Journal of American Science

Websites:
http://www.jofamericanscience.org
http://www.sciencepub.net

Emails:
editor@sciencepub.net
sciencepub@gmail.com

MARSLAND PRESS
Multidisciplinary Academic Journal Publisher

Technical and economic efficiency of fish production farms in kafr El-Sheikh Governorate

Dr. Adel Mohamed Abd elwahab Saleh[1] and Dr. Hassan Abdullah Mohamed Greda[2]

[1]Senior Researcher, Agricultural Research Center, Egypt - Agricultural Economics Research Institute, Egypt
[2] Researcher, Agricultural Research Center, Egypt - Agricultural Economics Research Institute, Egypt
Email: elshahedadel123@gmail.com, economic.2013@yahoo.com,

Abstract: The fisheries sector contributes about 9.9% of the total value of agricultural production, which amounts to about 465.2 billion pounds and about 27.4% of the total value of animal production, which amounts to about 169.8 billion pounds. The fisheries sector contributes to the production of fish meat with 83.26% of the total meat production in kafr El-Sheikh Governorate. The average annual production of fish farming was about 1506.5 thousand tons, while the role of capture fisheries in production was reduced to about 369.3 thousand tons, with a total of about 1875.7 thousand tons. tons as an annual average of production. The average annual domestic consumption was about 2,250 thousand tons, and the average per capita is estimated at 11.9 kg / year during the period (2016-2019) , the research problem is summarized in the insufficient production of fish to meet the needs of local consumption of fish, as the gap covers about 374.3 thousand tons with imports from abroad. The research aims to increase fish production and raise the rate of self-sufficiency by researching technical efficiency in both cases with fixed and variable returns to scale, and researching economic efficiency (cost efficiency) and determining the amount of resources achieved for economic efficiency.

The results of the research indicate that technical efficiency (TE) according to the concept of constant return to scale (CRS), the average of this indicator was estimated at 86.6%, that is, the same level of production can be achieved using only 86.6% of the actual summation of the used resources, according to the concept of Variable return to scale (VRS), the average of this indicator is estimated at 94%, which means that the same level of production can be achieved with 94%, the economic efficiency index is estimated at 66.5%.

[Adel Mohamed Abd elwahab Saleh and Hassan Abdullah Mohamed Greda **Technical and economic efficiency of fish production farms in kafr El-Sheikh Governorate**.*J Am Sci* 2022;18(10):1-11]. ISSN 1545-1003 (print); ISSN 2375-7264 (online). http://www.jofamericanscience.org. 01.doi:10.7537/marsjas181022.01.

Keywords: fisheries sector, fish farming, technical & economic efficiency.

Introduction:

The fisheries sector is considered one of the important sectors in the national economy it contributes about 9.9% of the total value of agricultural production of about 465.2 billion pounds, and about 27.4% of the total value of livestock production of about 169.8 billion pounds for the average period (2016-2019). Also, fish is a good alternative to red meat, especially in light of its high prices. The [(4)] importance of fish wealth in Egypt comes from the multiplicity of its sources.

On top of these sources comes fish farming, of which the annual average production amounted to about 1.5065 million tons, and the role of natural resources in production declined to about 369.3 thousand tons[(5)]. The annual average of production reached about 1.8757 million tons, while Domestic consumption of it is about 2.250 million tons, and the average per capita share is about 11.9 kg / year during the same period[(6)].

Some studies[(3)] indicated the importance of fish farming in providing a large amount of animal protein and increasing the level of food self-sufficiency, in addition to the fact that it uses resources that may be idle or do not achieve a moral return if used for plant production. The research also showed the contribution of farming to providing job opportunities for many Young.

Research problem:

The research problem is summarized in the fact that despite Egypt's possession of vast areas of water bodies and its enjoyment of productive advantages in the production of fish from both the natural sources of production, which include the seas, lakes and the Nile River, and from the unnatural sources that include fish farming in its various forms, this fish production It is not enough to cover Egypt's consumer needs of fish, so fish are imported from abroad to fill the fish gap of about 374.3 thousand tons, on average, for the research period, with mostly poor species, with which the burden on the Egyptian trade balance increases.

Research objective:

The research aims to research the technical and economic efficiency of fish production farms in kafr El-Sheikh Governorate to maximize the maximum return in a way that helps expand fish production and raise the percentage of self-sufficiency of it, by researching the technical efficiency in two cases constant return to scale and variable return to scale, and economic efficiency (cost efficiency), And the comparison between two averages: the actual quantities of resources used on the one hand and the optimum quantities achieved for technical and economic efficiency on the other hand, and the application of the amount of resources achieved for economic efficiency.

Methodology and Data Sources:

The achievement of the research's objectives was based on two types' descriptive statistical analysis and quantitative statistical analysis such as percentages, arithmetic mean, in addition to estimating production efficiency of its different types through the use of the Data Envelopment Analysis Program (DEAP) method When both the constant return to scale and the variable return to scale.

The research relied on a group of different sources to obtain the published and unpublished secondary data from the Ministry of Agriculture and Land Reclamation and the Fisheries Authority, and on the primary data that includes the various technical transactions of fish farming activities through the questionnaire conducted on a simple random sample that included 50 fish farms The Tilapia fish producers in the most important governorates of fish production in Egypt, Kafr El-Sheikh governorate, with 50 questionnaire forms collected through a personal interview during the months of January and February2022.

Definition of the Data Envelopment Analysis (DEA):

It is one of the non-parametric statistical analysis methods that use mathematical programming to find the relative efficiency, which uses a multiple set of inputs and outputs, by dividing the total outputs by the total inputs for each facility, and this percentage is compared with other facilities. Efficient limits. The degree of inefficiency of other facilities is measured in relation to the efficient limits using mathematical methods.

The efficiency index for the facility is confined between the value one (1), which represents full efficiency, and between the value zero (0), which represents complete inefficiency, through two assumptions to measure technical efficiency, namely, the constant return to scale and the variable return to scale, and the concept of constant return to scale assumes the exploitation of the farm and operating at its maximum scale, while the concept of variable return to scale assumes that the farm activity is at capacities less than the maximum scale, as the assumption of constant return to scale does not apply to some production units.

(a) Technical efficiency assuming constant return to scale (DEA Model - CRS):

The DEA scale represents the appropriate way to perform efficiency analysis, when there are multiple inputs and outputs measured in different units, and to build a mathematical model to measure production efficiency, it is required to adopt the appropriate function for this purpose and its determinants, and the general model of linear programming used to measure the technical efficiency of production units can be written. When constant return to scale in the following equations[8]:

(1)

$$Min_{\theta_x \lambda} \theta_i^{CRS}$$

S,t, $Y\lambda - y \geq 0$

$$\theta_{X_K} - X\lambda \geq 0 \quad K$$

=1,2,…,,n

$$\lambda \geq 0$$

whereas:

θ_i^{CRS} A value that measures the technical efficiency (TE) of the production unit number i λ, , the vector result N x1 of the constants or weights associated with all productive units that are characterized by efficiency θ_i is the degree of efficiency obtained for the production unit whose arrangement i ,**X** represents the resource, and the number of resources is K, and this evaluation must meet the constraint If it is $\theta \leq 1$, When it is $\theta = 1$ the production unit is working efficiently, and it produces on Production Possibility Curve optimum. If it is $\theta \leq 1$ then the unit of production lies under the Production Possibility Curve optimum and technically it is considered inefficient. To measure the economic efficiency (EE), we must obtain the minimization of the following linear function:

(2)

$$Min_{\theta_i CRS} \; W \grave{i} X_i^*$$

$$X_i^* \geq X \lambda$$

S,t $Y\lambda - y \geq 0$

$$\lambda \geq 0$$

whereas:

X_i^* Represents a vector of cost minimization per production unit No i taking into account that the prices of the inputs W_i^* the production rate Y is given, According to Data Envelopment Analysis (DEA), Economic Efficiency is divided into two parts. The first part is Technical Efficiency, which means the facility's ability to obtain the maximum possible output from a set of available inputs, and it is measured in terms of the iso-quant curve, It is the result of dividing the incurred costs by the observed costs:

$$EE_i = \frac{W_i^{`} X_i^*}{W_i^* X_i}$$

The second part is Allocative Efficiency, which refers to the firm's ability to use the optimum combination of inputs, which achieves the lowest possible cost, taking into account the prices of the inputs, and it can be obtained with the knowledge of both technical efficiency and economic efficiency, and the following equation represents the distributional efficiency:

(4)

$$AE_i = \frac{EE_i}{TE_i^{CRS}}$$

(b) Technical efficiency assuming variable return to scale (DEA Model - VRS):

The assumption of constant return to scale does not apply to some production units, so the modified model from DEA is used, which assumes instability)[7].

(5)

$$Min_{\theta_i \lambda} \theta^{VRS}$$

$$Y\lambda - y \geq 0 \quad \text{S,t,}$$
$$\theta_i - X\lambda \geq 0$$
$$i = 1,2,\ldots,N$$
$$N'\lambda = 1 \quad \lambda \geq 0$$

Scale Efficiency:

The nature of the return to scale for any unit of production is determined by measuring the efficiency of scale, and the main reason for this method is that economies of scale can directly determine the efficient and inefficient unit of production[8],[1].The scale efficiency is measured by analyzing the data envelope for constant and variable scales, and then dividing the degree of technical efficiency that was obtained through analyzing the data envelope when both the return to scale is constant and variable CRS& VRS DEA into two parts. The first can be attributed to scale inefficiency and the second technical inefficiency. If there is a difference between the technical efficiency obtained from both analyzes of the production unit, this means that the production unit suffers from scale inefficiency, which is equivalent to the difference between the degree of technical efficiency in both constant and variable scales. Thus, the scale efficiency can be determined by the following equation:

$$Se_i = \frac{TE_i^{CRS}}{TE_i^{VRS}}$$

Where Sei stands for scale efficiency and is calculated on the basis of dividing the technical efficiency of constant return of scale (TECRC) by the technical efficiency of variable return of scale (TEVRS), if $Se_i = 1$ Means the capacitance efficiency, but if $Se_i < 1$ It means scale inefficiency, that is, the scale efficiency of the production unit represents the ratio between the technical efficiency of the production unit with a constant return to scale and the technical efficiency of the same production unit with a variable return to scale.

First: The relative importance of the sources of fish production in Egypt:

By researching Table (1), which shows the relative importance of the sources of fish production in Egypt, it was found that the production of fish farming represents the first rank, as its average production reached about1506.5 Thousand tons, representing about 80.3% of the Egyptian fish production during the period (2016-2019), which amounted to about 1875.7 thousand tons, It was also found that the average production of the northern lakes amounted to about 150,5 thousand tons, representing about 8% of the total production during the same period, but the fish production from the seas averaged about 104.3 thousand tons, representing about 5.6% of the total production, It was found From the same table that the

average fish production of the Nile and its branches amounted to about 75.6 thousand tons, representing 4.03% of the total production, and the average production of the rest of the sources was about 38.9 thousand tons, representing about 2.07% of the annual average of total fish production in Egypt during that period.

Table (1): the relative importance of fish production sources in Egypt during the period (2016-2019)

(thousand tons)

%	Other fisheries	%	Nile and its branches	%	seas	%	Northern Lakes	%	Fish farming	total production	years
2.05	34.94	4.31	73.48	6.1	103.7	7.2	123.53	80.3	1370.7	1706.3	2016
2.05	37.28	4.26	77.73	6.0	109.8	8.0	146.19	79.6	1451.8	1822.8	2017
2.19	42.3	3.81	73.74	5.4	104.7	7.9	152.55	80.7	1561.5	1934.7	2018
2.01	41.07	3.80	77.38	4.9	99	8.8	179.64	80.5	1641.9	2038.9	2019
2.07	38.90	4.03	75.58	5.6	104.3	8.0	150.48	80.3	1506.5	1875.7	average

Source: Ministry of Agriculture and Land Reclamation, General Authority for Fisheries Development, Fisheries Statistics, various issues.

Second: The technical efficiency of fish production farms according to the concept of constant and variable return to scale:

Technical efficiency means the efficiency of the use of the economic resources specified in the efficiency estimation model. Technology efficiency is divided into:-

A- Technical efficiency according to the concept of constant return to scale (CRS):

The area of fish production for the research sample ranged between a maximum of 25 feddan and a minimum of one feddan, as shown in Table (2), According to the concept of fixed return on scale, which assumes the exploitation of the farm and its operation at its maximum scale, the technical efficiency ranged between a minimum of about 46.9% and a maximum of about 100%,The average of this indicator was 86.6%, that is, it is possible to achieve the same level of production using only 86.6% of the actual combination of the resources used, meaning that 13.4% of the resources can be saved on average and the same level of production can be achieved

B- Technical Efficiency According to the Concept of Variable Return to scale (VRS):

Table (2) shows that the technical efficiency indicator of farms that do not operate at their maximum scale ranged between 74.3% as a minimum, and 100% as a maximum, and the average of this indicator was 94%, meaning that the same level of production can be achieved using only 94% of the actual combination of resources used, meaning that 6% of the resources can be saved without affecting the level of production, and it should be noted that the technical efficiency with the variable return to scale means the farm activity at capacities less than the maximum scale, Thus, the technical efficiency indicators in this case are higher than in the case of the hypothesis of the constant return to scale, which considers the farms operating at its maximum scale. (13, 14, 16, 18, 21, 22, 24, 26, 29, 30, 31, 33, 34, 35, 39, 40, 43, 45, 47, 48, 49, 50) have achieved full proficiency from the It means that these farms should continue at their current production level.

When comparing the scale efficiency and the return to scale for the sample farms, it was found that there are 37 farms whose production must be increased by increasing the efficiency of resource use for these farms, and 8 farms have achieved full efficiency and these farms are (3, 8, 13, 14, 18, 21, 35, 47), which means that the actual combination of resources is the same as the

Optimum combination, so the efficiency of the scale reached the right one and the constant return to scale was achieved, and to increase the resource efficiency

of all farms, the level of production in farms (9, 24, 27, 28, 36).

Third: Distributive Efficiency and the economic efficiency of fish production farms:

It was previously mentioned to estimate the technical efficiency of the farmer of the research sample in the absence of information about the costs of the resources used in production, the efficiency index in this case does not take into account the cost of actual resources, and accordingly it is necessary to estimate the distributional efficiency of the resources used in fish production farms through the Data Envelope Analysis Program (DEAP) in light of the prices of those resources and a comparison of technical efficiency and economic efficiency (cost efficiency), as well as Distributive (price) efficiency, whereas, economic efficiency is the result of multiplying technical efficiency and distributive efficiency.

Table (3) indicates that the average economic efficiency index reached about66.5%, and this average ranges between a minimum of about 27.3%, and a maximum of about 100%, and five farms with numbers (3, 8, 13, 21,47) have achieved full efficiency. The rest of the farms did not achieve full efficiency. This can be explained economically by the failure of these farms to benefit from the advantages of return to scale when purchasing the factors of production, and when selling the final product.

Table (2): Indications of technical efficiency and return to scale for sample farms in Kafr El-Sheikh Governorate

farm number	farm area (feddan)	technical efficiency (CRS) (1)	technical efficiency (VRS) (2)	scale efficiency (2/1)	return to scale
1	12	0.97	1.000	0.970	increase
2	11	0.795	0.876	0.908	increase
3	8	1.000	1.000	1.000	stability
4	10	0.750	0.876	0.856	increase
5	6	0.669	0.777	0.861	increase
6	8	0.929	0.934	0.995	increase
7	3	0.469	1.000	0.469	increase
8	25	1.000	1.000	1.000	stability
9	25	0.909	1.000	0.909	shrinking
10	18	0.959	1.000	0.959	increase
11	17	0.977	1.000	0.977	increase
12	21	0.9	0.962	0.936	increase
13	11	1.000	1.000	1.000	stability
14	15	1.000	1.000	1.000	stability
15	4	0.72	0.849	0.848	increase
16	8	0.95	1.000	0.950	increase
17	4	0.716	0.822	0.871	increase
18	6	1.000	1.000	1.000	stability
19	11	0.716	0.902	0.794	increase
20	16	0.782	0.893	0.876	increase
21	23	1.000	1.000	1.000	stability

22	17	0.918	1.000	0.918	increase
23	8	0.729	0.754	0.967	increase
24	17	0.969	1.000	0.969	shrinking
25	11	0.68	0.932	0.730	increase
26	25	0.981	1.000	0.981	increase
27	5	0.639	0.892	0.716	decreasing
28	24	0.757	0.833	0.909	decreasing
29	3	0.993	1.000	0.993	increase
30	21	0.934	1.000	0.934	increase
31	21	0.862	1.000	0.862	increase
32	10	0.714	0.743	0.961	increase
33	18	0.935	1.000	0.935	increase
34	24	0.935	1.000	0.935	increase
35	12	1.000	1.000	1.000	stability
36	24	0.702	0.970	0.724	decreasing
37	5	0.825	0.846	0.975	increase
38	1	0.856	0.922	0.928	increase
39	11	0.969	1.000	0.969	increase
40	18	0.918	1.000	0.918	increase
41	18	0.729	0.854	0.854	increase
42	4	0.731	0.873	0.837	increase
43	3	0.95	1.000	0.950	increase
44	10	0.809	0.815	0.993	increase
45	12	0.998	1.000	0.998	increase
46	21	0.711	0.811	0.877	increase
47	15	1	1.000	1.000	stability
48	15	0.99	1.000	0.990	increase
49	5	0.987	1.000	0.987	increase
50	6	0.988	1.000	0.988	increase
average	12.92	0.868	0.943	0.919	
highest value	25	**1.000**	**1.000**	**1.000**	
lowest value	1	0.469	0.743	0.469	

Source: the results of the analysis for the data of the research sample in 2022.

Table (3): Estimation of allocative efficiency and economic efficiency of sample farms in Kafr El-Sheikh Governorate

farm number	farm area (feddan)	Technical efficiency TE	Allocative Efficiency AE	Economic efficiency
1	12	1.000	0.632	0.632
2	11	0.876	0.715	0.626
3	8	1.000	1.000	1.000
4	10	0.876	0.534	0.468
5	6	0.777	0.354	0.275
6	8	0.934	0.418	0.390
7	3	1.000	0.515	0.515
8	25	1.000	1.000	1.000
9	25	1.000	0.865	0.865
10	18	1.000	0.893	0.893
11	17	1.000	0.934	0.934
12	21	0.962	0.724	0.696
13	11	1.000	1.000	1.000
14	15	1.000	0.920	0.920
15	4	0.849	0.434	0.368
16	8	1.000	0.653	0.653
17	4	0.822	0.693	0.570
18	6	1.000	0.435	0.435
19	11	0.902	0.814	0.734
20	16	0.893	0.737	0.658
21	23	1.000	1.000	1.000
22	17	1.000	0.962	0.962
23	8	0.754	0.514	0.388
24	17	1.000	0.518	0.518
25	11	0.932	0.715	0.666
26	25	1.000	0.948	0.948
27	5	0.892	0.333	0.297
28	24	0.833	0.532	0.443
29	3	1.000	0.434	0.434
30	21	1.000	0.925	0.925
31	21	1.000	0.693	0.693
32	10	0.743	0.518	0.385
33	18	1.000	0.567	0.567
34	24	1.000	0.836	0.836
35	12	1.000	0.817	0.817
36	24	0.970	0.725	0.703
37	5	0.846	0.615	0.520
38	1	0.922	0.516	0.476
39	11	1.000	0.634	0.634
40	18	1.000	0.639	0.639
41	18	0.854	0.522	0.446
42	4	0.873	0.534	0.466
43	3	1.000	0.893	0.893
44	10	0.815	0.335	0.273
45	12	1.0000	0.873	0.873
46	21	0.811	0.678	0.550
47	15	1.000	1.000	1.000
48	15	1.000	0.812	0.812
49	5	1.000	0.714	0.714
50	6	1.000	0.733	0.733
average	12.9	0.943	0.696	0.665
highest value	25	1.000	1.000	1.000
lowest value	1	0.743	0.333	0.273

Source: the results of the analysis for the data of the research sample in 2022.

Fourth: Estimating the optimal employment for the economic use of fish farm in Kafr El-Sheikh Governorate:

Economic efficiency is estimated given both the actual combinations of resources and the unit price of each resource. This is achieved when the resource costs line touches the data envelope (the isoquant production curve), At this point, the efficient use of the resources used is achieved according to economic theory, where the optimal size of the resources used in production is achieved by reaching them.

Table (4) shows a comparison of the use of the optimal volume of resources on the one hand and the actual volume of the same resources on the other hand, it is clear from the total sample that it is necessary to reconsider the use of production resources in a way that achieves the economic efficiency of the farm by reducing the average cultivated area from about 12.92 to 12.54 feddan/farm, it is also necessary to reduce the average amount of water from about 80 to 78.7 million cubic meters/farm, as well as reducing the number of fry from about 180.5 to 178.2 million/farm, and reducing the amount of organic fertilizer used from About 44.2 to 28.8 cubic meters / farm, and also reducing the quantities of fodder used from about 59.4 to 58.1 tons / farm, and Reducing the number of non-technical workers from about 528.2 to 488.1 working days/farm, and also reducing the number of technical workers from about 319.1 to 309.3 working days/farm without affecting the condition farm access to full economic efficiency to the total farm production.

Summary and recommendations:

The fisheries sector contributes about 9.9% of the total value of agricultural production, which amounts to about 465.2 billion pounds and about 27.4% of the total value of animal production, which amounts to about 169.8 billion pounds. The fisheries sector also contributes from fish meat to 83.26% of the total meat production in Egypt.

Egypt is also the first in Africa and sixth in the world in aquaculture, the annual average production from fish farming was about 1506.5 thousand tons, while the role of natural fisheries in production shrank to about 369.3 thousand tons, with a total of about 1875.7 thousand tons as the annual average of production. And The annual average of domestic consumption was about 2,250 thousand tons, and the average per capita share was estimated at about 11.9 kg / year during the period (2016-2019).

The research problem is summarized in the insufficient production of fish for the local consumption needs of fish, the gap of about 374.3 thousand tons as an average for the research period is covered by importing fish from abroad of low quality species, in addition to the increasing burden on the trade balance.

The research aimed to research both the technical and economic efficiency of fish production farms in Egypt to maximize the maximum possible return to increase fish production and raise the rate of self-sufficiency, by researching the technical efficiency in both cases of constant and variable return to scale, and researching the economic efficiency (cost efficiency), and the comparison between both averages The actual quantities of the resources used and the optimum quantities achieved for technical and economic efficiency, and catching the amount of resources achieved for economic efficiency.

The results of the research indicate that the average production of the northern lakes amounted to about 150.5 thousand tons, representing 8% of the total production, from both the Mediterranean and the Red Sea about 104.3 thousand tons, representing 5.6%, and the Nile River and its branches 75.6 thousand tons, representing 4.03%, and the rest of the sources are about 38.9 thousand tons It represented 2.07% of the annual average of total fish production in Egypt during the period (2016-2019).

The research indicates that the technical efficiency (TE) in Kafr El-Sheikh Governorate according to the concept of constant return to scale (CRS), the average of this indicator was estimated at 86.6%, meaning that the same level of production can be achieved using only 86.6% of the actual combination of used resources, according to the concept of variable return to scale (VRS), the average of this indicator was estimated at 94%, meaning that the same level of production can be achieved using 94%,The economic efficiency index was estimated at 66.5%,These percentages reflect the optimal amount of resources compared to the actual quantities used of the resources, which are represented in the area, the amount of irrigation water, the number of fish fry, the amount of fodder, the amount of natural decomposing fertilizers, the number of non-technical workers, and the number of technical workers. When the optimum size of the resources used in production was estimated and compared with the actual size of the same resources, it was found that the average farm area should be reduced from about 12.9 to 12.6 faddan/farm, and the amount of irrigation water should be reduced from about 80 to 78.7 million cubic meters/farm, and also reducing the number of fish fry from about 180.5 to 178.2 million / farm, and reducing the amount of organic fertilizer from about 44.2 to 28.8 cubic meters / farm, and also reducing the quantities of feed used from about 59.4 to 58.1 tons / farm, and reducing the number of non-technical workers from about 528.2 working days to 488.1

working days/farm, and reducing technical workers from about 319.1 to 309.3 working days for each farm without affecting the total production.

The research recommends according to the results:

1- Stop the depletion of productive resources by overusing them and trying to make them the optimal use of those productive resources to reduce production costs and increase net returns and profits.

2- Directing agricultural extension and development programs implemented by the Ministry of Agriculture through specialized research centers and institutes towards focusing on the optimal use of productive resources.

3- The research expects an increase in the total production and the average per capita share of fish meat due to the expansion that took place for government investment in the field of fish farming.

Table (4): the actual and optimal quantities of production inputs used in the research sample farms in Kafr El-Sheikh Governorate

farm number	Cultivated area feddan		water quantity cubic meter		number of fry thousand units		volume organic fertilizer cubic meter		Feed quantity in tons		NO. non-technical workers days		NO. Technical workers days	
	actual	optimum	actual	optimum	actual	optimum	actual	optimum	actual	optimum	actual	optimum	actual	optimum
1	12	12	74772	67650	198822	197470	38.52	24.3	63	65	420	390	352	330
2	11	12.5	67750	68550	182600	190510	30.92	18.24	55.6	60	420	410	276	259
3	8	8	47172	47172	93944	93944	20.7	20.7	35.8	35.8	292	292	187	187
4	10	10	63690	63690	126200	126200	49	30	60	60	415	415	254	244
5	6	4.3	46935	42092	87534	64525	17.7	9.42	35.3	30.08	252	172	142	122
6	8	6.7	49381	44210	98048	90117	22.76	14.44	32	29.51	359	295	171	162
7	3	4.5	12726	14450	37950	39620	13.2	10.2	18.68	19.23	138	158	81	90
8	25	25	153065	153065	330775	330775	86.04	86.04	112.9	112.9	985	985	635	635
9	25	22.7	169600	169200	315000	300640	91.5	52.4	96.7	90.31	1075	908	640	620
10	18	18	99370	98870	189000	189000	67	24.5	54	54	720	700	360	360
11	17	17	111700	111700	253391	255440	85	30.5	85.2	83.8	632	600	474	470
12	21	21	140758	141852	312267	320125	75.6	50.2	110	105.3	913	823	570	561
13	11	11	68760	68760	175620	175620	26.34	26.34	51.57	51.57	425	425	224	224
14	15	16.2	94525	97600	225025	232000	44.53	30.56	75	78	570	551	410	413
15	4	3.2	14700	12420	50264	43680	9.94	5.03	24	21.92	188	140	108	90
16	8	6.7	51400	50220	96752	91136	24.3	14.97	41.95	38.34	362	278	210	190
17	4	3.7	14500	13820	50000	46328	10.6	5.14	20.42	19	210	170	102	92
18	6	4.3	43800	36890	75360	68780	18.1	9.61	24.87	21.6	250	182	132	116
19	11	11	67750	67650	162000	162533	29.32	19	42.3	42.3	427	415	225	215
20	16	14	83700	73400	229482	220563	49.63	23.43	86.4	82.4	576	490	334	308
21	23	23	96956	96956	304244	304244	45.8	45.8	113.5	113.5	916	916	568	568
22	17	15.3	121000	116756	262000	259852	52.7	26.36	78.9	75.41	625	578	428	406

23	8	6.4	49500	37814	109200	96384	23.5	11.7	24.14	22	346	289	138	115
24	17	18.6	120000	131000	286333	290472	46.92	32.55	91.1	96.65	642	638	538	541
25	11	11	57850	57850	184437	186500	33.25	27.54	35	35	450	374	203	198
26	25	25	181720	181630	354621	354990	100	95.3	132.5	130	1125	1119	700	696
27	5	3.7	28500	23220	60830	54305	17.3	10.25	30	26.32	252	187	110	85
28	24	21.6	161862	159170	310536	285640	96.2	55.39	120	110.62	1156	940	618	590
29	3	4.3	11800	12800	39967	41235	14.7	8.7	19.47	21.3	152	160	76	80
30	21	19	141960	123640	311271	296400	86.1	57.8	88.83	84.23	903	818	533	548
31	21	22	140758	142560	292400	291523	85	60.3	84	86.4	840	832	525	526
32	10	9.6	61476	60665	128220	128220	42.3	29.6	51.5	50	418	384	210	196
33	18	20	120916	135113	201562	227600	70.32	42.4	67.6	70.1	756	800	415	412
34	24	22.5	160240	151040	335000	329268	74.4	48.17	84	82.75	1030	945	652	625
35	12	13	73200	75075	185000	181762	35.84	22.49	55.8	57.16	453	440	335	340
36	24	24	160852	160280	346040	342621	87.2	59.2	96.8	95.3	994	960	630	624
37	5	5	25120	25120	56800	56800	19.3	19.3	22.21	22.21	215	215	111	111
38	1	1	5460	5375	15400	14850	2	1	9	7.6	60	49	25	23
39	11	9	68950	67460	144000	140000	15.35	15.35	45.7	43.7	330	300	184	160
40	18	18	102882	104251	243146	246000	69.4	30.18	90	87.7	774	735	445	441
41	18	19	98680	106254	241570	239344	79	39.3	74.5	75.8	792	761	430	437
42	4	3.2	14550	12320	49692	43296	12.4	7.7	23	20	185	144	104	81
43	3	3	19500	12665	40654	40453	9.75	5.32	21	20.2	135	125	70	65
44	10	9.6	58493	58765	121000	120000	40.2	28.2	49	49	425	400	210	196
45	12	14	76300	77364	196760	200456	36.21	26	66.5	69	392	406	312	315
46	21	21	114860	113560	317520	317520	76.5	56.2	75.6	73	819	798	512	508
47	15	13.7	84464	82150	236700	233700	46.16	28.32	66.25	60.8	562	466	325	310
48	15	15	94725	93916	224890	226400	40.06	20.83	65	62	565	510	390	380
49	5	3.7	27950	24870	58957	52784	19.72	11.3	27.3	24.24	235	150	133	95
50	6	4.3	45860	43310	77400	68566	20.4	10.48	36.64	30.23	233	165	137	105
average	12.92	12.61	80049	78724	180524	178204	44.2	28.8	59.4	58.1	528.2	488.1	319.1	309.3
highest value	25	25	181720	181630	354621	354990	100	95	133	130	1156	1119	700	696
lowest value	1	1	5460	5375	15400	14850	2	1	9	7.6	60	49	25	23

Source: the results of the analysis for the data of the research sample in 2022

References:

[1]. Somaya Mohieldin Hilal (Dr), "**Measuring the Relative Efficiency of Administrative Units Using the Data Envelope Analysis Method**", Master Thesis, Department of Business Administration, King Abdulaziz University, Jeddah, 1999 AD.

[2]. Essam El-Din Gholam Hussein, **"an analytical research of the economics of fish farms with reference to the farms affiliated with the General Authority for Fish Resources Development**", Master's thesis, Department of Agricultural Economics, Faculty of Agriculture, Cairo, Al-Azhar University, 2005

[3]. Manar Ezzat Mohamed, the Economics of Fish Farming Production **"A Comparative Research of the Cases of Fayoum and Beheira**", Master's Thesis, Faculty of Agriculture in Fayoum, Cairo University, 2002

[4]. Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **"Agricultural Income Bulletin**", various issues.

[5]. Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Fish and Insect **"Production Statistics and Food processing"**, various issues.

[6]. Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, **"Food Balance Bulletin**", various issues.

[7]. Afriat, P. (1972). **"Efficiency estimation of production functions**". International Economic Review 13: 568-598.

[8]. Coelli T. J., (1996). A Guide to DEAP Version 2.1: **"A Data Envelopment Analysis (Computer) Program**". CEPA Working Paper 96/08, Department of Econometrics.

10/22/2022