector in southern Iraq, providing employment opportunities for the rural poor, achieving more resilient food systems, enabling smallholders and landless people to enhance agricultural productivity and generate income in priority value chains for vegetables, buffaloes and dates while enhancing land, water and biodiversity resources.

The program targets several main pillars that seek to:

- Improve the enabling environment by participating in policies and legislative changes that will facilitate economic reforms and improve working conditions.
- Building the capacity of public and private sector actors and service providers.
- Support smallholder farmers in adopting sustainable practices such as training and technology.
- Promote MSMEs through the provision of technical and financial support.
- Promote agribusiness development and network linkages.
- Improve the management of natural resources, especially water and biodiversity, at the farm level.

2.Literature Review:

There is much research in this area; the following has been selected:

(Bardhan & Sharma, 2013) Conducted a study titled "Technical Efficiency of Milk Production in India," aiming to estimate milk production efficiency in the Kumaon District of Akhand State, India. They collected data from 60 cattle-breeding families across six randomly selected villages through personal interviews. Using the Cobb-Douglas production model, the analysis revealed that most breeders were not producing milk optimally. Smallholder producers were found to be more efficient than larger holders, particularly in the plains.

(Gül et al., 2018) "Technical Competence of Dairy Cow Breeders in the Eastern Mediterranean Region in Turkey " assessed 148 dairy breeders' technical competence. Using personal interviews and random boundary analysis, the study aimed to boost milk production without increasing feed, veterinary, or labor costs. Results showed a positive correlation between milk production and coarse feed usage, while labor utilization negatively impacted it. Farm efficiency ranged from 0.53 to 0.98, averaging 0.79, suggesting a potential 19% increase in milk production without changing input. It was also found that farmers over forty managed larger herds more efficiently due to their experience.

(Ma et al., 2019) Studied the impact of feed intensification on the technical efficiency of dairy cattle breeders in New Zealand using data from 257 breeders between 2010 and 2013. The findings revealed that supplementary feed significantly enhances technical efficiency, with farm size, herd size, and milking frequency also playing important roles. The study estimated production elasticity, showing that larger farms (elasticity of 0.368) experience greater production responsiveness to input changes. Overall, the results indicate a positive relationship between feed use and technical efficiency, highlighting that increased input usage boosts livestock output and that many dairy farmers in New Zealand are technically competent.

(Ali & Lafta, 2020) Assesses economic efficiency and productivity in six Iraqi agricultural companies from 2005 to 2017. Findings indicate that while some companies demonstrate technical efficiency, they lack optimal management. The Middle East Company led in technical and cost efficiency, while the Iraqi Seed Production Company had the highest overall efficiency. The National Company for Agricultural Production showed the greatest productivity and efficiency changes. A 1% increase in capital boosts the production value by 0.22%, suggesting a labor-capital substitution relationship with a sigma-squared value of 0.21.

(Ali et al., 2022) Evaluated the technical efficiency of wheat production using fixed and pivot sprinkler irrigation systems with data from 267 farmers in Salah Al-Din Governorate, Iraq. The pivot system showed an average efficiency of 0.86, while the fixed system was 0.84. Yields increased with mechanization and irrigation, and efficiency was linked to farmers' experience and land size. The pivot system at 120 dunams produced 108,930 kg, while the fixed system had the best water productivity at 10 and 40 dunams, with efficiency rates of 86% and 87%, respectively.

(Al-Nuaimy et al., 2018) Assessed production and cost efficiency, helping farmers optimize resources and make informed decisions. An analysis of 58 farms during the 2013 season in Badush, representing about 50% of Nineveh province's buffalo farms. Results indicate that the double logarithmic formula best represents the production function, with all variables significant except green feed and veterinary services. The employment variable has a positive effect on production (elasticity of 0.277). The optimal production volume is 10.77 kg/day at 1266 dinars/kg, with maximum profitability achieved at 15.99 kg/day and an average cost of 988 dinars/kg.

(Islam et al., 2016) examined the socioeconomic profile and income of buffalo farmers in ten districts. Five hundred farmers were interviewed from January to April 2016. Most farmers were aged 31-45, primarily engaged in agriculture (85%), and had an average farm size of 1.05 hectares. Per lactation costs were BDT 24,507, with a net return of BDT 7,865 and a BCR of 1.31. About 64% utilized artificial insemination, and 70% vaccinated their buffaloes. Buffalo rearing accounted for 33% of family income, highlighting the significance of buffalo development programs for farmers.

(El-Dalee, 2018) studied and analyzed dairy farms in Beheira Governorate, focusing on productivity differences and economic factors affecting raw milk production. Key findings showed that specialized buffalo farms outperformed other types, producing about 13.3 thousand pounds compared to 8.9 thousand pounds for traditional buffalo and specialized cattle farms. The cost of producing milk per kg from specialized buffalo was estimated at LE 4.03, with a 15% decrease in production costs, while traditional cows had a higher cost of 2.89 pounds per kg, only decreasing by 1.4%. The return on investment was also higher for specialized buffalo farms at 1.09 pounds compared to 0.76 pounds for traditional farms. Overall, specialized buffalo farms demonstrated superior economic efficiency.

The research assumption is that the introduction of modern technologies and the provision of production requirements by international organizations or government initiatives would enhance the production levels and productivity of the rural population. Consequently, this improvement may reflect their standard of living and strengthen their connection to the land, thereby reducing migration. These individuals not only require support to maintain their self-reliance without the need for future aid but also to evolve into a dynamic economic force contributing to the development of the national economy.

3.Research Methodology:

The Stochastic Frontier Analysis (SFA) method is used to estimate the level of technical efficiency of milk producers and sources of inefficiency, and the theoretical model of SFA is defined by:

$Y_i = f(x_i; B_i)exp(v_i - u_i)$

Y_i farm output for farm count, is a suitable function; x_i is the input vector used by farm B_i is a vector for the unknown parameter to be estimated. $i = 1, 2, 3 \ldots n$.

$v_i$is a random explanation for random differences in output due to factors beyond control, such as measurement error and similar.

u_i is a non-negative random variable that represents inefficiency in output relative to random limits.

$TE = Y_i Y_i^*$

$TE = f(x_i; B_i)exp(v_i - u_i)f(x_i; B_i)exp\ (v_i)$

$TE = exp(-u_i)$

The *TE* estimation process is a one-stage process that involves the first step of measuring the value of efficiency/inefficiency using the normal production function. The use of an appropriate model to determine the socio-economic factors that affect the efficiency value is the second stage. The Cobb-Douglas function for milk production in the study area (Maysan, Dhi Qar and Basra Governorate) in Iraq was described as follows:

$In\, Y_i = B_0 + B_1 InX_1 + B_2 InX_2 + B_3 InX_3 + B_4 InX_4 + u_i$

The dependent variable Yi is the amount of milk produced (litre), X_1 is the number of dairy buffalo (head), X_2 is the amount of hay (in kg), X_3 is the amount of wheat bran (in kg), and X_4 is the amount of green fodder (barley) (in kg).

The maximum probability method was used to estimate the impact of these social and economic factors on the technical efficiency of farmers and to determine the model of maximum probability estimates as follows:

$Ui = o_0 + o_1 z_1 + o_2 z_2 + o_3 z_3 + o_4 z_4 + o_5 z_5$

Unknown parameters (o_1, o_2, o_3, o_4, o_5) will be estimated.

z_1 Farmer's age in years.

z_2 Gender of head of household (male, female).

z_3 Education level.

z_4 Family size (number of family members).

z_5 Use molasses (1= use molasses, 0 = without molasses).

(Molasses, a food item provided by the WFP to increase the production of buffalo milk)

The resource efficiency coefficient for each input was measured by using the efficiency coefficient r, where the value of r is equal to one. This means that the input was used efficiently; otherwise, it was used inefficiently. It can be due to the inefficient use of input in one of the two scenarios. The first is the underutilization of the input indicated by the value of r. If the value of r is more than 1 in such a case, the output level can be increased by increasing the amount of input. The second scenario is the overuse of inputs; when the value of r for the input is less than 1, it means that this input has been overused, and the output can be maximized with a smaller amount of this input.

Efficiency is an indicator of the success of any organization and its superiority in the optimal use of inputs, whether in the field of goods or services (Saleh, 2021). The term efficiency is defined as the optimal use of resources, as it aims to maximize the production of goods and services; any economic system is considered more efficient compared to another system if it enables the provision of more goods and services to society without the use of any of the production inputs and refers to the ability of producers to make optimal decisions regarding the use of resources, and that enterprises Technical Efficiency and Allocative Efficiency (Farrell, 1957).

Technical efficiency refers to a facility's ability to produce a greater amount of output using a specific quantity of inputs or increase output considering specific inputs (Saleh & Maktoof, 2021). It involves maximizing production output while minimizing the use of production elements. Essentially, technical efficiency is about achieving higher levels of production with the same number of inputs or reducing input usage to produce more outputs. Additionally, it is possible to assess the technical efficiency of a product by comparing the actual production of a facility to its optimal production levels (Lin et al., 2005).

$$Technical\ Efficiency\ (TE) = \frac{Actual\ Production}{Optimum\ Production}$$

A technically efficient facility can obtain a higher amount of output using specific production inputs. When optimal production is equal to actual production, the farm is fully efficient (Charoenrat, 2012). When the actual production is smaller than the optimal production, the farm is inefficient. Technical efficiency is one of the parts of economic efficiency, and to reach technical efficiency, there must be the use of technical means at the lowest cost (Li et al., 2021).

Technical efficiency is an engineering concept that refers to the relationship of inputs and outputs, as it is said that the facility is more technically efficient than the other facility if it achieves the highest possible amount of production and the same number of resources or achieves the same level of production with fewer quantities of resources used.

Improving the level of economic performance of farms is a goal sought by various agricultural systems and many developing countries, including Iraq, suffer from the misappropriation of available resources, which leads to low economic efficiency of the farm, which is one of the important indicators by which it can be identified on the efficiency of management in directing various economic resources, and technical efficiency is defined as the efficiency of investing resources in technical terms and the degree of use of these uses to optimal levels from a scientific point of view to reach optimal levels in the field of Investing resources and achieving desirable goals and objectives, which also means technical efficiency and the ability of the enterprise to achieve the greatest output or service under the pool of available resources (Coelli, 2003).

It can also be defined in the same framework as the ratio of actual production corresponding to the production limits with the use of a certain level of inputs and represents a measure of the success of the farm in producing maximum energy from a set of inputs. Thus, it represents a physical relationship between the inputs used in the production process and how the facility or farm can use the best available technological variables (Chavas & Aliber, 1993).

Elsewhere, it is stated that it expresses the appropriate choice of production function from among the functions used by the producer and refers to the operational condition of the production unit produced at the maximum level as technically efficient. Therefore, technical efficiency means the ability of the enterprise to obtain the greatest amount of production using the available quantities of inputs.

Through the definitions of the concept of technical efficiency, it is possible to look at the technical efficiency index from two sides: the input side, which represents the definition of efficiency as the achievement of certain outputs with the lowest possible inputs and is expressed by the scale or criterion of savings or allocation in the inputs and this measure is achieved by comparing the optimal actual combination of inputs and outputs consider in terms of inputs with the inputs required for the actual efficient outputs and can be expressed in the following relationship (Mokhtar, 2013):

$$TE = \frac{Required\ Inputs}{actual\ Inputs} = 1$$

Therefore, an efficient unit has the actual inputs equal to the inputs required for the actual efficient outputs and thus achieves a ratio equal to one and is technically more efficient. In contrast, the inefficient unit has actual inputs greater than the inputs required for outputs, which means that the farm or facility can reduce the percentage of inputs that achieve previous production or provide a percentage of the production costs used to obtain the previous level of production.

The second aspect of technical efficiency is the output side, which represents the definition of efficiency as achieving the maximum outputs from the available resources and is expressed by a measure or criterion of increasing outputs. This measure is achieved by comparing the actual combination of inputs and outputs in terms of outputs with efficient outputs for the same inputs; in other words, it is the ratio between the actual outputs and the outputs that can be achieved (latent) at the level of the efficient limit using the actual inputs and measured by the following relationship:

$$TE = \frac{actual\ output}{latent\ output\ of\ the\ same\ input}$$

Therefore, a technically efficient unit achieves a ratio of one, and its actual outputs are equal to the latent outputs of its actual inputs. In contrast, a technically inefficient unit achieves less than one, and its actual outputs are less than the latent outputs of its inputs. The description of the model is according to random boundary analysis, as the dependent variable was the amount of milk production. The independent variables were (the number of dairy buffaloes, the amount of barley, the amount of bran, and the amount of hay), and the management variables represented the inefficiency variables. They included (the use of technology (molasses), educational level, breeder's age, experience, and gender). Frontier 4.1 and the ML method were used to estimate the model because the OLS method cannot be applied to nonlinear regression models, although it is used as a step in estimation here. After all, it gives the best unbiased linear estimate of the coefficients, except for the discontinuous part of the y-axis, B0. Then, we use the COLS method as a second step to obtain unbiased linear parameters. In the third step, the model is estimated using the ML method to obtain estimates of the maximum probability of the parameters of the production function.

4.Results And Discussion:

4.1 Estimation of the logarithmic production function:

The description of the model is prepared according to random boundary analysis, as the dependent variable was the amount of milk production. The independent variables are (the number of dairy buffaloes, the amount of barley, the amount of bran, and the amount of hay), and management variables represented the inefficiency variables. They included (the use of technology (molasses), educational level, breeder's age, experience, and gender). Frontier 4.1 and the ML method were used to estimate the model because the OLS method cannot be applied to nonlinear regression models, although it is used as a step in estimation here. After all, it gives the best unbiased linear estimate of the coefficients, except for the disconnected part of the Y-axis B0. Then, we use the COLS method as a second step to obtain unbiased linear parameters.

In the third step, the model is estimated using the ML method to obtain estimates of the maximum probability of the parameters of the production function. The results of the TL were according to the ML method and the inefficiency model according to random boundary analysis, as shown in Table 1.

Table 1. Results of the Superior Logarithmic Production Function (TL) and Inefficiency Model

Variable	Parameter	Cof.	St.	T-R
	Beta0	0.6704	0.4662685	0.6704
No. of milking buffalo	Beta1	0.65	0.36639811	0.17762659
Hay quantity	Beta2	0.48646750	0.8406382	0.57868828
Bran quantity	Beta3	-0.507076	0.69857364	-0.7258716
Barley quantity	Beta4	20.350425-	0.85084560	-0.4118552
Inefficiency model	**The Effects Model (inefficiency)**			
	Delta0	0.47427929	0.31871791	0.14880848
Age	Delta1	0.365479870	0.39413525	0.92729558
Sex	Delta2	-0.2376250	0.18298961	-0.1298571
Education	Delta3	0.16726366	0.88997944	0.18794104
No. of family members	Delta4	0.58955301	0.20152972	0.292539
The use of molasses	Delta5	-0.6350933	0.1969054	-0.32253726
	sigma-squared	0.1540573	0.4111747	0.37467601
	Gamma	0.7032683	0.128247	0.5483703
log-likelihood function		0.45615151 -		

Source: Frontier 4.1 output.

The results of the estimated efficiency function can be explained as follows:

X1: (Number of Buffalo) The elasticity value of this variable shows the direct relationship between the number of dairy buffalo and milk production, meaning that increasing the number of dairy buffalo by 1% leads to an increase in production by 0.65%, and this is consistent with economic logic, which is the most influential variable in the volume of output.

X2: (Amount of hay). The elasticity value of this variable shows the direct relationship between the amount of hay and milk production, and this means that increasing the amount of hay by 1% leads to an increase in production by 0.48%, and this is consistent with economic logic.

X3: (Amount of bran). The elasticity value of this variable shows the inverse relationship between the amount of bran and milk production, meaning that increasing the amount of bran by 1% leads to a decrease in production by 0.50%, which may be interpreted as increasing its use beyond the recommended limit has a negative effect.

X4: (Amount of barley). The elasticity value of this variable shows an inverse relationship between the amount of barley and milk production, and this means that increasing the amount of barley by 1% leads to a decrease in production by 0.35%, which may be explained by increasing its use beyond the recommended limit having a negative effect.

One of the results of estimating the superior logarithmic production function (TL) by the Maximum Likelihood method and using the Frontier 4.1 program, is that the state of inefficiency is conditionally estimated depending on the residual and that the form of the distribution of the residuals is implicitly determined, and that the error resulting from inefficiency has a one-sided distribution and this comes in fact that the inefficiency state comes from the negative deviation from the boundary efficiency curve, and the inefficiency analysis reflects the levels of administrative processes and that the inefficiency is three Models:

The first model presented by Colli & Battese in 1996 was based on the effect of temporal variation on inefficiency and its form.

$U_{it} = exp[-\eta(t-T)]$
Ŋ = unknown parameters, t-T = time variation
The second model presented by Ziu & Hanuy in 1994 calculated the overlap between the illustrative variables in the inefficiency model and took the following form:
$U_{it} = \sum z_{it} + \delta z_{it} + w_{it}$
The third model, presented by Colli & Battese in 1995, was for Panel Data and took the following form: -
$U_{it} = \delta z_{it} - w_{it}$
z_{it}, w_{it}: unforeseen random variable.
In our study, the second model was used to determine the impact of economic and social factors (management factors), and the results were as follows.
The effect of the age of the breeder (D1): The inefficiency function is positive and amounted to 0.36, and this means that the greater the age of the breeder, the negative reflected in the technical efficiency, meaning that young educators are more efficient because they can adopt knowledge and modern technology more than the elderly and can change and adapt to new technologies.
As for the sex of the breeder (D2): came negative in the function of inefficiency is negative and moral at the level of a significant 5%, and this indicates that technical efficiency varies according to the sex of the breeder, and it is likely that the sex of the breeder male technically efficient and inefficiency decreases over time.
As for the educational level (D3): positive and non-moral, this indicates that farmers at lower educational levels are more technically efficient than educated farmers, meaning that it has an impact on inefficiency, as the study supports the argument that buffalo breeders in the studied provinces do not have full technical efficiency and this is consistent with the technical reality of buffalo breeders as buffalo breeders rely on experience and that production processes need local experience more than certification.
The effect of family size (D4) is positive and moral at a level of 5% significance. This indicates that technical efficiency decreases when family size increases. The reason is likely that dealing with buffalo is done by certain individuals, and no one can deal with it, so increasing the number of family members does not improve production efficiency, and large families are less efficient than small families.
The use of molasses (D5) is negative and significant at a level of 5% morale, which indicates that technical efficiency increases when the use of molasses increases. Using molasses is technically efficient, and inefficiency decreases over time.
The value of the σ^2 of 0.154 is significant at a level of 1%, indicates the quality and correctness of the assumed distribution of the composite error, and the value of Gama Γ (0.703) is significant at the level of 1% indicates that the bulk of the deviation of values from the boundary product (variation of values) from production deviations is due to inefficient production.
The logarithmic function of the maximum probability of negative values (-0.456) indicates that there are technical changes that negatively affect the random variable and then the final production. Technical efficiency.

4.2 Estimation of Technical Efficiency:

The production function is used to estimate technical efficiency, and the estimation results are presented in Table 2. It is clear from the table below that the highest value of technical efficiency reached 93% when the breeder with a sequence of 96, meaning that the breeder approached the level of full efficiency as he was able to achieve the highest output among the breeders of the sample with a limited number of inputs, meaning that this breeder produces this amount of production using only 93% of the inputs or less. In comparison, the lowest level of efficiency reached 29% when the breeder with a sequence of 161 if the breeder who achieved this percentage must reach the efficiency phase and the production of the current amount of output or more using only 29% or less of the current input.

The average technical efficiency at the sample level reached 74%. This result indicates that breeders can increase their production by 26% without increasing any number of economic resources used in the production process, and this means that the sample loses some number of economic resources and thus bears additional costs equivalent to 26% of resource costs, and also means that breeders can produce the same previous output with less resources by approximately 26% of the resources used. The average efficiency indicates that there is a deviation in the actual production at optimal production by 26%. Breeders can achieve it if the available economic resources are used optimally, which is clear here that the sample breeders did not achieve 100% full economic efficiency. Therefore, each breeder did not produce on the production potential curve and move away from it in different proportions, and this means that these breeders have the opportunity to reduce the quantities of economic resources used to obtain the same level of output or use the quantities of resources used to obtain at a higher production level.

Table 2. Technical efficiency for the sample

Maysan		**Dhi-Qar**		**Basra**		**Non-adopters**	
Breeder	TE%	Breeder	TE%	Breeder	TE%	Breeder	TE%
1	0.8661	51	0.6471	101	0.761	151	0.571
2	0.7977	52	0.7401	102	0.771	152	0.621
3	0.7404	53	0.4541	103	0.761	153	0.511
4	0.8274	54	0.7391	104	0.821	154	0.601
5	0.8226	55	0.6071	105	0.921	155	0.571
6	0.5038	56	0.5051	106	0.861	156	0.551
7	0.7934	57	0.6371	107	0.821	157	0.601
8	0.7616	58	0.7671	108	0.811	158	0.511
9	0.6184	59	0.8531	109	0.881	159	0.351
10	0.469	60	0.6801	110	0.821	160	0.381
11	0.4737	61	0.6271	111	0.841	161	0.291
12	0.8175	62	0.7291	112	0.851	162	0.591
13	0.8361	63	0.7991	113	0.881	163	0.611
14	0.7825	64	0.7531	114	0.831	164	0.471
15	0.8685	65	0.7061	115	0.581	165	0.751
16	0.8243	66	0.8791	116	0.801	166	0.621
17	0.7393	67	0.9311	117	0.851	167	0.841
18	0.6102	68	0.8911	118	0.831	168	0.831
19	0.9007	69	0.9221	119	0.811	169	0.811
20	0.6564	70	0.8901	120	0.851	170	0.471
21	0.8278	71	0.8931	121	0.841	171	0.501
22	0.7601	72	0.9081	122	0.851	172	0.451
23	0.8957	73	0.8661	123	0.521	173	0.751
24	0.7117	74	0.8721	124	0.581	174	0.371
25	0.7379	75	0.9181	125	0.661	175	0.401
26	0.7766	76	0.8501	126	0.861	176	0.491
27	0.7347	77	0.8611	127	0.861	177	0.521
28	0.7381	78	0.8471	128	0.871	178	0.371
29	0.8334	79	0.8371	129	0.441	179	0.311
30	0.7439	80	0.8611	130	0.771	180	0.391
31	0.8614	81	0.8721	131	0.761	181	0.631
32	0.8096	82	0.8101	132	0.821	182	0.461
33	0.8235	83	0.8351	133	0.891	183	0.371
34	0.8253	84	0.8021	134	0.851	184	0.511
35	0.8424	85	0.8611	135	0.831	185	0.541
36	0.8242	86	0.8021	136	0.851	186	0.541

37	0.7829	87	0.8261	137	0.831	187	0.701
38	0.8415	88	0.8171	138	0.691	188	0.551
39	0.8298	89	0.8391	139	0.781	189	0.581
40	0.7099	90	0.8561	140	0.881	190	0.751
41	0.8826	91	0.8931	141	0.851	191	0.691
42	0.6557	92	0.8311	142	0.621	192	0.781
43	0.8498	93	0.9201	143	0.601	193	0.661
44	0.8551	94	0.9061	144	0.731	194	0.631
45	0.6011	95	0.9181	145	0.771	195	0.531
46	0.7411	96	0.9341	146	0.771	196	0.481
47	0.7841	97	0.9091	147	0.861	197	0.431
48	0.8921	98	0.9141	148	0.781	198	0.511
49	0.8091	99	0.8501	149	0.781	199	0.591
50	0.8621	100	0.7910	150	0.871	200	0.531
Average	**0.77**		**0.813**		**0.789**		**0.552**
St. De	**0.103**		**0.11**		**0.102**		**0.135**

Source: By Authors using the Frontier ouput.

Table 2. shows the level of technical efficiency of the milking buffalo breeders of 150 breeders working within the program from the three governorates (Maysan, Dhi Qar and Basra) and 50 from each governorate, as the sequence 1-50 from Maysan governorate, the sequence 51-100 Dhi Qar governorate, and the sequence 101-150 from Basra governorate, as producers adopting the technology, in addition to 50 breeders who are not subject to the work of the sequence program 151-200.

It is noted that there is a fluctuation and a large extent between the levels of technical efficiency of educators ranged between the highest value 0.9341 which is for educator No. 96 from Dhi Qar Governorate, which is one of the educators adopting the technologies of the program, and the lowest value 0.2910 was for educator No. 161, which is one of the educators who are not adopting technologies, as it can be noted the great disparity between the two values of technical efficiency, as the low technical efficiency reflects uneconomic use and a large waste of available resources, This confirms the importance of technologies and their impact on increasing the efficiency of the use of technical resources in the production of buffalo milk, the average technical efficiency at the level of the studied sample (adopted and non-adopters) of 200 breeders of buffalo 0.7328, which indicates the level of good technical efficiency in the use of resources available to breeders in milk production.

The value of the standard deviation, which is one of the most important statistical measures that measure the extent of dispersion and spacing between the values of one group, was a value of 0.152, as it is noted that the values of technical efficiency calculated are not spaced or non-dispersed when comparing the set of efficiencies calculated for all educators, whether adopters of technology or non-adopters.

It can be seen that all the averages of the samples in the studied and adopting governorates of technology were 0.77, 0.832, 0.798 sequentially (Maysan, Dhi Qar, and Basra), all of which are higher than the average technical efficiency in the sample for non-adoptive breeders, which was 0.552 and notes the importance of using and adopting technology and its impact on technical efficiency to improve the use of available resources for breeders.

Table 3. Frequency Distribution of Techno-Adopting Breeders

Categories	Repetition	Percentage (%)
(49-40)	4	2.7
(59-50)	5	3.3
(69-60)	14	9.3
(79-70)	36	24
(89-80)	79	52.7
(100-90)	12	8
Total	150	100

Source: By authors using sample data.

Table 3 shows the technical efficiency of milking buffalo breeders adopting technologies in the three governorates for 150 breeders, where the category of breeders whose technical efficiency ranges between 80 and 89 is the most frequent category by 79 breeders and constitutes 52.7% of the total sample studied. This confirms the importance of technologies and their impact on increasing the efficiency of using technical resources in the production of buffalo milk. This indicates a proficient level of technical efficiency in using resources available to breeders in buffalo milk production, and the 40-49 category was the least frequent, by only 4 breeders.

Table 4. Frequency Distribution of Non-Techno-Adopting Breeders

Categories	Repetition	Percentage (%)
(29-20)	1	2
(39-30)	9	18
(49-40)	7	14
(59-50)	16	32
(69-60)	9	18
(79-70)	4	%
(89-80)	3	6
(100-90)	1	2
Total	50	100

Source: By authors using sample data.

Table 4 shows the level of technical efficiency of milking buffalo breeders for 50 breeders who do not adopt technologies in the three governorates, which proves the importance of technology and its impact on increasing the efficiency of the use of technical resources in the production of buffalo milk.

When comparing the categories of educators using technology, we find the highest percentage of efficiency, 80-89%, which constitutes about 52%. With educators who do not use technology, we find the highest percentage of efficiency, 50-59%, and this confirms the validity of the research hypothesis.

5.Conclusions:

Based on the research findings, the study reached several conclusions, including that the impact of development programs using technology and support in buffalo milk production in the Iraqi marshes has a positive impact on the technical efficiency of producers, this confirms the validity of the research hypothesis. The study also found that the number of producing animals in the herd has a significant impact on the quantity of milk produced. The study also found that the production elements used in the production process have varying effects, both positive and negative. It was also found that some factors affect the inefficiency of milk production management. Furthermore, buffalo breeders in the marshlands produce with low technical efficiency due to their inefficient use of production resources.

The study recommended increasing the use of modern technologies, urging breeders to increase their use, and facilitating their adoption of this technology. It also recommended addressing the various factors that affect the inefficiency of the buffalo milk production process in the study area, such as the age of breeders, who prefer young males, the use of molasses as a feed to stimulate milk production and encouraging breeders to follow the guidelines set by the United Nations Development Program.

Authors Declaration:

Conflicts of Interest: None

-We Hereby Confirm That All The Figures and Tables In The Manuscript Are Mine and Ours. Besides, The Figures and Images, which are Not Mine, Have Been Permitted Republication and Attached to The Manuscript.

- Ethical Clearance: The Research Was Approved by The Local Ethical Committee in The University.

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